The Connecticut
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Department of
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Mamanasco Lake

Ridgefield, CT

Aquatic vegetation survey
Water chemistry
Aquatic plant management options

2016

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Connecticut Agricultural Experiment Station
Department of Environmental Sciences

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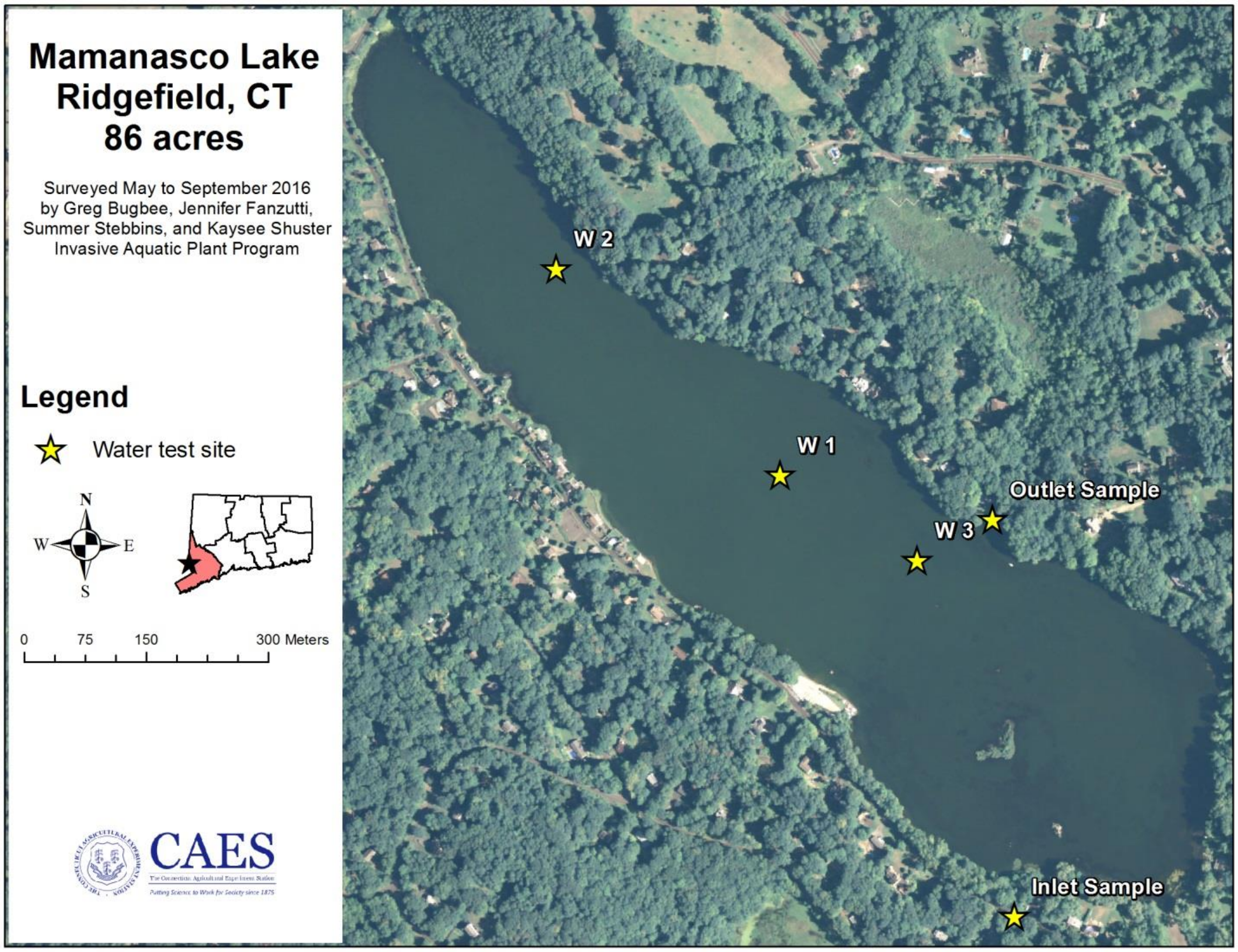


Figure 1. Aerial view of Mamanasco Lake including the locations of our water test sites.

Introduction

Mamanasco Lake is an 86 acre waterbody located in Ridgefield, CT (Figure 1). It has a maximum depth of 3.3 meters (m) and a mean depth of 2.2 m. The lake's shallow nature and organic-rich sediment makes its entire littoral zone suitable for luxuriant plant growth. This is the third Connecticut Agricultural Experiment Station (CAES) Invasive Aquatic Plant Program (IAPP) survey of Mamanasco Lake's aquatic vegetation and water chemistry. Our first survey in August 2005 was part of the CAES IAPP effort to quantify the extent of Connecticut's invasive aquatic plant problem. We found Mamanasco Lake's vegetation to be mainly Eurasian watermilfoil (*Myriophyllum spicatum*). As part of this initial survey, we set up nine georeferenced transects. Each contained 10 points where plant species, abundance and sediment type were recorded. These points could then be revisited in

Figure 2. CAES IAAP aquatic plant surveyors Jennifer Fanzutti (left) and Greg Bugbee (right).

future years to quantify changes. Water clarity, dissolved oxygen and temperature profiles were also recorded and water samples were tested for pH, alkalinity, conductivity and total phosphorus. Mamanasco Lake was determined to be a shallow eutrophic waterbody prone to nuisance vegetation problems. The lake was resurveyed by CAES IAPP in 2012 using identical protocols. Eurasian watermilfoil was found to be extremely sparse and more native species were present. It was presumed that the changes in the composition of aquatic plant species were due to ongoing nuisance plant management particularly herbicide applications. Nuisance plant management practices performed in Mamanasco Lake in past years included herbicide applications but details were not available for this report. Our 2016 surveillance was more extensive than in previous years and consisted of complete vegetative surveys in May and September, as well as monthly water sampling from three in-lake sites and a site at the lake's inlet and outlet.

Objectives:

- Survey Mamanasco Lake for aquatic vegetation and compare with previous surveys to provide information on aquatic plants for improved management.
- Test water on a monthly basis from the lakes inlet, outlet, surface, and bottom to quantify water chemistry and sources of nutrients.

Materials and Methods:

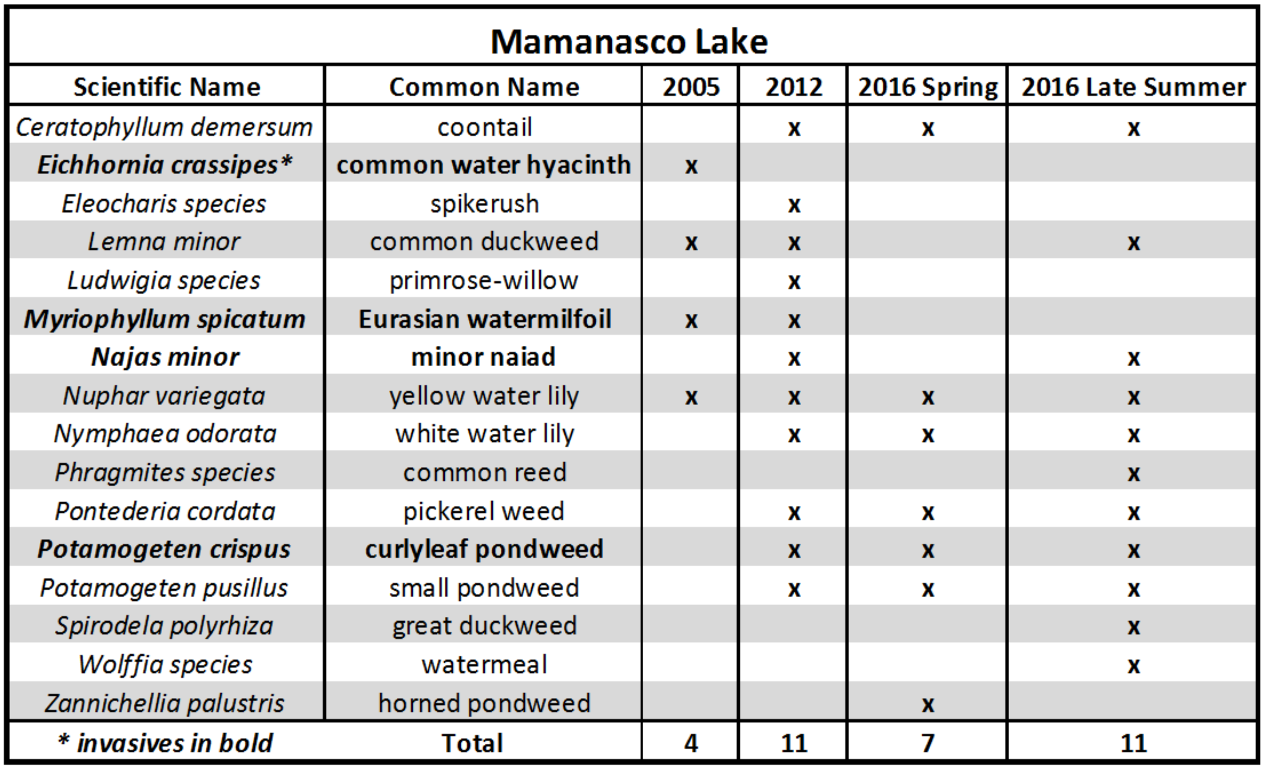
Aquatic plant surveys and mapping:

We surveyed Mamanasco Lake for aquatic vegetation from May 24 - 25, 2016 and again from September 9 - 21, 2016. Surveys were conducted from small boats traveling over areas shallow enough to support aquatic plants (Figure 2). Plant species were recorded based on visual observation or collections with a long-handled rake or grapple. Quantitative information on plant abundance was obtained from nine transects that were positioned perpendicular to the shoreline. These were the same transects as surveyed in 2005 and 2012. Transects were set using Trimble® global positioning systems with sub-meter accuracy. Transect locations represented the variety of habitat occurring in the lake. Sampling locations were along each transect at points 0, 5, 10, 20, 30, 40, 50, 60, 70, and 80 m from the shore. Abundances of species present at each point were ranked on a scale of 1 – 5 (1 = very sparse, 2 = sparse, 3 = moderately abundant, 4 = abundant; 5 = extremely abundant). One specimen of each species collected in each lake were dried, and mounted in the CAES aquatic plant herbarium and digitized mounts can be viewed online (www.ct.gov/caes/iapp).

Water Analysis:

Water was analyzed from five sites at the end of each month from May to September. Three sites (W1, W2, and W3) were located in the deepest parts of the lake (Figure 1). Another site was located at the inlet stream just prior to it entering the lake and another was located in the outlet stream just outside the lake. Site W1 was the original site set up during our 2005 survey. Water temperature and dissolved oxygen were measured at the in-lake sites at depths of 0.5, 1 and 2 m. We obtained water samples at 0.5 m below the surface and 0.5 m above the bottom. Sample size was 250-mL and all samples were stored at 38°C until analyzed for pH, alkalinity, conductivity, and total phosphorus. A Fisher AR20® meter was used to determine pH and conductivity. Alkalinity (expressed as mg/l $CaCO_3$) was quantified by titration with 0.016 N H_2SO_4 to an end point of pH 4.5. We determined total phosphorus using the ascorbic acid method preceded by digestion with potassium persulfate (APHA, 1995). Phosphorus was quantified using a Milton Roy Spectronic 20D® spectrometer with a light path of 2 cm and a wave length of 880 nm. Water was tested for temperature and dissolved

Table 1. Plants present in Mamanasco Lake in 2005, 2012 and 2016



Mamanasco Lake					
Scientific Name	Common Name	2005	2012	2016 Spring	2016 Late Summer
Ceratophyllum demersum	coontail		x	x	x
Eichhornia crassipes*	**common water hyacinth**	x			
Eleocharis species	spikerush		x		
Lemna minor	common duckweed	x	x		x
Ludwigia species	primrose-willow		x		
Myriophyllum spicatum	**Eurasian watermilfoil**	x	x		
Najas minor	**minor naiad**		x		x
Nuphar variegata	yellow water lily	x	x	x	x
Nymphaea odorata	white water lily		x	x	x
Phragmites species	common reed				x
Pontederia cordata	pickerel weed		x	x	x
Potamogeten crispus	**curlyleaf pondweed**		x	x	x
Potamogeten pusillus	small pondweed		x	x	x
Spirodela polyrhiza	great duckweed				x
Wolffia species	watermeal				x
Zannichellia palustris	horned pondweed			x	
**** invasives in bold***	**Total**	**4**	**11**	**7**	**11**

oxygen using an YSI 58® meter. Water clarity was measured by lowering a six inch diameter black and white Secchi disk into the water and determining to what depth it could be viewed. Where mean water data are reported significant differences are determined the by +/- one standard error of the mean (SEM).

Results and Discussion

General Aquatic Plant Surveys

Our spring 2016 survey of Mamanasco Lake found a total of seven plant species (Table 1). With the exception of curlyleaf pondweed (*Potamogeton crispus*) all were native. Unfortunately, curlyleaf pondweed dominated the lake (Figure 6). This is not unusual as this plant has a competitive advantage over other plants by starting its growth cycle in the fall, peaking in abundance in late spring, and then senescing. Small pondweed (*Potamogeton pusillus*) covered nearly the same area as curlyleaf pondweed but was less abundant and occurred at slightly deeper depths (Figure 3). Other natives plants commonly found in our spring survey were coontail (*Ceratophyllum demersum*) (Figure 3) and

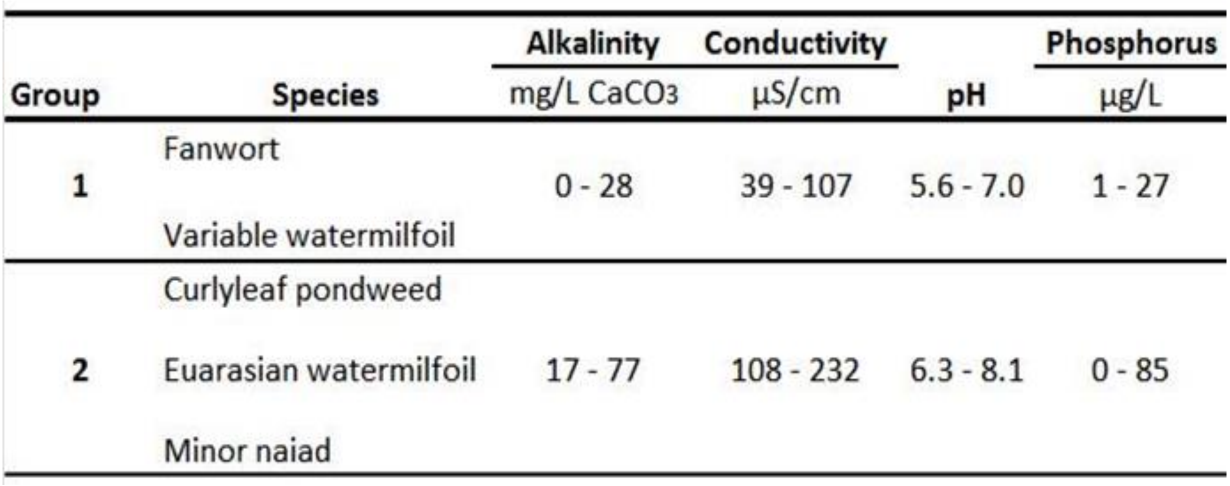
Figure 3. Coontail (left) and small pondweed (right) in Mamanasco Lake, 2016.

Figure 4. Algal blooms in Mamanasco Lake - May 24, 2016 (Left) August 29, 2016 (Right).

horned pondweed *(Zannichellia palustris)*. Both were found in patches in the southern and northern ends of the lake and near the boat launch.

Our 2016 late summer survey found a shift in the plant community (Figure 6) and the remnants of summer filamentous algal blooms (Figure 4). We found large patches of invasive minor naiad (*Najas minor*) particularly in the southern portion and very little curlyleaf pondweed. This is similar to what we observed in our 2012 survey (Figure 7). We saw a decrease in the coverage of small pondweed from spring to late summer with small patches located mainly in the southern portion of the lake. We also saw an overall decrease in small pondweed coverage between our 2012 and 2016 late summer

Table 2. Water chemistry preferences of invasive plants in Connecticut lakes.



Group	Species	Alkalinity mg/L CaCO3	Conductivity µS/cm	pH	Phosphorus µg/L
1	Fanwort Variable watermilfoil	0 - 28	39 - 107	5.6 - 7.0	1 - 27
2	Curlyleaf pondweed Euarasian watermilfoil Minor naiad	17 - 77	108 - 232	6.3 - 8.1	0 - 85

survey. This could be attributed to the extensive filamentous algal blooms blocking sunlight to the vegetation below. We saw an increase in coontail during our late summer survey including larger patches at either end of the lake and smaller patches scattered elsewhere. The coverage of coontail found in our 2016 survey was very similar to our 2012 survey.

Invasive Eurasian watermilfoil (*Myriophyllum spicatum*) was not found in our 2016 surveys. This is remarkable given the extensive coverage of Eurasian watermilfoil documented by CAES IAPP in 2005 (Figure 8). We did note a drastic decline of Eurasian watermilfoil in 2012 that was likely an indication of its apparent elimination in 2016. Reasons for this may include herbicide applications, other management practices, and/or some kind of natural control that may include insect or disease (Madsen et al. 1991). The Eurasian watermilfoil decline and resulting decrease in completion for resources may also explain the increase in native species in Mamanasco Lake from only four in 2005 to 11 in 2016.

Water Chemistry

CAES IAPP has found that the occurrence of invasive plants in lakes can be attributed to specific water chemistries (June-Wells et al. 2013). For instance, lakes with higher alkalinities and conductivities are more likely to support Eurasian watermilfoil, minor naiad and curlyleaf pondweed while lakes with lower values support fanwort (*Cabomba caroliniana*) and variable watermilfoil (*Myriophyllum heterophyllum*) (Table 2). Invasive zebra mussels (*Dreissena polymorpha*), a problem in nearby lakes, also prefer water in the former category. Water chemistry may be altered when nutrients are utilized

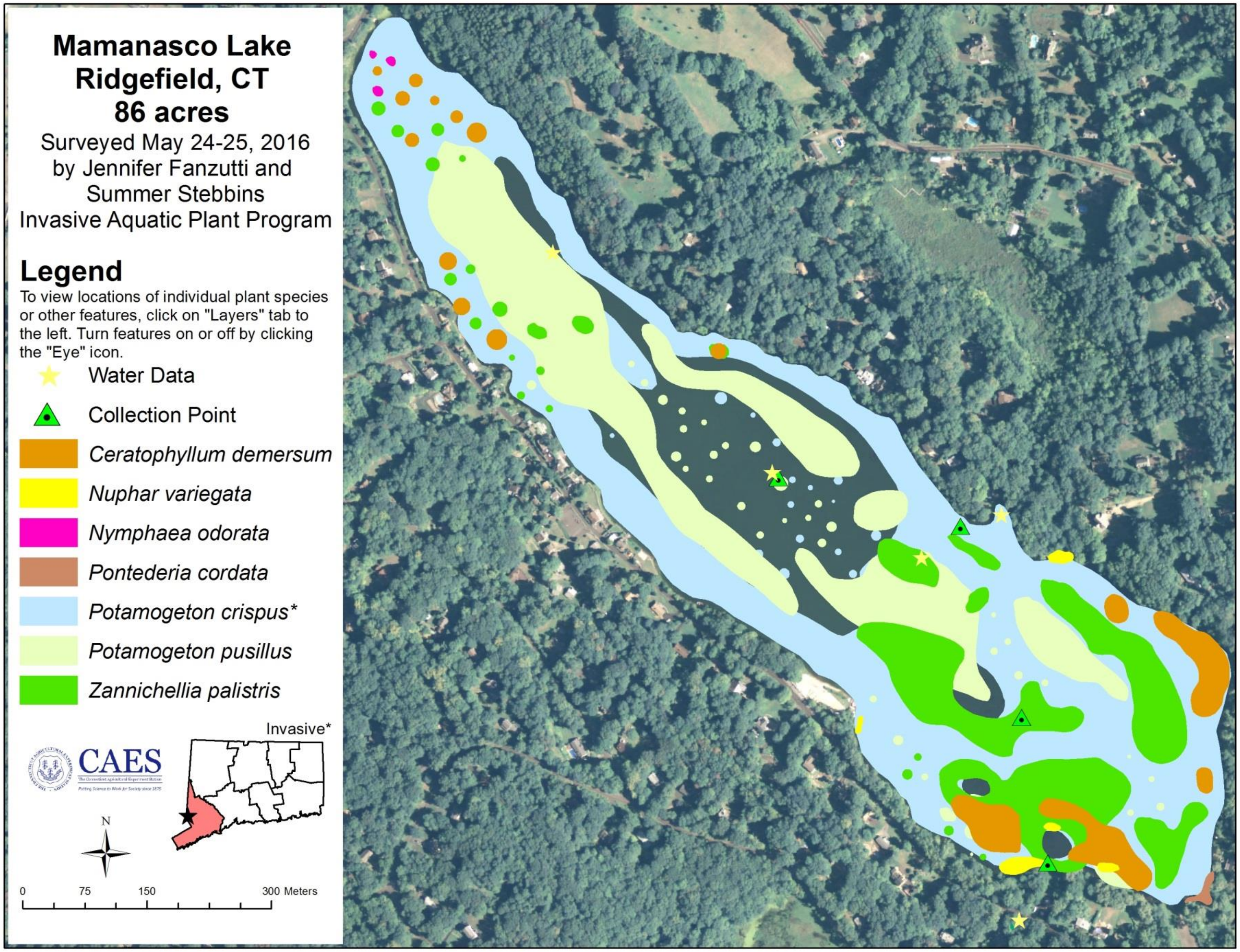


Figure 5. Spring 2016 survey of Mamanasco Lake.

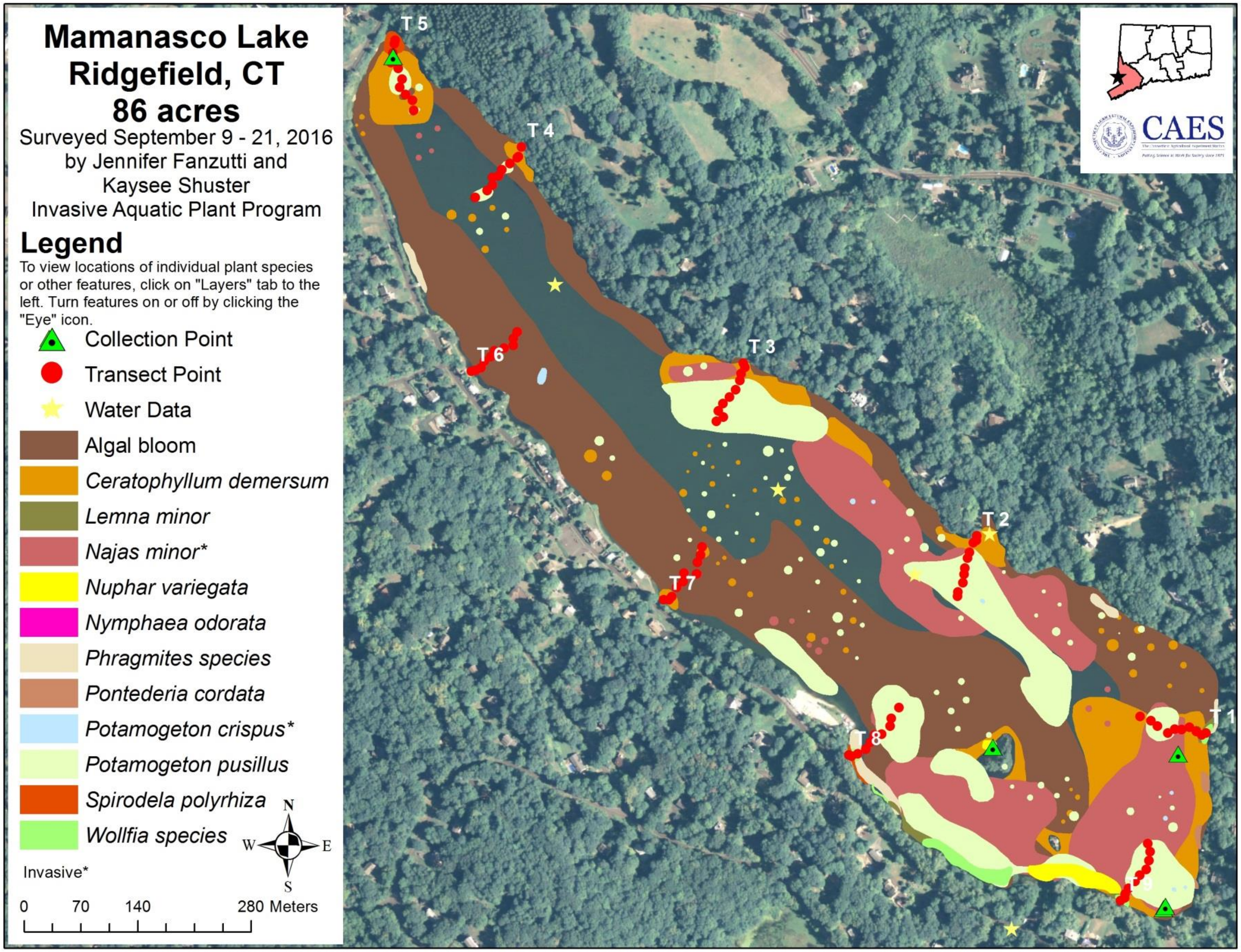


Figure 6. Late summer 2016 survey of Mamanasco Lake.

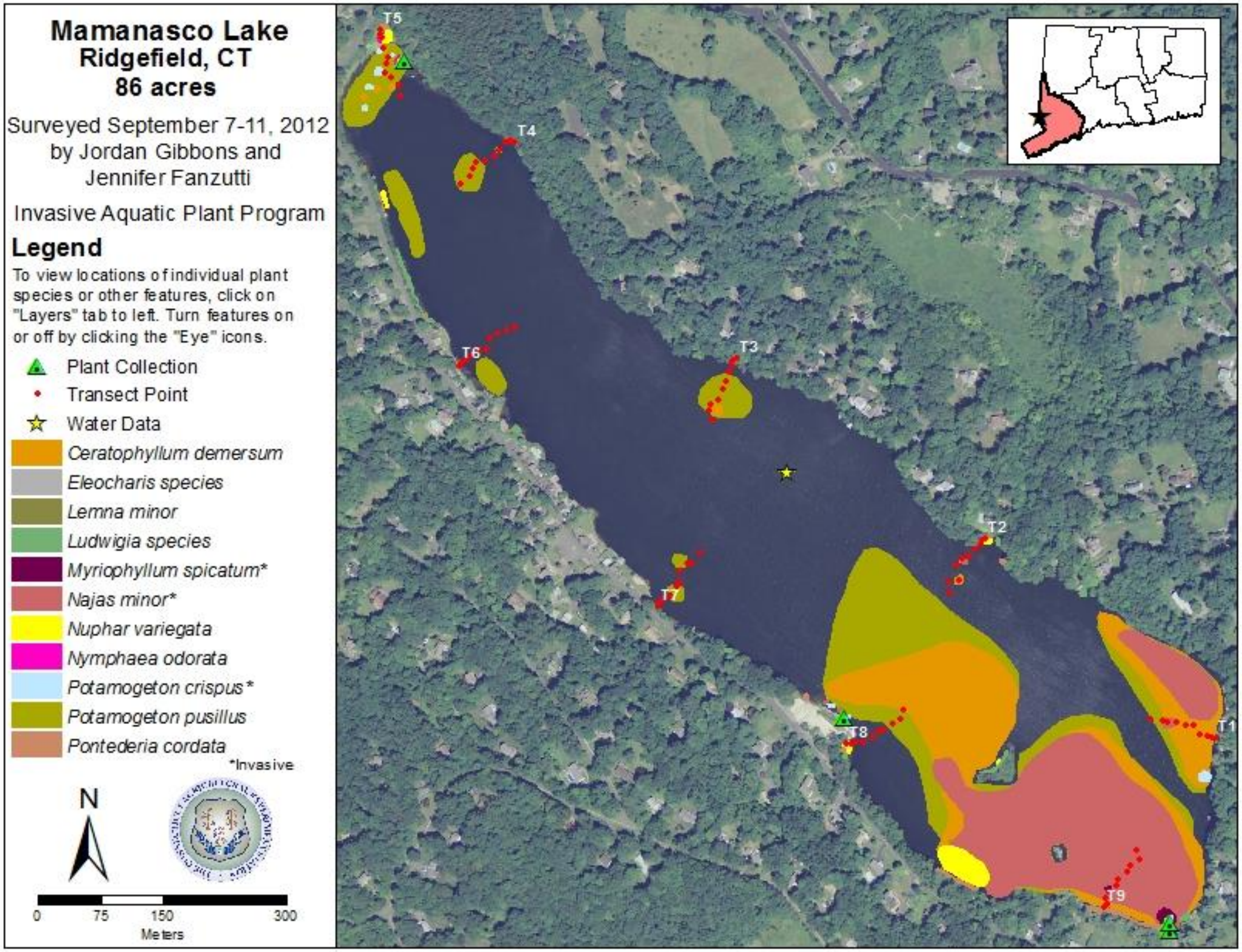


Figure 7. 2012 survey of Mamanasco Lake.

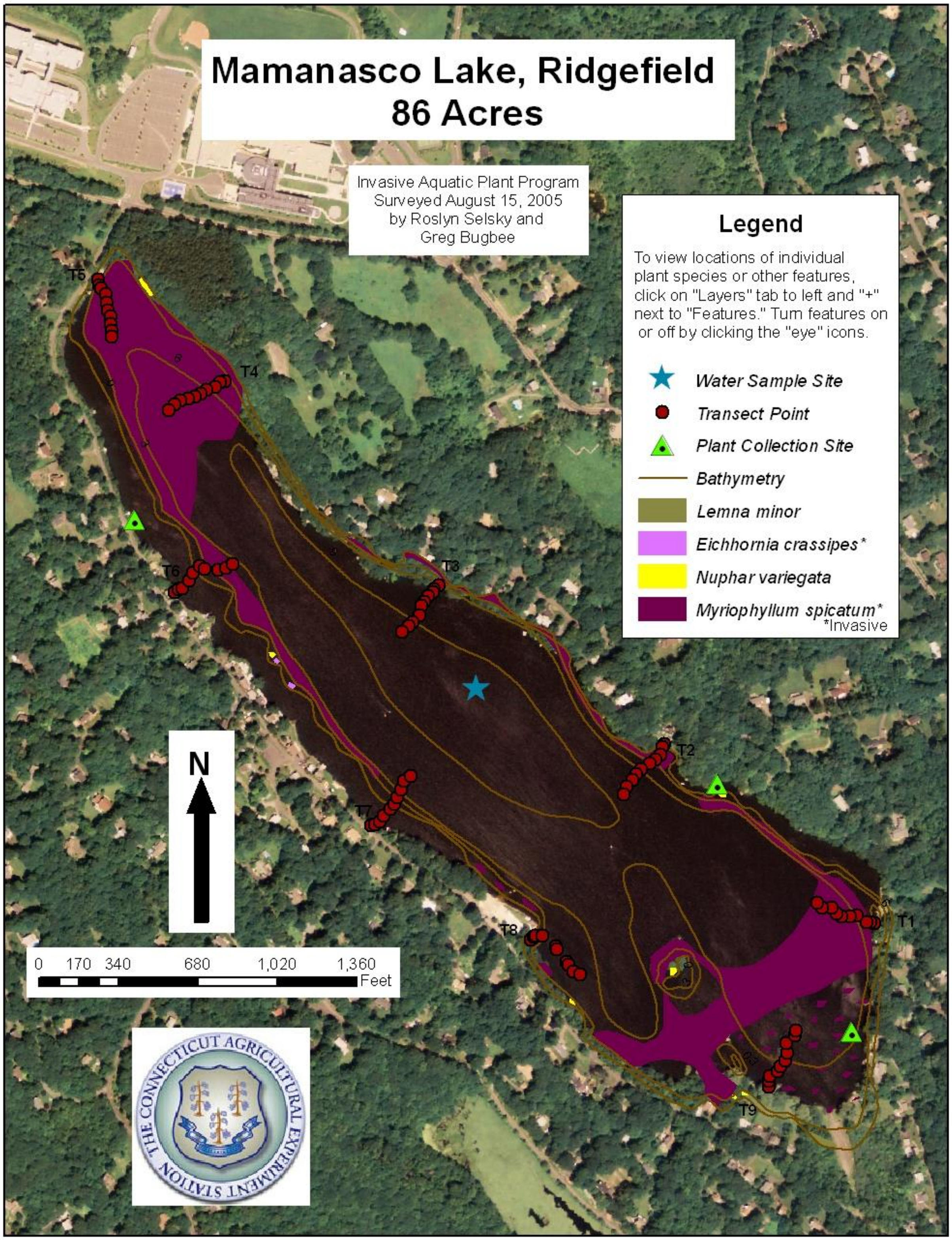


Figure 8. 2005 survey of Mamanasco Lake.

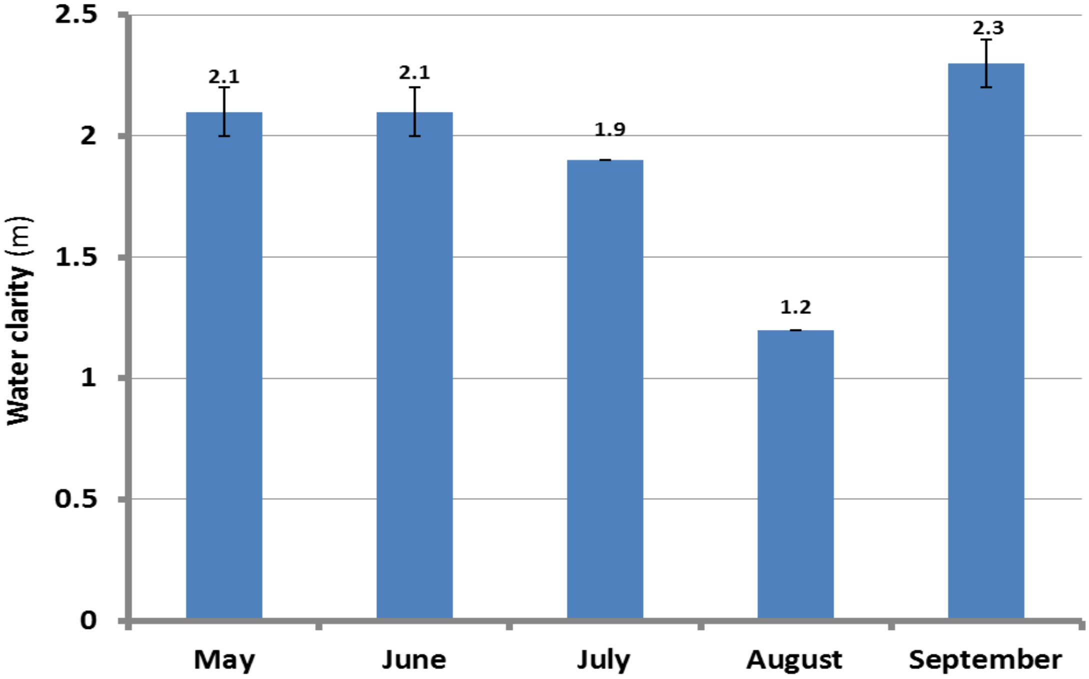


Figure 9. Water clarity in Mamanasco Lake in 2016. Error bars equal +/- one standard error of the mean (SEM).

by plants. In addition, nutrients not used by plants can support the occurrence of nuisance algal blooms.

The mean water clarity in Mamanasco Lake (average of W1, W2 and W3) ranged between 1.2 and 2.3 m throughout our 2016 surveys with a mean water clarity of 1.9 m (Figure 9). September was the clearest month with 2.3 m mean water clarity and August was the least clear with a 1.2 m water clarity. Water clarities in Connecticut's lakes ranged from 0.3 - 10 m with an average of 2.3 m (CAES IAPP, 2017). Thus, the water clarity of Mamanasco Lake ranks slightly below average.

A key parameter used to categorize a lake's trophic state is the concentration of phosphorus (P) in the water column. High levels of P can lead to nuisance or toxic algal blooms (Frink and Norvell 1984, Wetzel 2001). Rooted macrophytes are considered to be less dependent on P from the water column as they obtain a majority of their nutrients from the hydrosoil (Bristow and Whitcombe 1971). Lakes with P levels from 0 - 10 µg/L are considered nutrient-poor or oligotrophic. When P concentrations reach 15 - 25 µg/L, lakes are classified as moderately fertile or mesotrophic and when P reaches 30 - 50 µg/L they are considered fertile or eutrophic (Frink and Norvell, 1984). Lakes with P concentrations over 50 µg/L are categorized as extremely fertile or hypereutrophic. The mean monthly P

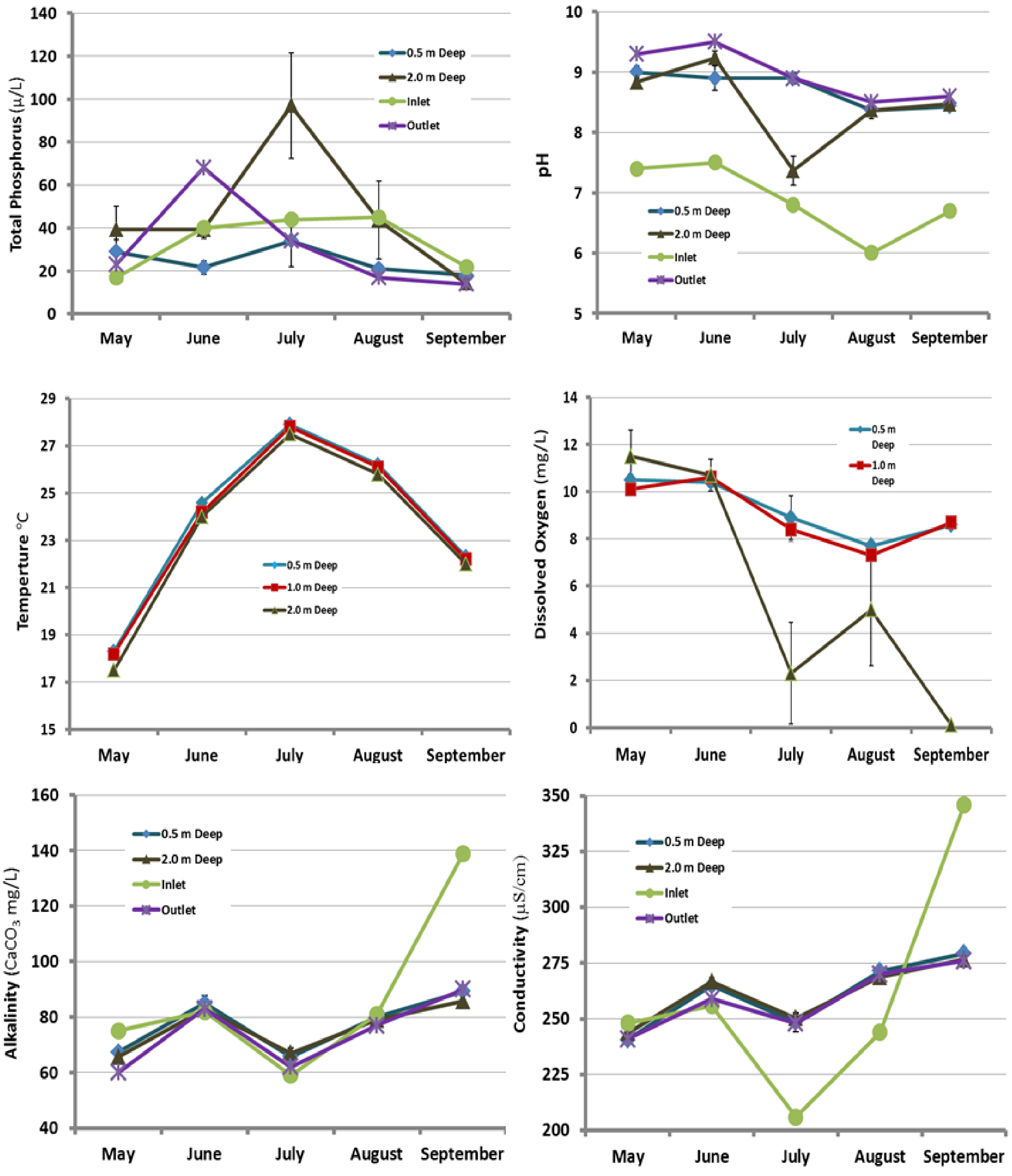


Figure 10. Water chemistry in Mamanasco Lake in 2016. Error bars equal +/- one standard error of the mean (SEM).

Figure 11. Zebra mussels in Lake Lillinonah.

concentration in Mamanasco Lake ranged from 18 - 34 µg/L at the surface to 14 - 97 µg/L at the bottom (Figure 10, top left). In mid-summer (July) the bottom water peaked to a mean P concentration of 97 µg/L and then rapidly declined. This mid-summer P increase is common in the summer as anoxic conditions release P from the sediment (Norvell, 1974).

The shallow nature of the lake likely promotes substantial vertical mixing of P to the surface where it is utilized by plants and algae. As a consequence, this removal of P by lake biota likely reduces the levels of P found by our tests. P concentrations in the lakes inlet stream were lowest in May and September (near 20 µg/L) and highest in the summer months (near 40 µg/L). Summer flow rates were minimal and significant P additions from the inlet are unlikely. With the exception of the June test, the outlet stream had P concentrations lower than the inlet. This is not unusual as lakes can act as biofilters to remove nutrients. These nutrients often end up in the sediment where they can be released in the future. Our 2016 water testing suggests that seasonal internal loading is a major source of nutrients that fuel plants and algae in Mamanasco Lake.

Temperature profiles in Mamanasco Lake ranged from 18 - 28 ^{o} C on a seasonal basis with little difference between surface and bottom (Figure 10, middle left). This was probably because of wind mixing the shallow lake. Conversely, dissolved oxygen (Figure 10, middle right) showed substantially

Figure 12. Dry dredging a small lake in Guilford, Connecticut.

more stratification with low oxygen in the bottom water in July and September (mean 2.3 and 0.1mg/L respectively). Low oxygen levels near the bottom can release phosphorus from the sediment and enrich the lake. Surface oxygen levels remained high in all surveyed months (7.7 - 10.5 mg/L).

The pH of Mamanasco Lake's surface and bottom water ranged between 8.4 and 9.2 with little depth differences (Figure 10, top right). The lowest pH's were in the inlet stream where they ranged from 6.0 – 7.5. Higher lake water pH is consistent with daytime removal of carbon dioxide by algae and aquatic plants.

The alkalinity and conductivity for Connecticut lakes average near 22 mg/L CaCO3, 7.0 and 95 us/cm, respectively (CAES IAPP 2017). Mean alkalinity in Mamanasco Lake ranged from 66 - 89 mg/L in 2016 with the lowest levels in May (Figure 10, bottom left). Surface and bottom alkalinities were similar in all months. Inlet and outlet alkalinities generally mirrored the lake with the exception of the September inlet which had the highest alkalinity of any test (139 mg/L).

Conductivity is an indicator of dissolved ions that come from natural and man-made sources (mineral weathering, organic matter decomposition, fertilizers, septic systems, road salts, etc.). The conductivities of Mamanasco Lake were similar throughout the season at the surface and bottom falling within a narrow range of 248 - 279 *us*/cm. These alkalinities rank Mamanasco Lake among the highest in Connecticut (CAES IAPP, 2017).

Mamanasco Lake's alkalinity, conductivity and phosphorus levels clearly categorize the lake as highly susceptible to invasion from curlyleaf pondweed, Eurasian watermilfoil, and minor naiad (June-Wells et al. 2013). Zebra mussels are currently present in the Housatonic River and associated lakes (Figure 11). Mamanasco Lake's water chemistry makes it a prime candidate for zebra mussel invasion.

Aquatic vegetation management options:

Managing nuisance aquatic vegetation in Mamanasco Lake will be challenging because the lake is shallow with nutrient-rich sediment. Controlling the vegetation alone will likely create unacceptable nuisance algal blooms. The best option would be to deepen the lake by dry dredging (Figure 12). This is usually prohibitively expensive unless a market is available for the sediment and any sand and gravel beneath. In the 1980's and 90's this was successfully accomplished in several lakes in Guilford CT at virtually no cost to the lake owners. Dry dredging is particularly disruptive to residents and lake ecology because the lake may be without water for years. The permitting process for dredging through the Connecticut Department of Energy and Environmental Protection (CTDEEP), the United States Army Corp of Engineers and the town is lengthy.

Harvesting or mechanical removal has the benefit of providing immediate control but problems include rapid regrowth, finding suitable disposal sites and spreading of weeds by fragmentation (Cooke et al., 2005). Weeds like milfoil (Madsen, et al, 1988) and fanwort spread by the rooting of broken pieces. Harvesting practices can distribute the weed throughout a lake. These weeds also have strong root systems that will cause regrowth. Usually, harvesting needs to be done each year. Early season harvesting of curlyleaf pondweed could remove the propagules (primarily turions) that support future growth.

Herbicides can be effective in controlling unwanted aquatic vegetation and algae but they rarely result in long-term control. Aquatic herbicide use requires permits from the CTDEEP (CTDEEP 2005). Currently Mamanasco Lake has a severe curlyleaf pondweed problem as well as problems with mat forming algae. Some of these mats have been identified as *Microseira wollei* (GreenWater Laboratories, 2016) which is extremely difficult to control with existing algaecides. CAES IAPP has done extensive testing of early season herbicide treatments to control curlyleaf pondweed. When diquat (Reward®)was applied in April in consecutive years, curlyleaf pondweed was controlled and native species were enhanced. This strategy may be effective for Mamanasco Lake. Controlling algal mats like *Microseira wollei* is likely to be a challenge as their filaments are nearly impervious to most algaecides. Offering the best hope are algaecides containing chelated copper and a surfactant (Cutrine Ultra® etc.) applied prior to mat development and routinely thereafter.

Although efforts are underway to find biological controls for nuisance aquatic vegetation, breakthroughs have been limited. Plant-eating fish, called grass carp *(Ctenopharyngodon idella)* can effectively reduce the populations of certain aquatic weeds. Often it is an “all or nothing” procedure where too few are introduced to have much of an effect or too many are introduced and both nuisance and desirable vegetation are eliminated. The introduction of grass carp into Connecticut lakes requires approval by the CTDEEP. Often these fish are considered inappropriate because their feeding is not selective and desirable plants can be eliminated. All lake inlets and outlets usually need to be screened to prevent movement of the fish. These screens must be CTDEEP approved and cannot interfere with the flow of water or the integrity of the dam. The screen must be kept free of debris to prevent flooding. Grass carp are not likely to control the problem algal mats in Mamanasco Lake and may promote them by releasing nutrients formerly tied up by aquatic vegetation. CAES has worked with officials from the United Sates Department of Agriculture to find new plant pathogens and insects that control nuisance aquatic plants with little success.

Conclusions

The shallow nature and fertile sediment of Mamanasco Lake makes it prime habitat for aquatic vegetation and algae. Eleven plant species occurred in the lake in 2016 with curlyleaf pondweed and minor naiad being invasive. Curlyleaf pondweed is the biggest problem in the spring while algal mats and native species like small pondweed become a nuisance in the summer. Long-term control can best be accomplished by dry dredging although this is often not practical unless the sediment and under burden can be sold. Lake Mamanasco is an alkaline eutrophic lake that is likely receiving most of its nutrients from internal loading. Without sediment removal this is unlikely to change. The lakes water chemistry makes it highly suitable for invasive curlyleaf pondweed, Eurasian watermilfoil and minor naiad. Zebra mussels will also be well suited to this lake. The apparent elimination of Eurasian watermilfoil from Mamanasco Lake where it dominated the plant community in our 2005 survey is remarkable.

Acknowledgments

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Summer Stebbins

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Appendix

Secchi water clarity, dissolved oxygen and temperature of Mamanasco Lake 2016

Date	May			June			July			August			September		
Location	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
Secchi (m)	2.0	2.3	2.0	2.0	2.3	2.1	1.9	1.9	1.9	1.2	1.2	1.2	2.3	2.1	2.4
Dissolved Oxygen (mg/L) 0.5m	10.3	10.4	10.7	10.1	10.7	10.3	10.7	7.6	8.5	8.2	7.4	7.6	8.6	8.5	8.8
Temperature (°C) 0.5m	18.2	18.4	18.4	24.5	24.6	24.6	27.9	27.9	27.9	26.0	26.3	26.2	22.2	22.2	22.5
Dissolved Oxygen (mg/L) 1m	10.0	9.9	10.5	10.3	11.1	10.3	9.4	7.9	7.8	7.6	6.8	7.6	8.9	8.4	8.7
Temperature (°C) 1m	18.1	18.4	18.2	24.3	24.2	24.2	27.7	27.8	27.8	26.0	26.2	26.0	22.1	22.1	22.3
Dissolved Oxygen (mg/L) 2m	10.4	10.3	13.7	9.4	11.6	11.1	6.6	0.1	0.2	8.0	6.6	0.3	0.0	0.0	0.0
Temperature (°C) 2m	17.6	17.4	17.5	24.0	24.0	24.0	27.5	27.4	27.5	25.7	26.0	25.7	21.9	21.9	22.1

Water chemistry in Mamanasco Lake in 2016

Date	Location	Latitude	Longitude	Depth (m)	Conductivity (µs/cm)	pH	Alkalinity $CaCO_3$ (mg/L)	Phosphorus (ppb)
5/24/2016	1	41.31983	-73.52753	0.5	242	8.9	70	23
	1			2.0	242	8.7	68	34
	2	41.32219	-73.53072	0.5	238	8.9	67	40
	2			2.0	246	8.8	67	60
	3	41.31892	-73.52536	0.5	242	9.2	65	24
	3			2.0	243	9.0	62	24
	Inlet	41.31499	-73.52390	0.5	248	7.4	75	17
	Outlet	41.31939	-73.52422	0.5	241	9.3	60	23
6/22/2016	1	41.31986	-73.52750	0.5	260	8.6	86	27
	1			2.0	263	9.0	85	40
	2	41.32217	-73.53069	0.5	266	9.3	89	22
	2			2.0	269	9.4	77	46
	3	41.31893	-73.52537	0.5	269	8.8	80	16
	3			2.0	268	9.3	86	32
	Inlet	41.31497	-73.52389	0.5	256	7.5	82	40
	Outlet	41.31940	-73.52419	0.0	269	9.5	83	68
7/29/2016	1	41.31993	-73.52766	0.5	240	9.1	65	44
	1			2.0	255	7.7	65	123
	2	41.32220	-73.53068	0.5	253	8.8	66	10
	2			2.0	247	6.9	71	120
	3	41.31850	-73.52509	0.5	252	8.8	65	48
	3			2.0	249	7.5	65	48
	Inlet	41.31941	-73.52423	0.5	206	6.8	59	44
	Outlet	41.31503	-73.52391	0.0	248	8.9	62	34
8/29/2016	1	41.31980	-73.52784	0.5	273	8.3	81	21
	1			2.0	270	8.1	80	79
	2	41.32221	-73.53064	0.5	272	8.3	80	18
	2			2.0	269	8.4	80	33
	3	41.31852	-73.52492	0.5	269	8.5	79	24
	3			2.0	267	8.6	77	19
	Inlet	41.31938	-73.52423	0.5	244	6.0	81	45
	Outlet	41.31499	-73.52390	0.0	270	8.5	77	17
9/21/2016	1	41.31986	-73.52737	0.5	281	8.3	87	16
	1			2.0	276	8.4	85	14
	2	41.32212	-73.53068	0.5	279	8.5	91	20
	2			2.0	278	8.5	86	12
	3	41.31894	-73.52534	0.5	278	8.5	90	18
	3			2.0	276	8.5	86	17
	Inlet	41.31939	-73.52425	0.5	346	6.7	139	22
	Outlet	41.31501	-73.52387	0.0	276	8.6	90	14

CAES IAPP On-Lake Time

On Lake Time	
Date	**(Lead Surveyor)**
5/24/2016	(Jennifer Fanzutti)
5/25/2016	(Jennifer Fanzutti)
6/22/2016	(Jennifer Fanzutti)
7/29/2016	(Jennifer Fanzutti)
8/29/2016	(Jennifer Fanzutti)
9/9/2016	(Jennifer Fanzutti)
9/14/2016	(Jennifer Fanzutti)
9/21/2016	(Jennifer Fanzutti)
8 Days	

Invasive Plant Descriptions

Myriophyllum spicatum


Photo by CAES IAPP

Common name:
Eurasian watermilfoil

Origin:
Europe and Asia

Key features:
Plants are submersed

Stems: Stem diameter below the inflorescence is greater with reddish stem tips

Leaves: Leaves are rectangular with ≥ 12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch (2.5 cm) apart

Flowers: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and have 4 lobed pistil

Fruits/Seeds: Fruit are round 0.08-0.12 inches (2-3 mm) and contain 4 seeds

Reproduction: Fragmentation and seeds

Easily confused species:
Variable-leaf watermilfoil: *Myriophyllum heterophyllum*
Low watermilfoil: *Myriophyllum humile*
Northern watermilfoil: *Myriophyllum sibiricum*
Whorled watermilfoil: *Myriophyllum verticillatum*


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Photo by
CAES IAPP


Photo by CAES IAPP


Photo by
CAES IAPP

Page 20 - Invasive Aquatic and Wetland Plant Identification Guide

Najas minor

Common names:

Minor naiad
Brittle waternymph
Spiny leaf naiad
Eutrophic waternymph

Origin:

Europe

Key features:

Plants are submersed

Stems: Branched stems can grow up to 4-8 inches (10-20 cm) long

Leaves: Opposite and lance shaped on branched stems with easily visible toothed leaf edges and leaves appear curled under, basal lobes of leaf are also serrated, 0.01-0.02 inches (0.3-0.5 mm)

Flowers: Monoecious (male and female flowers on same plant)

Fruits/Seeds: Fruits are purple-tinged and seeds measure 0.03-0.06 inches (1.5-3 mm)

Reproduction: Seeds and fragmentation

Easily confused species:

Other naiads (native): *Najas* spp.

Photo by CAES IAPP

Photo by CAES IAPP

Photos by CAES IAPP

Photo by CAES IAPP

Potamogeton crispus

Common names:

Curly leaf pondweed
Crispy-leaved pondweed
Crisped pondweed

Origin:

Asia, Africa, and Europe

Key features:

Plants are submersed

Stems: Stems are flattened, can form dense stands in water up to 15 feet (5 m) deep

Leaves: Alternate leaves 0.3-1 inches (3-8 cm) wide with wavy edges (similar to lasagna) with a prominent mid-vein

Flowers: Brown and inconspicuous

Fruits/Seeds: Fruit is oval 0.1 inches (3 mm) long

Reproduction: Turions (right) and seeds

Easily confused species:

None


Photo by CAES IAPP

Photo by CAES IAPP


Photo by Leslie J. Mehrhoff


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Potamogeton crispus
Curly pondweed

Transect Data

Mamanasco September Survey

Transect Data

Surveyed by Jennifer Fanzutti
and Kaysee Shuster

Plant abundance is on a scale of 1 - 5: 1 = present but rare (1 plant), 2 = occasional (a few plants), 3 = common (more than a few plants), 4 = abundant, 5 = extremely abundant or dominant							** Follow this link to convert decimal degrees into degrees minutes seconds https://www.fcc.gov/encyclopedia/degrees-minutes-seconds-tofromdecimaldegrees									
Surveyor	Depth (m)	Substrate	Transect	Point	Distance from Shore (m)	Notes	*Ceratophyllum demersum*	*Lemna minor*	*Najas minor*	*Potamogeton crispus*	*Potamogeton pusillus*	*Spirodela polyrhiza*	*Wolffia species*	Date	Longitude	Latitude
Jennifer Fanzutti	0.2	Muck	1	1	0.5	Algae and Phragmites	1	2	0	0	0	0	2	9/21/2016	-73.52104	41.31720
Jennifer Fanzutti	0.4	Muck	1	2	5	Algae and Phragmites	4	2	0	0	0	0	2	9/21/2016	-73.52110	41.31719
Jennifer Fanzutti	0.4	Muck	1	3	10	Algae	0	0	0	0	0	0	0	9/21/2016	-73.52118	41.31722
Jennifer Fanzutti	0.4	Silt	1	4	20	Algae	1	0	0	0	0	0	0	9/21/2016	-73.52128	41.31727
Jennifer Fanzutti	1.0	Silt	1	5	30		2	0	5	0	0	0	0	9/21/2016	-73.52140	41.31724
Jennifer Fanzutti	0.5	Silt	1	6	40		2	0	5	0	5	0	0	9/21/2016	-73.52150	41.31724
Jennifer Fanzutti	0.7	Silt	1	7	50		2	0	5	0	2	0	0	9/21/2016	-73.52160	41.31720
Jennifer Fanzutti	0.5	Silt	1	8	60	Chara	0	0	3	0	2	0	0	9/21/2016	-73.52176	41.31728
Jennifer Fanzutti	1.4	Silt	1	9	70	Chara	0	0	3	0	2	0	0	9/21/2016	-73.52185	41.31734
Jennifer Fanzutti	1.5	Silt	1	10	80	Chara	1	0	0	0	0	0	0	9/21/2016	-73.52202	41.31738
Jennifer Fanzutti	0.2	Muck	2	1	0.5	Algae	2	0	0	0	0	0	0	9/21/2016	-73.52444	41.31937
Jennifer Fanzutti	0.7	Muck	2	2	5	Algae	2	0	0	0	0	0	0	9/21/2016	-73.52444	41.31932
Jennifer Fanzutti	1.3	Silt	2	3	10	Algae	0	0	0	0	0	0	0	9/21/2016	-73.52449	41.31929
Jennifer Fanzutti	1.4	Silt	2	4	20	Chara	2	0	4	0	2	0	0	9/21/2016	-73.52455	41.31919
Jennifer Fanzutti	1.5	Silt	2	5	30	Chara	0	0	2	0	4	0	0	9/21/2016	-73.52457	41.31912
Jennifer Fanzutti	1.7	Silt	2	6	40	Chara	0	0	2	0	4	0	0	9/21/2016	-73.52461	41.31901
Jennifer Fanzutti	1.1	Silt	2	7	50		0	0	0	0	2	0	0	9/21/2016	-73.52462	41.31894
Jennifer Fanzutti	1.7	Silt	2	8	60		2	0	0	0	4	0	0	9/21/2016	-73.52464	41.31885
Jennifer Fanzutti	1.8	Silt	2	9	70		4	0	0	1	4	0	0	9/21/2016	-73.52471	41.31875
Jennifer Fanzutti	1.9	Silt	2	10	80		3	0	0	0	1	0	0	9/21/2016	-73.52471	41.31870
Jennifer Fanzutti	0.3	Silt	3	1	0.5	Algae	2	0	0	2	0	0	0	9/21/2016	-73.52790	41.32126
Jennifer Fanzutti	0.4	Silt	3	2	5		1	0	0	0	1	0	0	9/21/2016	-73.52788	41.32122
Jennifer Fanzutti	1.5	Silt	3	3	10	Algae	3	0	2	0	0	0	0	9/21/2016	-73.52793	41.32115
Summer Stebbins	1.7	Silt	3	4	20		1	0	0	0	3	0	0	9/21/2016	-73.52795	41.32107

Surveyor	**Depth (m)**	**Substrate**	**Transect**	**Point**	**Distance from Shore (m)**	**Notes**	***Ceratophyllum demersum***	***Lemna minor***	***Najas minor***	***Potamogeton crispus***	***Potamogeton pusillus***	***Spirodela polyrhiza***	***Wolffia species***	**Date**	**Longitude**	**Latitude**
Jennifer Fanzutti	1.6	Silt	3	5	30		2	0	0	0	3	0	0	9/21/2016	-73.52801	41.32097
Jennifer Fanzutti	1.8	Silt	3	6	40		2	0	0	0	2	0	0	9/21/2016	-73.52810	41.32088
Jennifer Fanzutti	2.0	Muck	3	7	50		3	0	0	0	2	0	0	9/21/2016	-73.52819	41.32081
Jennifer Fanzutti	2.1	Silt	3	8	70		5	0	0	0	2	0	0	9/21/2016	-73.52826	41.32073
Jennifer Fanzutti	2.1	Silt	3	9	70		3	0	0	0	2	0	0	9/21/2016	-73.52819	41.32066
Jennifer Fanzutti	2.1	Silt	3	10	80		0	0	0	0	3	0	0	9/21/2016	-73.52829	41.32061
Jennifer Fanzutti	0.2	Muck	4	1	0.5	Algae	1	0	0	0	0	3	0	9/21/2016	-73.53119	41.32364
Jennifer Fanzutti	0.3	Muck	4	2	5	Algae	2	0	0	0	0	0	0	9/21/2016	-73.53124	41.32353
Jennifer Fanzutti	0.5	Muck	4	3	10	Algae	1	0	0	0	0	0	3	9/21/2016	-73.53125	41.32352
Jennifer Fanzutti	1.4	Muck	4	4	20	Algae	0	0	0	1	2	0	0	9/21/2016	-73.53136	41.32345
Jennifer Fanzutti	1.4	Muck	4	5	30	Algae and Chara	0	0	3	0	3	0	0	9/21/2016	-73.53148	41.32338
Jennifer Fanzutti	1.8	Muck	4	6	40	Chara	0	0	0	0	0	0	0	9/21/2016	-73.53152	41.32332
Jennifer Fanzutti	2.1	Muck	4	7	50	Chara	0	0	0	0	0	0	0	9/21/2016	-73.53161	41.32330
Jennifer Fanzutti	2.0	Silt	4	8	60	Chara	0	0	0	0	0	0	0	9/21/2016	-73.53161	41.32321
Jennifer Fanzutti	2.3	Muck	4	9	70		0	0	2	1	2	0	0	9/21/2016	-73.53169	41.32315
Jennifer Fanzutti	2.3	Silt	4	10	80		4	0	0	0	2	0	0	9/21/2016	-73.53186	41.32307
Jennifer Fanzutti	0.2	Muck	5	1	0.5	Algae	0	2	0	0	0	2	0	9/21/2016	-73.53307	41.32481
Jennifer Fanzutti	0.3	Muck	5	2	5	Algae	0	3	0	0	0	3	0	9/21/2016	-73.53308	41.32477
Jennifer Fanzutti	0.3	Muck	5	3	10	Algae	2	3	0	0	2	3	0	9/21/2016	-73.53310	41.32467
Jennifer Fanzutti	0.3	Muck	5	4	20	Algae	3	0	0	2	0	0	0	9/21/2016	-73.53312	41.32456
Jennifer Fanzutti	0.5	Muck	5	5	30	Algae	2	0	0	0	2	0	0	9/21/2016	-73.53302	41.32450
Jennifer Fanzutti	0.4	Muck	5	6	40	Algae	2	0	0	1	3	0	0	9/21/2016	-73.53296	41.32438
Jennifer Fanzutti	1.0	Muck	5	7	50	Algae	2	0	2	0	2	0	0	9/21/2016	-73.53299	41.32429
Jennifer Fanzutti	1.0	Muck	5	8	60	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53290	41.32421
Jennifer Fanzutti	1.0	Muck	5	9	70	Algae	2	0	0	0	0	0	0	9/21/2016	-73.53280	41.32414
Jennifer Fanzutti	1.0	Muck	5	10	80	Algae	2	0	3	0	2	0	0	9/21/2016	-73.53278	41.32403

Surveyor	Depth (m)	Substrate	Transect	Point	Distance from Shore (m)	Notes	*Ceratophyllum demersum*	*Lemna minor*	*Najas minor*	*Potamogeton crispus*	*Potamogeton pusillus*	*Spirodela polyrhiza*	*Wolffia species*	Date	Longitude	Latitude
Jennifer Fanzutti	0.2	Muck	6	1	0.5	Algae and wetland reeds	0	2	0	0	0	0	2	9/21/2016	-73.53190	41.32115
Jennifer Fanzutti	0.2	Muck	6	2	5	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53184	41.32115
Jennifer Fanzutti	0.5	Muck	6	3	10	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53176	41.32119
Jennifer Fanzutti	1.0	Muck	6	4	20	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53171	41.32126
Jennifer Fanzutti	1.2	Muck	6	5	30		3	0	0	0	0	0	0	9/21/2016	-73.53161	41.32131
Jennifer Fanzutti	1.3	Muck	6	6	40	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53156	41.32138
Jennifer Fanzutti	1.7	Muck	6	7	50		0	0	0	0	0	0	0	9/21/2016	-73.53142	41.32140
Jennifer Fanzutti	1.8	Muck	6	8	60	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53128	41.32143
Jennifer Fanzutti	1.7	Muck	6	9	70	Algae	0	0	0	0	0	0	0	9/21/2016	-73.53129	41.32151
Jennifer Fanzutti	1.9	Organic	6	10	80		2	0	0	0	0	0	0	9/21/2016	-73.53123	41.32159
Jennifer Fanzutti	0.3	Muck	7	1	0.5	Algae	1	0	0	0	0	0	0	9/21/2016	-73.52904	41.31863
Jennifer Fanzutti	0.6	Muck	7	2	5		2	0	0	0	0	0	0	9/21/2016	-73.52896	41.31863
Jennifer Fanzutti	1.5	Silt	7	3	10	Algae	2	0	0	0	0	0	0	9/21/2016	-73.52892	41.31867
Jennifer Fanzutti	1.4	Silt	7	4	20	Algae	0	0	0	0	0	0	0	9/21/2016	-73.52885	41.31877
Jennifer Fanzutti	1.6	Silt	7	5	30	Algae and chara	0	0	0	0	0	0	0	9/21/2016	-73.52875	41.31883
Jennifer Fanzutti	1.9	Silt	7	6	40	Chara	0	0	0	0	2	0	0	9/21/2016	-73.52874	41.31893
Jennifer Fanzutti	2.0	Silt	7	7	50	Chara	4	0	3	0	0	0	0	9/21/2016	-73.52856	41.31892
Jennifer Fanzutti	2.1	Silt	7	8	60	Chara	0	0	0	0	0	0	0	9/21/2016	-73.52855	41.31905
Jennifer Fanzutti	1.4	Silt	7	9	70	Chara	3	0	0	0	2	0	0	9/21/2016	-73.52850	41.31913
Jennifer Fanzutti	2.1	Silt	7	10	80	Chara	2	0	0	0	0	0	0	9/21/2016	-73.52848	41.31922
Jennifer Fanzutti	0.1	Organic	8	1	0.5		2	0	0	0	0	2	2	9/21/2016	-73.52629	41.31693
Jennifer Fanzutti	0.2	Muck	8	2	5	Algae	0	0	0	0	0	3	3	9/21/2016	-73.52625	41.31692
Jennifer Fanzutti	0.3	Muck	8	3	10	Algae	0	0	0	0	0	0	3	9/21/2016	-73.52616	41.31694
Jennifer Fanzutti	0.9	Muck	8	4	20	Algae	0	0	0	0	0	0	0	9/21/2016	-73.52604	41.31699
Jennifer Fanzutti	1.1	Muck	8	5	30	Algae	1	0	0	0	0	0	0	9/21/2016	-73.52598	41.31707
Jennifer Fanzutti	1.3	Muck	8	6	40	Algae	0	0	0	0	0	0	0	9/21/2016	-73.52592	41.31715

Mamanasco September Survey

Transect Data

Surveyed by Jennifer Fanzutti
and Kaysee Shuster

Surveyor	**Depth (m)**	**Substrate**	**Transect**	**Point**	**Distance from Shore (m)**	**Notes**	***Ceratophyllum demersum***	***Lemna minor***	***Najas minor***	***Potamogeton crispus***	***Potamogeton pusillus***	***Spirodela polyrhiza***	***Wolffia species***	**Date**	**Longitude**	**Latitude**
Jennifer Fanzutti	1.5	Muck	8	7	50	Algae	0	0	2	0	3	0	0	9/21/2016	-73.52581	41.31716
Jennifer Fanzutti	1.5	Muck	8	8	60	Chara	0	0	2	0	2	0	0	9/21/2016	-73.52569	41.31725
Jennifer Fanzutti	1.6	Muck	8	9	70	Chara	2	0	4	0	3	0	0	9/21/2016	-73.52567	41.31734
Jennifer Fanzutti	1.2	Muck	8	10	80	Chara	3	0	0	0	5	0	0	9/21/2016	-73.52556	41.31746
Jennifer Fanzutti	0.2	Muck	9	1	0.5	Algae	2	2	0	0	0	0	2	9/21/2016	-73.52228	41.31534
Jennifer Fanzutti	0.4	Muck	9	2	5	Algae and Chara	2	2	0	0	4	0	2	9/21/2016	-73.52221	41.31537
Jennifer Fanzutti	0.6	Muck	9	3	10	Algae	4	0	0	0	0	0	0	9/21/2016	-73.52221	41.31541
Jennifer Fanzutti	0.7	Muck	9	4	20		4	0	3	0	4	0	0	9/21/2016	-73.52216	41.31548
Jennifer Fanzutti	0.7	Muck	9	5	30		4	0	3	0	4	0	0	9/21/2016	-73.52207	41.31555
Jennifer Fanzutti	0.7	Muck	9	6	40		5	0	4	0	2	0	0	9/21/2016	-73.52200	41.31562
Jennifer Fanzutti	0.7	Muck	9	7	50	Algae	5	0	3	0	2	0	0	9/21/2016	-73.52190	41.31569
Jennifer Fanzutti	0.7	Muck	9	8	60	Algae	3	0	3	0	2	0	0	9/21/2016	-73.52186	41.31579
Jennifer Fanzutti	0.7	Muck	9	9	70	Algae	3	0	2	0	2	0	0	9/21/2016	-73.52185	41.31588
Jennifer Fanzutti	1.0	Muck	9	10	80	Algae	4	0	4	0	2	0	0	9/21/2016	-73.52189	41.31597

May 2016 photos of inlet to Mamanasco Lake

July 2016 Small pondweed growing to the surface)

August 2016 algal bloom in Mamanasco Lake (Top) Coontail growing to the surface (bottom)

September 2016 algal bloom in Mamanasco Lake

October 2016 algal bloom in Mamanasco Lake


OCT/14/2016


OCT/14/2016