**Chautauqua Lake Monitoring Program**
Submersed Aquatic Vegetation Survey Results
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## Introduction

Chautauqua Lake, located in Western New York's Chautauqua County, is a popular destination for boating, fishing, and other forms of outdoor recreation. Its shoreline is heavily developed and spans across the towns of Busti, Chautauqua, Ellery, Ellicott, and North Harmony. The waterbody supports 42 miles of shoreline, spans over 13,000 surface acres, and is divided into two unique basins. Despite being similar in size, the southern basin tends to be shallower, warmer, and more nutrient rich when compared to the northern basin (Smith 2020; EcoLogic 2018).

The topography surrounding Chautauqua Lake has resulted in an extensive littoral zone that has the ability to support a highly productive ecosystem. Historic records and recent surveys have determined that the submersed aquatic vegetation (SAV) community of Chautauqua Lake is exceptionally diverse with over 50 aquatic plant species recorded since first surveyed in 1937 (Johnson 2018). Of these, five non-native aquatic plant species, Eurasian watermilfoil (*Myriophyllum spicatum*), brittle naiad (*Najas minor*), starry stonewort (*Nitellopsis obtusa*), water chestnut (*Trapa natans*) and curly-leaf pondweed (*Potamogeton crispus*) have been discovered within the waterbody.

The growth and proliferation of non-native plants ultimately impairs the recreational, ecological, and economical uses of Chautauqua Lake. To date, mechanical harvesting has been the most commonly used method for aquatic plant management in the waterbody. In 2025, mechanical harvesting efforts removed over 24 million pounds of vegetation from the lake (CLA 2025). In addition, select regions of the lake received herbicide treatments to target non-native plant growth. Continual monitoring of the abundance and distribution of both native and non-native SAV species within the lake is critical for evaluating the overall sustainability of the aquatic ecosystem, and for determining an appropriate long-term lake management strategy.

Aquatic plant presence and abundance at Chautauqua Lake is dynamic in both temporal and spatial aspects due to differences in plant-specific phenological traits. This is especially true for curly-leaf pondweed, which initiates active growth relatively early in the growing season (early spring).

The fall 2025 survey followed methods comparable to previous survey efforts at Chautauqua Lake by NC State University (NCSU). The presence and abundance of SAV was documented using a subset of historical survey points located within the littoral zone of Chautauqua Lake's North and South Basins. Additional survey points were added within pre-established herbicide treatment areas (provided by Ready Scout, LLC) to document the SAV community within current herbicide management areas.

**Methods**

A survey of aquatic vegetation occurred at Chautauqua Lake between August 5th – August 12th, 2025. Point-intercept methods followed the guidelines proposed by Madsen (1999). These survey methods have been utilized by NCSU researchers to assess the aquatic vegetation community at Chautauqua Lake beginning in 2020 and allows for historical comparisons of aquatic plant communities between survey years. Historically sampled survey points were uploaded to an on-board GPS enabled chartplotter with ~5 ft horizontal accuracy. Additional sample points were included within the boundaries of proposed treatment areas to bolster sampling in those areas of active plant management. These points were also surveyed in June 2025, allowing for early and peak-season growth or reduction comparisons. An additional set of sample points were also added along the deep edges of the littoral zone in select locations around the lake in an effort to capture the full extent of SAV growth. With these additions, a total of 1076 point intercept locations were sampled during this survey period. At all sample point locations, the plants that were present on two independent rake toss were documented and a visual estimate of whole-rake density was recorded (Table 1). Each rake received a plant-specific relative abundance estimate (Figure 1a). When applicable, floating and emergent shoreline species were recorded at each point location using a binary presence/absence system.

<u>Sonar-Based Biovolume Survey</u>

The survey vessel was configured with a Lowrance HDS-7 Gen3 consumer-grade fish-finding echosounder and chartplotter to record passive sonar tracks during the point-intercept survey (Figure 1b). The echosounding transducer emits a 200kHz acoustic signal through the water column which is returned to the receiver. Sonar data were saved by the echosounder to 32GB memory cards for further processing. Boat speed did not exceed 7 mph between point intercept locations to ensure accurate interpolation of SAV presence and abundance. Sonar logs were recorded for approx. 2 hrs.

Raw .Sl3 sonar data files were uploaded to BioBase C-Map cloud-based processing service to extract bathymetry estimates and SAV biovolume (quantity of the water-column occupied by SAV; *0-100%*) from boating transects. All processed sonar logs were then exported as tabular data for further GIS post-processing, mapping, and statistical analysis.

*In Situ* Water Quality & Turbidity Survey

Water quality parameters and water clarity measurements were recorded among 29 discrete point-intercept sampling locations that were located within the defined survey area. Sampling points were defined prior to the start of the lake wide survey to ensure uniform spatial representation across the lake with 1.13-mile average spacing between points (Figure 2). Sampling point locations have remained consistent over survey years.

A Eureka MantaPlus water probe was deployed at the select water quality points to measure profiles of temperature, pH, specific conductivity, and dissolved oxygen. At each sampling point, recordings occurred 0.5 m below the water's surface, mid-water column, and 0.5 m above the sediment-water interface. These values were then averaged to determine mean water quality parameters at each point. To determine relative turbidity, a Secchi disk with graduated measurements was utilized. A Secchi measurement was taken when the disk was no longer visible to the surveyor when lowered in the water column. These readings can be useful in locating the boundaries of suspended solids, specifically planktonic algal blooms, between the North and South basins.

Post-Processing and Data Analytics

An average of the total abundance ratings of each toss was generated in Microsoft Excel to determine rake-toss density estimates. For example, if both rake tosses yielded *moderate* density the point was assigned an average of *moderate*. Whereas if one rake yielded *no plants* and the other yielded *moderate* density, the point was classified as *sparse*. Then, mean relative species abundance was calculated. Species abundances were classified as *trace*, sparse, *moderate*, or *dense* as a function of their estimated percent cover on the rake and the respective rake fullness estimate. For example, a *sparse* rake with 50% occupancy of Eurasian watermilfoil and 50% coontail resulted in a *trace* estimate of both Eurasian watermilfoil and coontail at the surveyed point. Further, a *dense* rake with 100% cover of Eurasian watermilfoil resulted in a *dense* species rating for Eurasian watermilfoil. Resulting values were then used to identify native and non-native dominance and distribution throughout the lake through the generation of point and heat density maps in ArcGIS Pro (v. 3.4.2).

Since sonar data does not provide species specific information, but rather a generalization of SAV water column occupancy and spatial breadth, point-intercept data was attributed to the biovolume estimates to determine species-specific estimated extent. To provide acre estimates of non-native SAV, specifically Eurasian watermilfoil, rake toss point data was combined with the exported echosounding outputs from BioBase into ArcGIS Pro. Survey point interpolation occurred using a geostatistical interpolation function. Interpolations are utilized to predict the non-surveyed areas between survey points. Input variables consider the mean buffered distance between rake toss locations to account for nearest neighbor influence. That is, alike SAV species were given a higher probability of occupying an area than plants which were less prevalent in proximity. The resulting interpolation raster was then clipped to the sonar biovolume areas where a non-occupancy threshold of <10% biovolume was set. This value is standard for interpolated biovolume datasets to reduce the possibility of false-positive SAV detection when evaluating submersed plant bed breadth using sonar.

Due to unforeseen site characteristics that were encountered during the fall 2025 survey, satellite imagery acquired by the Sentinel-2A satellite (European Space Agency) at a 10 m resolution was utilized as an additional post-hoc data source for assessment of the topped-out vegetation that occurred in Burtis Bay. This imagery source captured imagery of Burtis Bay on 17 April, 10 May, 11 June, 4 July, and 3 August of 2025, allowing for time-series comparison. True color (RGB) imagery was transformed to false color (NIR,R,G) images for improved SAV viewing, and a Normalized Difference Vegetation Index (NDVI) was calculated to quantify the spatial abundance of near-surface vegetation. The NDVI allows for greater contrast between vegetation presence and open water as NDVI values >0.1 were considered near-surface vegetation and NDVI values <0.1 were considered open-water or SAV not near the water's surface. The outcome of this analysis from the 3 August image was utilized as a reference for bolstering collected sonar data in Burtis Bay, as data gaps caused by topped-out vegetation and associated access limitations under-represented raw SAV biovolume in the region (Figure 4).

**Results Summary**

In total, 1076 points were sampled at Chautauqua Lake during the fall 2025 survey, with aquatic vegetation present at 942 of those points (88%) (Table 2). The overall abundance of submersed species at the vegetated points were most commonly classified as sparse (41%), followed by moderate (26%), trace (19%), and dense (14%) (Table 2; Figure 3). The average biovolume throughout the surveyed area was 38.6% (Figure 4).

In total, 29 aquatic species were documented during the survey, which includes submersed, emergent, floating, and algal growth forms. However, 16 of these 29 documented species were present at less than 5% of the sampled points (Table 2). The primary species present during the survey included western waterweed (*Elodea nuttallii*) at 62% of survey points, Eurasian watermilfoil (EWM; *Myriophyllum spicatum*) at 59% of survey points, coontail (*Ceratophyllum demersum*) at 43% of survey points, water stargrass (*Heteranthera dubia*) at 38% of survey points, and wild celery (*Vallisneria americana*) at 36% of survey points (Table 2).

Four non-native submersed aquatic plant species were documented during the survey: EWM, starry stonewort (*Nitellopsis obtusa*), curly-leaf pondweed (CLP; *Potamogeton crispus*), and brittle naiad (*Najas minor*). With the exception of EWM, all other non-native species were present at less than 5% of sampled sites. An estimated 2,350 acres of EWM were present in the surveyed regions of Chautauqua Lake during the survey period (Figure 5). Where present, EWM was observed in trace abundance at 82% of points, and moderate or dense at 12 total points (Figure 6). The region of the lake that supported the majority of moderate-to-dense EWM growth was Burtis Bay.

Despite dense CLP growth documented during a spring (June) 2025 survey, presence of CLP was scarce within Chautauqua Lake in August. In June, CLP was detected at 421 of 563 (75%) sampled locations in the South Basin. In August, CLP was present at only 15 total survey points (1%) throughout the whole lake (Figure 7). This seasonal difference is expected for CLP due to natural phenological change. While the CLP presence in fall 2025 was low, it was similar to levels observed during 2020 – 2022 fall surveys (2024: 13%; 2023: 14%; 2022: 3%; 2021: 4%; 2020: 5%). Further, CLP turions were only documented at 5 total survey sites (<1%) during the fall 2025 survey. However, the sampling methods utilized are not designed to accurately assess turion presence.

Starry stonewort was documented at 17 total sample points (2%) during this survey effort, indicating similar population levels in comparison to previous survey years (2024: 12 points; 2023: 24 points, 2022: 12 points, 2021: 7 points; 2020: 13 points) (Figure 8). When starry stonewort was found, additional rake tosses were conducted around the area to delineate extent of coverage. Active bulbil production was visually observed on starry stonewort biomass collected from Ashville Bay, Prendergast Point, and Fluvanna/Townline Road locations.

Very dense vegetation was present throughout Burtis Bay during the fall 2025 survey and to extents that have not been documented by the NCSU survey team in the past several years. Topped out biomass extended throughout the region to a degree in which water flow (as evidenced by contained pools of algal blooms and other debris) and general navigability via outboard motor was severely limited (Figures 9 & 10). Of the 130 points that extend from Burtis Bay to the lake's outlet, the composition of species in this region included western waterweed at 94% occurrence, EWM at 89% occurrence, and coontail at 66% occurrence (Figure 11). To support mapping efforts for this region, satellite imagery was utilized (Figure 12). When combined, satellite imagery and hydroacoustic datapoints estimate SAV extent to cover 825 of 885 acres (93%) and mean biovolume of the region was estimated to be 50% (Figure 13 & 4).

Measured water quality parameters were relatively consistent between basins, with differences between basins only occurring in site depth, Secchi depth, and pH measurements (Table 3). Water temperatures at the time of survey averaged 25.7°C and mean dissolved oxygen levels were 10 mg/L (121% saturation). Water clarity was lower in the South Basin (0.8 m) as compared to the North Basin (1.8 m); however, sample site depth was also shallower in the South Basin (1.7 m) than the North Basin (2.2 m) which likely has some influence on Secchi results. Visual observations throughout the lake during the survey period indicated that algal blooms were present in both the North and South Basins with major genera documented consisting of *Gloeotrichia*, *Microcystis*, *Dolichospermum*, and *Microseria* (Figure 14).

Town of Chautauqua

A total of 21 unique submersed aquatic plant species were identified in survey points within the Town of Chautauqua's shoreline (Table 4). Eleven survey points were added along the deep edge of the Town of Chautauqua's survey region to capture the full littoral zone extent (Figure 15). Of the 372 total survey points sampled, 341 (92%) contained vegetation. Water stargrass, EWM, and western waterweed were the three most prevalent species present, each documented in 54 – 55% of survey points. Almost half (46%) of rake tosses were rated as sparse within the Town of Chautauqua's survey area and 35% of rake tosses were of moderate or dense overall ratings. The only species to earn species-specific relative abundances of moderate or dense were EWM, tapegrass (*Vallisneria americana*), coontail, and whitestem pondweed (*Potamogeton praelongus*).

While EWM made up the majority of SAV within the Town of Chautauqua's survey region, it was classified as trace in 89% of points in which it was present. As seen around the majority of the lake in general, EWM was commonly documented intermixed with other species on rakes that were generally of sparse or moderate overall density. In total, the estimated extent of EWM in this region covers 623 acres.

Starry stonewort was also present at 11 survey sites within the Town of Chautauqua including four along the shallow Mayville region, two around the Chautauqua Marina, and three around Prendergast Point. Of these regions, points within the Chautauqua Marina and Prendergast Point were of greater overall biomass. Additional surveillance around Prendergast Point allowed for observation of moderate starry stonewort biomass forming pillow-like mats within Prendergast Creek leading into Snug Harbor Marina.

Village of Mayville

The Village of Mayville region of Chautauqua Lake was sampled at 121 total sites, and of which, 114 (94%) contained aquatic vegetation (Table 5; Figure 16). Water stargrass was the most commonly documented species, followed closely by EWM and slender naiad. The Village of Mayville shoreline contained 19 SAV species. In total, 47% of rake tosses were classified as sparse, or with the rake half full of plants. Starry stonewort was present at 6 total survey sites in this region, however, it was found in trace abundance and was not in healthy condition, as has been observed in previous survey years. It is hypothesized that perhaps the sandy bottom in this region is preventing the proliferation of starry stonewort biomass.

Town of Ellery

A total of 323 survey points were sampled within the Town of Ellery's region of Chautauqua Lake during the fall 2025 survey (Figure 17). A total of 263 (81%) contained aquatic vegetation (Table 6). Areas that lacked aquatic vegetation included deep sections around Long Point State Park and Bemus Point and the shallow, rocky shoreline along the Chautauqua Lake Wildlife Management Area in the South Basin. Where vegetation was present, 40% of rakes were classified as sparse, followed by 25% as moderate.

EWM was present at 49% of sampled sites at an estimated extent of 618 acres. CLP and starry stonewort were also present in 4 and 1 sample sites within the Town of Ellery, respectively. The starry stonewort location occurred just along the shoreline in Greenhurst. An additional population of starry stonewort was identified after investigation of a report of presence in Fluvanna at a lake access point off Townline Road on the southernmost edge of the Town of Ellery's survey region. This population was robust and highly intermixed with other aquatic plant species. This presence of starry stonewort was found outside of established survey points, however, future survey efforts will ensure that this area remains monitored.

Village of Bemus Point

Twenty one of the 32 (66%) survey points within the Village of Bemus Point's shoreline contained aquatic vegetation (Table 7; Figure 18). Of all regions of the lake, this area accounted for the least amount of overall SAV presence. Where SAV occurred, 57% of surveyed points were classified as trace abundance. Native species comprised the majority of Bemus Point's SAV community, with EWM present at only 3 (9%) of survey points. Benthic filamentous algae was present at 72% of survey points. Eurasian watermilfoil was the only non-native species within the Village of Bemus Point's shoreline region. In total, 12 unique submersed aquatic plant species were documented.

Town of Busti

Aquatic vegetation was present at 135 of the 144 (94%) survey points within the Town of Busti region of Chautauqua Lake during the fall 2025 survey (Table 8; Figure 19). Western waterweed and EWM were the two dominant species in this region, comprising 86% and 79% of surveyed points, respectively. Overall SAV abundance was classified as sparse at 45% of sample points, moderate at 27% of sample points, trace at 16% of sample points, and dense at 11% of sample points. Dense areas were concentrated towards the eastern end of this region, within Burtis Bay, and within shoreline areas of Sherman's Bay.

It is estimated that the EWM extent covers 512 acres within the Town of Busti, more than has ever been estimated in previous surveys (2024: 393 acres; 2023: 120 acres; 2022: 144 acres; 2021: 403 acres; 2020: 352 acres). It should be noted that the survey area in this region was expanded compared to recent years, with additional points sampled along the deep littoral edge in Sherman's Bay and leading out of Burtis Bay.

Starry stonewort was present at a single survey point within the Town of Busti, on the westernmost edge of the Town's shoreline. This location is in close proximity to additional points located in the Town of North Harmony. Only a single piece of starry stonewort was present at this point, and additional biomass could not be recovered with additional rake tosses, indicating that growth is exceptionally sparse in this area.

Village of Lakewood

Sampled points within the Village of Lakewood's shoreline totaled 81, and of which, 75 contained vegetation (93%) (Table 9; Figure 19). Similar to trends within the Town of Busti, major species included western waterweed, EWM, and coontail, present at 86%, 83%, and 65% of sampled points, respectively. The only species with moderate or dense relative abundance was western waterweed occurring in Burtis Bay. CLP was also documented in the Village of Lakewood, but only at a single survey site (Figure 7).

Town of Ellicott

Only 2 of the 60 surveyed points within the Town of Ellicott's shoreline did not contain aquatic vegetation during the fall 2025 survey (Table 10; Figure 21). Western waterweed was present at all vegetated locations and EWM was present at 85% of sampled locations. Where vegetation was present, 47% of points were classified as dense and 22% were classified as moderate. Western waterweed was the only species that received a species-specific abundance rating greater than sparse. Conditions within this region were uncharacteristically poor, with dense vegetation dominating the water column in the majority of the region. The composition of the vegetated mats contained western waterweed, EWM, and coontail. The estimated extent of EWM within the Town of Ellicott is 300 acres.

Village of Celeron

All survey points within the Village of Celeron's shoreline contained aquatic vegetation (Table 11; Figure 22). With western waterweed, EWM, and coontail presence documented at 100%, 96%, and 96% of all points, respectively. Only three species were present at relative abundance ratings greater than trace and included western waterweed, coontail, and water stargrass. CLP and brittle naiad were also present in this region of the lake at 1 survey point each.

An EWM treatment zone was present within the Village of Celeron's shoreline region around the boat slips of the Chautauqua Harbor Hotel. Herbicide treatments had recently been applied when this area was assessed, so some EWM biomass was still present. However, treatment symptomology was highly apparent with signs of epinasty (twisted) of stems and biomass in poor overall condition.

Town of North Harmony

The shoreline region along the Town of North Harmony contained 147 survey points (Table 12; Figure 22). In total 127 (86%) contained vegetation. Major species present included western waterweed at 71% of sample points, EWM at 61% of sample points, and coontail at 56% of sample points. EWM was only classified as trace or sparse abundance throughout the region. On average, the majority of overall rake ratings were classified as sparse (38%) followed by moderate (31%). The overall estimated extent of EWM in the Town of North Harmony is 297 acres.

Starry stonewort remained present within 3 survey points in Ashville Bay and an additional survey point at the eastern edge of the Town of North Harmony's shoreline. In Ashville Bay, starry stonewort biomass was classified as moderate and was observed to be producing rhizoids and bulbils. The majority of the growth occurs within waters that are approximately 4 feet deep within Ashville Bay Marina.

## Discussion

The fall 2025 survey of Chautauqua Lake's aquatic plant community revealed that SAV continues to occupy the majority of the lake's littoral zone. Generally, SAV abundance and extent was similar to observations made in August of 2024, with the exception of the major plant growth that occurred in Burtis Bay in 2025.

During this year's survey effort, EWM remained present at the majority of sampling points, however, it was most often observed to be intermixed with other species and not forming dense monocultures. Some of the EWM observed was in flower at several locations during the survey, including Burtis Bay and along the Stow shoreline region. Some stems were also producing adventitious roots as observed during previous fall survey efforts.

The CLP population was rarely observed during the fall 2025 survey. As discussed previously, this finding does not come at a major surprise, as the life cycle of CLP ends in the summer months when water temperatures warm. In June 2025, CLP was the most abundant species present and was documented at 75% of surveyed sites with an estimated coverage extent of 1,549 acres in the surveyed South Basin region. The senescence of CLP biomass between June and August can contribute to increased nutrient availability within the waterbody for late-season growth of other SAV.

In all Towns and Villages, native SAV represented the most abundant species according to fall 2025 survey results. This was especially apparent in Burtis Bay, where native plant growth dominated the water column. While western waterweed (*Elodea nuttallii*) is considered an invasive species in Europe, studies have documented that *E. nuttallii* presence can be positively correlated with increased nutrient availability, soft P-rich substrates, and the presence of zebra mussels (*Dreissena polymorpha*) – which are all factors that Chautauqua Lake provides (Crane et al. 2022). The positive relationship between zebra mussel recruitment by SAV and enhanced conditions for SAV growth (i.e. increased water clarity) could be a factor to further investigate within Chautauqua Lake's aquatic ecosystem.

Active mechanical harvesting efforts were being carried out during the survey period, and likely influenced some findings, especially with respect to species abundance and recorded biovolume in surveyed areas. Additionally, 172 acres were treated for EWM control, and 286 acres were treated for CLP prior to survey in June and April, respectively. In EWM treatment zones, average rake abundance was classified as moderate in June and sparse in August. Further, EWM abundance was reduced from sparse to trace average abundance within that same period (Figure 24).

Overall estimated EWM extent was comparable to 2024 estimates (2024: 2324 acres; 2025: 2350 acres), with some reduction observed within Ellery along the Bemus Point shoreline and some increase observed in Busti along the Lakewood shoreline (Figure 25). Overall relative abundance of EWM at survey points was slightly reduced in 2025 (59%) when compared to 2024 (64%) levels (Figure 26).

**Conclusions**

- Eurasian watermilfoil (EWM) was present at 59% of points surveyed during the fall 2025 survey, but was most commonly found in trace or sparse abundance, intermixed with other SAV species.

- Presence of CLP was greatly reduced during the fall 2025 survey when compared to spring 2025 conditions, as is expected due to the plant's early season life cycle. The major reduction of biomass is likely attributed to warm water temperatures and natural growth habit. Continued monitoring in spring seasons should be considered to fully capture CLP extent within Chautauqua Lake.

- The most abundant species documented during the fall 2025 survey was western waterweed, which was present at 62% of surveyed points. Although western waterweed was found throughout the lake, it was present in particularly aggressive growth form in Burtis Bay intermixed with coontail and EWM.

- Starry stonewort was discovered at 17 survey points within 4 of the 5 townships at Chautquaua Lake. The majority of these locations are those where starry stonewort was documented in previous surveys. As described in prior survey reports, special attention should be allocated to starry stonewort populations in high use areas including marinas and fuel stations. Bulbil production was observed in fall 2025, with at least 8 bulbils found in a moderate-sized handful of biomass (Figure 27).

- The lakewide average hydroacoustic biovolume estimate was 38.6%, with an average of 39.9% in the North Basin and 37.3% in the South Basin. Biovolume in Burtis Bay averaged 50%. Biovolume is highly dependent on water depth, species type/presence, and management activities.

- Physical water quality parameters were relatively consistent between North and South Basins although differences were observed in pH, Secchi depth, and site depth. Algal blooms were commonly observed during the fall 2025 survey period. Algal accumulation of high density has the potential to influence SAV growth due to competition for space, light and nutrients.

**References**

[CLA] Chautauqua Lake Association. 2025. Chautauqua Lake Association Work Reports. Accessed from: https://chautauqualakeassociation.org/management/work-reports/

Crane, K., L. Kregting, N.E. Coughlan, R.N. Cuthbert, A. Ricciardi, H.J. MacIsaac, J.T.A. Dick, N. Reid. 2022. Abiotic and biotic correlates of the occurrence, extent and cover of invasive aquatic *Elodea nuttallii*. Freshwater Biology. 67: 1559 – 1570.

EcoLogic, LLC. 2018. 5-year implementation strategy for the management of Chautauqua Lake and its watershed. Report. Prepared for Chautauqua Lake and Watershed Management Alliance, Jamestown, NY. 1 – 42.

Johnson RL. 2018. Early Fall 2017 presence and abundance of the aquatic plants in Chautauqua Lake with additional Bemus Bay survey. Racine-Johnson Aquatic Biologists. Ithaca, NY. 1 - 115.

Madsen, J. D. 1999. Point intercept and line intercept methods for aquatic plant management. APCRP Technical Notes Collection (TN APCRP-M1-02). U.S. Army Engineer Research and Development Center, Vicksburg, MS. 1-17.

[NCSU] North Carolina State University. 2020. Chautauqua Lake Monitoring Program Submersed Aquatic Vegetation Survey Results - August 2020. Prepared for Chautauqua Lake Partnership, Bemus Point, NY.

[NCSU] North Carolina State University. 2021. Chautauqua Lake Monitoring Program Submersed Aquatic Vegetation Survey Results - August 2021. Prepared for Chautauqua Lake Partnership, Bemus Point, NY.

[NCSU] North Carolina State University. 2022. Chautauqua Lake Monitoring Program Submersed Aquatic Vegetation Survey Results - August 2022. Prepared for Chautauqua Lake Partnership, Bemus Point, NY.

[NCSU] North Carolina State University. 2023. Chautauqua Lake Monitoring Program Submersed Aquatic Vegetation Survey Results - August 2023. Prepared for Chautauqua Lake Partnership, Bemus Point, NY.

[NCSU] North Carolina State University. 2024. Chautauqua Lake Monitoring Program

Submersed Aquatic Vegetation Survey Results - August 2024. Prepared for Chautauqua Lake Partnership, Bemus Point, NY.

Smith ZJ, Conroe DE, Schulz KL, Boyer GL. 2020. Limnological differences in a two-basin lake help to explain the occurrence of anatoxin-a, paralytic shellfish poisoning toxins, and microcystins. Toxins. 12: 559.

Solitude Lake Management. 2019. Chautauqua Lake monitoring program: 2019 delineation of aquatic vegetation in Chautauqua Lake. Report. 1 – 23.

Solitude Lake Management. 2018. Chautauqua Lake monitoring program: 2018 delineation of non-native macrophytes and other submersed aquatic vegetation (SAV) in Chautauqua Lake. Report. 1 – 21.