2024 Lake Gaston Vegetation Survey Report

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Introduction

Lake Gaston is a 20,000 acre reservoir located along the Roanoke River, divided by the border of North Carolina and Virginia. Lake Gaston is dammed between two other Roanoke River chain reservoirs, which includes Kerr Lake (50,000 acres; US Army Corps of Engineers) upstream and Roanoke Rapids Lake (4,600 acres; Dominion Energy) downstream. Lake Gaston was impounded in 1964 by the Virginia Electric Power Company and maintains a normal pool of 200 feet above sea level. Water levels are mandated to remain within one foot of normal pool, except in the case of emergency. Lake Gaston's primary utility is for generating hydroelectric power by Dominion Energy and provide drinking water to Virginia Beach, VA. However, the lake also provides recreational boating and sporting activities opportunities, and is highly developed along its 350 miles of shoreline.

Lake Gaston's aquatic vegetation community is annually surveyed to evaluate the diversity, abundance, and distribution of aquatic plant and algae species throughout the system. A combination of point intercept and SONAR surveys are performed along the lake's shoreline to provide a robust evaluation of the aquatic plant community. These surveys are completed through a collaborative effort between the Lake Gaston Association (volunteers) and researchers from the North Carolina State University (NCSU) Aquatic Plant Management Program. Funding for these surveys is provided by the Lake Gaston Weed Control Council.

Currently, there are two problematic aquatic species found in Lake Gaston; the invasive submersed weed, hydrilla (*Hydrilla verticillata*), and the nuisance alga, lyngbya (*Microseira wollei*). Both hydrilla and lyngbya require continued monitoring to help facilitate appropriate management action. Hydrilla, a federally listed noxious species, has been successfully managed within the system for almost a decade. However, hydrilla produces vegetative reproductive structures (turions and tubers) that can lay dormant for up to 7 years before germination, thus extending the persistence of the population (Nawrocki et al. 2016).

The first documentation of lyngbya within Lake Gaston occurred in the mid 1990's. Lyngbya is a free-suspension filamentous cyanobacterium that can produce robust filamentous mat formations along the benthic environment. During warmer summer months, these benthic mats have the potential to proliferate upward through the water column producing thick floating mats along the water's surface. Lyngyba has become increasingly problematic for southeastern reservoirs over the past decade and management requires a lengthy and expensive program.

Management response to both hydrilla and lyngbya has been extensive at Lake Gaston. In 2012, hydrilla was reported to cover over 1,500 acres of Lake Gaston's shoreline. An integrated management program using a combination of chemical (herbicide) and biological (grass carp) control methods has greatly reduced the level of hydrilla infestation to 329 in

2023 In 2012, approximately 230 acres of lyngbya were reported within Lake Gaston and to date, the infestation has continued to increase to over 1,000 acres. Large scale management efforts directed at lyngbya initiated in 2021 when 300 acres were targeted. Following initiation, the management program increased the targeted lyngbya management area to 375 for the 2022 and 2023 seasons, and 500 acres for the 2024 season. Yearly monitoring of both species is critical for continued management success.

Methods

Vegetation Survey

A point intercept survey was implemented to quantify the diversity and distribution of aquatic plants within Lake Gaston between August 16th and October 29th, 2024. This survey, conducted primarily by volunteer effort, recorded all aquatic plant species that were present at individual points using a combination of visual surveys and rake toss sampling approaches. At each point, the presence of emergent and floating-leaved species were recorded using a visual survey of the shoreline, while submersed and algal species were recorded using a rake toss method. The rake toss method utilized a double-sided metal rake, created by welding two steel garden rake heads together, attached to a rope that is thrown towards the shoreline and dragged along the bottom to collect any submersed plant material. A total of 2 rake tosses were conducted at each survey site. If hydrilla or lyngbya were detected at a sample point, additional data was collected. If hydrilla was present, average plant length was recorded. If lyngbya was present, the density of mat material collected by the survey rake was ranked and recorded. Survey points were not pre-determined and were chosen at random by the survey team in the field; however, the targeted distance between points was 200 feet. The GPS location of surveyed points, along with the species present, was recorded on handheld tablets equipped with GIS Cloud™ software.

Sonar surveys were conducted by NCSU researchers and were used to calculate the overall biovolume (% vertical occupancy) of submersed vegetation within the lake. The data collected during this survey was post-processed using BioBase™ cloud-based technology and then used in combination with the point intercept data to calculate the acreage of submersed species using Esri™ ArcGIS Pro software.

Tuber Survey

Due to the life history traits of hydrilla, additional survey methods were required to evaluate the distribution of this species in Lake Gaston. While the point intercept and sonar surveys identify the present status of hydrilla within the lake, a survey of the tuber bank within lake sediments was also needed to evaluate future succession potential. Tuber surveys were conducted by NCSU researchers at 11 creeks located throughout the lake. Within each creek, there were 1 to 4 individual sampling sites, each of which were located in an area that historically contained hydrilla. Tubers were collected utilizing a core sampler that removes a

circular plug of sediment from the substrate and that sediment core was then washed over a screen to expose any tubers that were present. Depending if tubers were detected, 30 to 50 core samples were collected at each individual site. Tuber densities (tuber per m^2) were calculated per site and then averaged over all sites within a creek to determine the overall tuber bank density for each creek.

During years of peak hydrilla management,there were a total of 71 historical tuber survey sites used to capture the extent and density of the hydrilla tuber bank across 18 creeks at Lake Gaston. Beginning with the 2023 season, protocols for site selection were adjusted due to decreased hydrilla abundance and distribution throughout the lake. Individual survey sites are currently prioritized based on the number of years since hydrilla has last been detected (plant biomass or tuber occurrence). If biomass was detected in areas adjacent to survey sites during the current growing season or if tubers were detected during the previous year, these sites were considered priority (1) and tuber sampling occurred for that given season. Priority (2) sites are sampled on a bi-annual basis and were identified as sites that had low and inconsistent detection of plant biomass and/or a tuber bank over the past 7 years. Priority (3) sites have not documented plant biomass and/or a tuber bank presence in over 5 years, therefore the hydrilla population is considered below detectable limits. Priority (3) sites will not be actively sampled but will remain closely monitored and future sampling will occur if hydrilla is detected in areas adjacent to the survey sites.

Results

Point Intercept Survey Effort

The 2024 point intercept survey was conducted between August 16th and October 29th. During this timeframe, 60 individual teams comprised of 106 volunteers surveyed a total of 5,637 sites. These teams put in a total effort (including both preparation and active surveying time) of 622 hours for the 2024 survey and accounted for 529 hours of the active surveying time. NCSU staff surveyed a total of 567 sites and accounted for 30 hours of active surveying time. In total, 6,204 sites were surveyed by both volunteers and NCSU in a time span of 560 hours. This level of sampling effort is comparable to previous survey years (Figure 1).

Overall Vegetation

Overall, 81% of the sites surveyed contained aquatic vegetation (Table 1). The aquatic plant community was primarily comprised of emergent species (64%), followed by algal species (22%), submersed species (10%), and floating-leaved species (5%). (Table 1; Figure 2). Due to the high stocking rate (18.5 fish / standing acre) of Grass Carp within Lake Gaston as part of an integrated management protocol for hydrilla, the low percentage of submersed and floating-leaved species was expected. Grass Carp will indiscriminately feed on other aquatic plant species in addition to hydrilla, although emergent and algal species are not generally a preferred food source. Within the aquatic plant community, water willow was the most prevalent species found (40%) (Table 1; Figure 2) and has consistently remained the most

abundant plant found within the system since 2018. The second most abundant species were represented two alga's, lyngbya and chara, both of which made up 11% of the total vegetation (Table 1; Figure 2). Water willow and lyngbya are also well distributed throughout Lake Gaston; however, chara is more closely associated with those areas that are not heavily infested with lyngbya, such as Pea Hill and Lizard Creeks (Figures 3-5). Both water willow and chara are considered native beneficial species, while lyngbya is considered a nuisance alga that can have negative impacts to aquatic ecosystems.

Hydrilla

Hydrilla was distributed throughout Lake Gaston in 2024 (Figure 6), however overall acreage has remained at low levels since 2014 (Figure 7). NCSU has been actively involved in the management of the aquatic plant community since 2012, and during that time the standing acreage of hydrilla has decreased from 1,541 acres reported in 2012 to 289 acres in 2024 (Figure 7). Percent occurrence of hydrilla within sites surveyed has also followed a negative trend, with hydrilla being reported at 64% of survey sites in 2012 and only 6% in 2024 (Figure 7). Results from the tuber bank survey conducted in winter of 2024 also indicate a drastic decrease from initial densities reported in 2012 (Table 2). The tuber bank located within the eastern portion of the lake (east of Eaton Ferry's Bridge) remains near undetectable levels. Lizard and Jimmies Creek are the only creeks in which a persistent tuber bank has been detected over the last three sampling years, but both sites displayed decreases from the reported 2023 density levels. The western portion of the lake (west of Eaton Ferry's Bridge) also remains near undetectable tuber bank levels. Hawtree and Cotton Creek were the only two areas in which tubers were detected, and both creeks have consistently reported a tuber bank presence over the last three years. The highest density of tubers detected during the 2024 survey season was reported in Hawtree Creek (24.67 tuber/m2).

Lyngbya

In 2024, lyngbya represented 11% of the total aquatic plant community, was present at 16% of sites surveyed, and was estimated to cover 1,037 acres along the shoreline of Lake Gaston (Table 1; Figure 8). Since 2020, lyngbya has been the second most prevalent species reported in Lake Gaston and has steadily increased in total acreage from 2012 to 2021 (Figure 8). However, in 2021 management efforts directed at lyngbya intensified and 300 acres of lyngbya were targeted for direct management utilizing algaecide treatment protocols. The treatment program increased the targeted amount of acres to 375 for the 2022 and 2023 seasons, and 500 acres for 2024. This increase in directed management coincides with reported lyngbya acres that were maintained at approximately 1,300 between 2021 and 2023, and then decreased to 1,037 acres in 2024. However, it should also be noted that a decrease in overall growth potential was displayed system wide for lyngbya in 2024. Surface mat formations were found at low levels in areas that have been historically inundated, and in certain areas, benthic mats were not as robust as in previous years. Therefore, it is difficult to determine the driving factor for the decreased lyngbya acreage in 2024.. Temporal trends

in lyngbya acreage will need to be monitored in consecutive years to understand this potentially downward trend in total acreage.

Lyngbya forms robust, filamentous mats along the bottom of the lake and density levels of those mats could help explain growth potential for lyngbya and/or treatment efficacy for targeted areas. Therefore, the annual survey also collects data to determine the density of those benthic mats at each survey site. For all sites in which lyngbya was present a large proportion was represented by benthic mats that were reported at trace densities (43%), which has increased from the 33% reported in 2023. Sites that contained moderate density levels decreased from 44% reported in 2023 to 35% in 2024. These shifts in areas that contain trace to moderate density levels indicate that although benthic mats persist in the system, they are becoming less robust in nature. Lyngbya sites that contained benthic mat displaying high densities of lyngbya represented 22% and this value has not shifted from levels reported in 2023.

Eel grass

Eel grass, *Vallisneria neotropicalis*, is a native and beneficial submersed species that has displayed increased distribution and abundance at Lake Gaston (Figure 10). In 2024, eel grass represented 2% of the total aquatic plant community, was present at 3% of total survey sites, and was estimated to cover 123 acres of shoreline (Table 1). Eel grass was found primarily in the lower, eastern section of the lake and has increased its distribution from that reported in 2023 (Figure 11). Although native, concern over eel grass distribution has been noted due to the rapid growth and expansion capabilities displayed by invasive and hybridized eel grass populations established throughout the southeast. To address these concerns, eel grass samples were collected from Lake Gaston in 2023 and genetic analysis was performed by the Thum Lab at Montana State University. The results of that study concluded that the samples collected at Lake Gaston were a native species of eelgrass, *V. neotropicalis*, and were closely related to other eel grass samples collected from populations in North Carolina, South Carolina and Florida (R. Thum, personal communication).

Conclusion and Management Implications

- For a reservoir system, the aquatic plant community at Lake Gaston is quite diverse compared to similarly sized reservoirs in NC/VA. The aquatic community is represented by a host of native emergent, submersed, and floating-leaved species, all of which provide beneficial ecosystem services to the lake. Though diverse in species composition, density levels of submersed and floating-leaved species are low and likely due to the herbivory pressure that results from high stocking rates of Grass Carp for hydrilla management.
- Hydrilla remains at low acreage levels throughout the system and current management strategies seem to be effective at managing and maintaining this invasive species. Overall acreage has decreased from 2023 to 2024 and tuber bank detections remained relatively stable suggesting hydrilla expansion has not occurred. Continued management of this species is recommended due to the rapid growth potential presented from overwintering vegetative structures (tubers and turions).
- The current lyngbya management program within Lake Gaston is producing positive results. Success of this treatment program could potentially be reflected in the stability of reported lyngbya acreage from 2021 to 2023 and the decrease in acreage reported in 2024. However, the distribution of lyngbya is widespread throughout Lake Gaston, with many areas still displaying moderate to dense mat densities. Continued management of this algal species is recommended.
- The eel grass population continues to increase in distribution and abundance at Lake Gaston. Although DNA extraction methods have confirmed plant sample locations to be of the native *V. neotropicalis*, continued monitoring and sample collections is recommended to determine if management efforts are needed in the future.
- Continued annual surveying of Lake Gaston's aquatic plant community is needed to monitor growth and distribution of native plant communities and those which are considered nuisance, noxious, or potentially harmful species.

References

Nawrocki JJ, Richardson RJ, Hoyle ST. 2016. Monoecious hydrilla tuber dynamics following various management regimes on four North Carolina reservoirs. Journal of Aquatic Plant Management. 54: 12 – 19.

Table 1. The abundance and diversity of the aquatic plant community as reported during the 2024 shoreline vegetation survey at Lake Gaston, NC/VA.

LAKE GASTON AQUATIC PLANT COMMUNITY - 2024				
	# of Total Sites	**% of Total Sites**	**% of Total Vegetation**	**Previous % of Total Vegetation (2023)**
SURVEYED SITES	6,204			
VEGETATED SURVEY SITES	5,049	81		82
Emergent				
AMERICAN LOTUS	101	2	1	1
ARROWHEAD	319	5	3	4
CATTAIL / CUTGRASS	615	10	7	5
PICKERELWEED	349	6	4	3
RUSH	357	6	4	4
SPATTERDOCK	405	7	4	3
WATER WILLOW	3,746	60	40	39
TOTAL EMERGENT SPECIES	*5,892*	*95*	*64*	*63*
Submersed				
EEL GRASS	187	3	2	2
EGERIA / ELODEA	19	0	0	0
COONTAIL	109	2	1	1
NAIAD	0	0	0	2
HYDRILLA	400	6	4	4
PONDWEED	189	3	2	1
WATERMILFOIL	18	0	0	0
TOTAL SUBMERSED SPECIES	*922*	*15*	*10*	*9*
Floating-leaved				
WHITE WATERLILY	195	3	2	2
WATERSHIELD	224	4	2	2
TOTAL FLOATING-LEAVED SPECIES	*419*	*7*	*5*	*5*
Algae				
CHARA / NITELLA	1,022	16	11	13
COMPSOPOGON	0	0	0	0
LYNGBYA	1,014	16	11	13
TOTAL ALGAE SPECIES	*2,036*	*33*	*22*	*23*

Table 2. Hydrilla tuber bank densities (tuber/ m^2) calculated for 18 creeks throughout Lake Gaston, NC/VA. Average density estimates for each creek are shown for the initial survey (2012) and the last five surveys that were conducted (2020-2024). Results represented by italics indicate sites in which the hydrilla population are classified as priority levels 2 or 3 and therefore are not sampled on a regular basis.

LAKE GASTON HYDRILLA TUBER BANK ESTIMATES								
	Priority Level (2024)	**Years Since Last Tuber Detection**	**Starting Bank Density (2012)**	**2020**	**2021**	**2022**	**2023**	**2024**
East of Easton's Ferry Bridge								
Jimmies Creek	1	0	36.41	0	0	0.82	12.33	8.39
Timberline Shores	3	*6*	3.08	0	0	0	*n/a*	*n/a*
Cold Springs Branch	2	0	34.95	0	0	0	*n/a*	1.64
Lakeview	3	*10*	124.37	0	0	0	*n/a*	*n/a*
Lizard Creek	1	0	N/A	0	24.39	53.72	15.90	7.40
Big Stone House	1	1	31.25	0	0	0	7.40	0
Pretty Creek	2	*8*	38.72	0	0	0	*n/a*	0
Poe Creek	2	*5*	125.4	0	0	0	*n/a*	0
Woodland Hurst	1	6	135.67	0	0	0	0	0
Sledge Creek	2	*2*	8.22	0.82	0	2.47	*n/a*	*n/a*
Hamlin	1	5	446.08	0	0	0	0	0
West of Easton's Ferry Bridge								
Hubquarter	1	4	292.73	1.64	0	0	0	0
Lyons Creek	2	*5*	293.96	0	0	0	0	*n/a*
Poplar Creek	1	1	89.63	8.22	0	0	31.52	0
Hawtree	1	0	38.03	6.58	4.93	22.61	84.28	24.67
Smith Creek	1	1	8.22	0	0	3.70	0.62	0
Flats	3	*6*	119.23	0	0	0	*n/a*	*n/a*
Cottons Creek	1	0	217.9	42.48	0	5.76	13.16	13.16

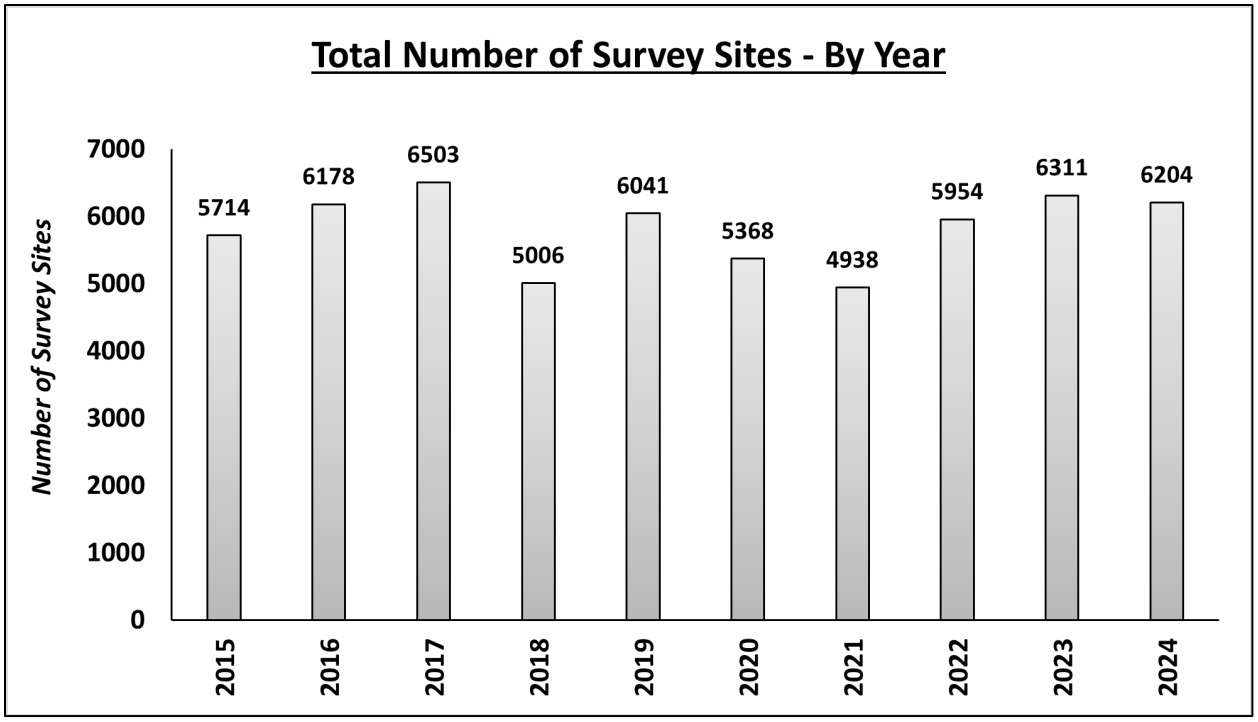

Figure 1. Bar graph representing total sites surveyed during yearly vegetation surveys conducted on Lake Gaston, NC/VA between 2015 and 2024.

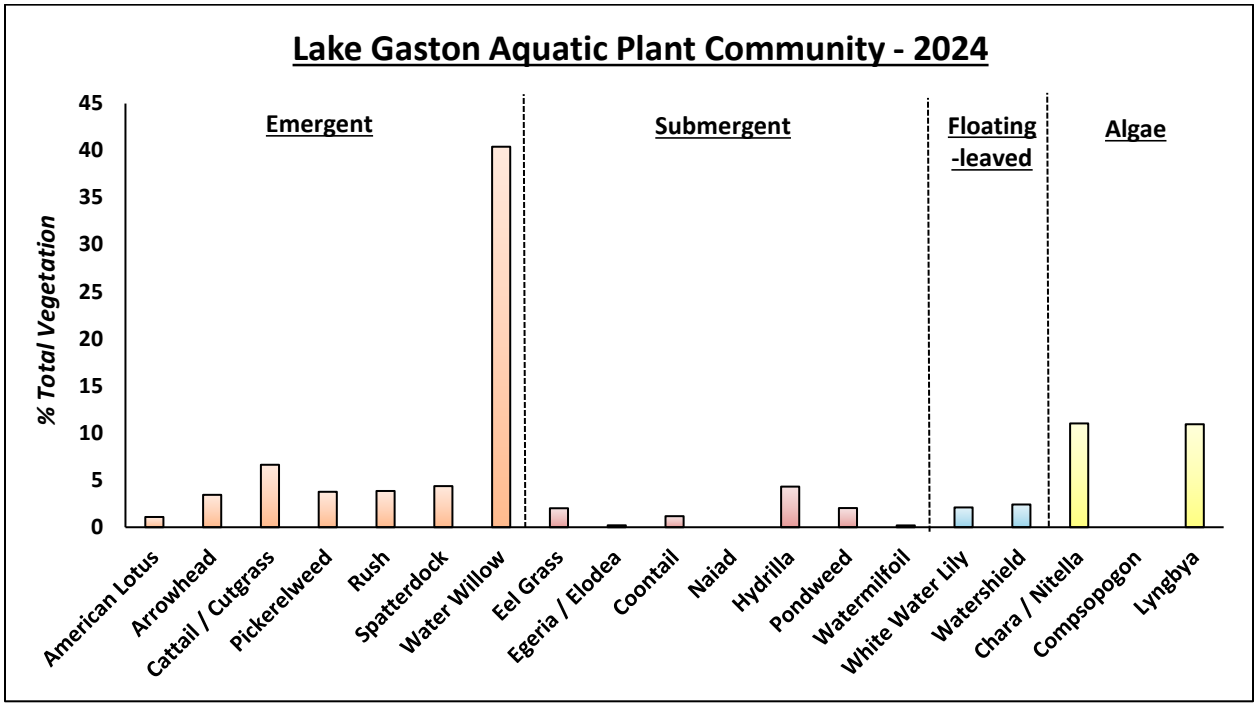

Figure 2. Bar graph representing the overall aquatic plant community of Lake Gaston, NC/VA in 2024. Overall, the community is represented by emergent (64%), submersed (10%), floating-leaved (5%), and algae (22%) species.

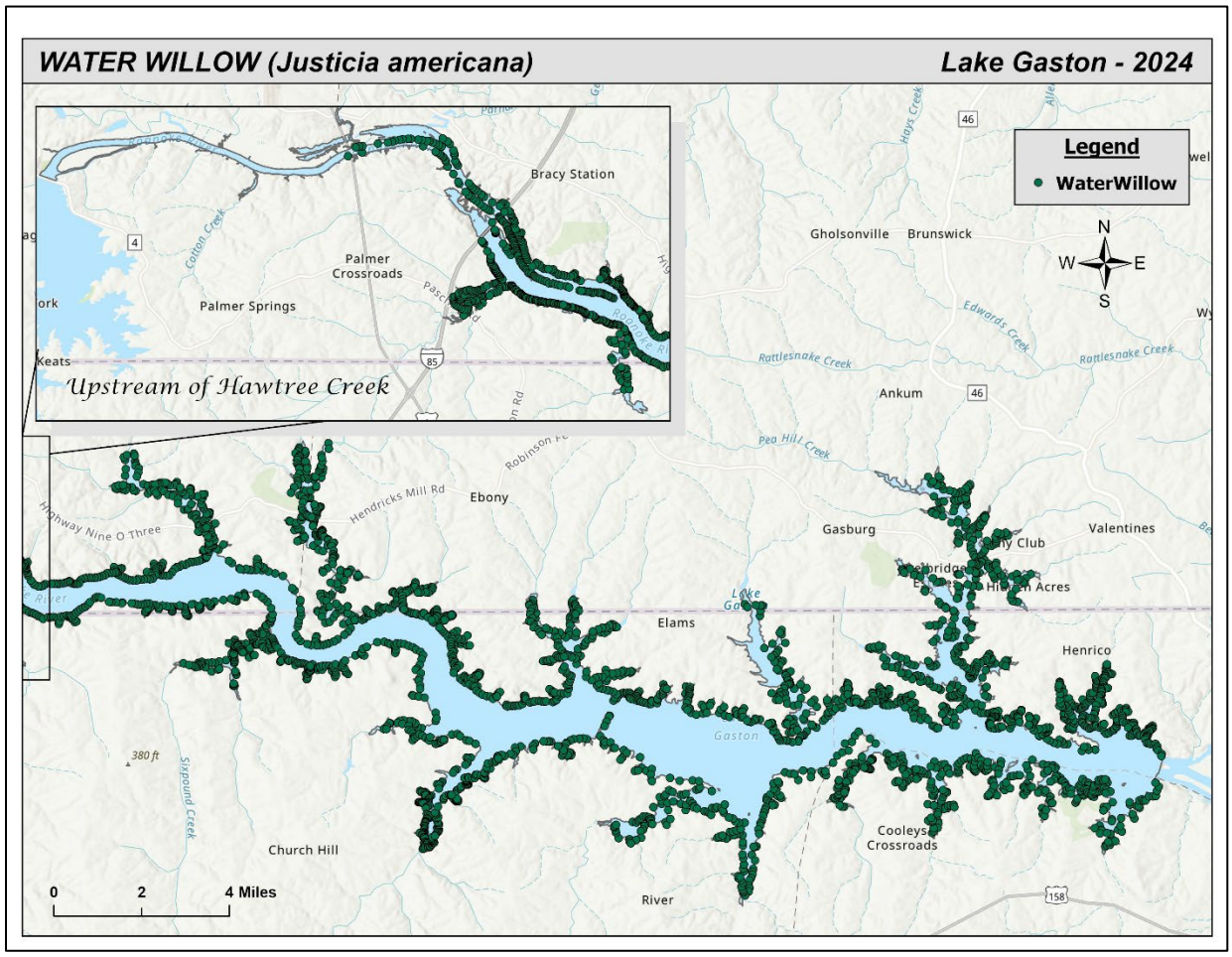

Figure 3. Map indicating sites where water willow was present during the shoreline vegetation survey of Lake Gaston, NC/VA in 2024. Water willow was the most prevalent species found in 2024.

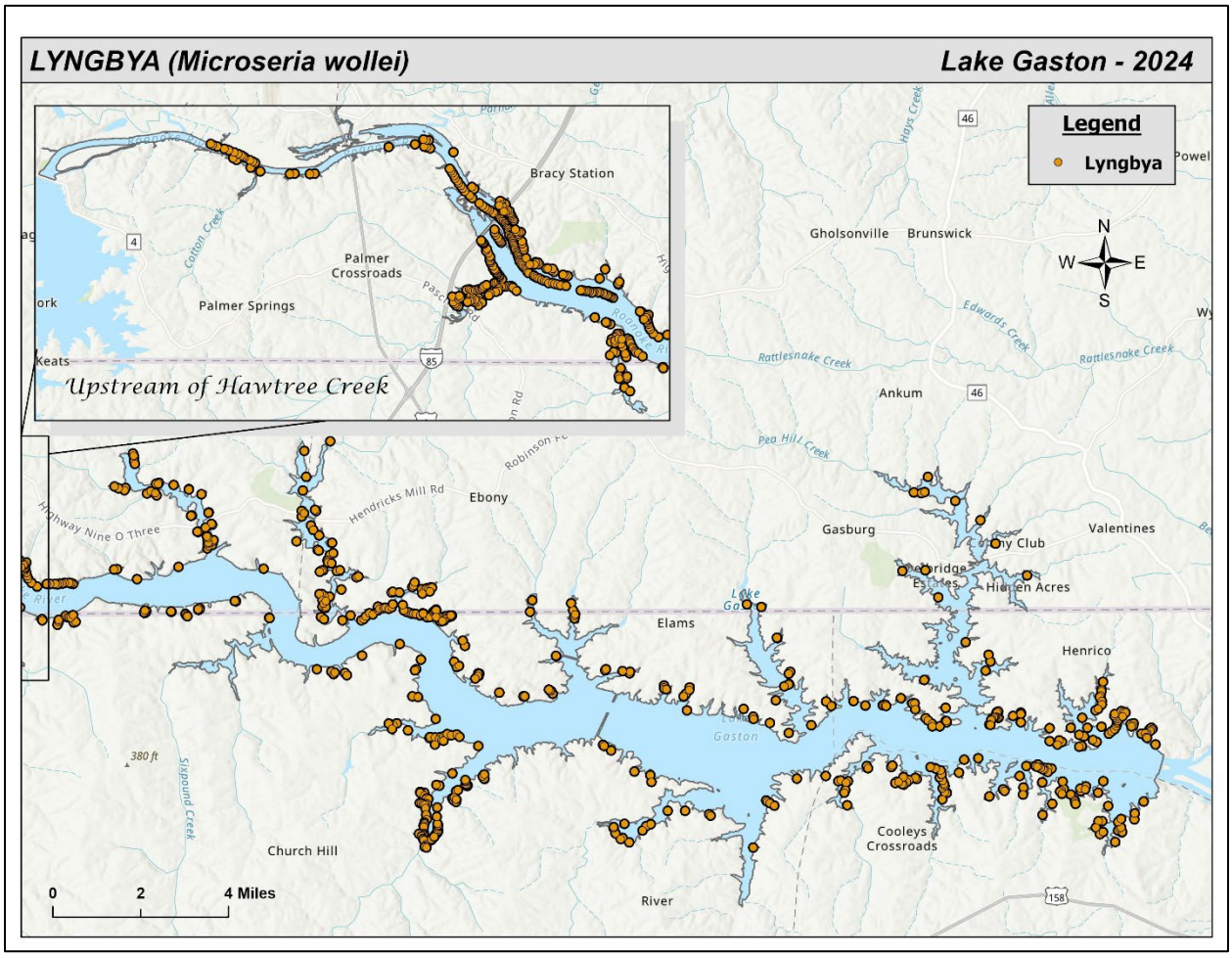

Figure 4. Map indicating sites where lyngbya was present during the shoreline vegetation survey of Lake Gaston, NC/VA in 2024. Lyngbya is a native species but is considered to be at noxious levels within the system and is one of the second most prevalent species found in 2024.

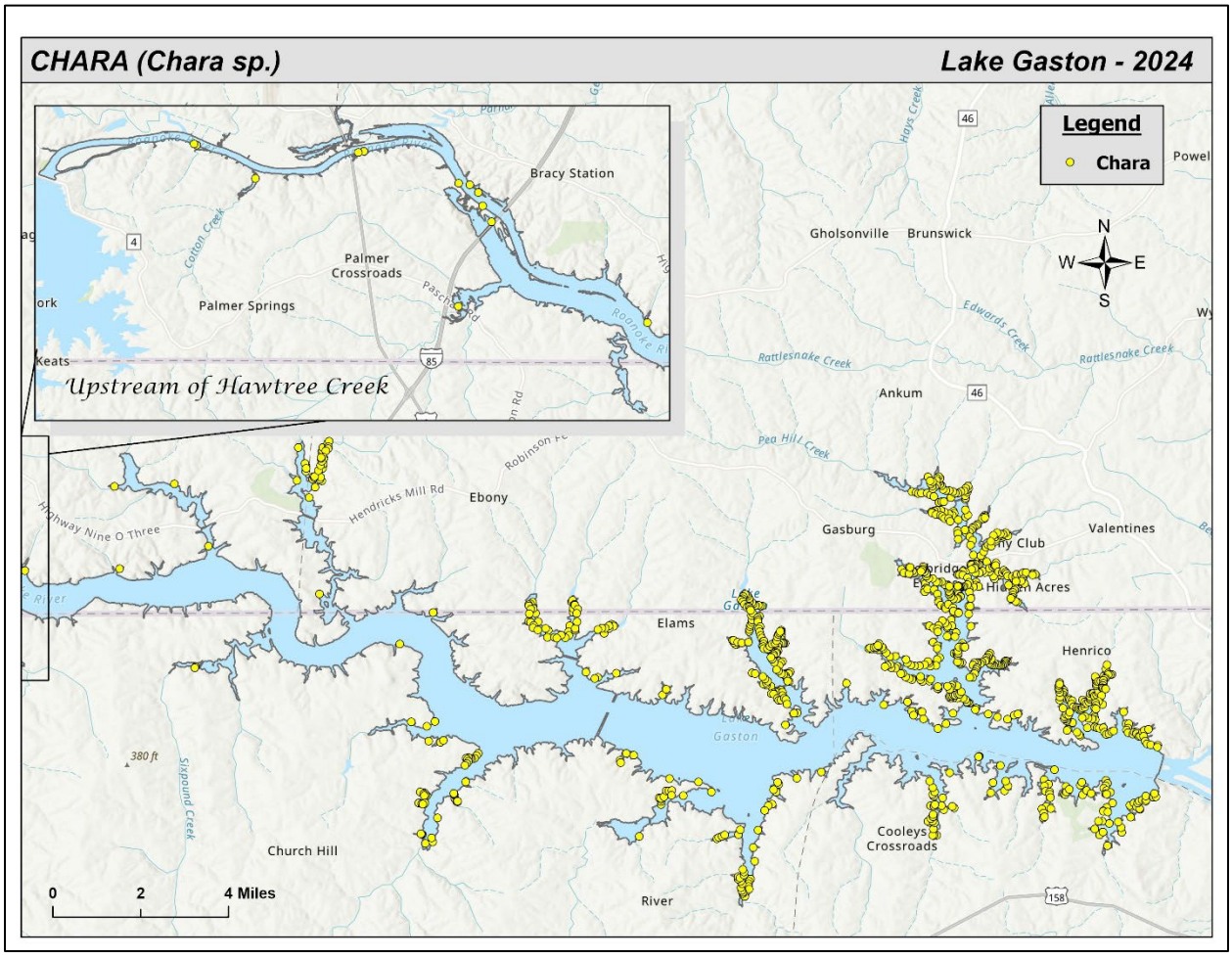

Figure 5. Map indicating sites where chara/nitella was present during the shoreline vegetation survey of Lake Gaston, NC/VA in 2024. Chara/nitella is a native species and was one of the second most prevalent species found in 2024.

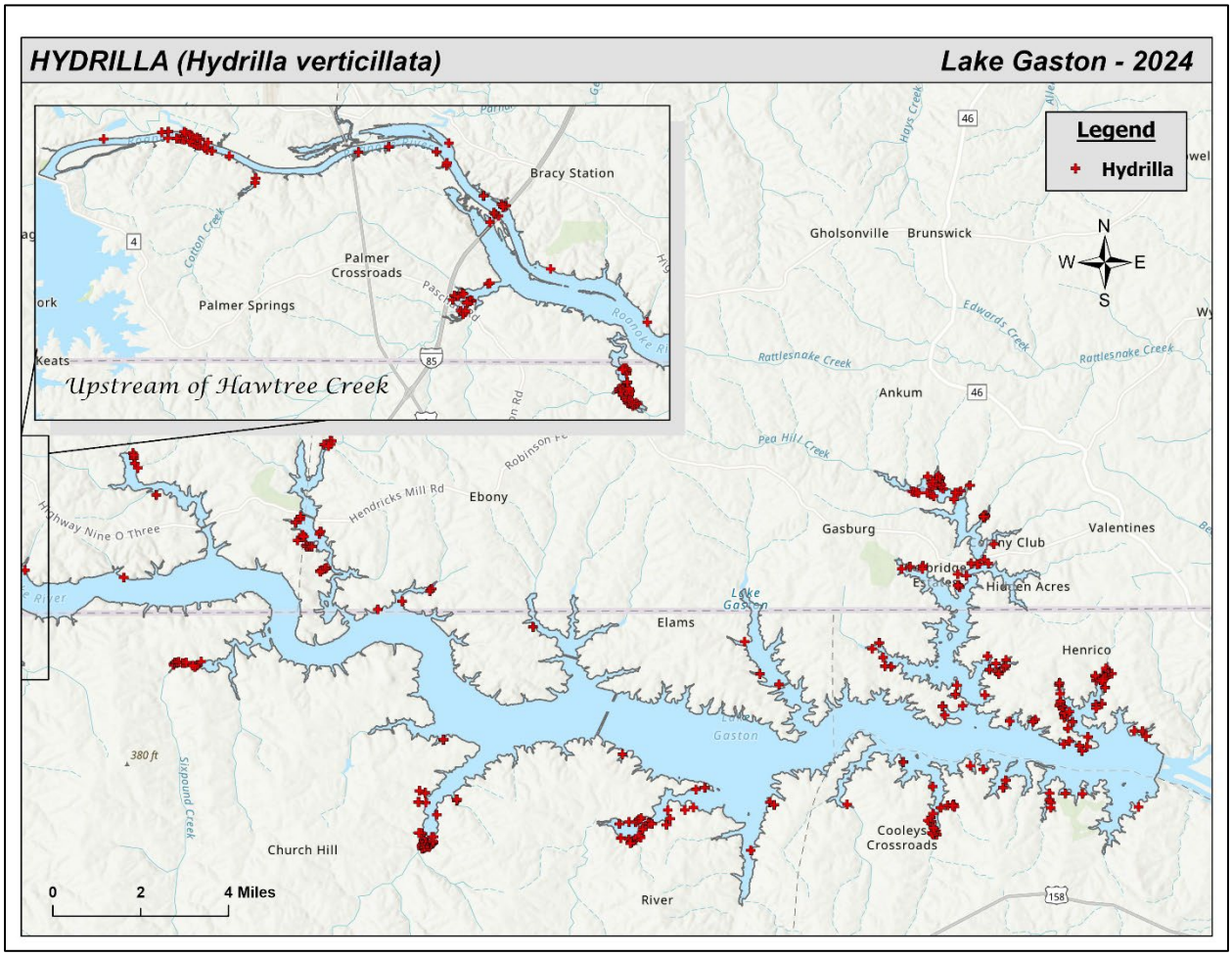

Figure 6. Map indicating sites where hydrilla was present during the shoreline vegetation survey of Lake Gaston, NC/VA in 2024. Hydrilla is a federally noxious weed species and was the most prevalent submersed species found in 2024.

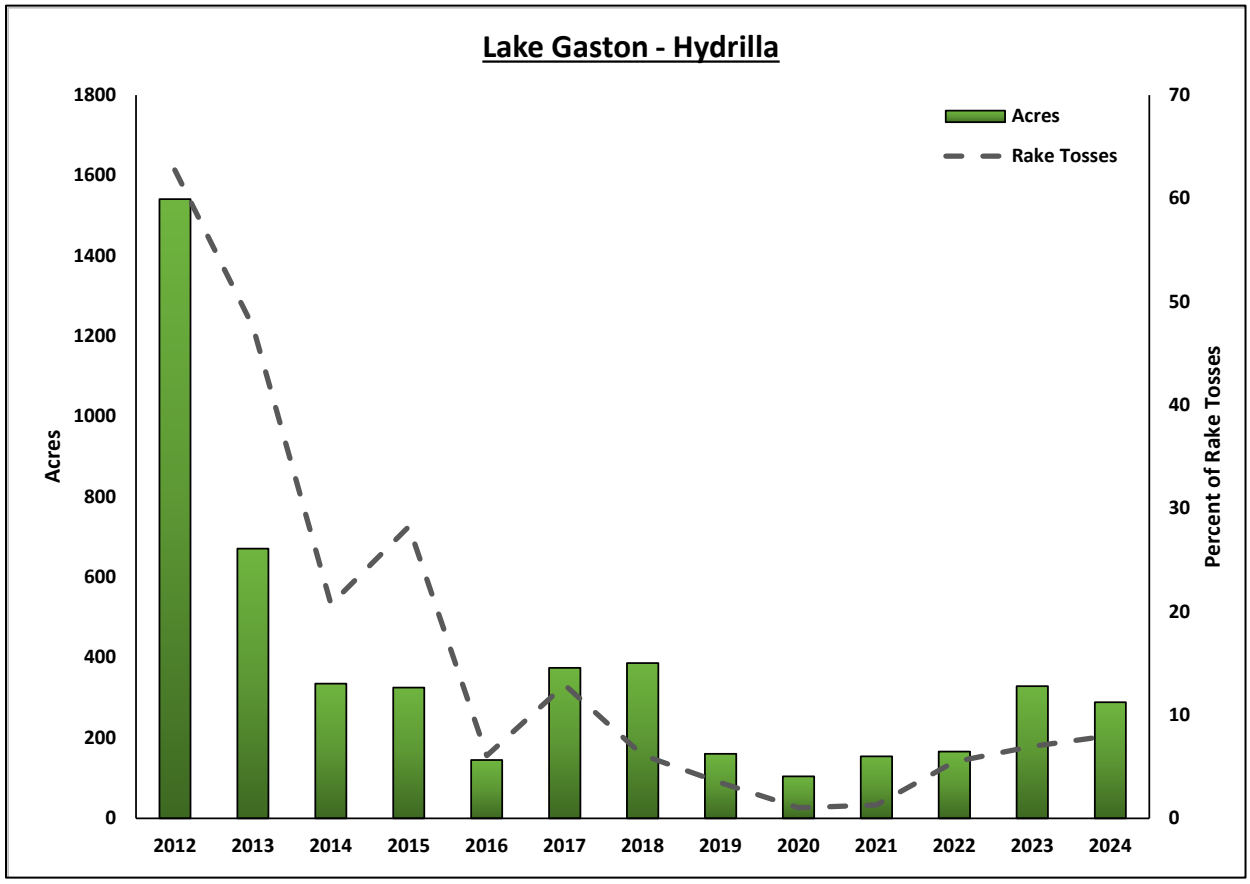

Figure 7. Estimated standing acreage (bars) and percent occurrence in the vegetation survey (line) of hydrilla in Lake Gaston, NC/VA between 2012 and 2024.

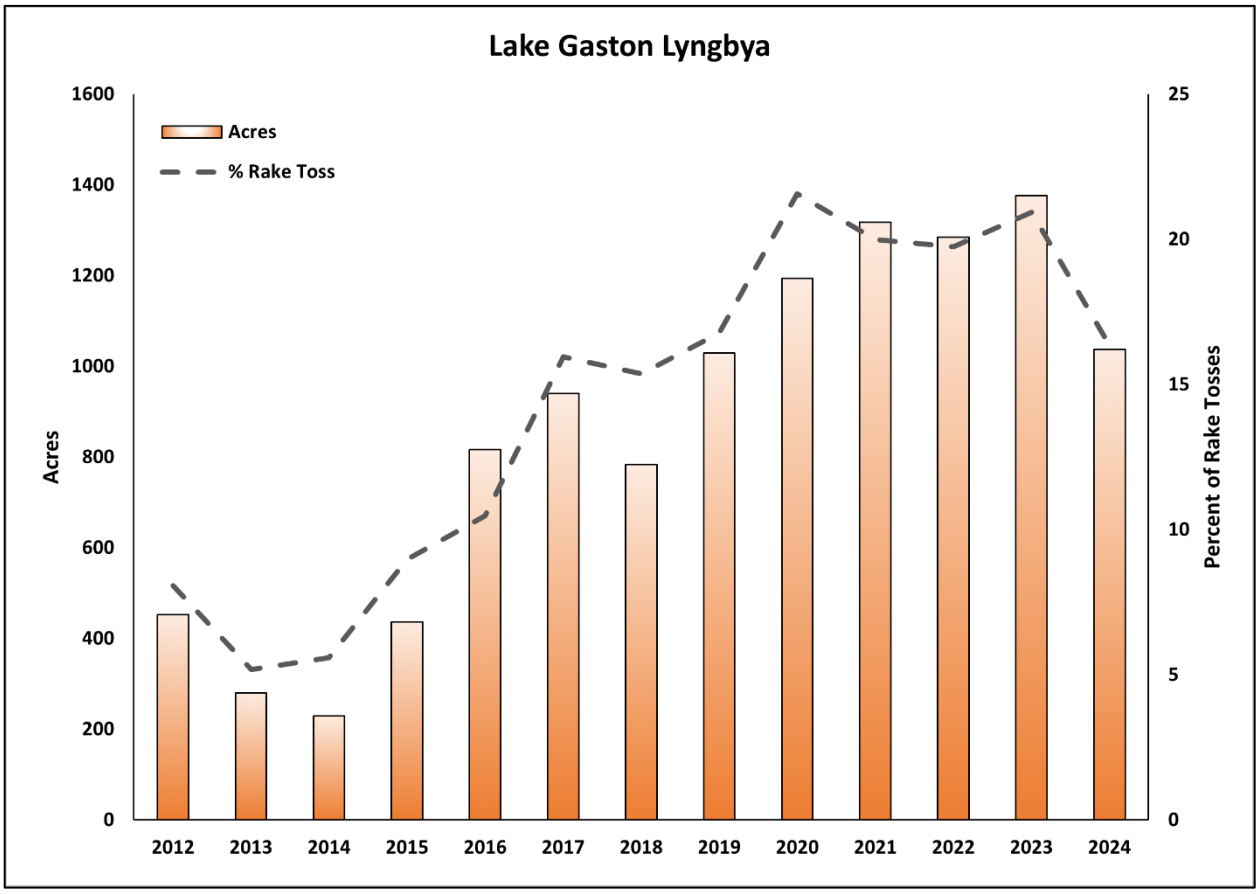

Figure 8. Estimated standing acreage (bars) and percent occurrence in the vegetation survey (line) of lyngbya in Lake Gaston, NC/VA between 2012 and 2024.

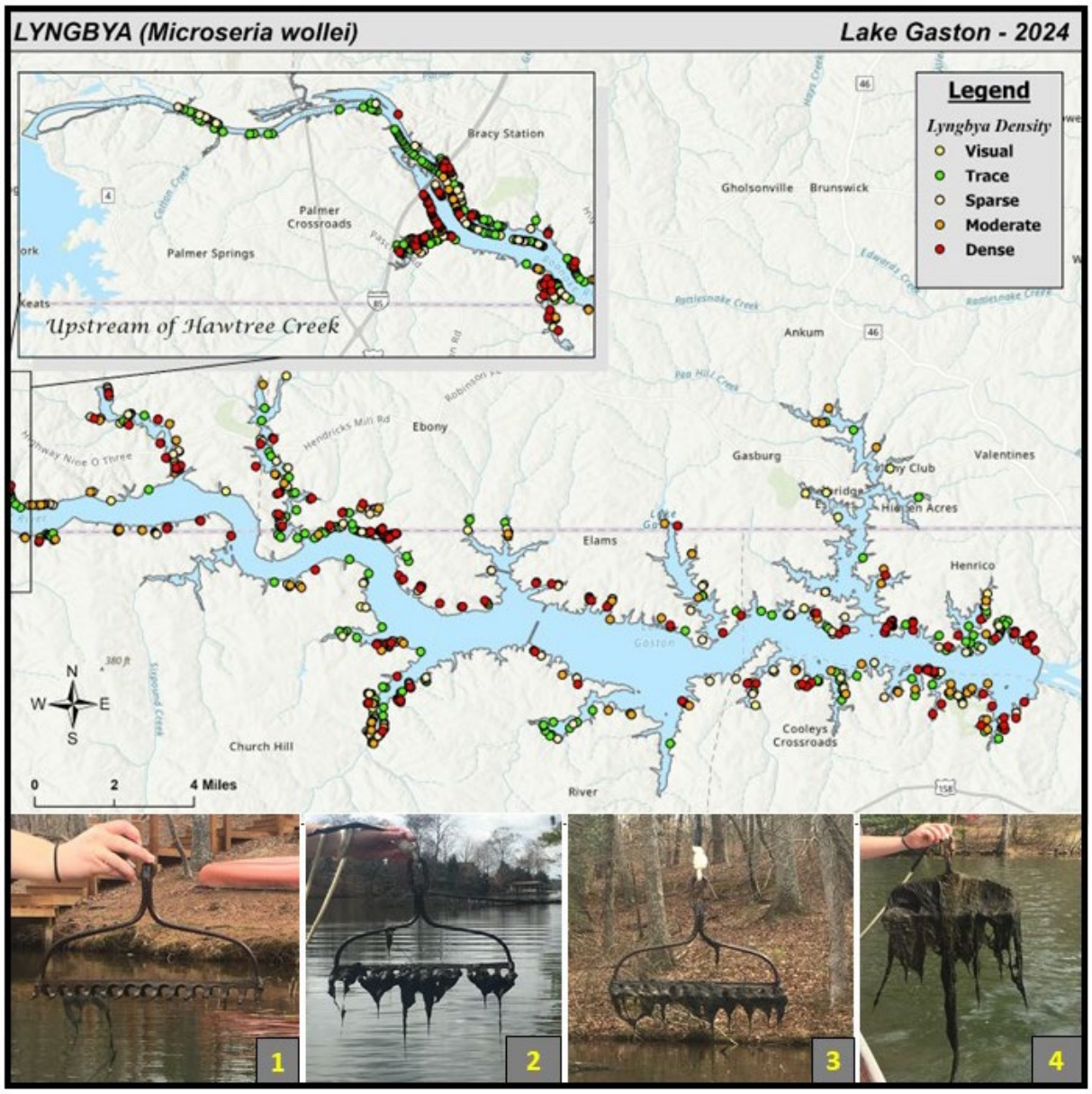

Figure 9. Map indicating the site rankings for locations that contained lyngbya during the shoreline vegetation survey of Lake Gaston, NC/VA 2024. Survey sites are incrementally ranked with 1 (green dots) representing trace detection and low mat growth density, 2/3 (orange dots) representing sparse to moderate growth density, and 4 (red dots) representing gear saturation due to high mat growth densities. Yellow dots indicate areas where surface mats were detected, however mat density was not sampled.

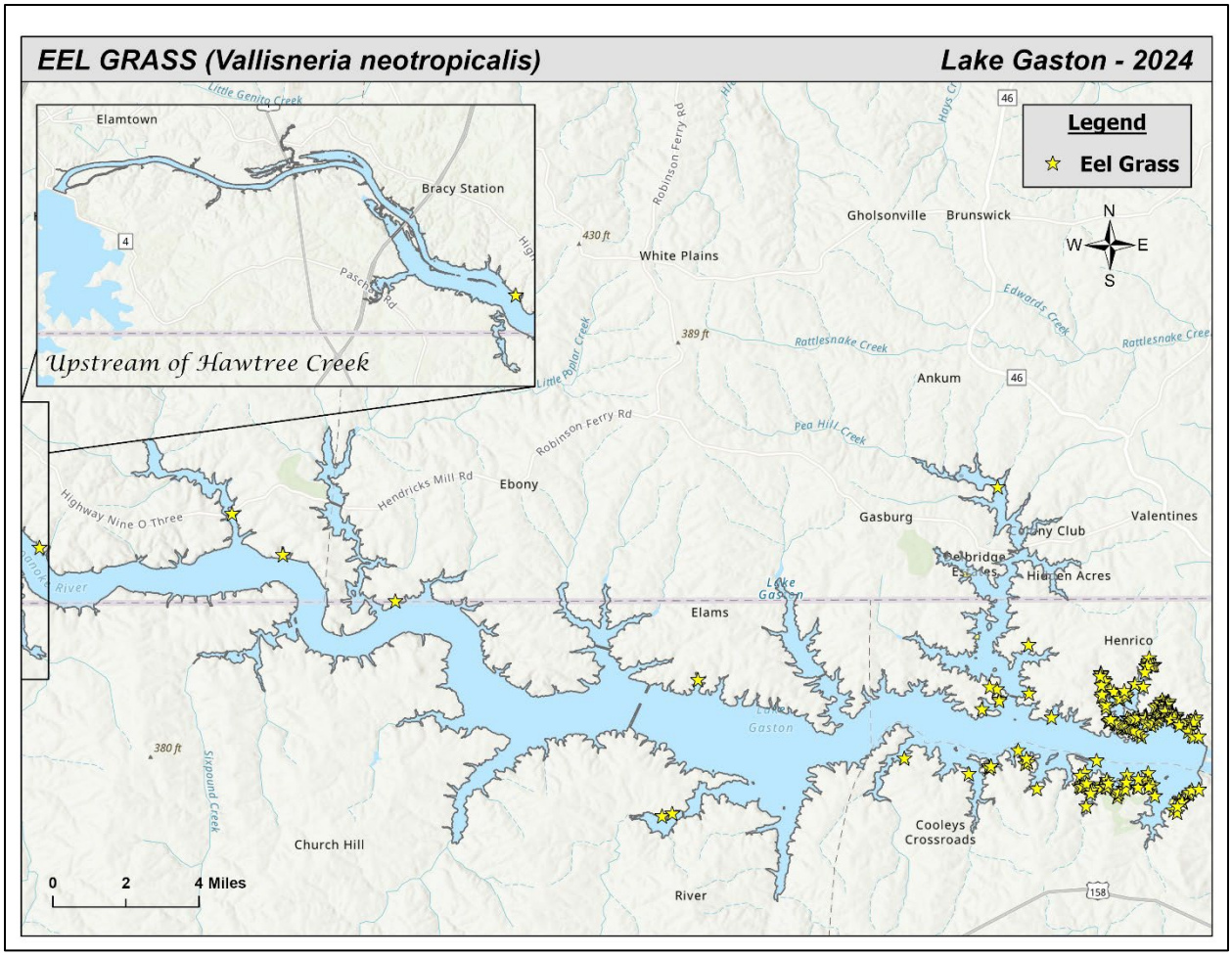

Figure 10. Map indicating sites where eel grass was present during the shoreline vegetation survey of Lake Gaston, NC/VA in 2024.

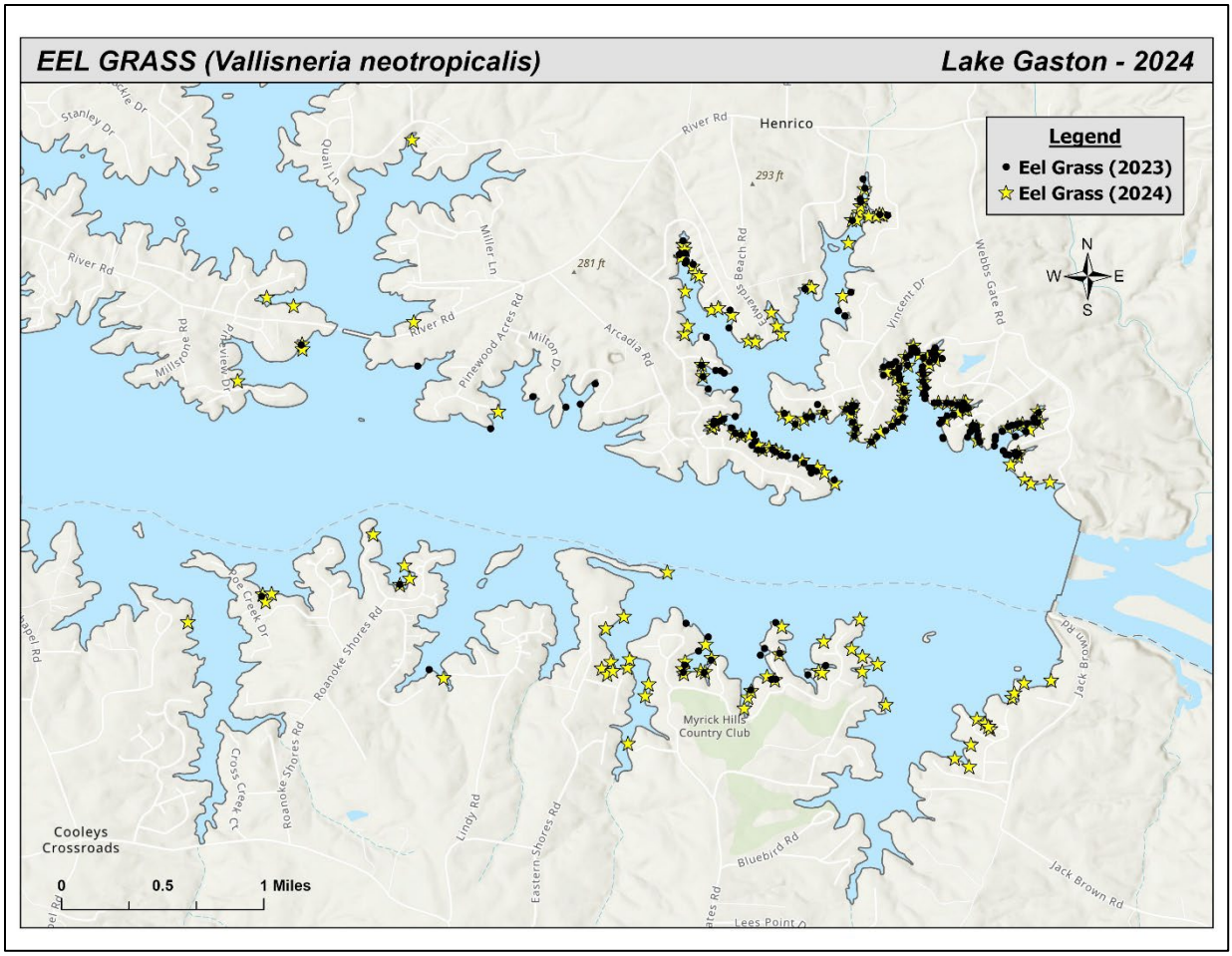

Figure 11. Map showing eel grass distribution and expansion from the 2023 survey to the 2024 survey. Black dots represent sites in which eel grass was present in 2023 and yellow stars indicate sites where it was present during the 2024 survey.