



Northeast Aquatic Research



74 Higgins Highway
Mansfield Center, CT 06250
www.northeastaquaticresearch.net

February 4th, 2022

TO: Crystal Pond Association

ATTN: Tom Hawkins

FROM: Kendra Kilson

Re: Crystal Pond 2021 Water Quality and Aquatic Plant Results

Discussion of 2021 Water Quality Results

Water Clarity

Water clarity fluctuated this season, but generally was better early in the season and worsened later in the season (Figure 1). The best water clarity was 7.5m (24.5ft), recorded on April 18th. The worst water clarity was 3.6m (11.8ft), recorded on October 3rd. These readings were all taken using the viewscope and are the averages of three Secchi disk depths taken by lake monitor volunteers.

Dissolved Oxygen

Thanks to the dedication of Crystal Pond volunteer monitors, 2021 was the first year where there were frequent and consistent dissolved oxygen profile readings throughout the season. It is evident that there was a fluctuation in the seasonal height of the anoxic boundary, and that anoxia tended to be worst in July, where it reached a maximum height of around 6-meters.

Nutrients

Total phosphorus (TP) remained below 20ppb in the top and middle of the lake, with concentrations ranging from 4ppb to 18ppb. August and September bottom water concentrations were elevated as a result of internal nutrient release during periods of anoxia at the lake bottom. Total nitrogen (TN) concentrations at the bottom of the lake were also highest in August and September, and slightly elevated in July. TN concentrations in the top and middle of the lake ranged from 187ppb to 270ppb. Bottom water ammonia nitrogen (NH₃) was elevated in August and September.

Inlet Nutrients

Inlet samples were collected on June 20th from five flowing inlets. In Inlets 1, 7 and 8, total phosphorus (TP) was equal to or less than 20ppb. The highest TP concentration was 78ppb at Inlet 9. The highest total nitrogen (TN) concentration was 499ppb at Inlet 7. The TN concentration at Inlet 9 was also elevated.

Aquatic Plants

NEAR conducted a full-lake aquatic plant survey on August 30th, 2021 and documented a total of 27 native species. No invasive species were found in the lake during this survey. *Potamogeton robbinsii* (Robbin's pondweed) and *Potamogeton amplifolius* (Largeleaf pondweed) were present at 77% and 45%

frequencies, respectively. *Bidens beckii* (Water marigold), which is a Connecticut state listed protected species, was present at 25% of the survey waypoints. *Potamogeton natans* (Floating pondweed) and *Vallisneria americana* (Tapegrass) were present at 16% and 14%, respectively.

Recommendations

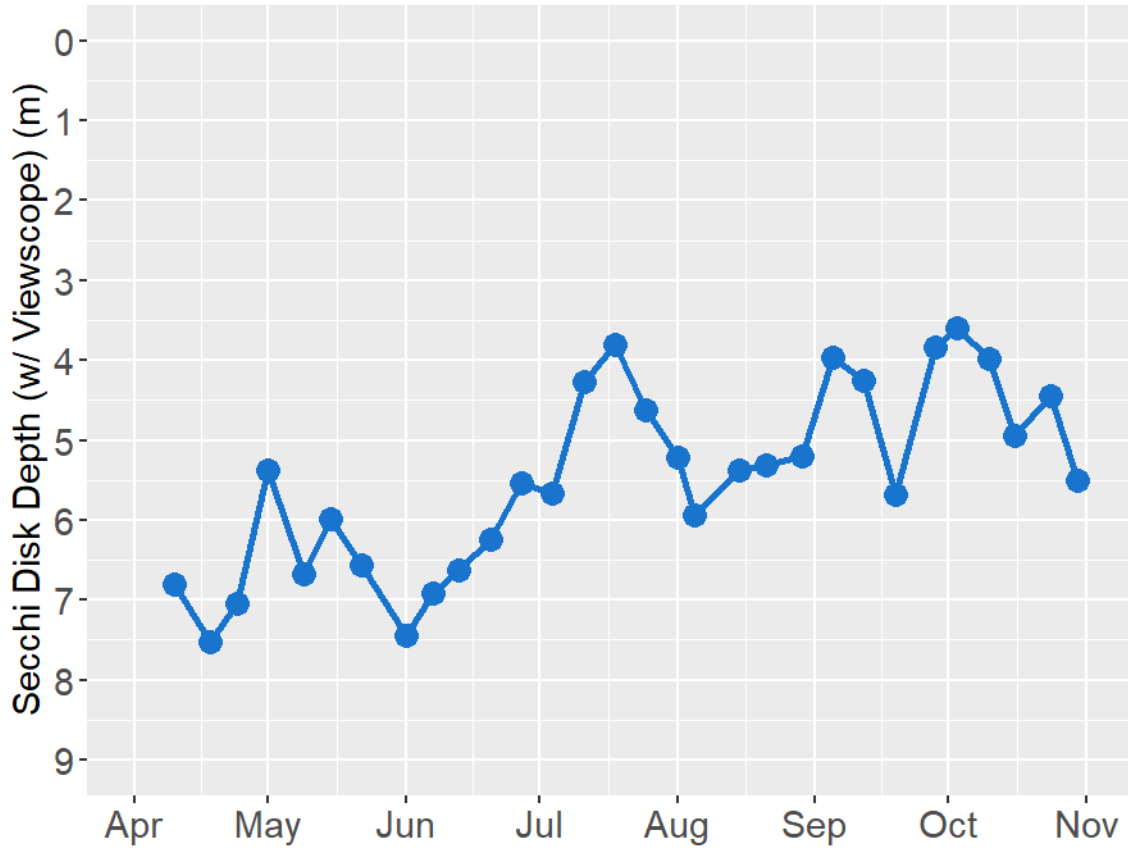
We recommend continued lake monitoring from April through November 2022. NEAR will conduct a full-lake aquatic plant survey to determine the presence and density of native plant species. We will additionally search the entire pond for any new native or invasive species and their composition. This survey will also continue to map the state-listed Water marigold (*Bidens beckii*) population in the pond and report to the Natural Diversity Database (NDDB) office at CT DEEP.

If residents feel plants are a nuisance in certain small areas (such as around docks or recreational areas), those can be prioritized for hand-removal management.

Thank you for your tireless efforts to monitor and manage Crystal Pond.

Sincerely,
Kendra Kilson, Research Scientist
Northeast Aquatic Research, LLC

Secchi disk depths (m) in Crystal Pond in 2021.



2021 Nutrient Results

Total Phosphorus (TP) ppb ($\mu\text{g/L}$)

Depth	Apr 24	Jun 20	July 25	Aug 29	Sep 26
Top (1m)	10	12	14	14	7
Top (1m) Duplicate	9	10	15	17	5
Middle (4, 4.5 or 5m)	7	13	18	18	4
Bottom (8, 8.5 or 9m)	13	14	16	47	24

Total Nitrogen (TN) ppb

Depth	Apr 24	Jun 20	July 25	Aug 29	Sep 26
Top (1m)	232	223	249	249	219
Top (1m) Duplicate	226	187	243	270	210
Middle (4, 4.5 or 5m)	221	230	267	267	217
Bottom (8, 8.5, or 9m)	223	239	314	373	392

Ammonia Nitrogen (NH_3) ppb NA=Not available

Depth	Apr 24	Jun 20	July 25	Aug 29	Sep 26
Top (1m)	3	6	1.5	1.5	1.5
Top (1m) Duplicate	4	NA	1.5	5	4
Middle (4, 4.5 or 5m)	1.5	7	3	7	1.5
Bottom (8, 8.5 or 9m)	1.5	10	NA	195	116

Nitrate Nitrogen (NO_x) ppb ND=Not Detected, below lab detection limit

Depth	Apr 24	Aug 29
Top (1m)	ND	ND
Top (1m) Duplicate	ND	ND
Middle (4 or 4.5m)	ND	ND

Inlet Sample Results from June 20th, 2021

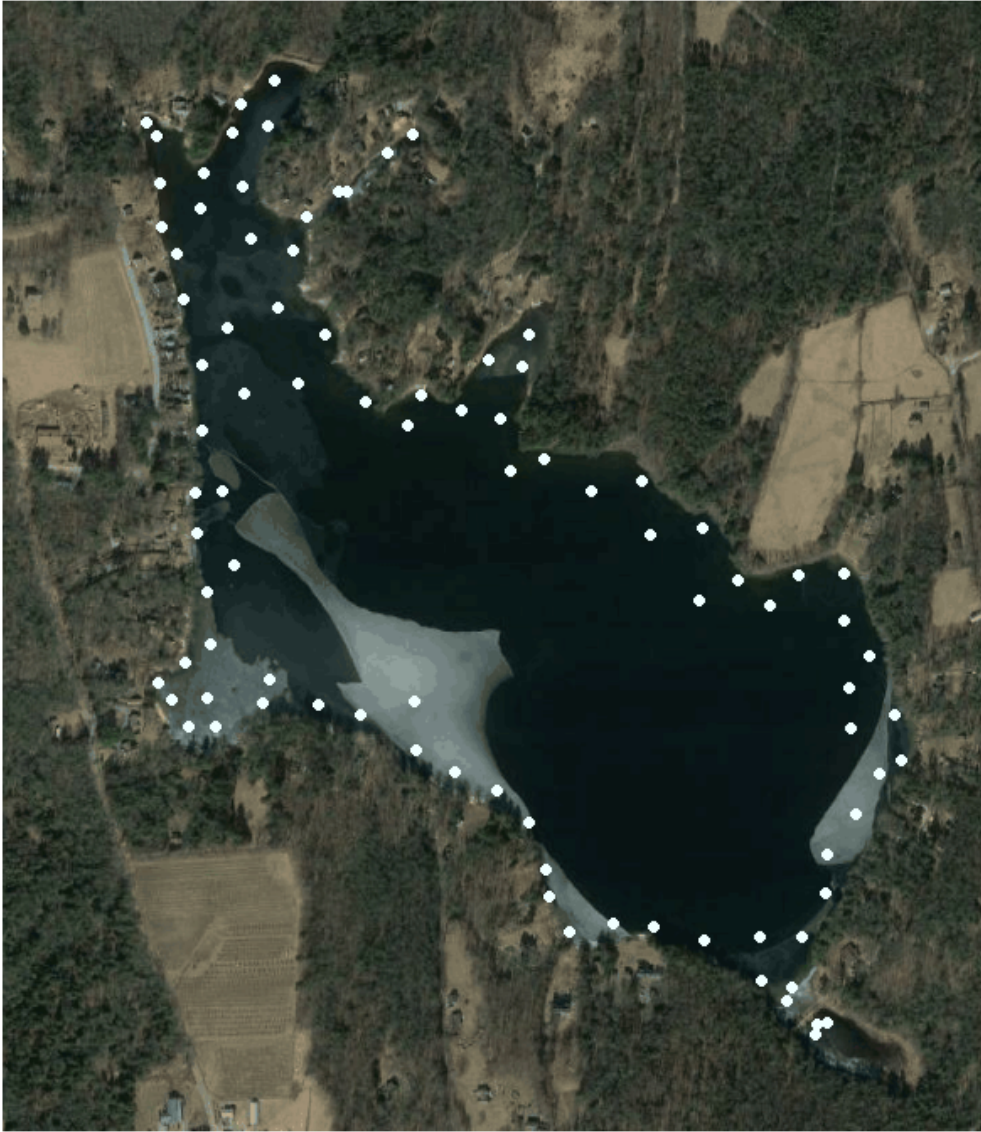
Inlet #	TP (ppb)	TN (ppb)
1	15	83
4	28	308
7	20	499
8	14	167
9	78	439

List of aquatic plant species documented during August 30th, 2021 full-lake survey of Crystal Pond. Connecticut state-listed species is highlighted in blue.

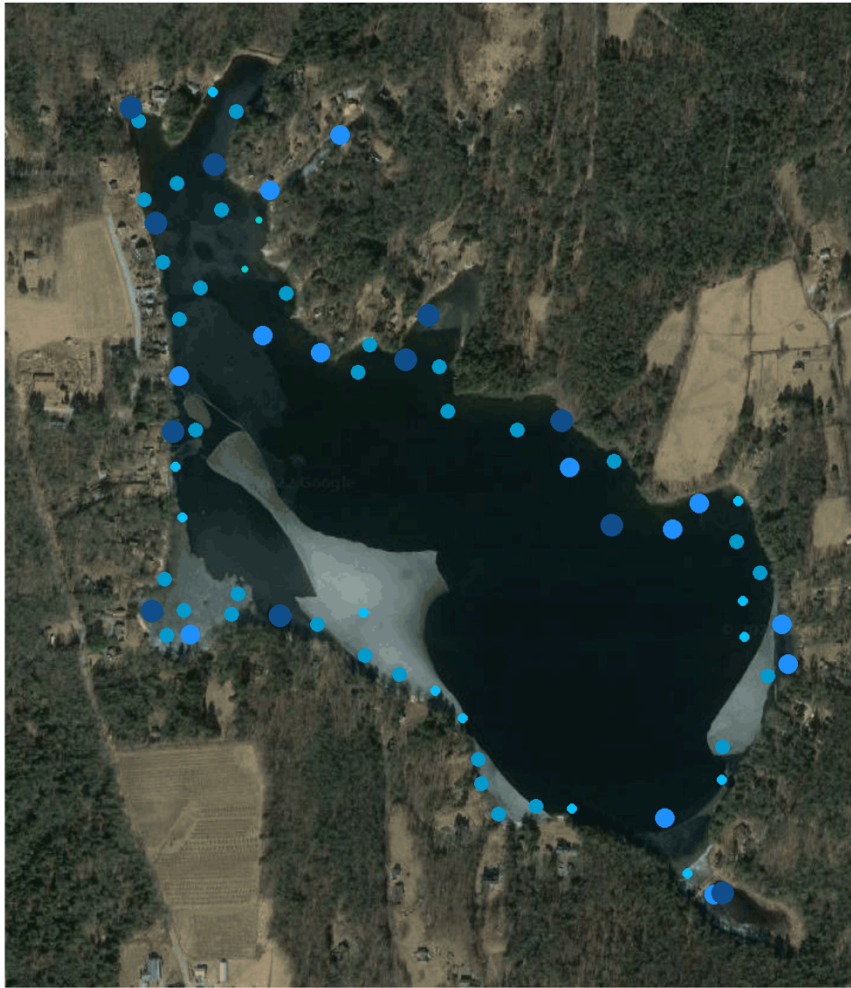
Scientific Name	Common Name	% Occurrence	Average Density
<i>Potamogeton robbinsii</i>	Robbin's pondweed	77	45
<i>Potamogeton amplifolius</i>	Large-leaf pondweed	45	43
<i>Bidens beckii</i>	Water marigold	25	39
<i>Potamogeton natans</i>	Floating pondweed	16	14
<i>Vallisneria americana</i>	Tapegrass	14	62
<i>Potamogeton epihydrus</i>	Ribbon-leaf pondweed	12	27
<i>Potamogeton oakesianus</i>	Oake's pondweed	10	43
<i>Utricularia purpurea</i>	Purple bladderwort	9	12
<i>Typha sp.</i>	Cattail sp.	4	39
	Filamentous algae	3	17
<i>Najas flexilis</i>	Nodding water nymph	3	17
<i>Sagittaria graminea</i>	Grassy arrowhead	3	7
<i>Utricularia macrorhiza</i>	Common bladderwort	3	27
<i>Utricularia minor</i>	Lesser bladderwort	3	5
<i>Brasenia schreberi</i>	Watershield	2	9
<i>Eleocharis acicularis</i>	Needle spikerush	2	30
<i>Sparganium sp.</i>	Emergent bur-reed	2	13
<i>Nitella sp.</i>	Stonewort sp.	2	5
<i>Nuphar variegata</i>	Yellow lily	2	13
<i>Nymphaea odorata</i>	White lily	2	23
<i>Potamogeton gramineus</i>	Grassy pondweed	2	18
<i>Elatine sp.</i>	Waterwort sp.	1	20
<i>Elodea nuttallii</i>	Waterweed	1	35
<i>Fontinalis sp.</i>	Aquatic moss	1	5
<i>Ludwigia palustris</i>	Water purslane	1	1
<i>Stuckenia pectinata</i>	Sago pondweed	1	10
<i>Utricularia geminiscapa</i>	Hiddenfruit bladderwort	1	40
<i>Utricularia radiata</i>	Floating bladderwort	1	10

Crystal Pond 8-30-2021 Survey Points

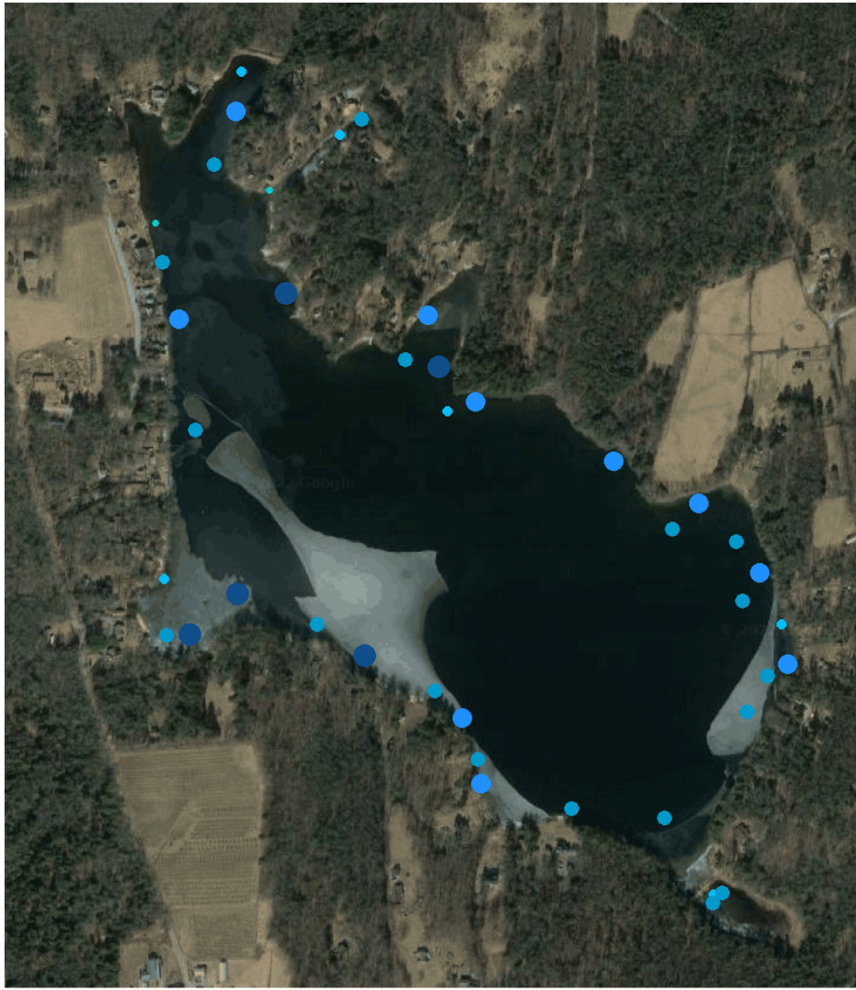
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Crystal Pond August 30th, 2021: Robbin's Pondweed (*Potamogeton robbinsii*)
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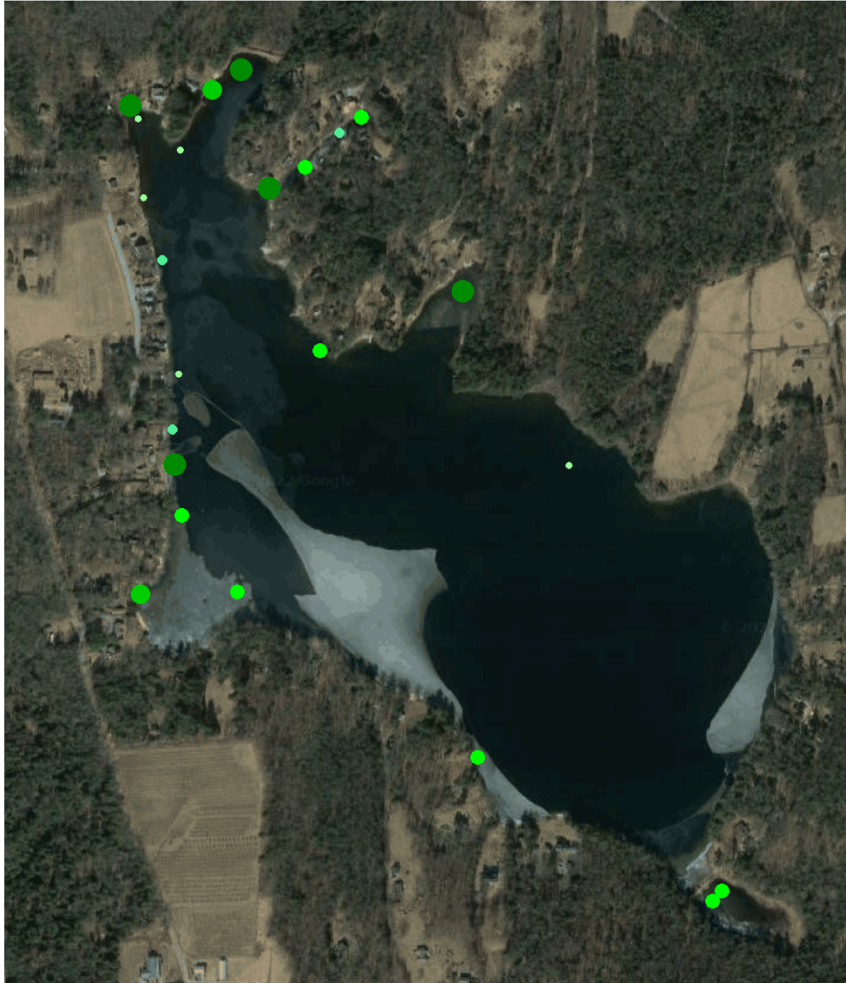
Crystal Pond August 30th, 2021: Largeleaf Pondweed (*Potamogeton amplifolius*)
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Largeleaf Pondweed

- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense

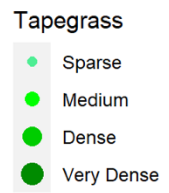
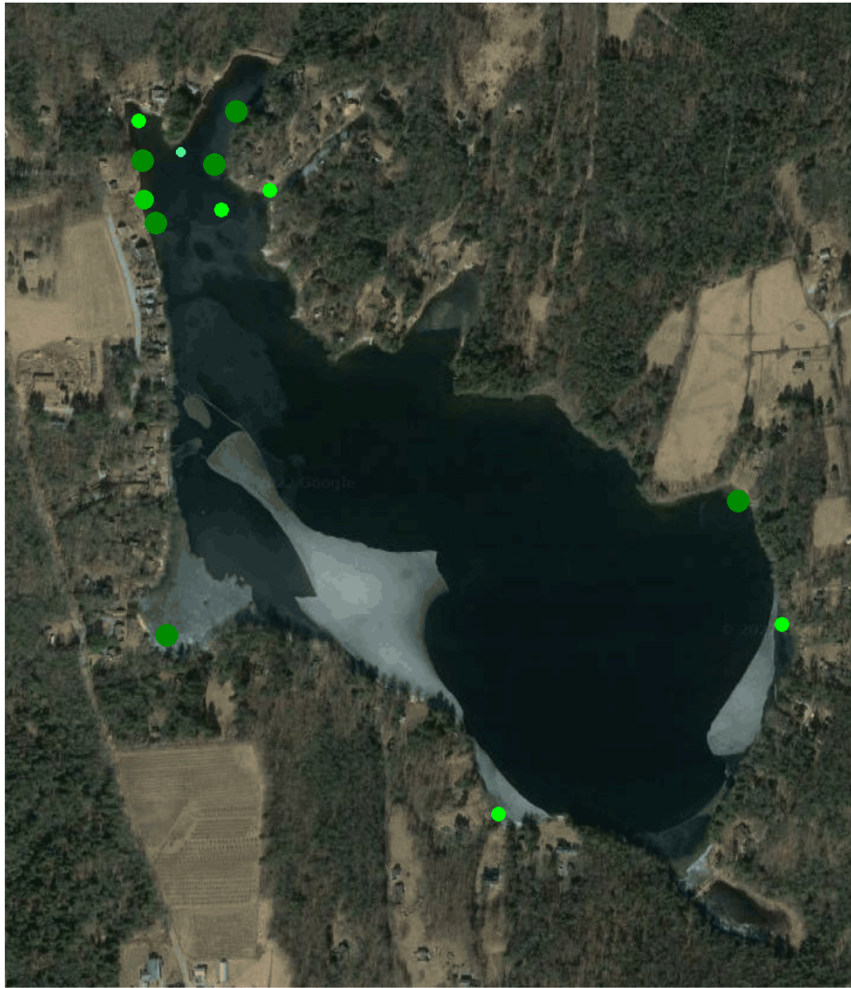
Crystal Pond August 30th, 2021: Water marigold (*Bidens beckii*)
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Water marigold

- Very Sparse
- Sparse
- Medium
- Dense
- Very Dense

Crystal Pond August 30th, 2021: Tapegrass (*Vallisneria americana*)
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Aquatic Plant Surveys Comparisons

Dominant aquatic plant species in Crystal Pond. Connecticut state-listed species is highlighted in blue.

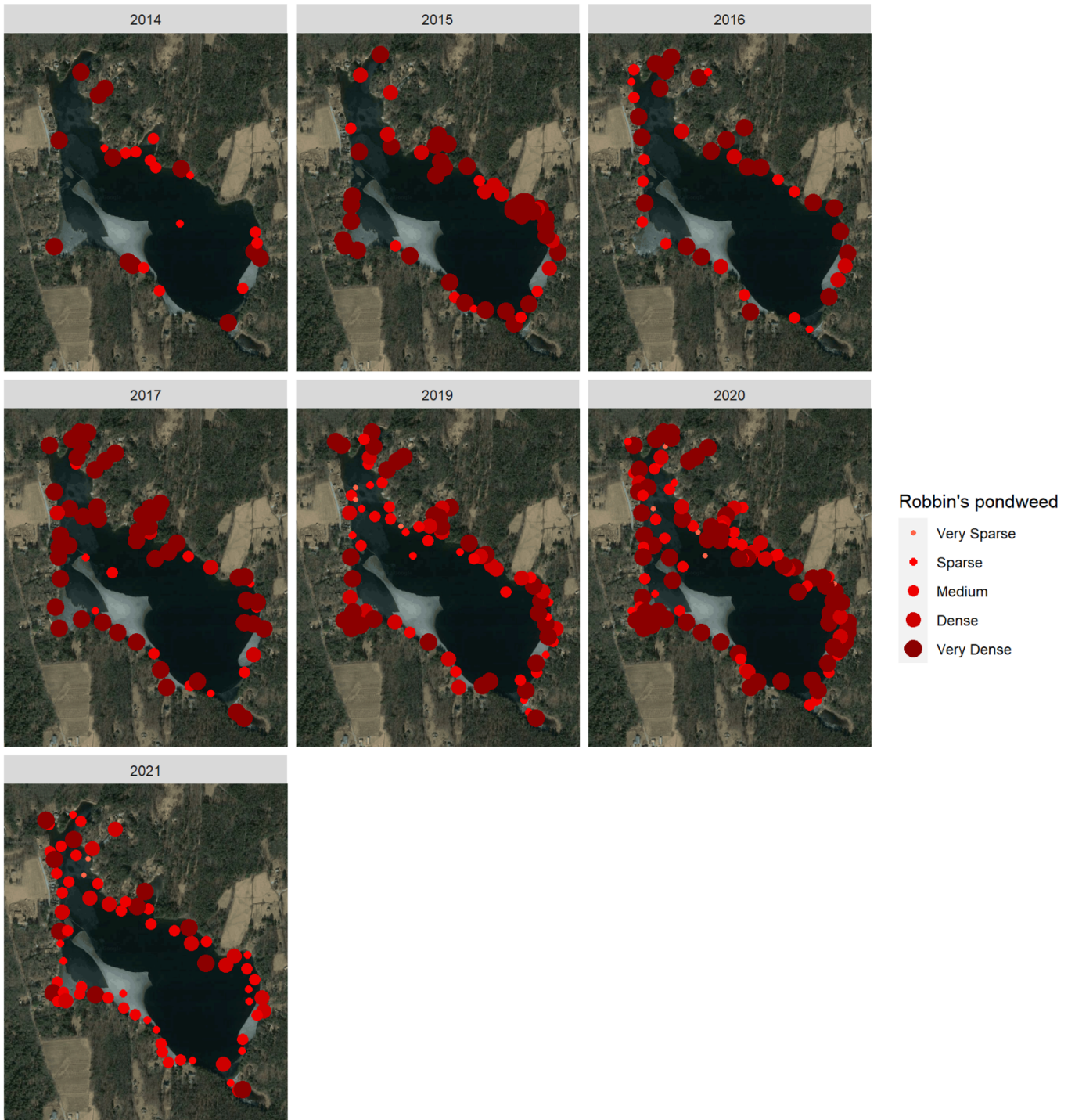
Scientific Name	Common Name	Percent Occurrence										
		2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
<i>Potamogeton robbinsii</i>	Robbin's pondweed	77	83	63	53	54	77	52	31	27	42	57
<i>Bidens beckii</i>	Water marigold	25	15	11	29	27	35	23	30	26	19	40
<i>Potamogeton gramineus</i>	Grassy pondweed	2	22	21	19	31	35	15	20	21	44	23
<i>Potamogeton amplifolius</i>	Largeleaf pondweed	45	47	44	34	49	33	52	43	16	19	28
<i>Vallisneria americana</i>	Tapegrass	14	13	15	11	11	14	10	6	5	7	6

List of NEAR Surveyors 2011-2021.

Date	Surveyors
7/14/2011	George Knoecklein
9/13/2012	George Knoecklein, Jason Lech
9/23/2013	George Knoecklein, Jason Lech, Hillary Kenyon
8/5/2014	George Knoecklein, Hillary Kenyon, Sabina Perkins
7/31/2015	George Knoecklein, Hillary Kenyon, Sabina Perkins
9/15/2016	George Knoecklein, Hannah Moore
9/11/2017	Hillary Kenyon, Hannah Moore, Kendra Kilson
8/20/2018	George Knoecklein, Madeline Kollegger
8/27/2019	Hillary Kenyon, Ryan Mayer
9/8/2020	Hillary Kenyon, Kendra Kilson
8/30/2021	Hannah Moore, Emma Sloan

Crystal Pond: Robbin's Pondweed (*Potamogeton robbinsii*)

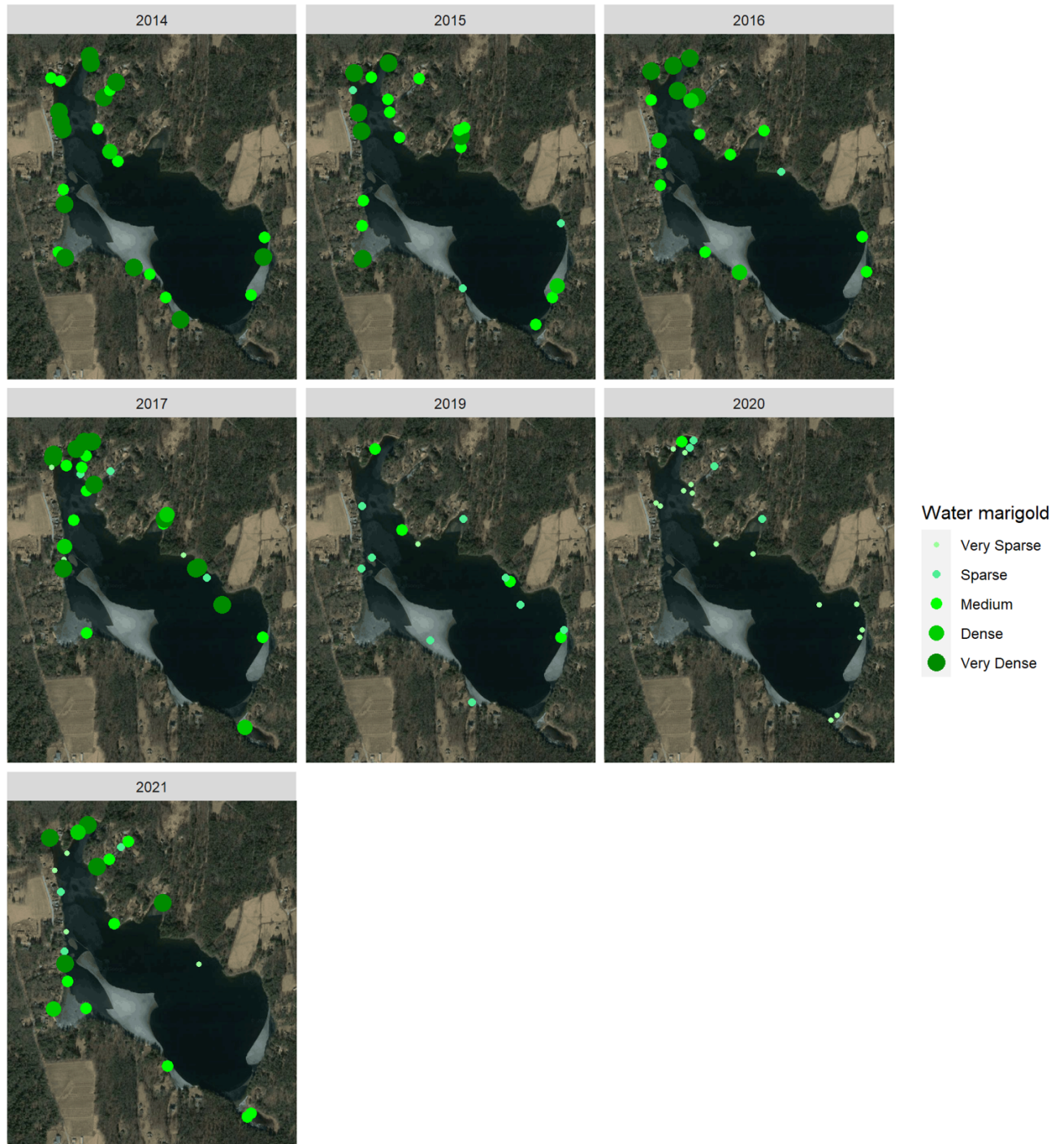
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Robbin's pondweed (*Potamogeton robbinsii*) has consistently been one of the most dominate plant species since 2011, when NEAR began annually surveying the pond. This species has dominated the littoral zone of the pond. In 2021, Robbin's pondweed was slightly less frequent (77%) than 2020 (83%). Since 2015, Robbin's pondweed has remained greater than 50% frequency.

Crystal Pond: Water marigold (*Bidens beckii*)

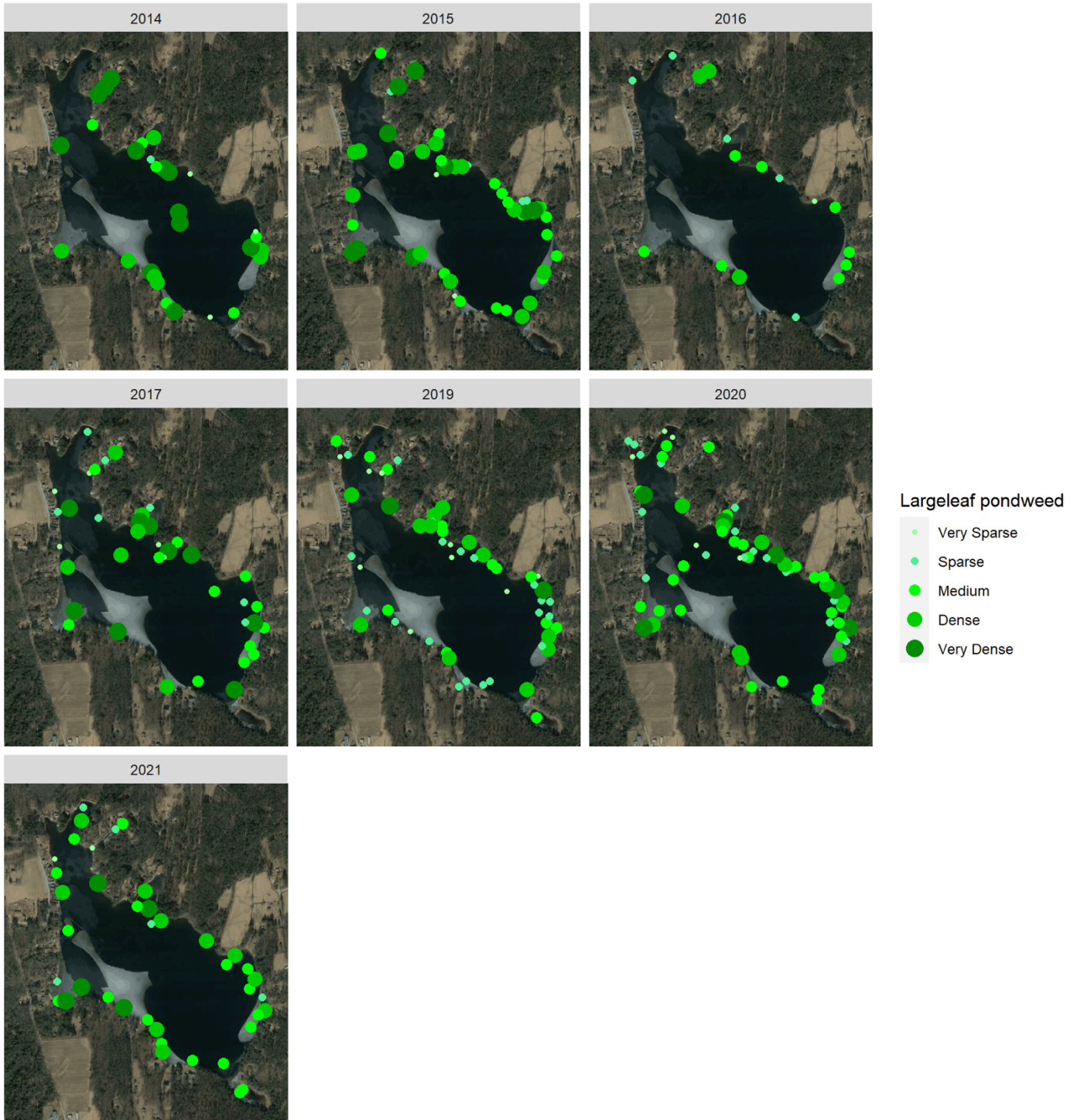
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Water marigold (*Bidens beckii*) frequency has fluctuated slightly throughout the years but continues to be a dominant species present in the pond. It is generally found to be the densest at the northwestern end of the pond. The southern end of the pond does not contain as dense a population of water marigold, as the plants are more scattered. Since NEAR began annually surveying in 2011, water marigold was least frequent in 2019 (11%).

Crystal Pond: Largeleaf Pondweed (*Potamogeton amplifolius*)

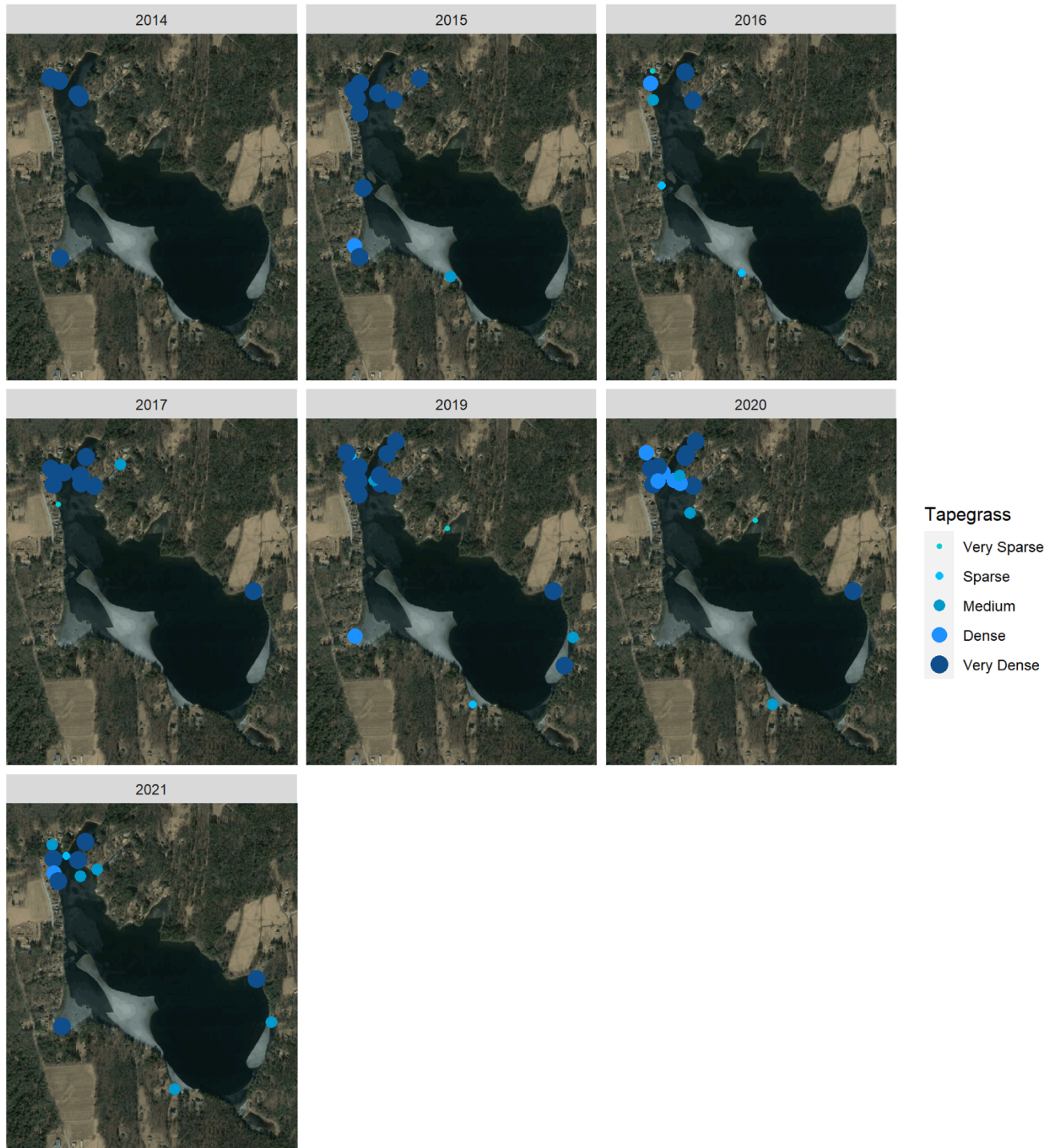
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Large-leaf pondweed has expanded along the northwestern and southeastern shoreline over the years. It also has expanded into the somewhat shallower water in the center of the lake. Large-leaf pondweed has been found at frequencies greater than 40% since 2014. It continues to be the second most frequently observed species in the pond, after Robbin’s pondweed.

Crystal Pond: Tapegrass (*Vallisneria americana*)

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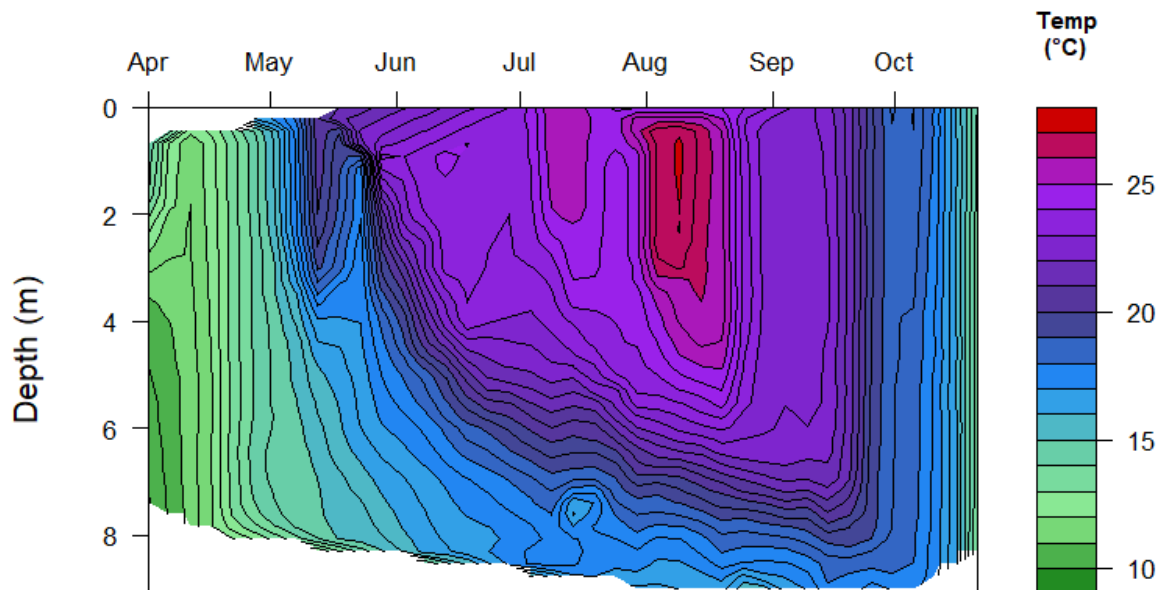
Tapegrass (*Vallisneria americana*) has remained at or below 15% frequency every year. It has been consistently the densest at the northeastern end of the pond. It has slowly expanded into the southern end of the pond since 2015. Tapegrass appears to be increasing in abundance throughout the lake, with a possible doubling in frequency of occurrence between 2011 and 2021.

Appendix

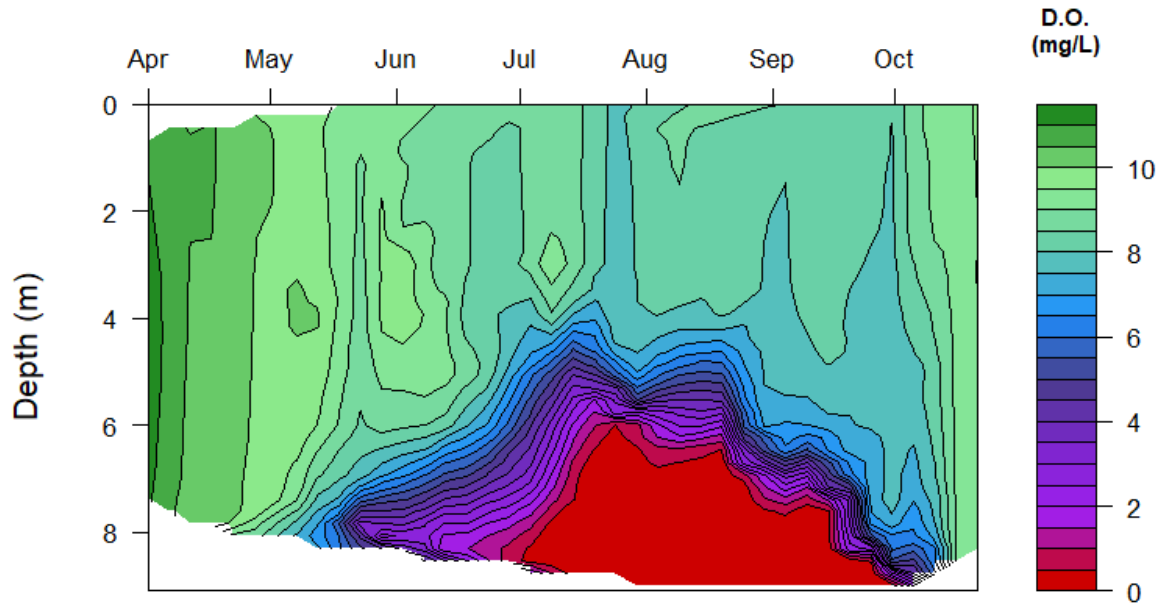
Connecticut DEEP Trophic Categories and Ranges of Indicator Parameters.

Category	T. Phosphorus (ppb)	T. Nitrogen (ppb)	Secchi Depth (m)	Chlorophyll <i>a</i> (ppb)
Oligotrophic	0 -- 10	2 -- 200	6 +	0 -- 2
Oligo-mesotrophic	10 -- 15	200 -- 300	4 -- 6	2 -- 5
Mesotrophic	15 -- 25	300 -- 500	3 -- 4	5 -- 10
Meso-eutrophic	25 -- 30	500 -- 600	2 -- 3	10 -- 15
Eutrophic	30 -- 50	600 -- 1000	1 -- 2	15 -- 30
Highly Eutrophic	50 +	1000 +	0 -- 1	30 +

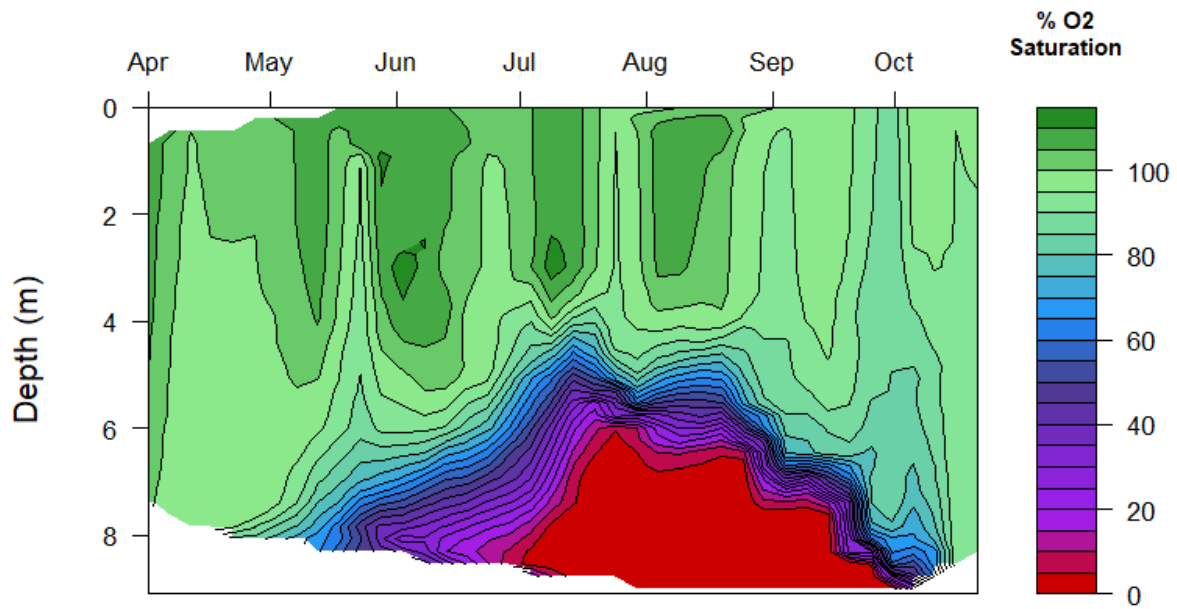
Crystal Pond 2021 Temperature Isoleth at the Deep Station.



Crystal Pond 2021 Dissolved Oxygen Isopleth at the Deep Station.



Crystal Pond 2021 Percent Oxygen Saturation Isopleth at the Deep Station.



Map of Inlet Locations.

