Cayuga and Seneca Lakes
Macrophyte Monitoring Report, 2025

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Executive Summary

The Finger Lakes PRISM and Finger Lakes Institute prioritize scientific data collection to inform management of freshwater resources in the Finger Lakes region. In 2025, the aquatic invasive species field crew monitored sites on Cayuga and Seneca lakes. Staff also incorporated Early Detection and Rapid Response for emerging invasions, which is key to mitigating outbreaks of invasive species in new locations. They collected data on native and invasive aquatic macrophytes and water quality, which was analyzed for temporal, spatial, and community-level trends. Cayuga Lake sites had a higher volume and diversity of macrophytes than Seneca Lake sites. Both lakes had native and invasive macrophytes. Water quality monitoring revealed differences between the two waterbodies, which may impact species distributions. This report summarizes work from 2025, provides insight into the status of these freshwater ecosystems, and serves as a guide for future decisions about monitoring and targeted management for aquatic invasive species.

Objectives

The Finger Lakes PRISM and Finger Lakes Institute prioritize scientific data collection to inform management of freshwater resources in the surrounding region. Part of this goal includes running an aquatic invasive species (AIS) field crew to perform early detection and rapid response (EDRR) in high-priority areas. EDRR is a tactic used for preventing outbreaks of invasive species in new locations. Through identifying areas of high concern (e.g. near other infestations, lots of foot traffic and boating, previous reports of invasive species), and monitoring those areas with precision, invasive species populations are quickly identified, and management is implemented before ecological and economic consequences increase.

The AIS field crew monitored sites on Cayuga and Seneca Lakes during the 2025 field season. They collected data on native and invasive aquatic macrophytes and water quality, which was analyzed for temporal, spatial, and community-level trends. Understanding the status of macrophyte communities in waterbodies across the Finger Lakes region will provide information about critical habitat for freshwater fish and invertebrates, inform future decisions about macrophyte monitoring sites, and guide targeted management of emerging and established aquatic invasive species.

Methods

Sampling locations

The AIS field crew performed macrophyte surveys at eleven sites during the 2025 field season: six sites on Cayuga Lake and five sites on Seneca Lake (Table 1; Figure 1). Macrophyte sampling sites were selected based on proximity to highly trafficked boat launches or based on proximity to other ongoing environmental sampling projects. The survey areas on Cayuga Lake were centered around public launches to monitor areas with an increased likelihood of AIS transmission. The survey areas on Seneca Lake were centered around private properties where the Finger Lakes Institute was conducting water sampling for nutrient analysis. The macrophyte data collected on Seneca Lake can supplement the nutrient data in future analyses.

The sites were sampled four or five times each in “sampling rounds”. For one lake, a sampling round took approximately two weeks to complete. Seneca Lake sites received four rounds of sampling (June-September), and Cayuga Lake sites received five rounds (June-October). During each visit, the macrophyte community was sampled within a half mile radius (searched area) of a center point.

Table 1. Sampling locations for the AIS field team during the 2025 field season.

Sites	Waterbody	Site abbreviation	# of Sampling rounds
Allan H. Treman State Marine Park	Cayuga Lake	AT	5
Dean's Cove Boat Launch	Cayuga Lake	DC	5
Frontenac Park / Union Springs	Cayuga Lake	FP	5
Mud Lock DEC Boat Ramp	Cayuga Lake	ML	5
Salt Point Boat Launch (Lansing)	Cayuga Lake	LS	5
Sheldrake Boat Launch	Cayuga Lake	SP	5
Emerson Cove	Seneca Lake	EC	4
High Banks	Seneca Lake	HB	4
Pastime Park	Seneca Lake	PT	4
Perry Point	Seneca Lake	PP	4
Roy's Marina/ Cottonwood Cove	Seneca Lake	CC	4

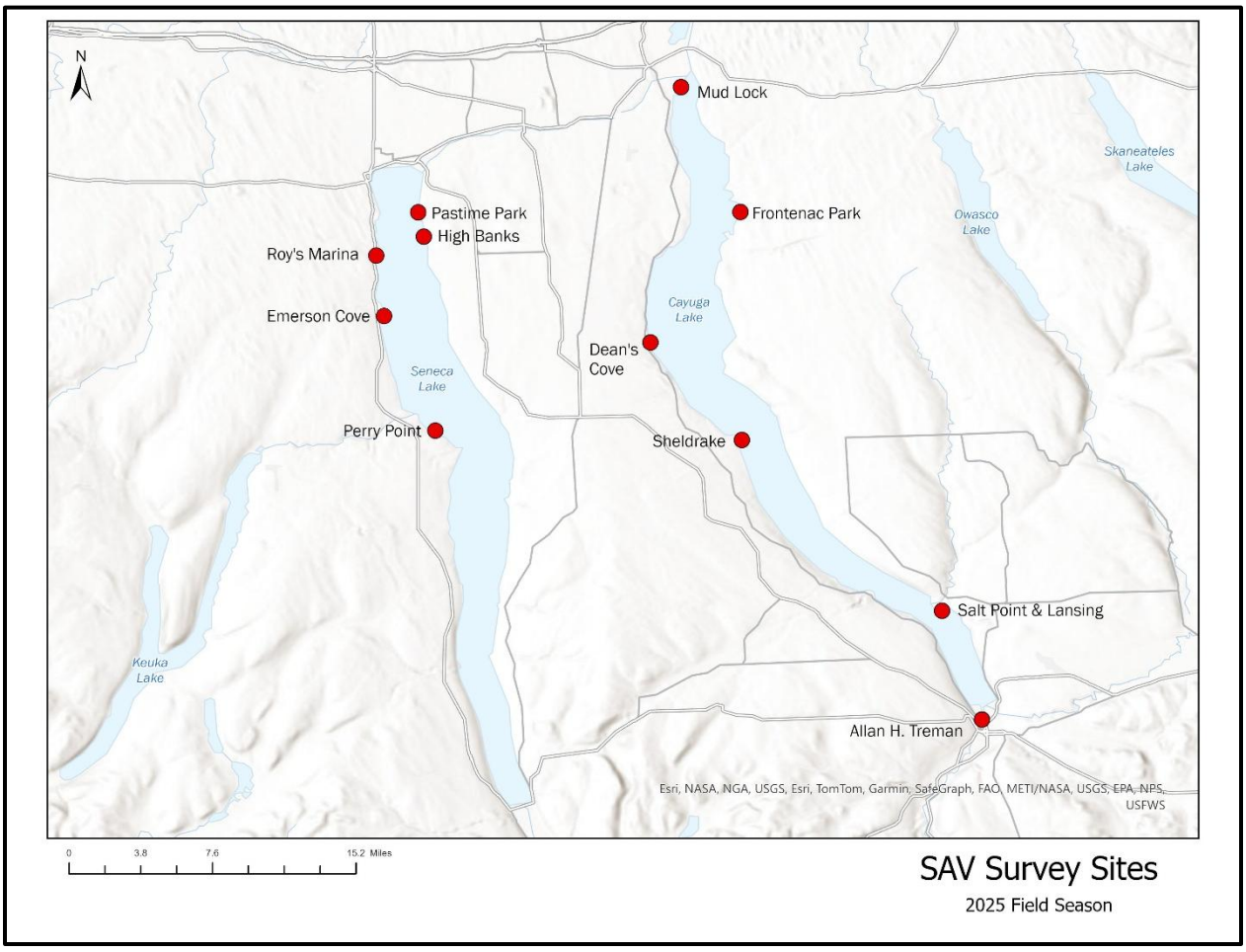


Figure 1. Macrophyte sampling locations on Seneca and Cayuga Lakes for the 2025 field season.

Survey procedure

The field crew worked from kayaks and conducted point intercept sampling of the macrophyte community every 50 meters (m) along transects extending from the shoreline. They used a 50 by 50 m grid on ArcGIS Field Maps as a guide. The number of points sampled per site varied depending on macrophyte abundance, shape of the shoreline, bathymetric profile (samples taken at <10 m depth), number of crew members, weather conditions, and scheduling conflicts. There were 4,124 rake tosses conducted at six sites on Cayuga Lake, across five sampling rounds (Table 3). There were 2,513 rake tosses conducted at five sites on Seneca Lake, across four sampling rounds. There were 589 tosses on average at Cayuga Lake sites and 503 at Seneca Lake sites.

At each point, the field crew marked a "presence point" on Field Maps to indicate confirmed sampling activity and collected coordinates using a handheld GPS unit. Then, using a rake made from two 16-inch garden rakes zip-tied together and tethered to a 10-meter rope, the field crew conducted a rake toss away from the kayak. One rake toss was completed at each point. After tossing to the lake bottom, the rake was dragged along the substrate. The rake was then carefully brought to the surface, and the depth of each point was recorded using the 0.5-meter increments on the rope. Rakes with macrophytes attached were carefully brought into the boat to prevent the loss of vegetation. Based on the quantity of macrophytes attached to the rake, each toss was assigned a density rating on a scale of 0-4: 0 = zero individuals; 1 = trace; 2 = sparse; 3 = moderate; 4 = dense (Table 2). Once in the kayak, the macrophytes were removed from the rake and volume (mL) of vegetation was measured using plastic beakers. Macrophytes were then identified to the genus or species level and sorted into piles based on their identity. Each macrophyte group was assigned a percentage of the total for that toss.

All data collected was recorded on Survey123. Invasive macrophyte presences were reported to the iMap Mobile Advanced (iMMA) layer on Field Maps, which was uploaded to iMapInvasives at the end of the year. Macrophyte community values (richness, diversity, floristic quality index (FQI)) were calculated from this data.

Table 2. Density ratings for vegetation pulled up on rake tosses.

Density Rating	Name	Description
0	Zero	No specimens
1	Trace	A single specimen
2	Sparse	A handful of specimens
3	Moderate	Most of the rake is covered
4	Dense	Rake is completely covered

Water quality sampling

Water quality parameters were measured at select sampling sites on Cayuga Lake (Mud Lock, Dean's Cove, Salt Point, and Sheldrake) for all sampling rounds and all Seneca Lake sites for the last three sampling rounds. Parameters were collected once per sampling round within 50 m of the central point (boat launch or private dock) at each site.

A Eureka Manta RS-232 multi-parameter water quality sonde was utilized for taking vertical profile measurements. The parameters measured included dissolved oxygen (DO), specific conductance (µS/cm), pH, and temperature (°C). A Secchi disk reading (m) was taken to determine the clarity of the water. Selected water quality parameters were examined for relationships with macrophyte data in a correlation analysis.

Results

Macrophyte communities

Cayuga Lake had five recorded invasive species: starry stonewort, Eurasian watermilfoil, curly leaf pondweed, brittle naiad, and hydrilla (Figure 2; Table 4). The most common macrophyte found was starry stonewort followed by American eelgrass. Seneca Lake had four recorded invasive species: starry stonewort, Eurasian watermilfoil, curly leaf pondweed, and brittle naiad (Figure 3; Table 4). The most common macrophyte found on Seneca Lake was American eelgrass followed by filamentous algae. There was a greater amount of total and invasive macrophyte volume across sites on Cayuga Lake compared to Seneca Lake (Figures 4, 5). Cayuga Lake also had a greater proportion of invasive species across sites, with Frontenac Park having the greatest average macrophyte volume per rake toss and Sheldrake having the greatest proportion of invasive species. Distribution maps of native and invasive species at each site are included for reference in the appendix (Figures A1-A12).

There was a total of 21 native macrophyte species found on Cayuga Lake and 18 found on Seneca Lake (Figures 2, 3; Table 4). Mud Lock had the greatest number of native species (n=20) of all sites, and Emerson Cove had the fewest (n=7). Cayuga Lake had an overall native species diversity value (Shannon Index) of 2.10, and Seneca Lake had a value of 1.95 (Figure 4). Floristic Quality Index (FQI), which is higher for sites with more sensitive plants, was 20.06 on Cayuga Lake and 19.07 on Seneca Lake, with Seneca Lake having a broader range of values across sites.

Macrophyte trends

Seasonal trends were explored for native and invasive macrophytes on Cayuga and Seneca Lakes (Figure 6). Both lakes experienced maximum native and invasive volume in August. Cayuga Lake demonstrated a consistent trend of increasing volume from June to August, whereas Seneca lake showed a decrease from June to July before peaking in August. With an additional sampling round for Cayuga sites, there was a second increase in native species volume in October, driven mostly by the high volume of macrophytes at Frontenac Park, while invasive species volume continued to decline.

The relationship between total macrophyte volume and depth from all rake tosses on Cayuga Lake showed greatest macrophyte volume just above 2.5 m (Figure 7). There was a steady increase in total macrophyte volume from 0 to 2.5 m and then a decline from 2.5 to 10 m. On Seneca Lake, the maximum macrophyte volume was found just below 2.5 meters.

A correlation analysis between macrophyte volume and water quality parameters on Cayuga Lake demonstrated that greater water clarity (Secchi depth) was positively associated with invasive species, including starry stonewort and hydrilla (Figure 8). The same correlation analysis for Seneca Lake showed that greater water clarity was negatively associated with some native species, including American eelgrass, coontail and flat stem pondweed, indicating that these species were found less frequently in areas with greater water clarity. The recorded Secchi depths ranged from 1.6 m to 10 (+) m on Cayuga Lake and 2.3 m to 6.1 m on Seneca Lake (Figures 10, 11). Secchi depths generally followed expected seasonal trends, although some sites did not include full-season data. There were also significant negative correlations on Seneca Lake between DO and coontail and chara (Figure 8), meaning that there was greater abundance of these species in areas with lower DO. DO ranged from 8.5 to 9.6 mg/L at Seneca sites and from 8.9 to 10.7 mg/L at Cayuga sites (Table 5). Additionally, conductivity positively correlated with brittle naiad on Cayuga Lake and negatively correlated with filamentous algae on Seneca Lake. Specific-conductance was highest at Mud Lock (772.2 µS/cm) and lowest at Salt Point (460.6 µS/cm) (Figure 9; Table 5). Seneca Lake sites had higher average specific conductance than Cayuga Lake sites, apart from Mud Lock.

Species to species correlations can also be observed in Figure 8, with a greater number of significant correlations observed on Cayuga Lake. Filamentous algae was positively correlated with *Chara* spp., implying that both algae groups may benefit from the same types of conditions. Coontail and American eelgrass seem to perform well alongside most other macrophytes, indicating a potential generalist tendency of these native species. Curly leaf pondweed does not correlate with many macrophyte groups, likely due to its growth peaking earlier in the season than other species.

Discussion and Conclusions

Seneca and Cayuga lakes were found to have different macrophyte communities at select sites in 2025, based on data collected by the Finger Lakes PRISM aquatic invasive species field team. Overall, Cayuga Lake sites had a higher volume of macrophytes and more invasive species. Some of these differences could be attributed to launch type (private or public), sites depths, or water level, among other factors. All invasive macrophytes detected have been recorded previously at the respective waterbodies, meaning no new infestations were discovered during these surveys.

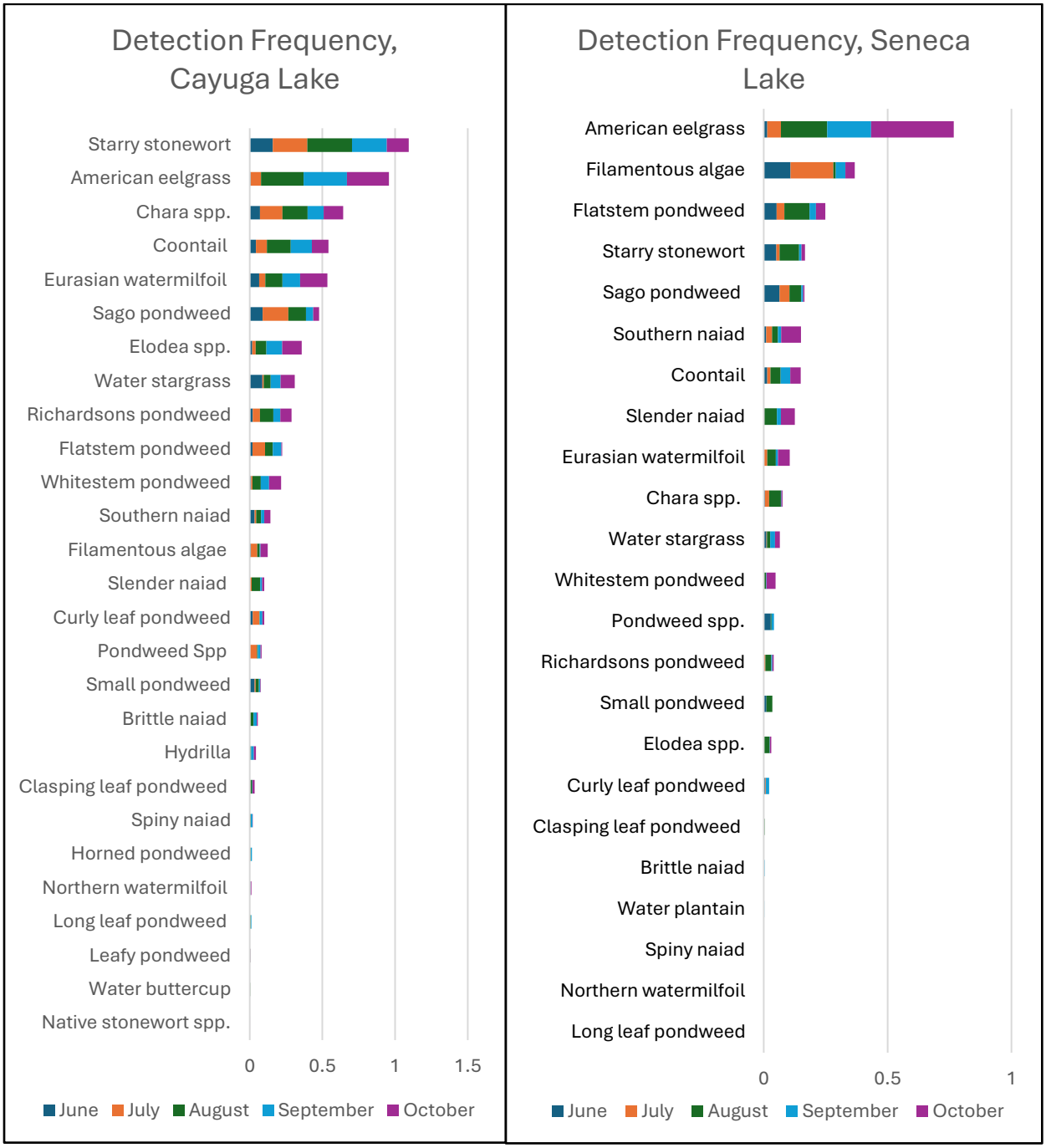
Although the lakes differed in macrophyte communities overall, starry stonewort was the most frequently detected invasive macrophyte and American eelgrass was the most frequently detected native macrophyte on both waterbodies. Starry stonewort is a tier 4 invasive species in the Finger Lakes region, meaning it is widespread. Other studies have explored the impacts and invasive capabilities of starry stonewort (Brainard & Schultz, 2017). Management of this species has proven to be difficult, especially due to its reproductive capacity (Glisson et al, 2020). While there was a significant amount of starry stonewort and other invasives, native species are prevalent and persisting on Cayuga and Seneca lakes at this time. American eelgrass is a

common native species in the area with important ecological functions, and it has been used in aquatic restoration projects in recent years as well (Yoder, 2024).

Through water quality monitoring at these survey sites, it was determined that conductivity, DO, and Secchi depth produced significant correlations with some species. Specific conductance measures the ion content in a waterbody, and high values indicate a saline or anthropogenically impacted system. The high conductivity at Mud Lock aligns with another study by the FLI in 2025 that found high conductivity and nutrients in the Cayuga-Seneca Canal, which is directly connected to Mud Lock. The canal receives water from wastewater treatment plants in Waterloo and Seneca Falls as well as from several tributaries. The trends in conductivity, DO, and Secchi depth across the 2025 survey sites may provide some insight into the community structure of macrophytes in these locations. Water quality parameters should continue to be measured in different Finger Lakes to determine whether correlations with macrophytes are consistent across regional spatial scales and have a significant influence on the establishment of high-priority invasives, such as hydrilla. Hydrilla was frequently observed in low turbidity areas. These types of parameters could be used to predict where invasive species are more likely to establish, and which sites are at greatest risk of invasion.

These findings are from only one year of surveying, and thus only represent a snapshot of the ecosystems. Additionally, there was a significant decrease in water levels in 2025 due to drought conditions, which likely impacted the results of these surveys. Therefore, the results should be analyzed in conjunction with future macrophyte surveys to understand yearly fluctuations and explore long-term trends in the Finger Lakes region. The results will also inform future survey site choice and procedures. For example, the relationship between public and private launch locations may be tested, to determine whether there is a consistent difference in macrophyte communities between launch types. Additionally, the efficiency of sampling procedures based on these findings will be considered, to ensure sampling efforts are maximized while collecting high quality and representative data.

Figures



Figures 2 & 3. Detection frequency of each species found in Cayuga Lake (left; Figure 2) and Seneca Lake (right; Figure 3) from June-October 2025. For each species, total bar length indicates the combined frequencies for which that species came up on a rake toss each month, with colors indicating each month's independent detection frequency (0-1; out of 100%).

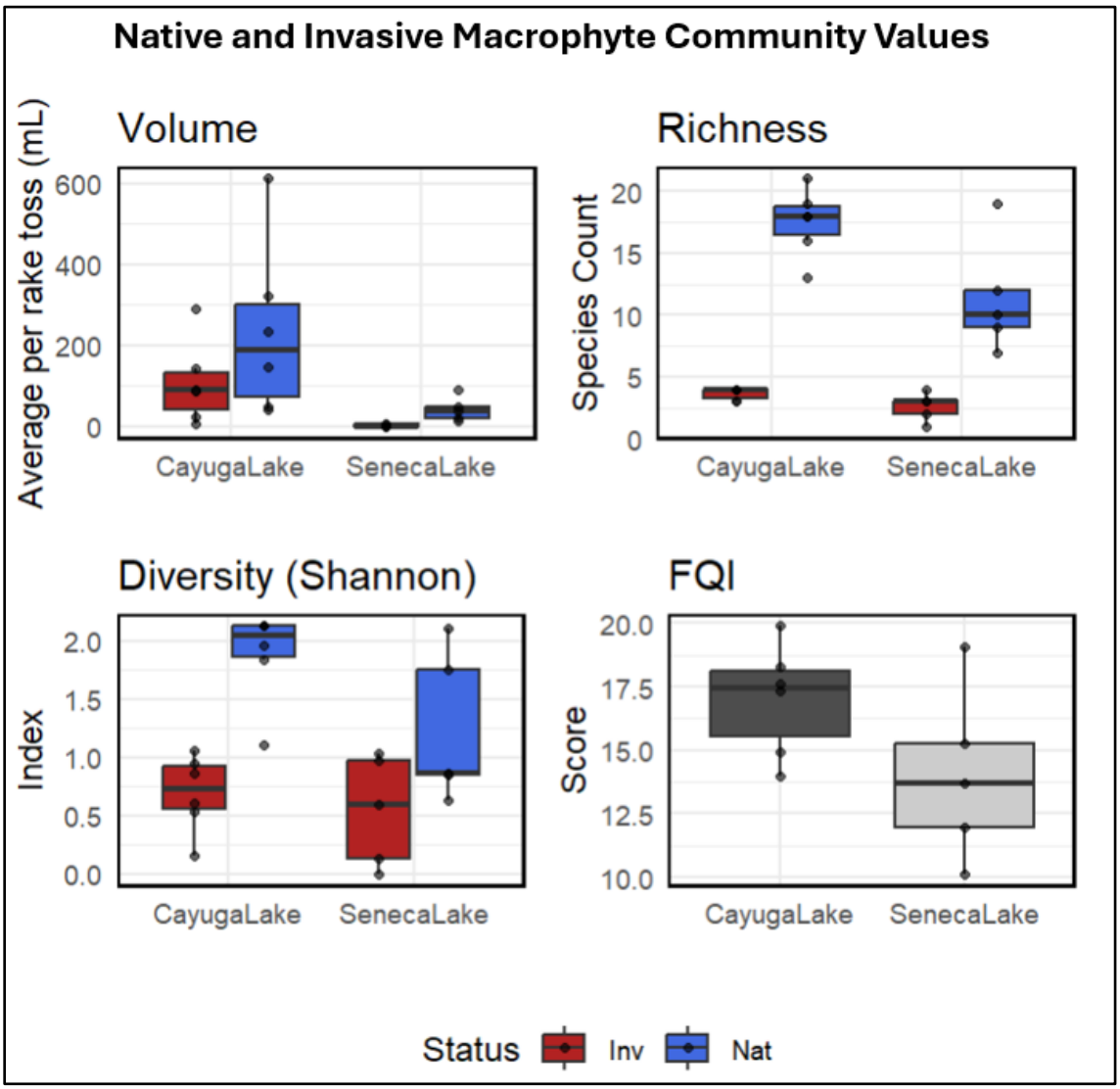


Figure 4. Box-and-whisker plots comparing macrophyte community characteristics between invasive (red) and native (blue) macrophytes at Cayuga Lake and Seneca Lake sites. Metrics shown include average macrophyte volume per rake toss (mL), species richness (species count), Shannon diversity index, and Floristic Quality Index (FQI). Individual points represent site-level observations. Native assemblages generally exhibited greater richness and diversity than invasive assemblages at both lakes, particularly in Cayuga Lake. FQI values, calculated using the combined macrophyte community (native and invasive taxa), were higher overall in Cayuga Lake than in Seneca Lake. Boxes represent the interquartile range (IQR), center lines indicate medians, whiskers denote the range of non-outlier values, and points beyond whiskers indicate potential outliers.

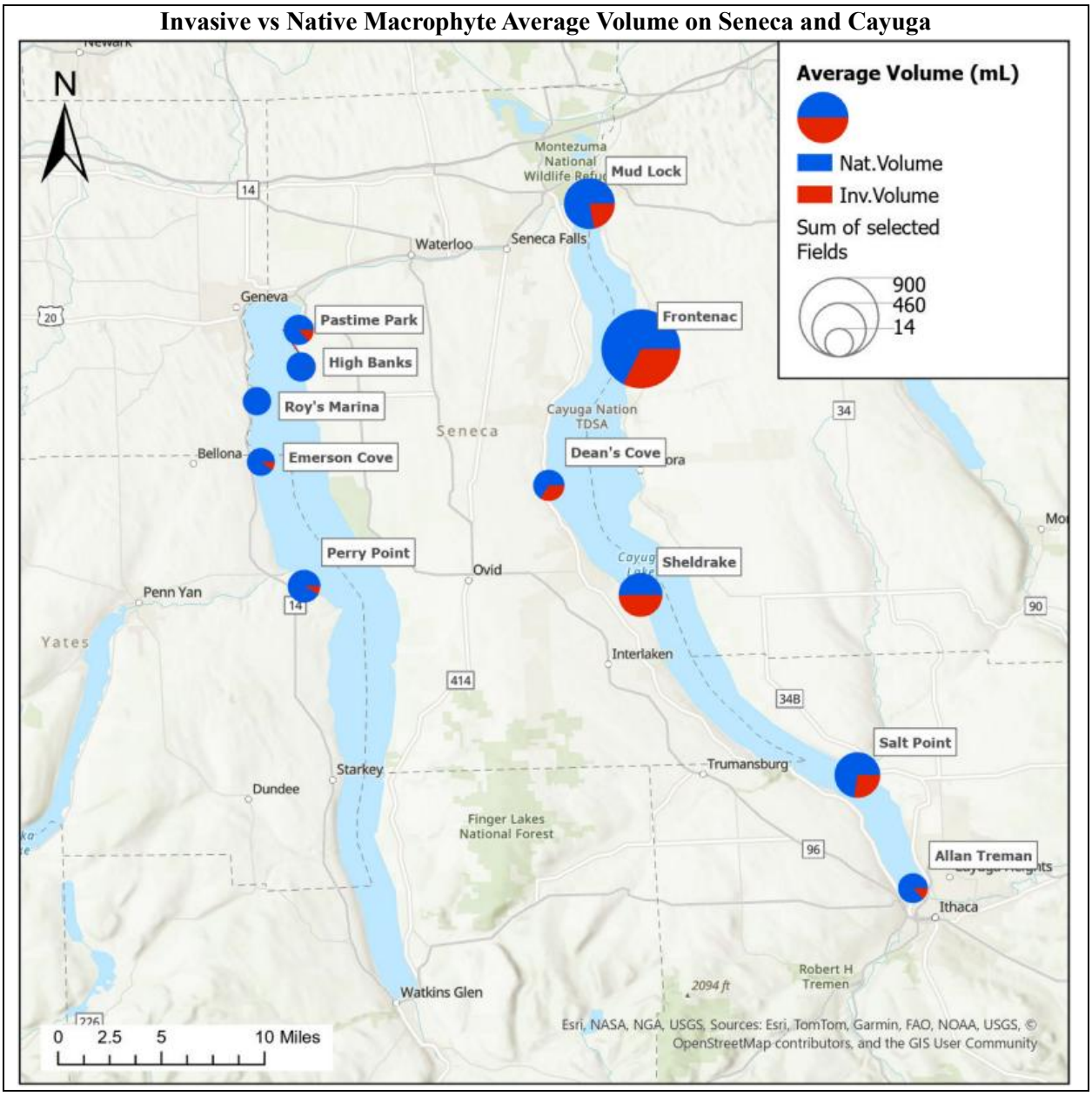


Figure 5. Map of sampling locations on Cayuga and Seneca Lakes displaying relative native and invasive aquatic macrophyte abundance at each study site during the 2025 sampling season. Pie charts represent the proportional average volume of native species (blue) and invasive species (red) collected per rake toss. Pie chart size is scaled to the total average macrophyte volume (mL) recorded at each site, providing a visual comparison of overall vegetation density among locations.

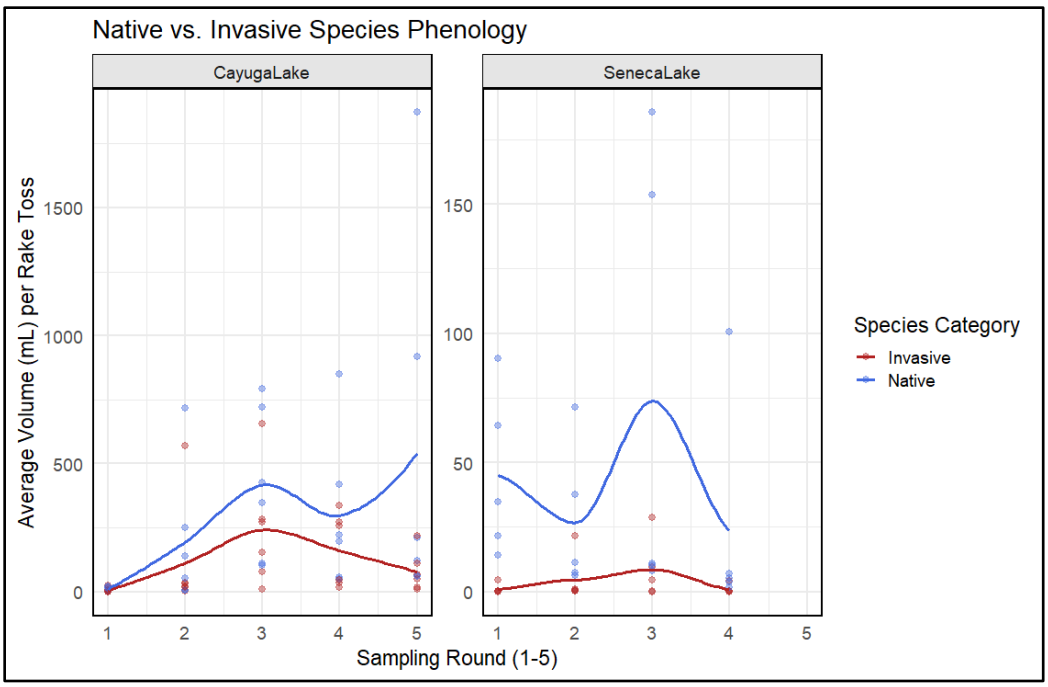


Figure 6. Seasonal phenology of native (blue) and invasive (red) macrophyte assemblages at sites on Cayuga Lake and Seneca Lake across five sequential sampling rounds. Sampling rounds correspond approximately to June (1), July (2), August (3), September (4), and October (5). Points represent site-level average macrophyte volume per rake toss (mL) for native or invasive taxa during each sampling period, while solid lines indicate LOESS smoothed temporal trends. Native macrophytes generally exhibited higher biomass and stronger seasonal peaks than invasive assemblages, with peak native abundance occurring during mid- to late summer. Invasive taxa showed lower overall biomass and more gradual seasonal variation across both lakes. Note that y-axis scales differ between Cayuga Lake and Seneca Lake panels to accommodate differences in observed macrophyte volume.

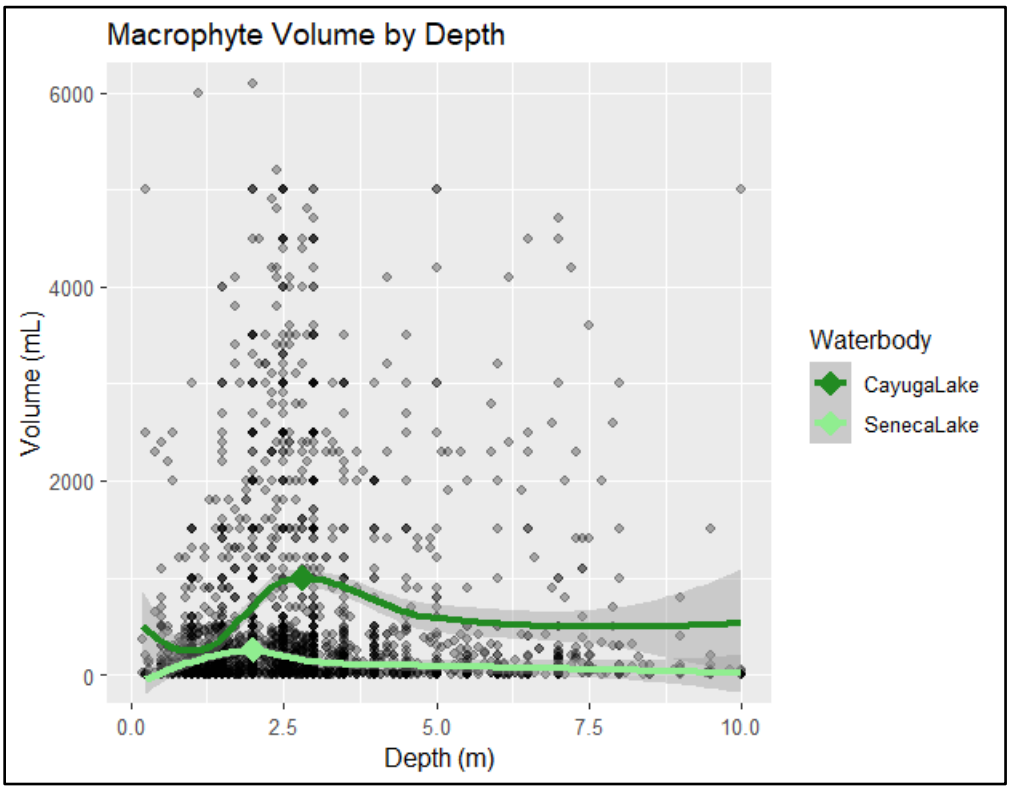


Figure 7. Relationship between macrophyte volume and water depth at sampling sites on Cayuga Lake and Seneca Lake. Black points represent individual rake toss observations of macrophyte volume (mL) across sampled depths (m). Smoothed LOESS trendlines illustrate general patterns in macrophyte abundance with increasing depth for Cayuga Lake (dark green) and Seneca Lake (light green), with shaded regions indicating the confidence interval around each trend. Large green points denote the approximate depth at which maximum macrophyte volume was observed for each lake. Macrophyte abundance in Cayuga Lake peaked at intermediate depths (~2.5–3 m) and remained relatively elevated across a broader depth range, whereas Seneca Lake exhibited lower overall macrophyte volume and a more limited depth distribution.

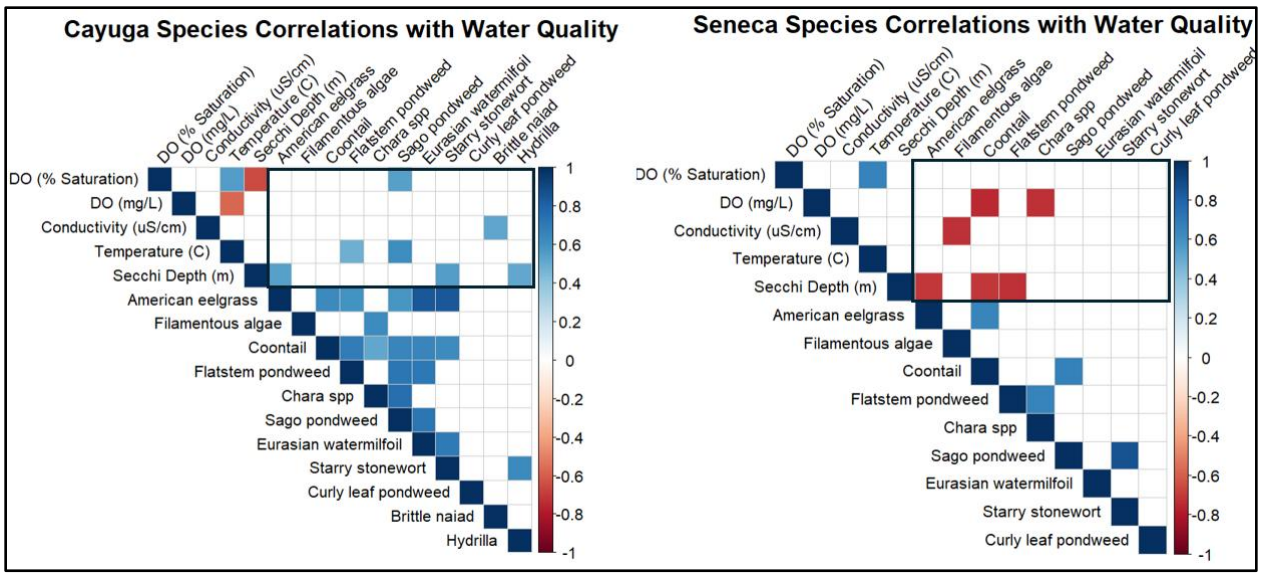


Figure 8. Pearson correlation matrices showing relationships among water quality variables and aquatic macrophyte metrics for sampling sites in Cayuga and Seneca Lakes. The matrices display correlations between physicochemical water quality parameters and individual macrophyte species volumes. Blue cells indicate significant positive correlations, and red cells indicate significant negative correlations, with color intensity corresponding to correlation strength (Pearson's *r*). Colors are shown for statistically significant correlations only ($p < 0.05$).

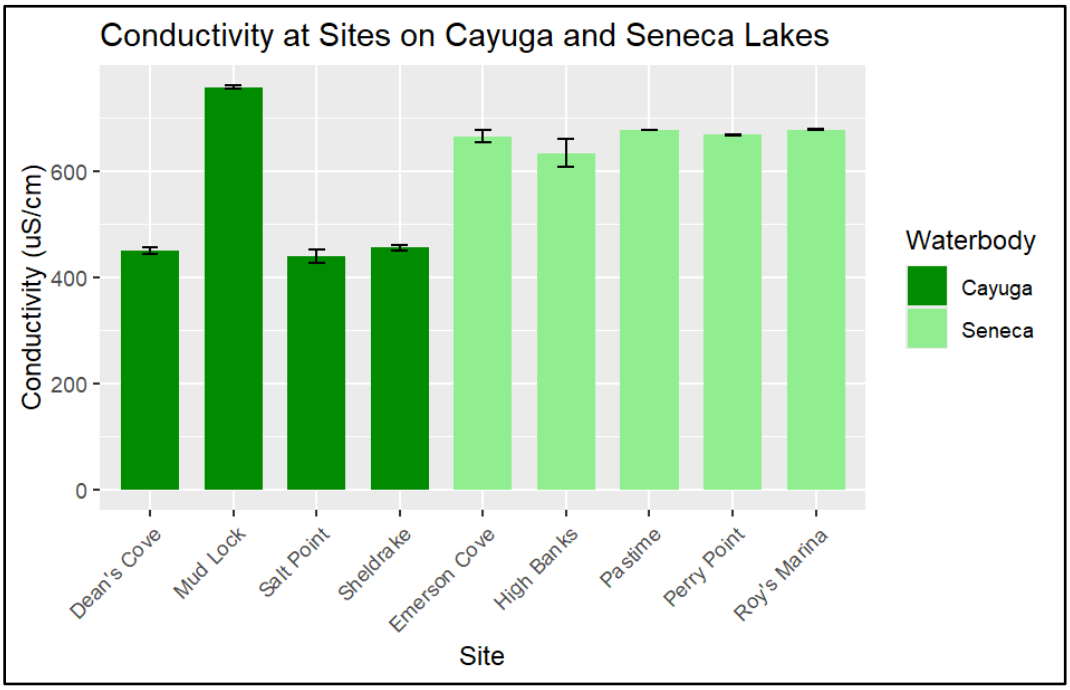
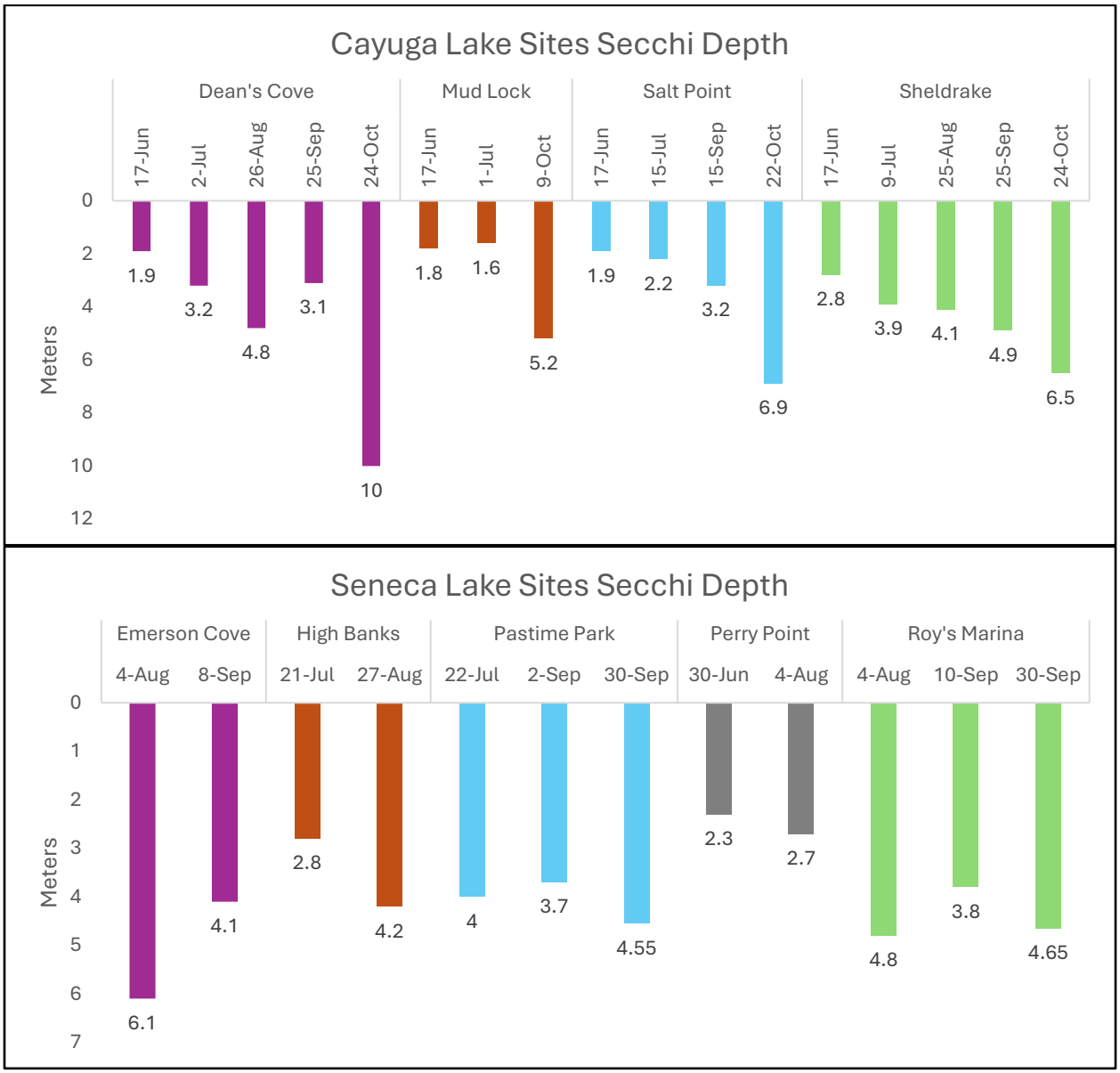


Figure 9. Mean specific conductance (µS/cm) measured at sampling sites in Cayuga and Seneca Lakes from June through October 2025. Dark green bars represent Cayuga Lake sites and light green bars represent Seneca Lake sites. Error bars indicate ±1 standard error of the mean, illustrating temporal variability among sampling periods. Conductivity values varied among sites, with Mud Lock exhibiting the highest mean conductivity among Cayuga Lake locations, while Seneca Lake sites generally displayed consistently elevated conductivity levels across the study period.



Figures 10-11. Secchi depth measurements (m), used as an indicator of water clarity, recorded at sampling sites on Cayuga Lake (top; Figure 10) and Seneca Lake (bottom; Figure 11) during the 2025 growing season. Measurements were collected from June through October at Cayuga Lake sites and from June through September at Seneca Lake sites. Bars represent individual sampling events at each site, with values indicating measured Secchi depth in meters. Greater Secchi depths correspond to increased water transparency. Temporal and spatial variation in water clarity was observed among sites, with several Cayuga Lake locations exhibiting the highest transparency values during late-season sampling periods.

Tables

Table 3. Number of rake tosses performed at each site on Cayuga Lake and Seneca Lake in each of the five macrophyte sampling rounds. Data from June-October of 2025.

Waterbody	Site	Number of rake tosses					
		Round 1	Round 2	Round 3	Round 4	Round 5	Grand Total
Cayuga	Allan Treman	205	117	120	140	48	630
	Dean's Cove	148	148	87	69	51	503
	Frontenac	304	200	100	82	97	783
	Mudlock	120	85	114	48	75	442
	Salt Point	229	116	111	80	97	633
	Sheldrake	200	192	150	201	44	787
Seneca	Emerson Cove	164	37	115	93	-	409
	High Banks	158	154	164	98	-	574
	Pastime Park	124	102	105	73	-	404
	Perry Point	278	102	93	120	-	593
	Roy’s Marina/Cottonwood Cove	241	127	103	62	-	533

Table 4. Macrophyte species found at sites on Cayuga and Seneca Lakes from June-October 2025. Macrophyte species detected at a site are indicated by a "1". If not detected, macrophytes are indicated with a "0". Invasive species are listed in red. Site abbreviations are as follows: AT= Allan H Treman State Park; DC= Dean's Cove; FP= Frontenac Park; ML= Mud Lock; Salt Point/ Lansing= LS; SP= Sheldrake Point; EC= Emerson Cove; HB= High Banks; PT= Pastime Park; PP= Perry Point; CC= Roy's Marina/ Cottonwood Cove.

Species		Cayuga Lake						Seneca Lake				
Common name	**Scientific name**	**AT**	**DC**	**FP**	**ML**	**LS**	**SP**	**EC**	**HB**	**PT**	**PP**	**CC**
American eelgrass	*Vallisneria americana*	1	1	1	1	1	1	1	1	1	1	1
Chara spp	*Chara* spp.	1	0	1	1	1	1	0	1	1	1	1
Clasping leaf pondweed	*Potamogeton perfoliatus*	1	1	1	1	1	1	0	0	0	1	0
Coontail	*Ceratophyllum* spp.	1	1	1	1	1	1	1	1	1	1	1
Elodea spp	*Elodea spp.*	1	1	1	1	1	1	0	0	1	1	0
Eurasian watermilfoil	*Myriophyllum spicatum*	1	1	1	1	1	1	1	1	1	1	0
Illinois pondweed	*Potamogeton illinoisensis*	0	0	0	0	0	0	0	0	0	0	0
Pondweed spp	*Potamogeton spp.*	1	0	1	1	1	1	0	0	0	1	0
Filamentous algae	*Cladophora* spp.; *Spirogyra* spp.	1	1	1	1	1	1	1	1	1	1	1
Brittle naiad	*Najas minor*	1	0	0	1	0	0	0	0	0	1	0
Common bladderwort	*Utricularia vulgaris*	0	0	0	0	0	0	0	0	0	0	0
Crystalwort	*Riccia fluitans*	0	0	0	0	0	0	0	0	0	0	0
Curly leaf pondweed	*Potamogeton crispus*	1	1	1	1	1	1	0	1	1	1	0
Fanwort	*Cabomba caroliniana*	0	0	0	0	0	0	0	0	0	0	0
Fineleaf pondweed	*Stuckenia filiformis*	0	0	0	0	0	0	0	0	0	0	0
Flatstem pondweed	*Potamogeton zosteriformis*	1	1	1	1	1	1	1	1	1	1	1
Horned pondweed	*Zannichellia palustris*	0	0	1	1	0	0	0	0	0	0	0
Hydrilla	*Hydrilla verticillata*	0	0	0	0	1	1	0	0	0	0	0
Large leaf pondweed	*Potamogeton amplifolius*	0	0	0	0	0	0	0	0	0	0	0
Leafy pondweed	*Potamogeton foliosus*	1	0	1	1	0	0	0	0	0	0	0
Long leaf pondweed	*Potamogeton nodosus*	1	0	0	1	1	1	0	0	0	1	0
Native stonewort spp	*Nitella* spp.	0	0	0	1	0	0	0	0	0	0	0
Northern watermilfoil	*Myriophyllum sibiricum*	0	1	1	1	1	1	0	0	0	1	0
Other	Other	1	0	0	1	0	0	0	0	0	0	1
Richardsons pondweed	*Potamogeton richardsonii*	1	1	1	1	1	1	0	0	1	1	0
Sago pondweed	*Stuckenia pectinata*	1	1	1	1	1	1	1	1	1	1	1

Slender naiad	*Najas flexilis*	1	0	1	1	1	1	1	0	1	1	0
Small pondweed	*Potamogeton pusilis*	1	1	1	1	1	1	0	0	0	1	1
Southern naiad	*Najas guadalupensis*	0	1	1	1	0	1	1	1	1	1	1
Spiny naiad	*Najas marina*	1	0	0	1	0	1	0	0	0	1	0
Starry stonewort	*Nitellopsis obtusa*	1	1	1	1	1	1	1	1	1	1	1
Unknown spp	*Unknown* spp.	1	0	1	0	0	0	1	0	0	0	0
Water buttercup	*Ranunculus* spp.	1	0	1	0	0	0	0	0	0	0	0
Water plantain	*Alisma* spp.	0	0	0	0	0	0	0	0	0	1	1
Water stargrass	*Heteranthera dubia*	1	1	1	1	1	1	0	1	1	1	1
Whitestem pondweed	*Potamogeton praelongus*	1	1	1	1	1	1	0	1	1	1	0

Table 5. Minimum and maximum readings of dissolved oxygen saturation (%), dissolved oxygen (mg/L), specific conductance (µS/cm), and temperature (°C) for nine sites on Seneca and Cayuga Lakes. Data from June-October 2025 collected using a Eureka Manta RS-232 multi-parameter water quality sonde.

Waterbody	Site	Min & max	HDO (%Sat)	HDO (mg/l)	Sp. Cond (uS/cm)	Temp (℃)
Cayuga	Dean's Cove	Minimum	97.0	8.9	422.3	14.8
		Maximum	107.2	10.4	466	22.8
	Mud Lock	Minimum	102.3	8.9	515	18.8
		Maximum	111	10	759	22.5
	Salt Point	Minimum	109.4	9.9	417.4	17.3
		Maximum	115.5	10.6	460.9	23.4
	Sheldrake	Minimum	90.9	8.9	452	13.5
		Maximum	105.8	10.7	460.3	23.1
Seneca	Emerson Cove	Minimum	102.9	9.3	657.8	20.8
		Maximum	111.1	9.5	679	23.7
	High Banks	Minimum	89.8	8.5	626.2	15.5
		Maximum	97.5	9	644	22.3
	Pastime Park	Minimum	103.8	9.2	680	20.3
		Maximum	104.5	9.4	681	22.1
	Perry Point	Minimum	104	8.8	668.2	22.31
		Maximum	110	9.6	673.5	23.8
	Roy's Marina/ Cottonwood Cove	Minimum	103.0	9.4	675	20.3
		Maximum	108.4	9.2	682	24.0

Appendix

Cayuga Lake Invasive Macrophyte Maps

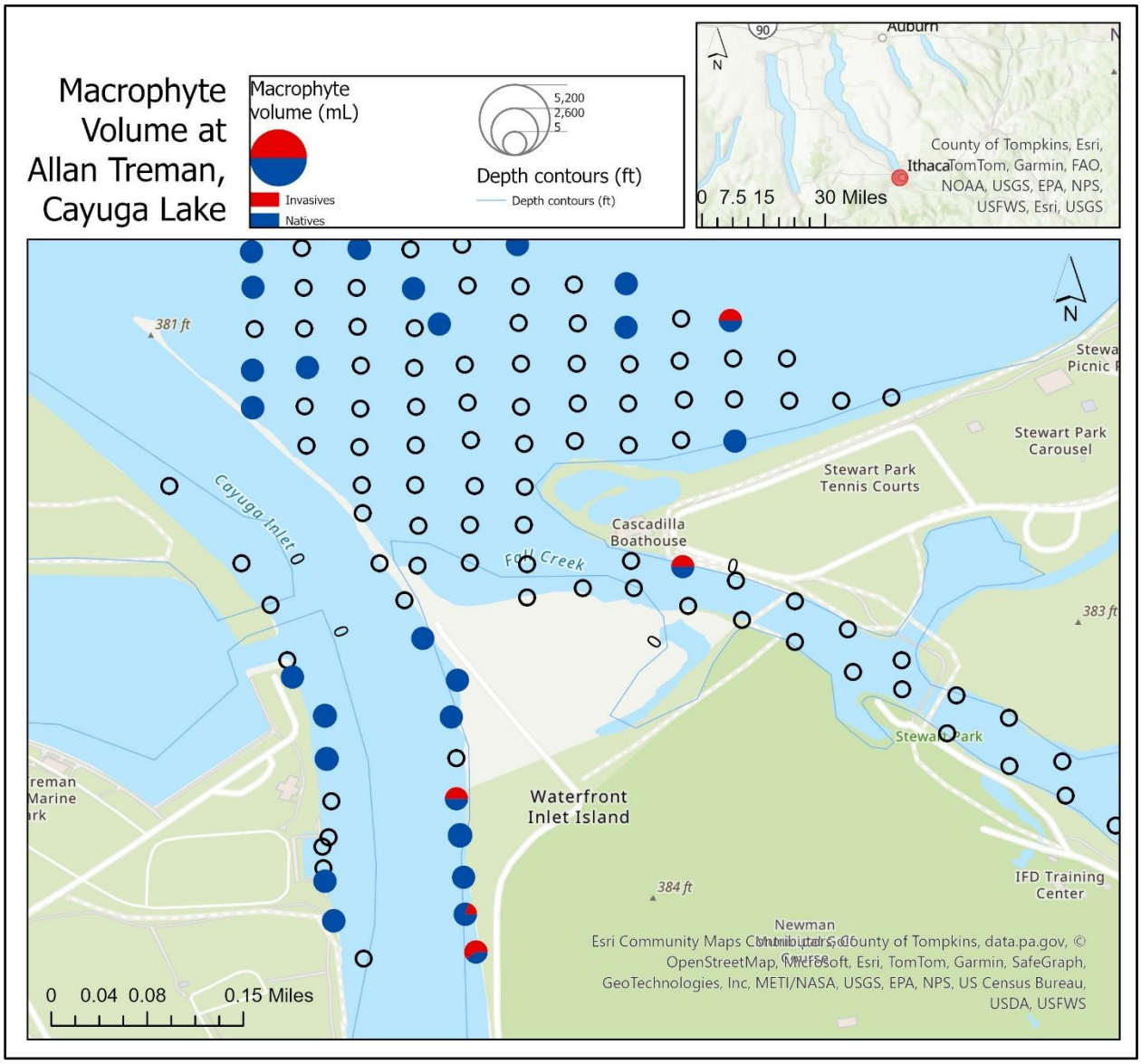


Figure A1. Rake toss locations for sampling round two (July) at Allan H. Treman State Marine Park on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include Eurasian watermilfoil (3%) and brittle naiad (3%).

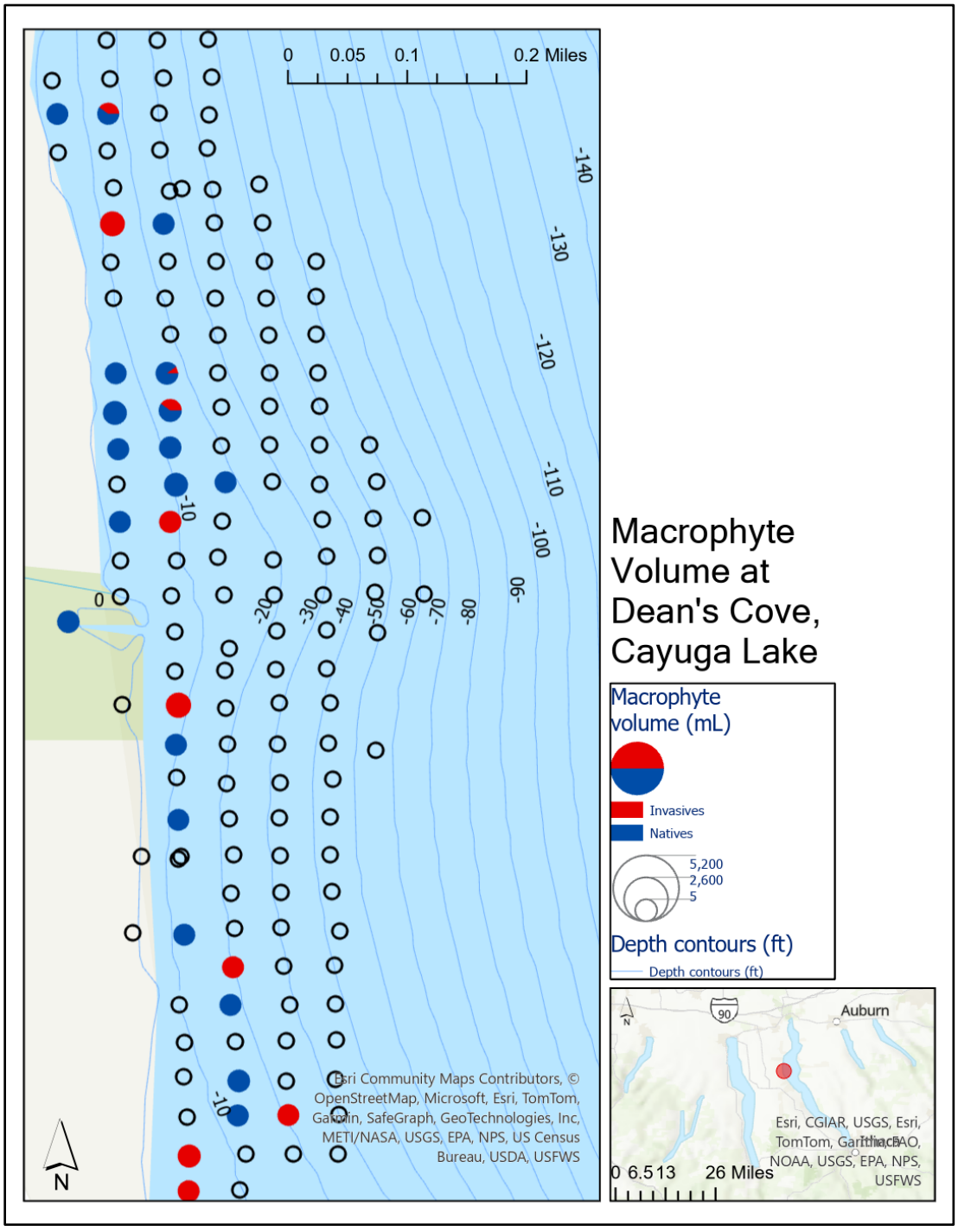


Figure A2. Rake toss locations for sampling round two (July) at Dean's Cove on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include starry stonewort (9%), Eurasian watermilfoil (4%), and curly leaf pondweed (3%).

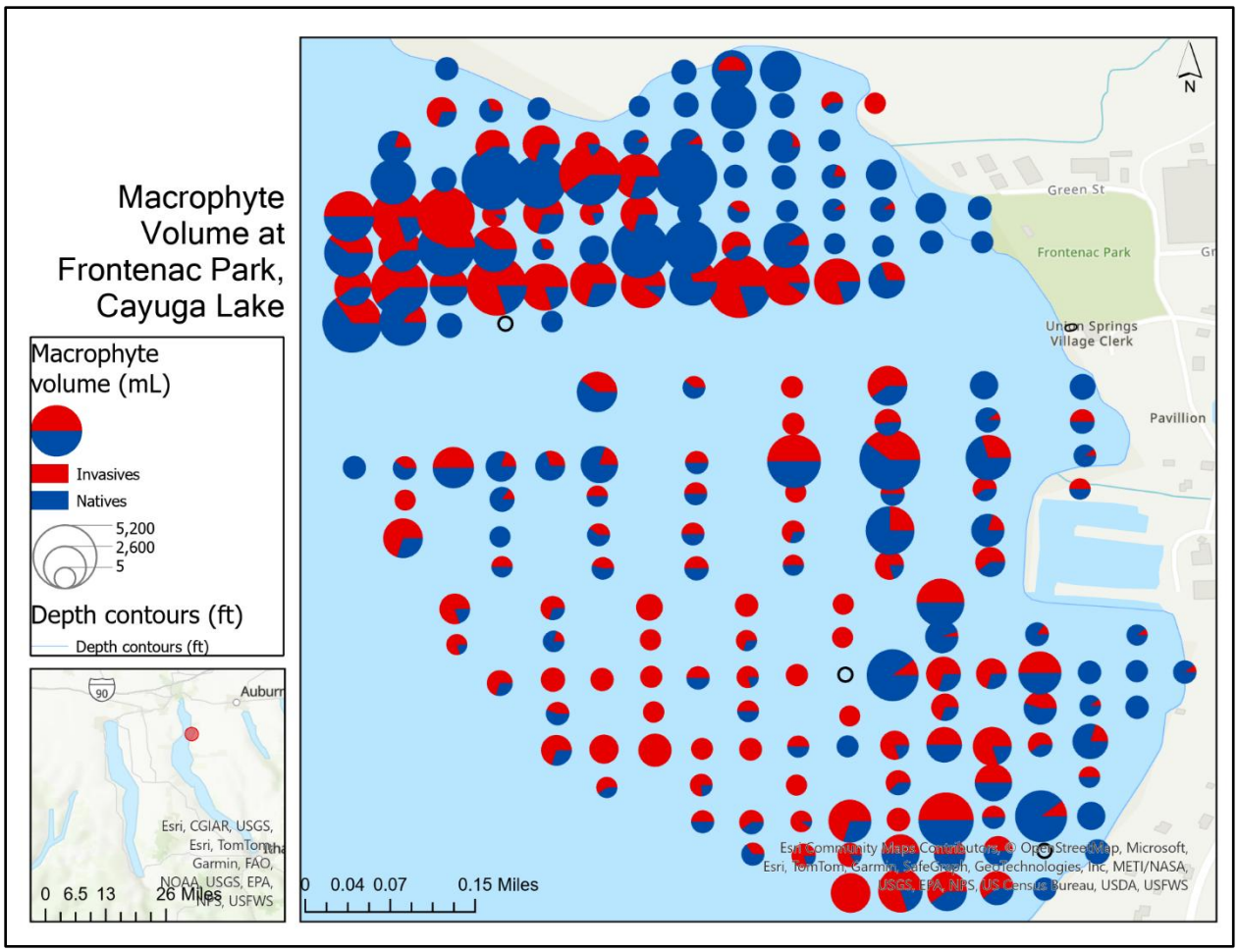


Figure A3. Rake toss locations for sampling round two (July) at Frontenac Park in Union Springs on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include starry stonewort (57%) and curly leaf pondweed (4%).

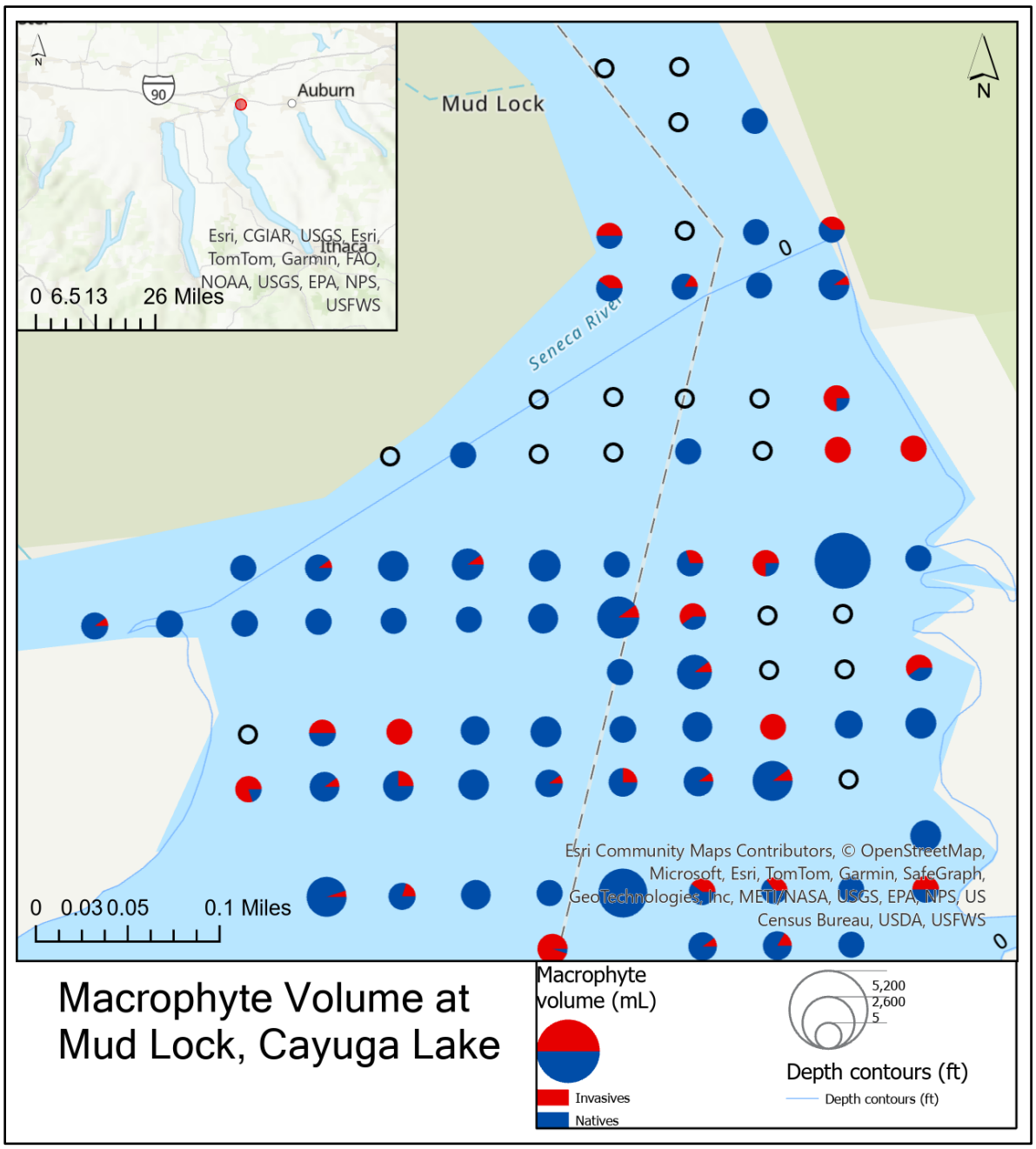


Figure A4. Rake toss locations for sampling round two (July) at Mud Lock boat launch on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include starry stonewort (22%) and Eurasian watermilfoil (17%).

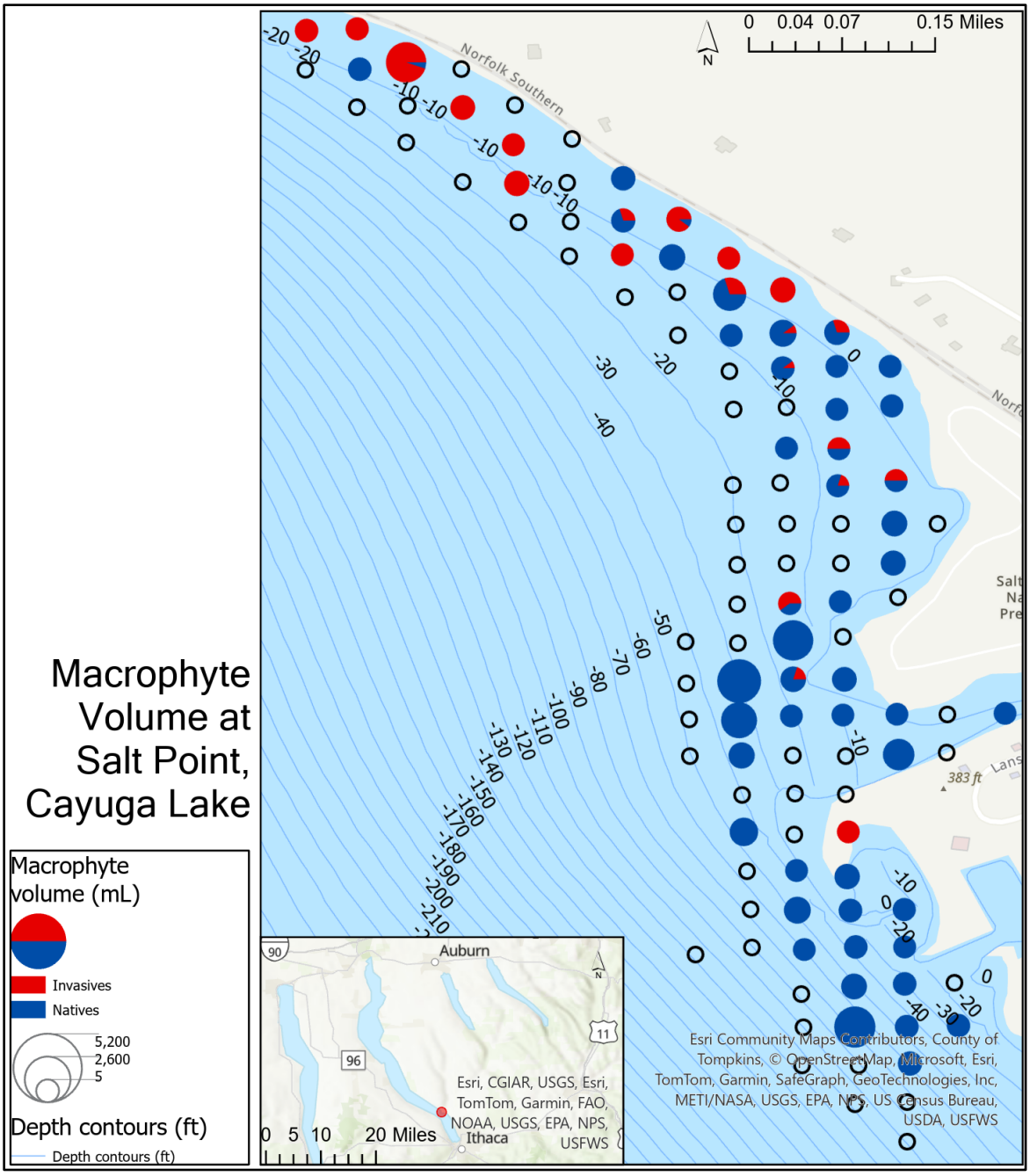


Figure A5. Rake toss locations for sampling round two (July) at Salt Point/Lansing on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include Eurasian watermilfoil (15%) and starry stonewort (9%).

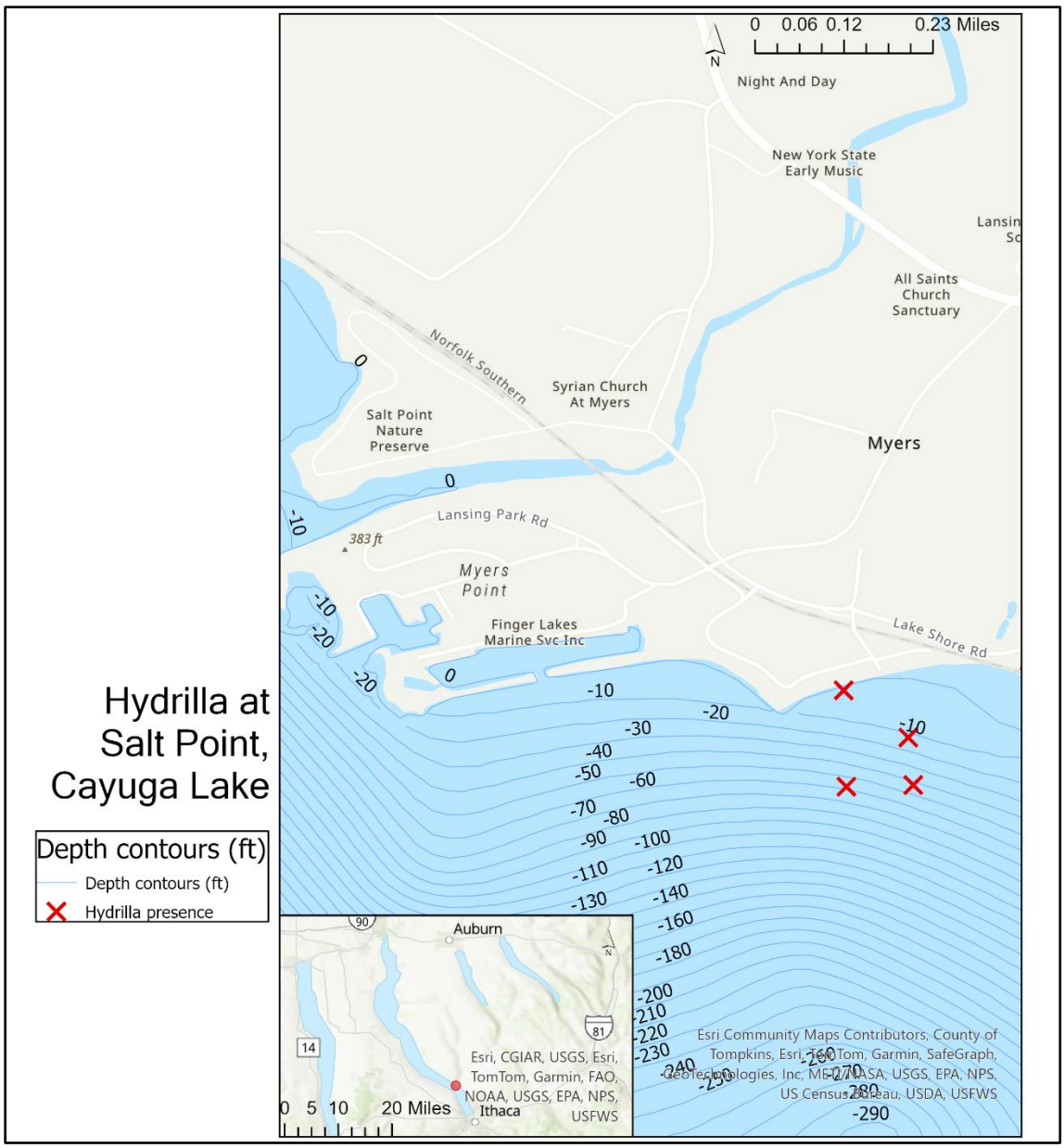


Figure A6. Hydrilla detection locations from all sampling rounds at Salt Point (Ladoga Bay) on Cayuga Lake in 2025. Hydrilla detections are indicated with a red "X" on the map. Hydrilla was detected using point-intercept rake tosses along a larger survey grid than our routinely searched area, provided by the DEC.

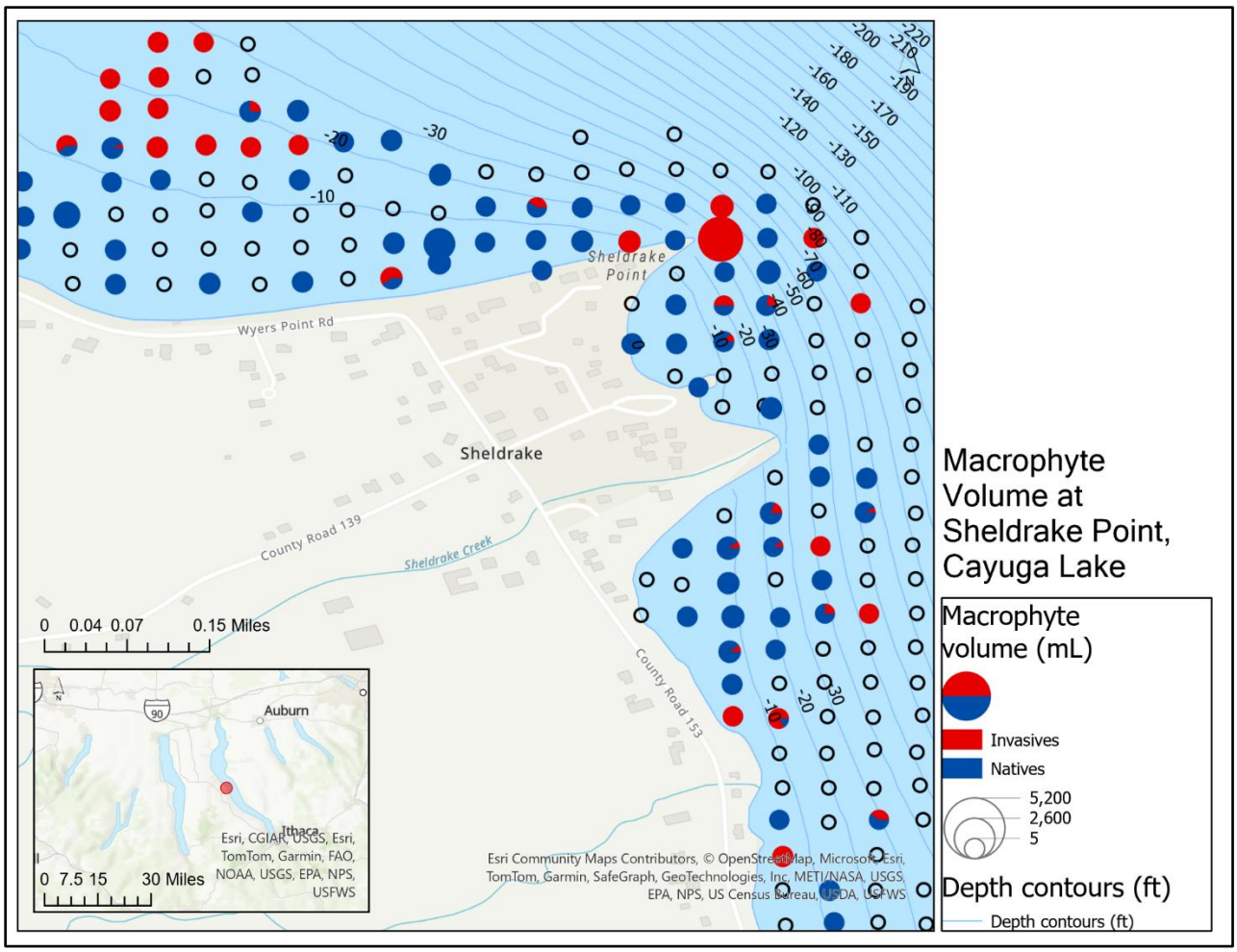


Figure A7. Rake toss locations for sampling round two (July) at Sheldrake Point on Cayuga Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include starry stonewort (16%) and Eurasian watermilfoil (8%).

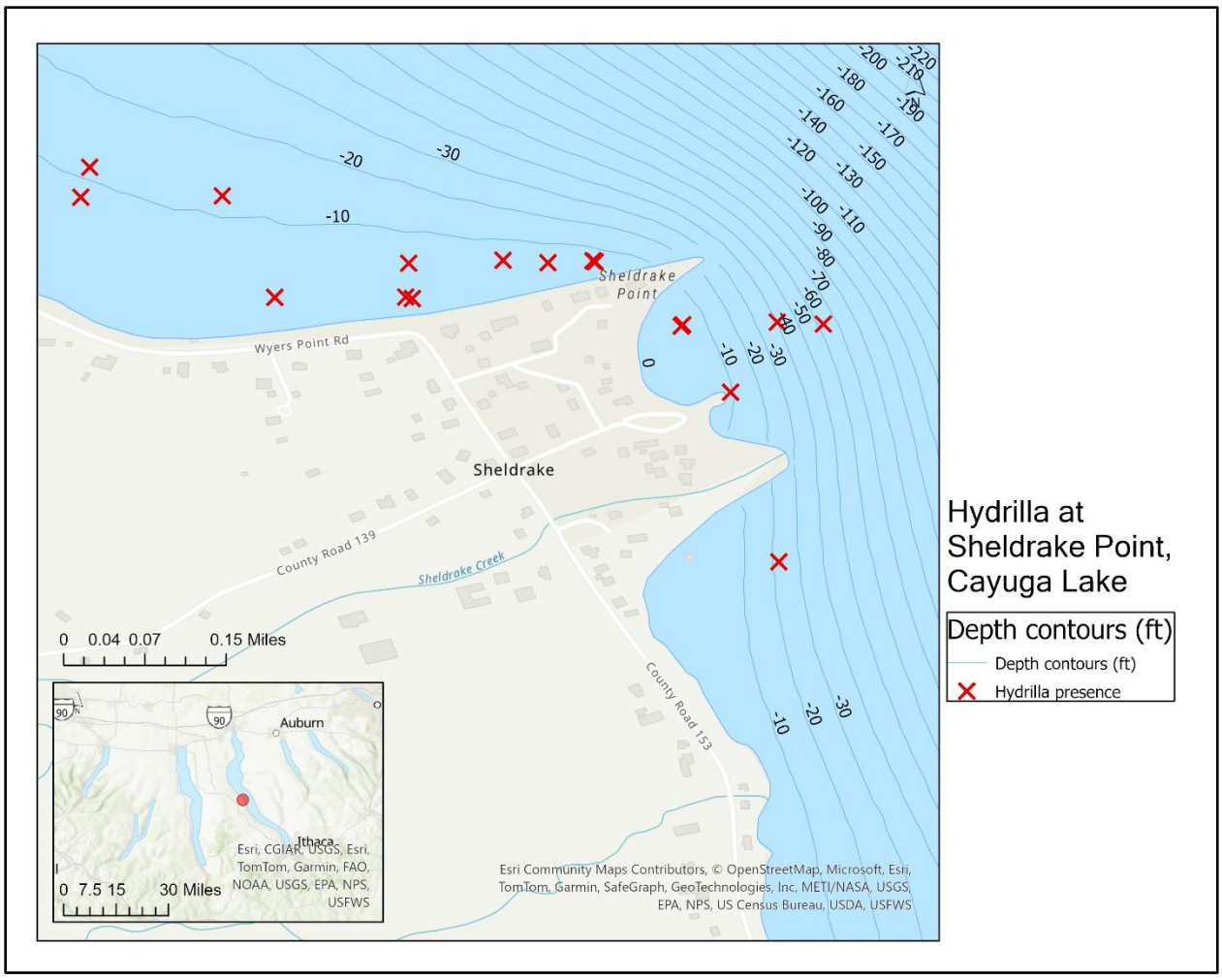


Figure A8. Hydrilla detection locations from all sampling rounds at Sheldrake Point on Cayuga Lake in 2025. Hydrilla detections are indicated with a red "X" on the map. Hydrilla was detected using point-intercept rake tosses along the grid demonstrated by the points in Figure A7.

Seneca Lake Invasive Macrophyte Maps

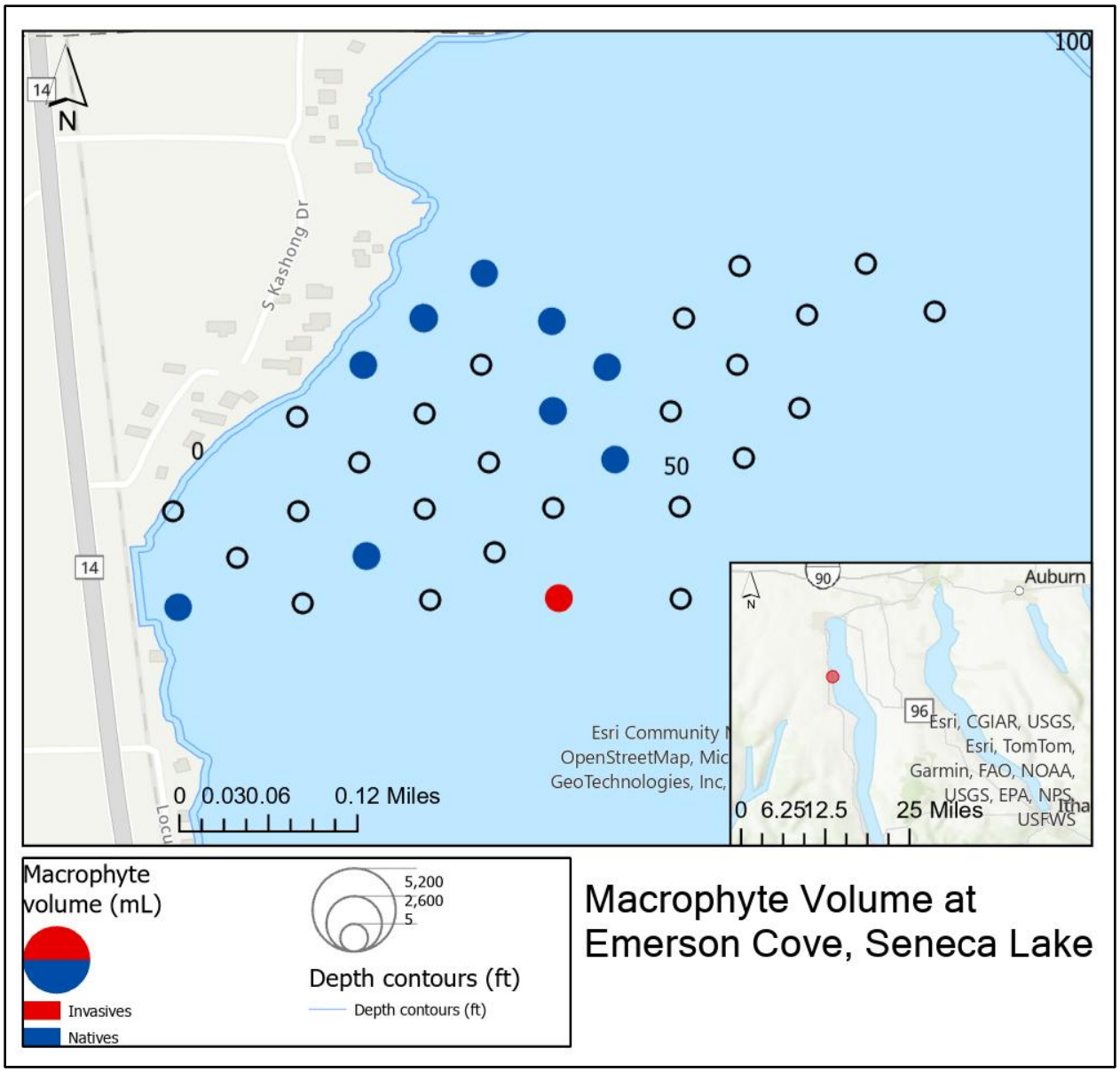


Figure A9. Rake toss locations for sampling round two (July) at Emerson Cove on Seneca Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The only detected invasive species across all sampling rounds at this site was starry stonewort (1%).

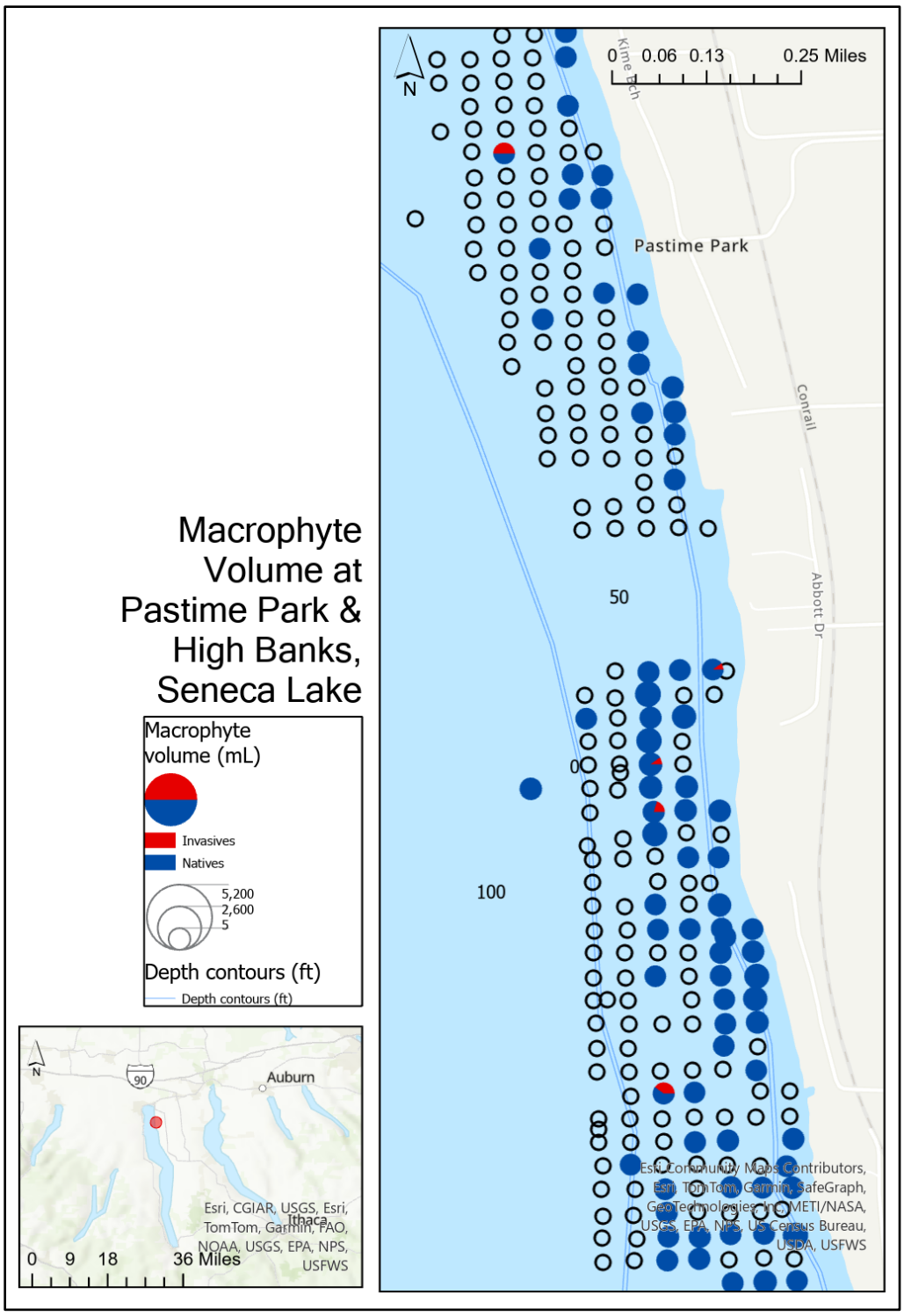


Figure A10. Rake toss locations for sampling round two (July) at Pastime Park and High Banks on Seneca Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds include Eurasian watermilfoil (3%) and starry stonewort (1%) at Pastime Park and starry stonewort at High Banks (1%).

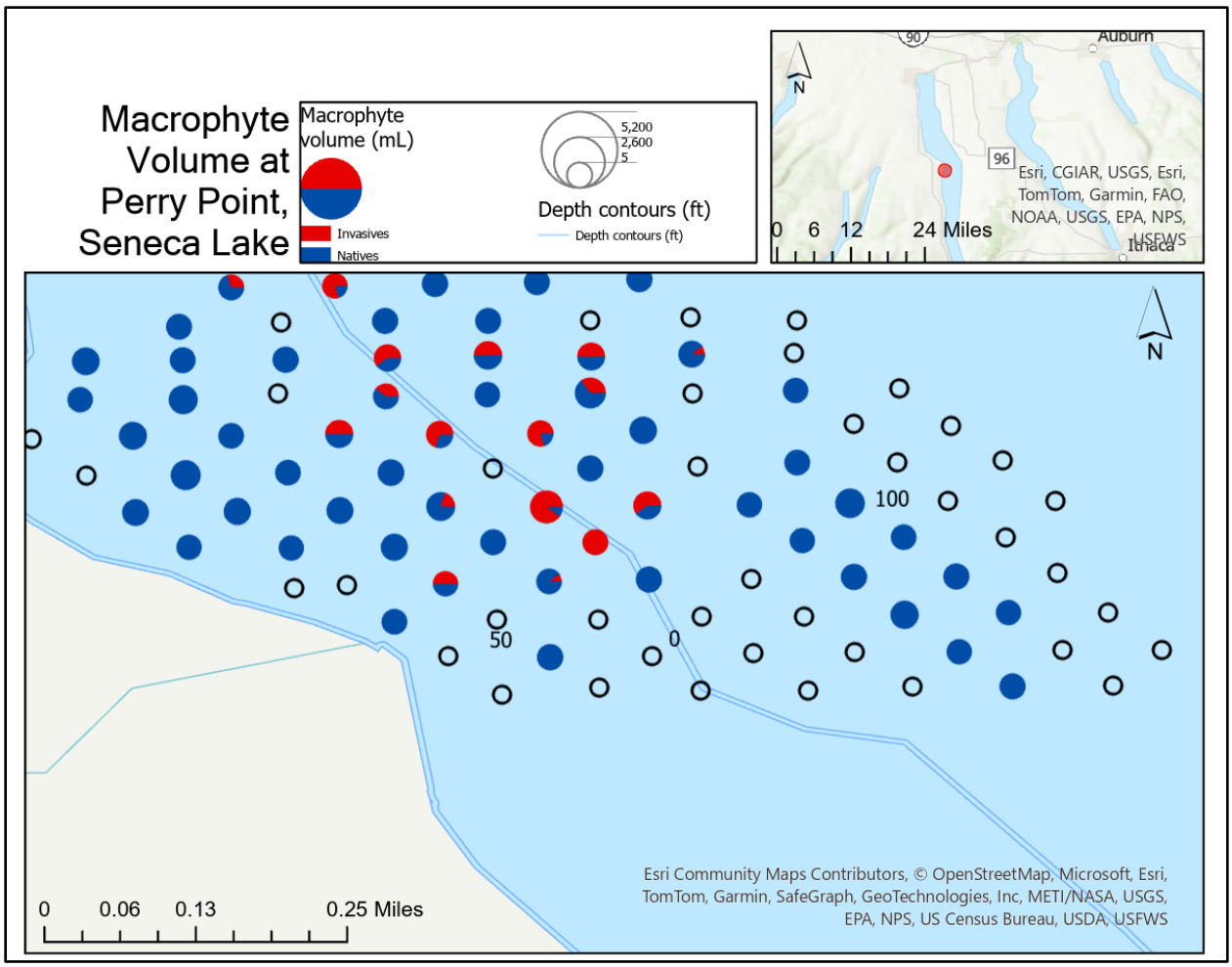


Figure A11. Rake toss locations for sampling round two (July) at Perry Point on Seneca Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The most frequently detected invasive species across all sampling rounds at this site include starry stonewort (11%) and Eurasian watermilfoil (3%).

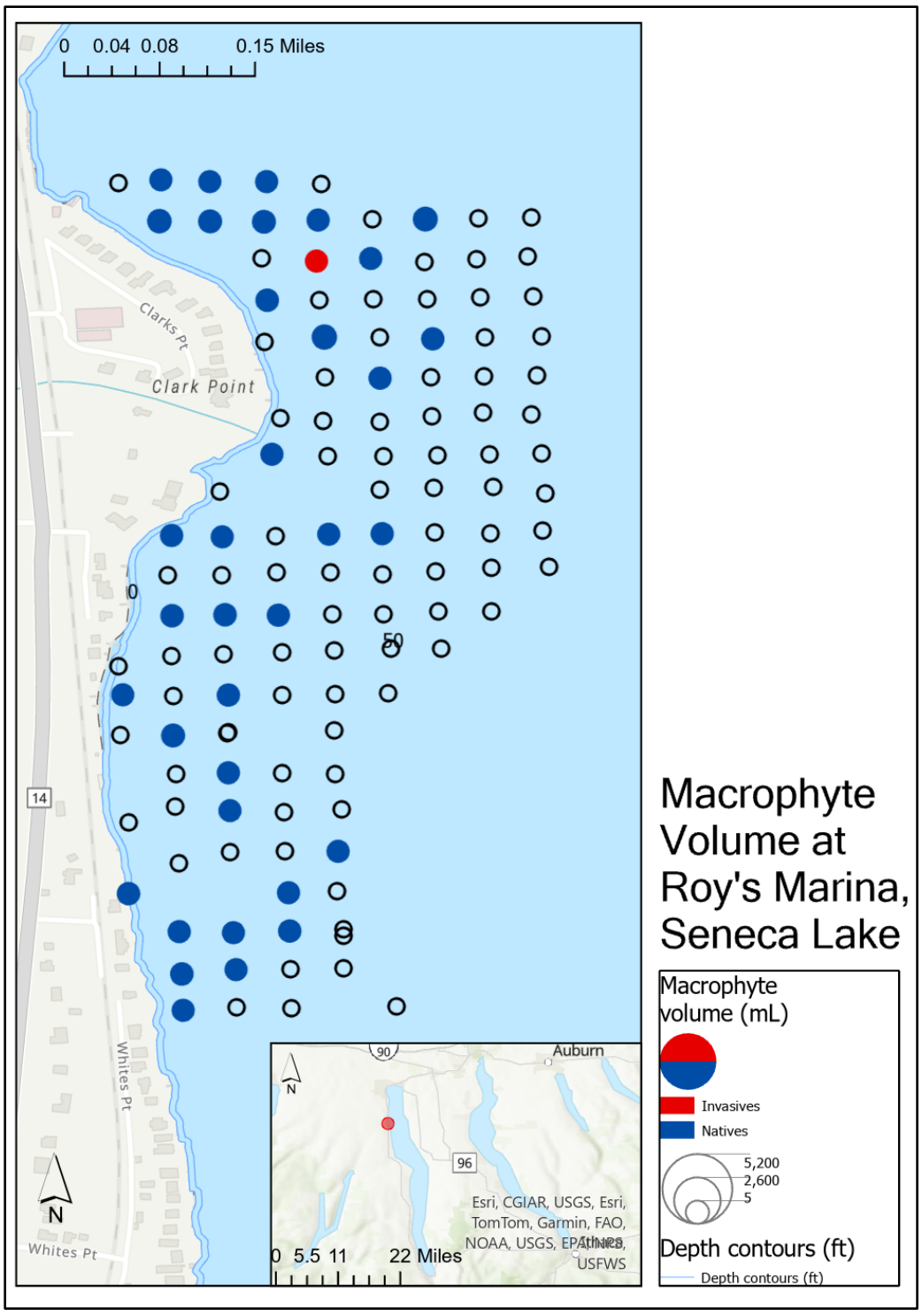


Figure A12. Rake toss locations for sampling round two (July) at Roy's Marina, near Cottonwood Cove on Seneca Lake in 2025. Pie chart ratios depict average native (blue) and invasive (red) macrophyte volume per rake toss. Size of pie charts corresponds with the total average volume (mL) per rake toss at each site. Empty circles indicate that no vegetation was found. The only detected invasive species across all sampling rounds at this site was starry stonewort (1%).

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