

TAHOE KEYS 2023 AQUATIC MACROPHYTE SURVEY REPORT

PREPARED PURSUANT TO
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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TAHOE KEYS 2023 AQUATIC MACROPHYTE SURVEY REPORT

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Prepared by
Sierra Ecosystem Associates



2311 Lake Tahoe Blvd., Ste. 8
South Lake Tahoe, CA 96150

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ACRONYMS AND ABBREVIATIONS

2023 Survey	2023 Aquatic Macrophyte Survey
AIS	Aquatic Invasive Species
BB	Bottom Barrier
CMT	Tahoe Keys Lagoons Aquatic Weed Control Methods Test
DASH	Diver-Assisted Suction Harvesting
ESA	Environmental Science Associates
IDW	Inverse Distance Weighted
IMP	Integrated Management Plan
Lahontan	Lahontan Regional Water Quality Control Board
LFA	Laminar Flow Aeration
Keys lagoons	Tahoe Keys lagoons
SEA	Sierra Ecosystem Associates
TKPOA	Tahoe Keys Property Owners Association
UV-C	ultraviolet light at the “C” wavelength
WDR	Waste Discharge Requirements
YPL Project	Lake Tallac Yellow Pond Lily Abatement Project

1.0 INTRODUCTION

As required by the Waste Discharge Requirements (WDR) issued by the Lahontan Regional Water Quality Control Board (Lahontan), Order No. R6T-2014-0059 on July 18, 2014, this report summarizes the results of the annual aquatic macrophyte survey completed in the Tahoe Keys lagoons (lagoons or Keys lagoons) in 2023. The survey took place July 10 – July 14, 2023 and was conducted by Sierra Ecosystem Associates (SEA) Ecologist, Jeremy Waites, SEA Natural Resources Analyst Summer Abel, and Assistant Environmental Scientist Aria Pauling with the assistance of Tahoe Keys Property Owners Association (TKPOA) Water Quality Manager (Kristine Lebo) and staff. The report presents the sampling methodology (Section 2.0), results of the sampling activities in each of the lagoons (Section 3.0), and a narrative summary of the results based on the last eight years of data (Section 4.0). Section 4.0 also includes a discussion on curlyleaf pondweed and the relationship of plant biovolume to water volume in response to TKPOA and stakeholder interest in these two topics.

1.1 Overview of Site

The Tahoe Keys is a housing, public marina, and commercial office development, created in the 1950s and 1960s, located at the south end of Lake Tahoe. It is comprised of a residential area, the largest Lake Tahoe commercial marina open to the public, and commercial business center covering an area of approximately 372 acres. In addition to the approximately 1,529 private homes and townhomes, several public and private entities own and manage land in and around the Tahoe Keys development including: Tahoe Keys Village, Tahoe Keys Marina (purchased by Suntex Marinas in 2022), the State of California, USDA Forest Service, CA Tahoe Conservancy, and Tahoe Keys Beach and Harbor Association.

The water surface area encompassed by the 2023 Aquatic Macrophyte Survey (2023 Survey) was approximately 167 acres. This area includes the West Lagoon, Marina Lagoon, Lake Tallac Lagoon, and a portion of the dredged channels into Lake Tahoe. The survey areas and the results described in the report are separately addressed for the East Lagoon, West Lagoon, and Lake Tallac (Figure 1).

Figure 1. Point Sampling Locations 2023

1.2 Purpose of 2023 Survey

Beginning in 2014, in compliance with the WDR issued by Lahontan to TKPOA (Lahontan 2014), and in response to the increase of the Aquatic Invasive Species (AIS) infestation, TKPOA began preparing and updating an Integrated Management Plan (IMP) annually to develop and report on control measures that may be more effective than the historical harvesting program. The aquatic macrophyte survey supplies data that can identify trends in species composition, track the efficacy of IMP methods, and help identify successful approaches to achieve the IMP goals and objectives.

Past aquatic macrophyte surveys of the Keys lagoons were conducted in 2009, 2011, and annually from 2014 to 2023 to measure presence and absence of plant species (composition). The 2015-2022 annual surveys, as well as 2023's survey, also benefit from hydroacoustic scanning performed by TKPOA staff to determine the percent plant biovolume within the water column.

1.3 Summary of 2023 Survey Results

The 2023 point-intercept survey was conducted over the course of five days: July 10 - July 14, 2023. During the survey, a total of 735 points were sampled throughout the Keys lagoons, including the East Lagoon (109 points), West Lagoon (560 points), and Lake Tallac (66 points).

Hydroacoustic scans conducted shortly before the survey period (June 26 - June 27, 2023) provided aquatic plant biomass information. The results of the 2023 survey were compared to results of the prior annual surveys to determine whether there were any identified trends in growth of the aquatic macrophyte populations, including possible trends in species composition or abundance. Overall, species presence in 2023 for most areas of the lagoons was found to be like that of previous years. Species identified during the survey were:

- *Myriophyllum spicatum* (Eurasian watermilfoil)
- *Potamogeton crispus* (curlyleaf pondweed)
- *Ceratophyllum demersum* (coontail)
- *Potamogeton richardsonii* (Richardson's pondweed)
- *Potamogeton foliosus* (leafy pondweed)
- *Elodea canadensis* (elodea)
- *Brasenia schreberi* (watershield)
- *Nuphar polysepala* (Yellow pond-lily)
- *Myriophyllum quitense* (Andean watermilfoil)
- *Persicaria amphibia* (water smartweed)
- various species of *Nitella*, *Chara*, *Spirogyra*, and other filamentous algae

Among these species, non-native Eurasian watermilfoil and curlyleaf pondweed, along with native coontail, have remained the most prevalent species in the waterways of the Keys lagoons since sampling began in 2014. However, except for curlyleaf pondweed, there is no clear trend in species abundance over time, either decreasing or increasing.

Curlyleaf pondweed has shown a general increasing trend of occurrence in the lagoons since sampling began, especially in the West Lagoon. The exception to this was after the Tahoe Keys Lagoons Aquatic Weed Control Methods Test (CMT) 2022 treatments in the West Lagoon. The occurrence rate from 2021 to 2022 decreased by 25% in the West Lagoon. In some cases, the 2022 survey data was collected behind the turbidity curtains in which CMT treatments impacted the presence and abundance of species being targeted by the CMT. These treatments inside the turbidity curtains generally decreased biovolume and altered species composition, which was not observed in the CMT control (untreated) areas. The general increasing trend in curlyleaf pondweed for the West Lagoon resumed in 2023 with a 5% increase over 2022 levels.

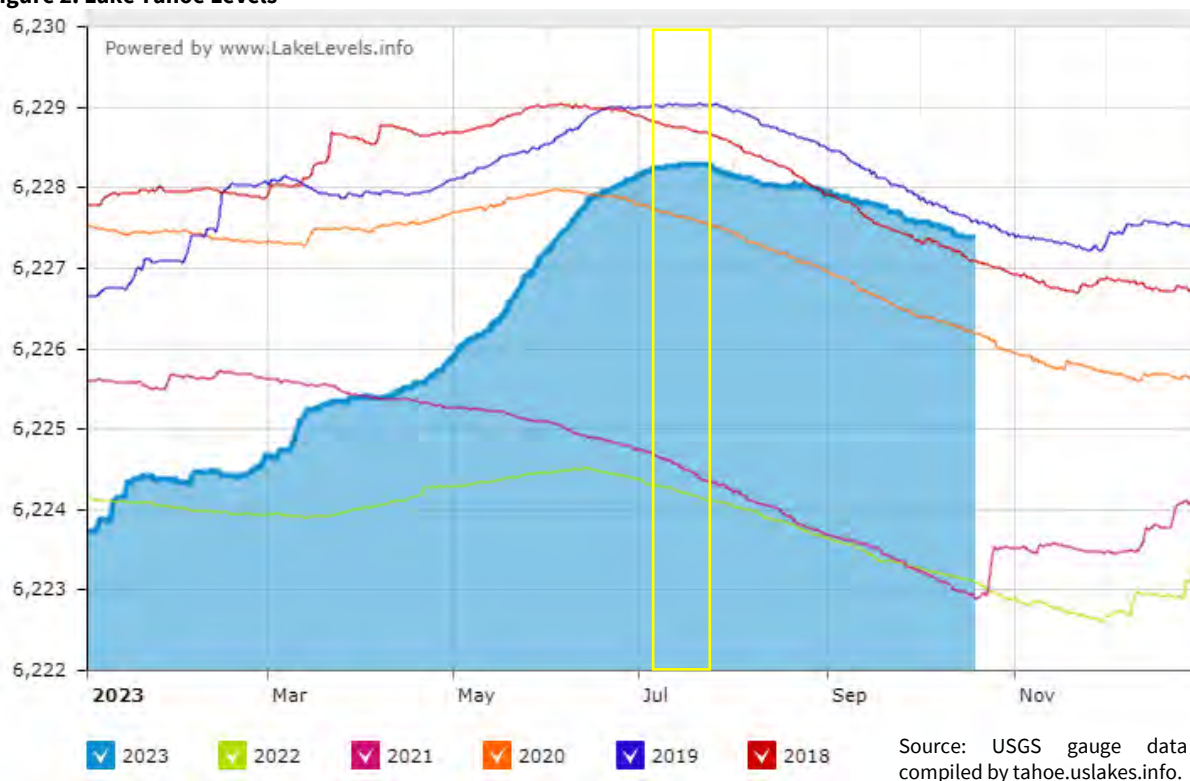
2.0 METHODOLOGY

The annual aquatic macrophyte surveys focus on submersed and floating-leaf aquatic plants in the littoral zones of the surveyed areas in the Keys lagoons. Fringe wetlands and emergent species were not sampled. As with previous years, the method used for the 2023 survey was point-intercept to determine composition and hydroacoustic scanning to determine plant biovolume.

2.1 Timing

The 2023 point-intercept survey was conducted over the course of five days: July 10-July 14. This time period was chosen to coincide with the evident and identifiable point in the growing season and with germinating, sprouting, flowering, or fruiting stages of the various species. Due to the short growing season in Lake Tahoe and the germination and sprouting timing of the aquatic plants of concern, one period of data collection is considered sufficient to assess presence and relative abundance. The 2023 survey followed an unusual (above average total precipitation) water year for the 2022-2023 winter and spring; lake/lagoon levels were above average for the survey period. United States Geological Survey gauge data for Lake Tahoe is seen in Figure 2.

Figure 2. Lake Tahoe Levels



Hydroacoustic scans were conducted June 26 and June 27, 2022. Scans are conducted on a regular basis by TKPOA Water Quality staff to track the growth of aquatic macrophytes throughout the season. The scans presented in this report are those that most closely coincide with the timing of the point sampling survey.

2.2 Point Intercept Sampling

Point-intercept sampling involves plunging a double-tined, telescoping pole-mounted “thatch” rake into the water to the bottom, twisting the attached vertical pole when retrieving the rake, and then identifying the plant species in the sample (DiTomaso 2003). Georeferenced sample locations were accessed by boat along regularly spaced and somewhat linear transects that represented the conditions of the area. The percent species composition was determined visually and recorded, and then the sample was photographed. Water depth at each sample was also recorded using reference marks on the pole attached to the sampling rake. Due to curlyleaf pondweed’s morphology, this species may have been less efficiently sampled than Eurasian watermilfoil or coontail using the thatch rake. As a result, curlyleaf pondweed may be underrepresented by the estimated composition percentages.

Floating plants, such as watershield (*Brasenia schreberi*) and water smartweed (*Persicaria amphibia*) are not well sampled with the method used in this survey. Water smartweed was rare, and the only floating aquatic plant observed in the West and East lagoons, but was prevalent along the north and south near-shore areas of Lake Tallac. Additionally, the native emergent plant, yellow pond lily (*Nuphar polysepala*), was found in the stormwater inflow channel into Lake Tallac between Lassen and Whitney Drives. In the summer of 2020, TKPOA conducted the Lake Tallac Yellow Pond Lily Abatement Project (YPL Project), removing approximately 212 yd³ of plant material (dried rhizomes weighed approximately 3,500 lbs). The YPL Project was initially successful at completely clearing the Lake Tallac stormwater inflow channel of yellow pond lily, however, within two weeks following project completion, regrowth up to 50% was noted (TKPOA 2020b). Yellow pond lily occurrence data may be different from previous years due to implementation of the 2020 YPL Project, however no further steps are anticipated for this control project as funding only permitted one round of harvesting and hand removal. The 2023 survey found that YPL was at least as prevalent as in previous years. No samples of yellow pond lily were collected in 2023 due to the inability to travel far into the inflow channel of Lake Tallac because of the obstructing aquatic vegetation.

2.3 Hydroacoustic Sampling

Hydroacoustic sampling uses sonar technology to scan a water body to determine and record the surface water temperature, depth to bottom, presence of plant matter, plant height, and biovolume. Scans are made using a Lowrance HDS Live 7 attached to a boat. The system is fine-grained, collecting data at a frequency of 10 times per second. The digitized data obtained is uploaded to BioBase, a third-party service company. Hydroacoustic scanning produces

percent biovolume which represents the percent of the water column occupied by plant matter at each sonar ping. It is plant height divided by water depth multiplied by 100 for each location along a traveled path. The biovolume range of values is from 0% (bare bottom with no plants in water column) to 100% (vegetation growth from the bottom to the surface).

Hydroacoustic data is also used to determine the average vessel hull clearance, which is the distance between the water surface and the top of the aquatic plant canopy. Vessel hull clearance is also an efficacy measurement for CMT evaluations.

2.4 Data Analysis

Spatial data obtained from point sampling and transect sampling for species occurrence were analyzed using ArcGIS 10 with Spatial Analyst to create the thematic heat maps showing the composition and distribution of a species based on percent of composition. The species composition data was interpolated into a raster surface from points using an Inverse Distance Weighted (IDW) technique. IDW uses data points to predict the values of un-sampled locations by weighting the surrounding values by distance. This method interpolates the composition percentage of the data points into a surface display representing the species composition and distribution within the Keys lagoons. Appendix A contains the survey data points from the study and Appendix B the species composition maps.

To compare the 2023 survey data with data from past surveys, the current data was normalized to show species presence or absence. This approach provided a means to reveal trends in relative abundance and prevalence of the various aquatic plants over the past years.

3.0 RESULTS

A total of 735 points were sampled throughout the Keys lagoons, including the East Lagoon (109 points), West Lagoon (560 points), and Lake Tallac (66 points), as shown in Figure 1. Sections 3.1 through 3.3 below discuss the point-intercept data collection results. Section 3.4 discusses and compares the 2023 and 2022 hydroacoustic data sets.

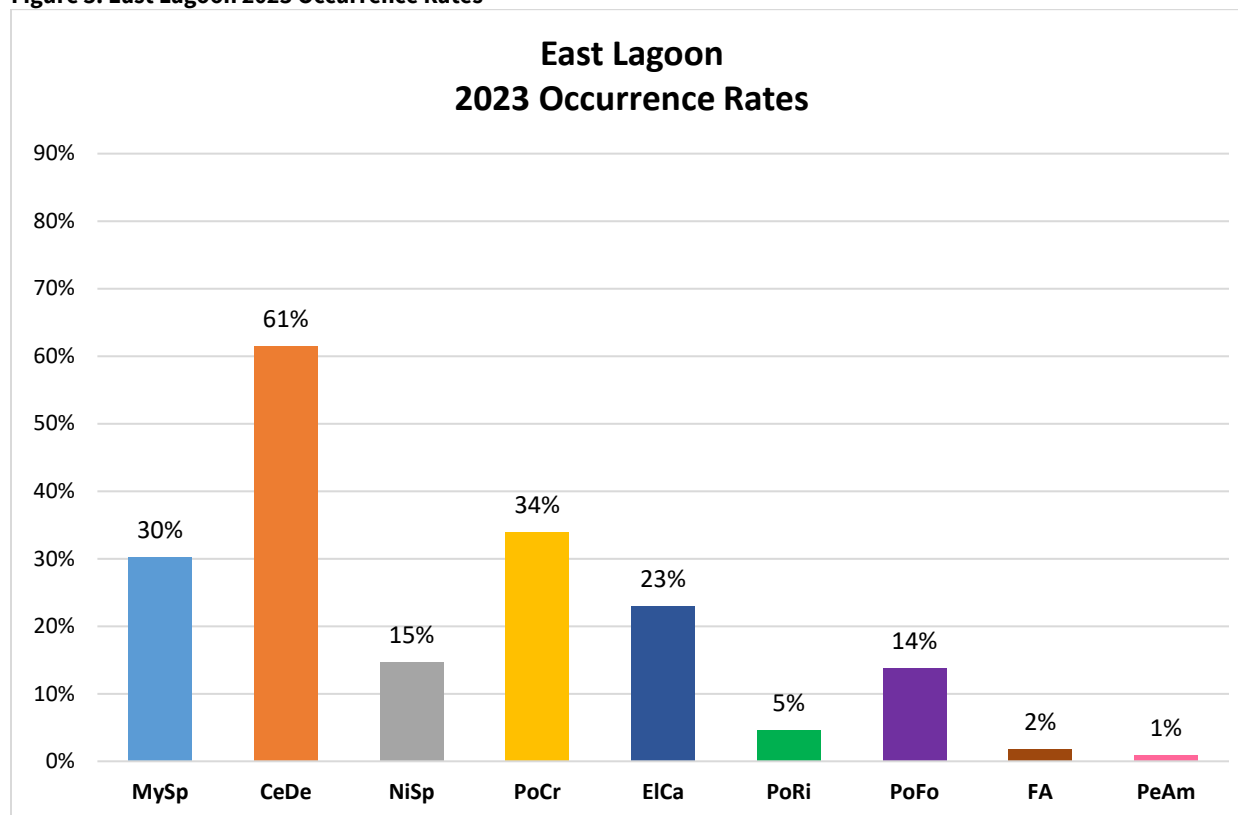
Note that the values (percentages) for occurrence rates represent the frequency that each species was detected. For example, in the East Lagoon *M. spicatum* could be detected in 30% of samples and *C. demersum* could be detected in 61% of the samples. Thus, these data do not represent the relative abundance totaling 100%, but instead individually represent frequency of occurrence for the sample data set

The abbreviations on the species occurrence charts are as follows:

- MySp = *Myriophyllum spicatum* (Eurasian watermilfoil)
- PoCr = *Potamogeton crispus* (curlyleaf pondweed)
- CeDe = *Ceratophyllum demersum* (coontail)
- PoRi = *Potamogeton richardsonii* (Richardson's pondweed)
- PoFo = *Potamogeton foliosus* (leafy pondweed)
- ElCa = *Elodea canadensis* (elodea)
- BrSc = *Brasenia schreberi* (watershield)
- NuPo = *Nuphar polysepala* (yellow pond-lily)
- NiSp = *Nitella* sp. (filamentous algae)
- FA = Other Filamentous Algae
- MyQu = *Myriophyllum quitense* (Andean watermilfoil)
- PeAm = *Persicaria amphibia* (water smartweed)

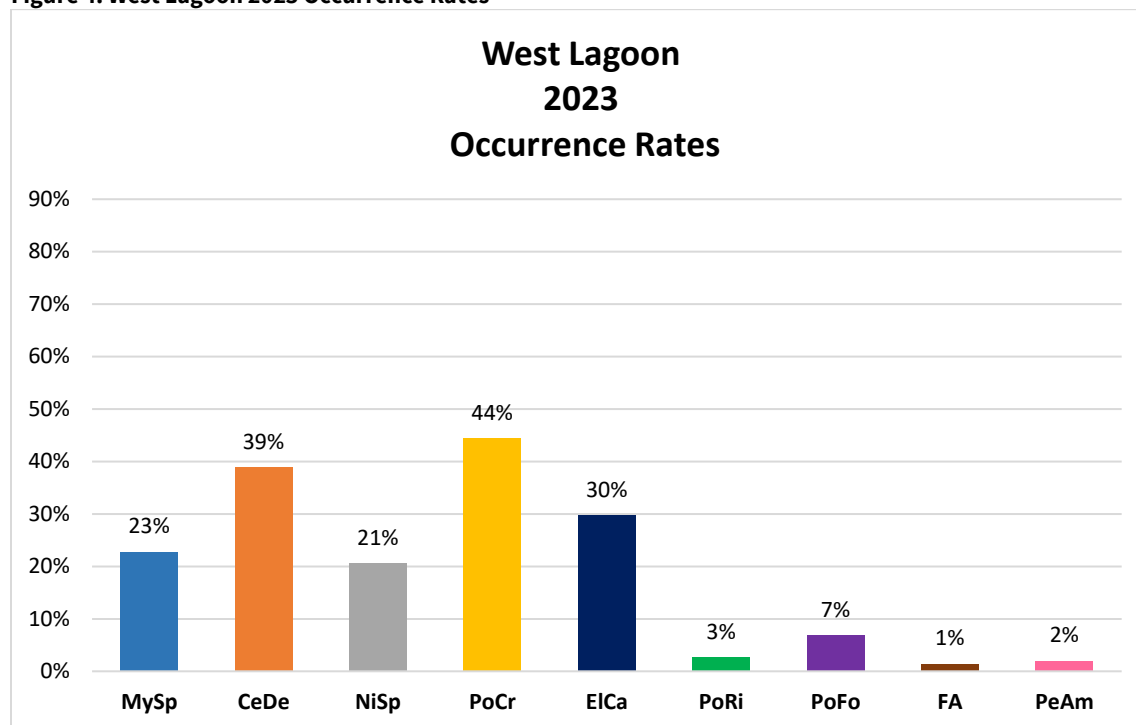
3.1 East Lagoon

In the East Lagoon, a presence/absence analysis (Figure 3) shows a frequency of occurrence of 30% for Eurasian watermilfoil - *M. spicatum* (MySp) and 61% for coontail - *C. demersum* (CeDe). Other species occurrences included: 15% filamentous algae - *Nitella* (NiSp), 34% curlyleaf pondweed - *P. crispus* (PoCr), 14% leafy pondweed - *P. foliosus* (PoFo), 23% Elodea - *E. canadensis* (ElCa), 5% Richardson's pondweed - *Potamogeton richardsonii* (PoRi), 2% other filamentous algae (FA), and 1% water smartweed (*Persicaria amphibia*).

Figure 3. East Lagoon 2023 Occurrence Rates

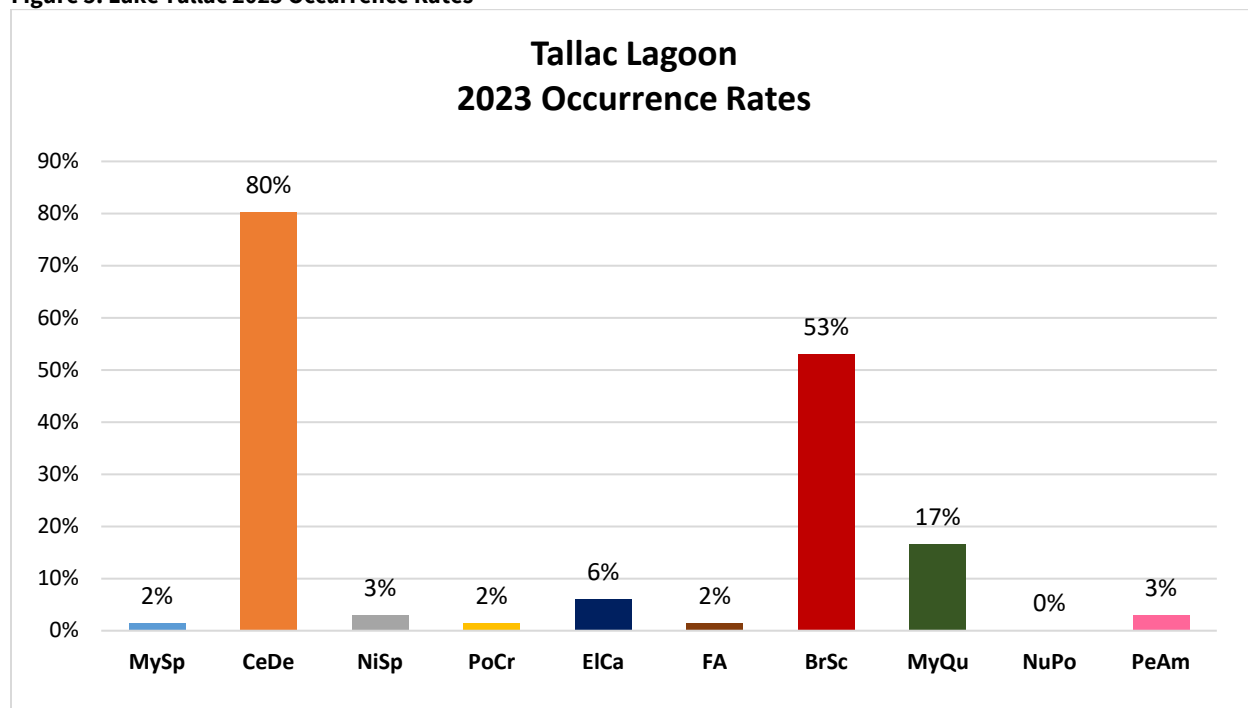
3.2 West Lagoon

In the West Lagoon, presence/absence analysis (Figure 4) shows a frequency of occurrence of 23% for Eurasian watermilfoil - *M. spicatum* (MySp) and 39% for coontail - *C. demersum* (CeDe). Other species occurrences included: 44% curlyleaf pondweed - *P. crispus* (PoCr), 7% leafy pondweed - *P. foliosus* (PoFo), 21% *Nitella* spp (NiSp), 30% Elodea - *E. canadensis* (ElCa), 3% Richardson's pondweed - *P. richardsonii* (PoRi), 1% other filamentous algae (FA), and 2% water smartweed - *P. amphibia* (PeAm).

Figure 4. West Lagoon 2023 Occurrence Rates

3.3 Lake Tallac

In Lake Tallac, presence/absence analysis (Figure 5) showed a frequency of occurrence of 2% for Eurasian watermilfoil - *M. spicatum* (MySp) and 80% for coontail - *C. demersum* (CeDe). Other species detected included: 2% curlyleaf pondweed - *P. crispus* (PoCr), 6% Elodea - *E. canadensis* (ElCa), 2% other filamentous algae (FA), 0% yellow pond lily - *N. polysepala* (NuPo) (however, as noted earlier, this species dominates the stormwater inflow channel to Lake Tallac), 53% watershield - *B. schreberi* (BrSc), 17% Andean watermilfoil - *M. quitense* (MyQu), and 3% water smartweed - *P. amphibibia* (PeAm).

Figure 5. Lake Tallac 2023 Occurrence Rates

3.4 Hydroacoustic Sampling

The East Lagoon had a percent area plant coverage of approximately 92% and an average plant biovolume of approximately 25%, meaning that, on average, within the portion of the lagoon where plant cover existed (92% of the lagoon area), 25% of any given sample within a column of water would contain plant matter and the remaining 75% would be water.

The West Lagoon had a percent area plant coverage of approximately 74% and an average plant biovolume of approximately 33%, meaning that, on average, within the portion of the lagoon where plant cover existed (74% of the lagoon area), 33% of any given sample within a column of water would contain plant matter.

Lake Tallac had a percent area plant coverage of approximately 95% and an average plant biovolume of approximately 37%, meaning that, on average, within the portion of the lagoon where plant cover existed (95% of the lagoon area), 37% of any given sample within a column of water would contain plant matter.

Figure 6 presents the heat map of vegetation biomass in the East Lagoon for the hydroacoustic scan performed on June 26, 2023. Figure 7 shows the heat map of all aquatic vegetation for the West Lagoon and Lake Tallac from hydroacoustic scan data collected on June 27, 2023.

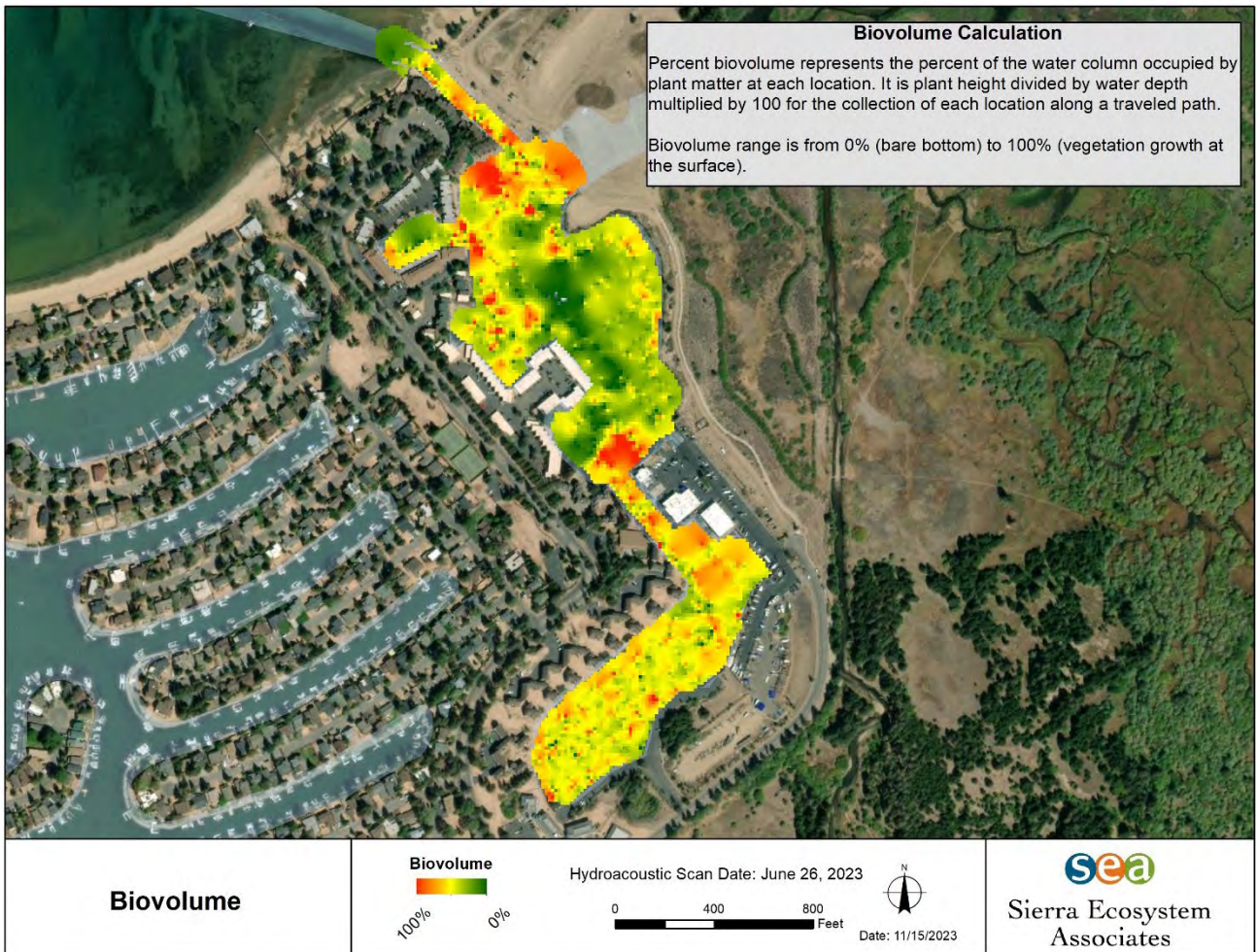
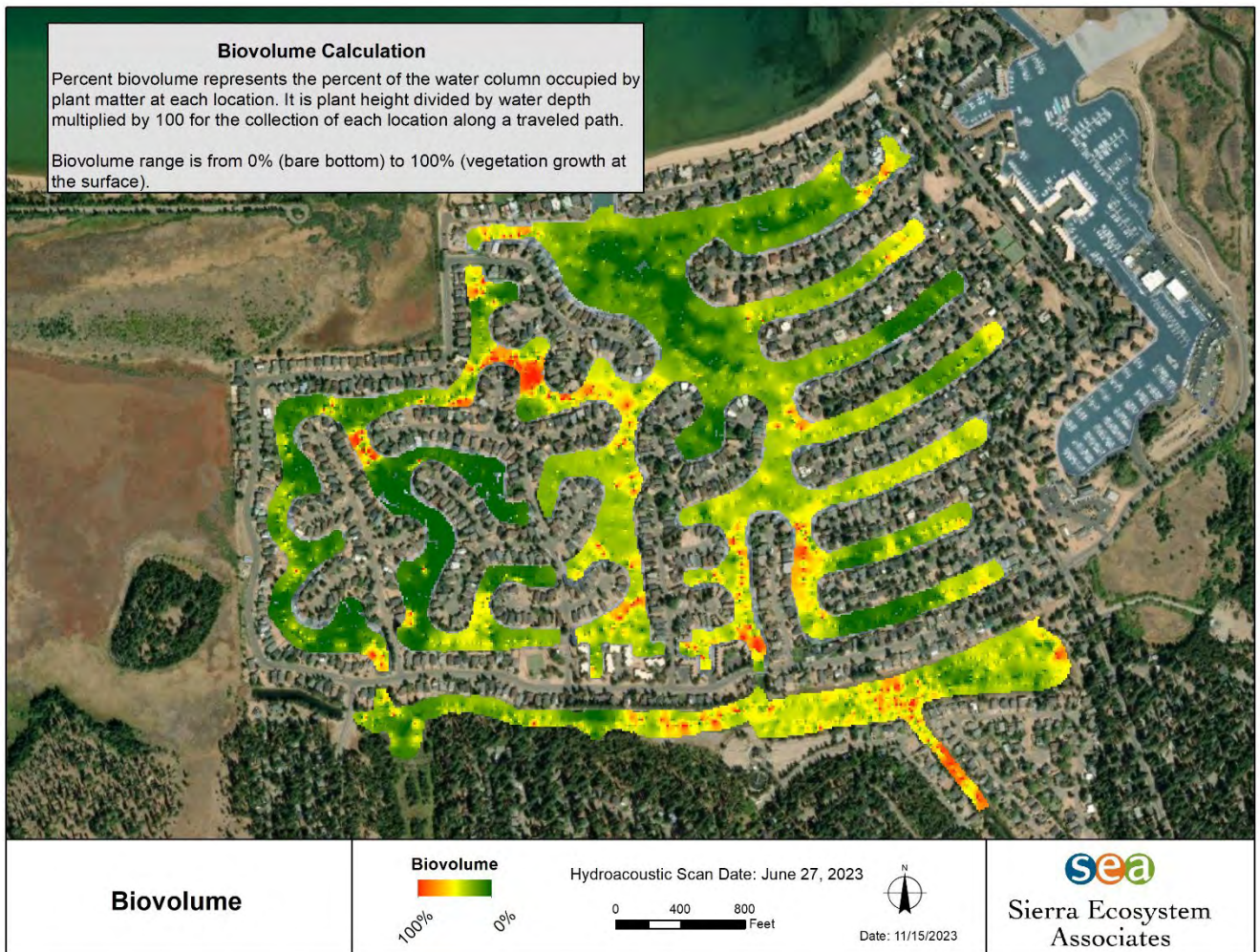
Figure 6. Heat Map of East Lagoon

Figure 7. Heat Map of West Lagoon and Lake Tallac

4.0 DISCUSSION AND ANALYSIS

The 2023 Survey showed some similarities to previous surveys. Many other species were observed in the waterways, but for the purpose of discussion, the primary focus is on Eurasian watermilfoil, coontail, and curlyleaf pondweed, which are the three invasive species highlighted for control in the IMP. Table 1 shows the frequency of occurrence for species recorded in the 2015 through 2023 macrophyte surveys (TKPOA 2015, 2016, 2017, 2018, 2019a, 2019b, 2020a, 2021, 2022).

Table 1. Frequency of Occurrence for Species Recorded from 2015 to 2023

East Lagoon									
Species	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eurasian watermilfoil (<i>M. spicatum</i>)	42%	51%	50%	52%	50%	42%	49%	30%	30%
Coontail (<i>C. demersum</i>)	66%	67%	62%	57%	64%	64%	68%	63%	61%
Curlyleaf Pondweed (<i>P. crispus</i>)	0%	12%	21%	20%	23%	17%	27%	60%	34%
Leafy Pondweed (<i>P. foliosus</i>)	0%	11%	8%	4%	5%	9%	12%	7%	14%
Nitella (<i>Nitella sp.</i>)	2%	10%	11%	18%	5%	4%	3%	0%	15%
Elodea (<i>Elodea sp.</i>)	1%	21%	21%	10%	14%	10%	12%	3%	23%
Richardson's Pondweed (<i>P. richardsonii</i>)	0%	2%	0%	2%	1%	1%	4%	2%	5%
Watershield (<i>B. schreberi</i>)	0%	0%	0%	0%	0%	1%	0%	0%	0%

Table 1. Frequency of Occurrence for Species Recorded from 2015 to 2023 (Cont.)

West Lagoon									
Species	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eurasian watermilfoil (<i>M. spicatum</i>)	50%	65%	39%	36%	60%	53%	60%	32%	23%
Coontail (<i>C. demersum</i>)	37%	70%	49%	37%	51%	50%	52%	38%	39%
Curlyleaf Pondweed (<i>P. crispus</i>)	3%	31%	41%	42%	48%	59%	64%	39%	44%
Leafy Pondweed (<i>P. foliosus</i>)	5%	28%	10%	9%	9%	4%	14%	10%	7%
Nitella (<i>Nitella sp.</i>)	7%	17%	19%	39%	11%	10%	9%	18%	21%
Elodea (<i>Elodea sp.</i>)	6%	48%	34%	24%	21%	19%	27%	42%	30%
Richardson's Pondweed (<i>P. richardsonii</i>)	3%	5%	4%	4%	3%	2%	2%	2%	3%
Watershield (<i>B. schreberi</i>)	0%	0%	0%	0%	0%	2%	0%	0%	0%

Table 1. Frequency of Occurrence for Species Recorded from 2015 to 2023 (Cont.)

Lake Tallac									
Species	2015	2016	2017	2018	2019	2020	2021	2022	2023
Eurasian watermilfoil (<i>M. spicatum</i>)	42%	61%	21%	33%	47%	40%	38%	12%	2%
Coontail (<i>C. demersum</i>)	95%	94%	87%	83%	91%	86%	95%	86%	80%
Curlyleaf Pondweed (<i>P. crispus</i>)	0%	21%	29%	18%	8%	22%	15%	1%	2%
Leafy Pondweed (<i>P. foliosus</i>)	3%	12%	5%	1%	0%	0%	0%	0%	0%
Nitella (<i>Nitella</i> sp.)	0%	3%	13%	6%	0%	0%	0%	1%	3%
Elodea (<i>Elodea</i> sp.)	3%	6%	0%	0%	2%	4%	2%	2%	6%
Richardson's Pondweed (<i>P. richardsonii</i>)	0%	0%	0%	0%	0%	0%	0%	1%	0%
Watershield (<i>B. schreberi</i>)	8%	0%	32%	23%	6%	38%	35%	47%	53%

4.1 Species Composition Based on Occurrence Rate

4.1.1 East Lagoon

In past surveys, species composition in the East Lagoon was primarily dominated by Eurasian watermilfoil in the shallower areas and coontail in the deeper areas with a relatively low occurrence of other species such as leafy pondweed, curlyleaf pondweed, and Elodea. The 2023 survey found that curlyleaf pondweed decreased in occurrence by 26% from 2022 with 34% of all samples containing curlyleaf pondweed. As in previous reports, coontail is still more dominant in the deeper lagoon areas. Eurasian watermilfoil is being gradually overtaken by curlyleaf pondweed in the shallower areas based on the years of survey data.

Eurasian watermilfoil and coontail composition are shown in Figures 8 and 9. The frequency of curlyleaf pondweed in the East Lagoon has shown an overall annual increase, with a large increase from 2021 to 2022. Curlyleaf pondweed occurrence rate was 27% in 2021, 10% higher than the 17% occurrence rate in 2020. The significant increase from 2021 to 2022 (60%) was followed by the substantial drop (to 34%) in 2023. The occurrence rate of coontail has remained relatively stable with a range from 57% in 2018 to 63% in 2022. In 2023, the occurrence rate of coontail was 61%.

4.1.2 West Lagoon

Species composition in the West Lagoon was dominated by curlyleaf pondweed, coontail, and Elodea. Eurasian watermilfoil continued a decreasing occurrence trend from 32% to 23%. Coontail occurrence rate remained similar to 2021. Curlyleaf pondweed showed a small increase from 39% to 44% following the dramatic decrease in 2022 that coincided with the CMT treatments. This decrease appears to have set back the expansion of curlyleaf pondweed 4-5 years to 2018 levels. Elodea remains at a high rate with 30% following the large rate increase in 2022.

4.1.3 Lake Tallac

Species composition in Lake Tallac continued to be mostly dominated by coontail, a consistent finding since 2015 sampling. This year coontail had an 80% occurrence rate in Lake Tallac. This was the lowest occurrence rate recorded since data collection began in Lake Tallac. The occurrence rate of Eurasian watermilfoil decreased from 38% in 2021 to 12% in 2022. In 2023, this decreasing trend continued with an occurrence rate of only 2%.

The occurrence rate of curlyleaf pondweed peaked in 2017 at 29%, up from a 0% occurrence rate in 2015. This year the occurrence rate of curlyleaf pondweed was 2% with an increase of 1% from 2022. Another species consistently present in Lake Tallac is watershield, with yellow pond-lily dominating the stormwater inflow channel to Lake Tallac. Watershield and yellow pond-lily are native to the area but, like coontail (also a native plant), can become a nuisance in certain habitats. Watershield increased in occurrence in Lake Tallac from 47% in 2022 to 53% in 2023.

Figure 8. Eurasian Watermilfoil Percent Composition Map

Figure 9. Coontail Percent Composition Map

4.2 Curlyleaf Pondweed

While sampling indicates that the occurrence of curlyleaf pondweed has varied somewhat since sampling began, overall, survey data indicates that the target invasive plant has become more established in the East and West lagoons over the eight-year period. In 2015, the average total occurrence rate (combining samples pulled from the East Lagoon, West Lagoon and Lake Tallac) was 4%. In 2019, the average occurrence rate was 39% for the 623 point samples taken that year throughout all three lagoons. In 2021, the occurrence rate was 54%, showing a substantial increase and clear trend. In 2023, the frequency of occurrence for curlyleaf pondweed was 39%, up from 32% in 2022.

Figure 10 shows the relative changes in curlyleaf pondweed from 2015 to 2023. As shown, the most dramatic increase took place from 2015 to 2016 and the largest decrease from 2021 to 2022. The 2018 data demonstrated a minor fluctuation in the occurrence rate of the species, but the general trend shows a relatively steady increase. Variations in water year types (e.g., drought, average or wet years) and shifts in growing seasons (e.g., early spring v. late spring) are believed to contribute to some variability observed in the sample data.

The overall increase in spread and occurrence of curlyleaf pondweed is of concern for the Tahoe Keys and the Tahoe Basin as a whole (University of Nevada, Reno 2015). Curlyleaf pondweed is very adaptable to the climate and ecology of Lake Tahoe because it sprouts in the fall, can over-winter under ice, and begin growing in spring while temperatures are still cool. This gives it a competitive advantage in the early growing season over native aquatic plants.

In addition to tolerating colder and deeper waters, this invasive plant also produces turions during the growing season. Turions are vegetative propagules that can break free from the parent plant and settle in the sediment where they can either sprout in the late summer to fall or remain dormant for several years until habitat conditions are adequate for growth (Sastroutomo 2003). Increasing occurrence is not uncommon for invasive species. When a new species is introduced, a lag time often exists between the first occurrence and a large, widespread presence of the species. A larger study of upper-Midwest plant invasions looked at a number of herbarium records and reported that lag times for species can be anywhere from three to 140 years. This wide range can be attributed to the vast differences in plant morphology. Curlyleaf pondweed was recorded as having a lag time of 8 to 35 years (Larkin 2012). Curlyleaf pondweed was first discovered in Lake Tahoe in 2003 (Wittmann and Chandra 2015).

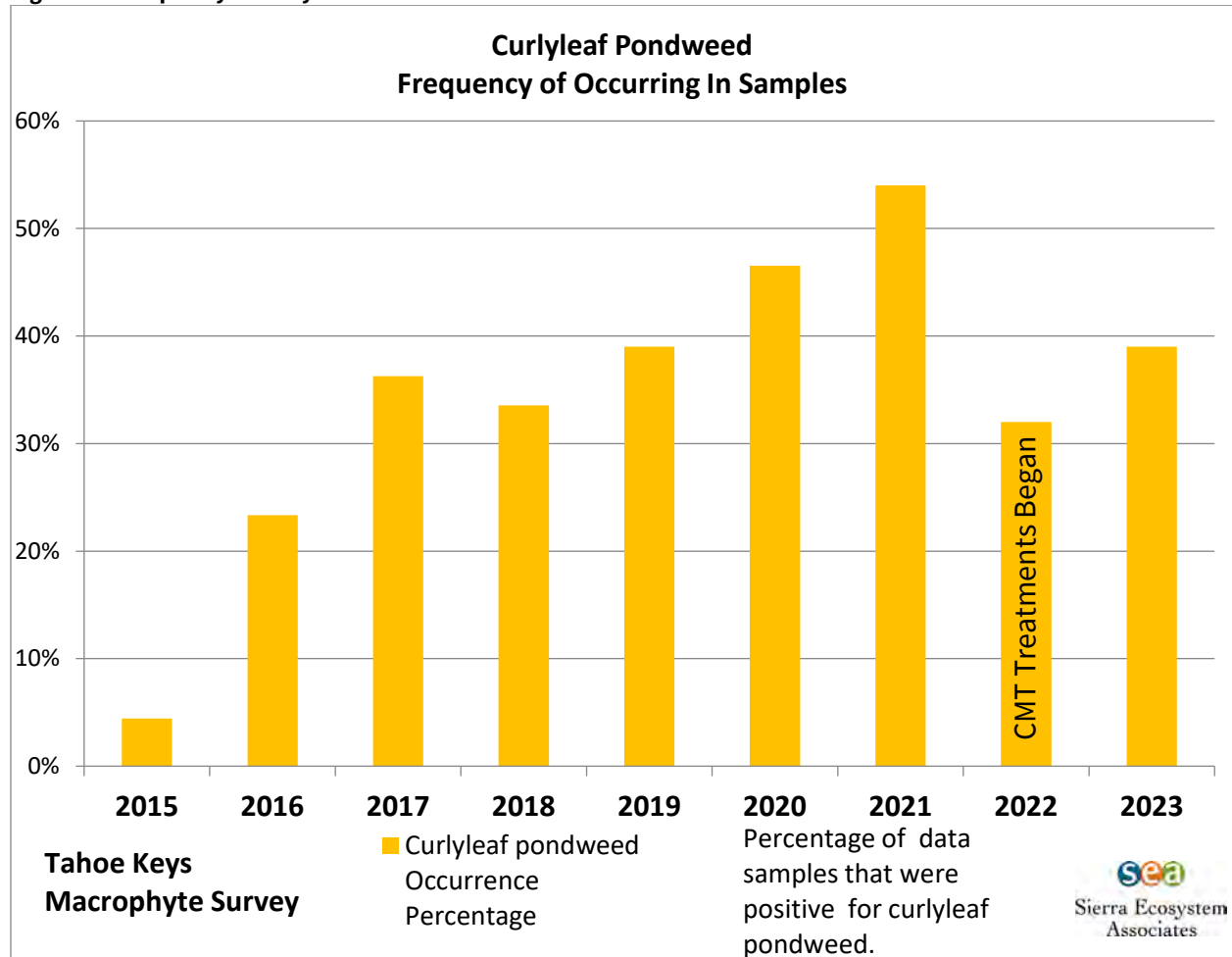
Figure 10. Frequency of Curlyleaf Pondweed Occurrence

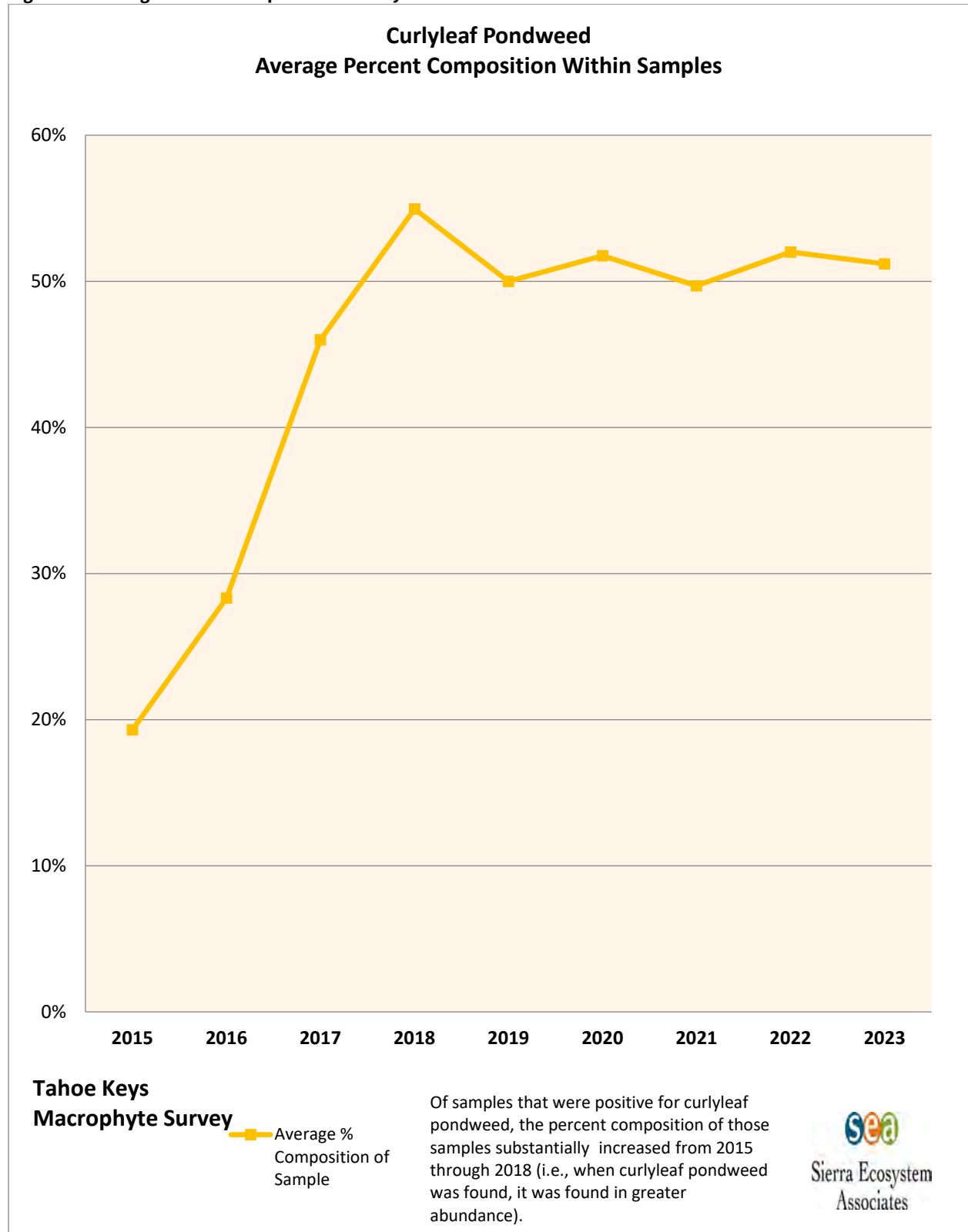
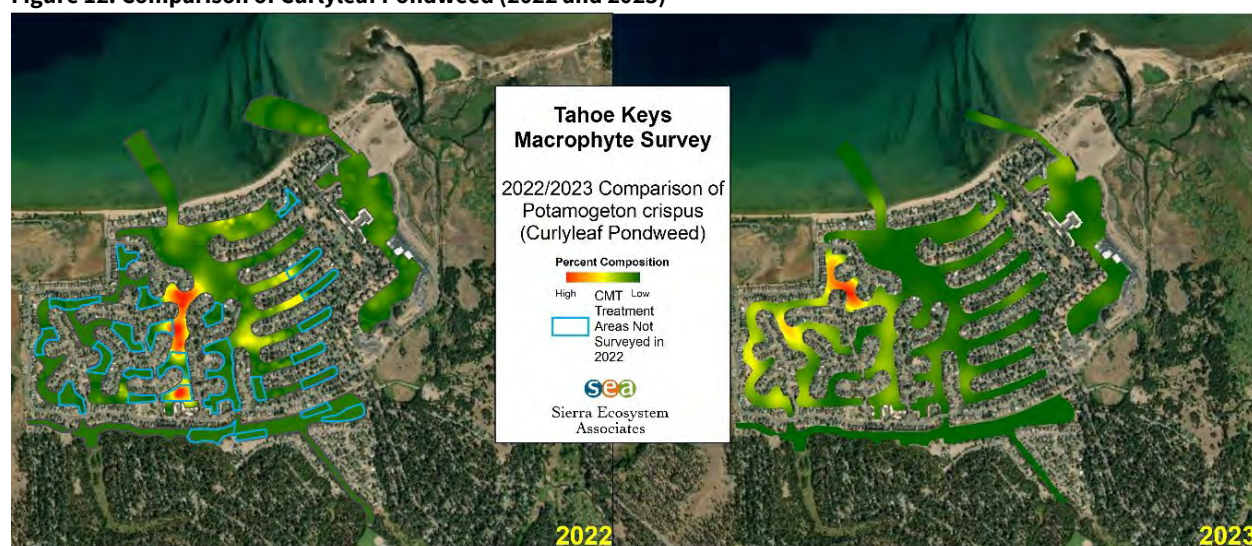
Figure 11. Average Percent Composition of Curlyleaf Pondweed

Figure 11 shows the average percent composition of curlyleaf pondweed collected in each sample. This averaged value means that in each sample in which curlyleaf pondweed was found, the sample was composed of this percent of curlyleaf pondweed. While the average percent composition of samples decreased by 1% for curlyleaf pondweed in 2023 (Figure 11), the overall occurrence rate for curlyleaf pondweed increased by 7% in the 2023 survey. This increase was most prominent in the West Lagoon where 2022 CMT treatments did not occur. In the West Lagoon, the occurrence rate increased by 5% and the rate in Lake Tallac increased by 1%. Figure 12 shows the composition of curlyleaf pondweed within the lagoons based on survey data collected in 2022 and 2023. It is uncertain to what extent, if any, the exclusion of the CMT treatment areas affected the results of the 2022 macrophyte survey. The 2022 CMT treatment areas are shown in Figure 12 as blue polygons. The macrophyte survey in 2022 was conducted from June 27 – July 6, 2022, approximately 1 month following the start of the 2022 CMT treatments.

Figure 12. Comparison of Curlyleaf Pondweed (2022 and 2023)



4.3 Biovolume

Analysis of TKPOA hydroacoustic data from surveys in 2015, 2016, 2018, 2019, 2020, 2021, 2022, and 2023 is presented in Table 2 (below)¹. The table shows percent (spatial) area covered by plants in each lagoon, along with average biovolume percentages (within the water column) for each lagoon. Based on the data referenced above, the average biovolume percentages (average biovolume of all lagoons) have fluctuated between 30% and 55% over the eight years of displayed data (Table 2). The fluctuations are likely due to annual differences in water temperature and water level during the collection of the hydroacoustic data.

Biovolume in the West Lagoon has been steady or slightly decreasing from 2021 to 2023. Despite the West Lagoon survey data being collected outside the defined treatment areas shown in Figure 1, many data points were collected in sites where Diver-Assisted Suction Harvesting (DASH), Bottom Barrier (BB), Laminar Flow Aeration (LFA), and ultraviolet (UV-C) activities occurred.

Table 2. Average Biovolume Percentages

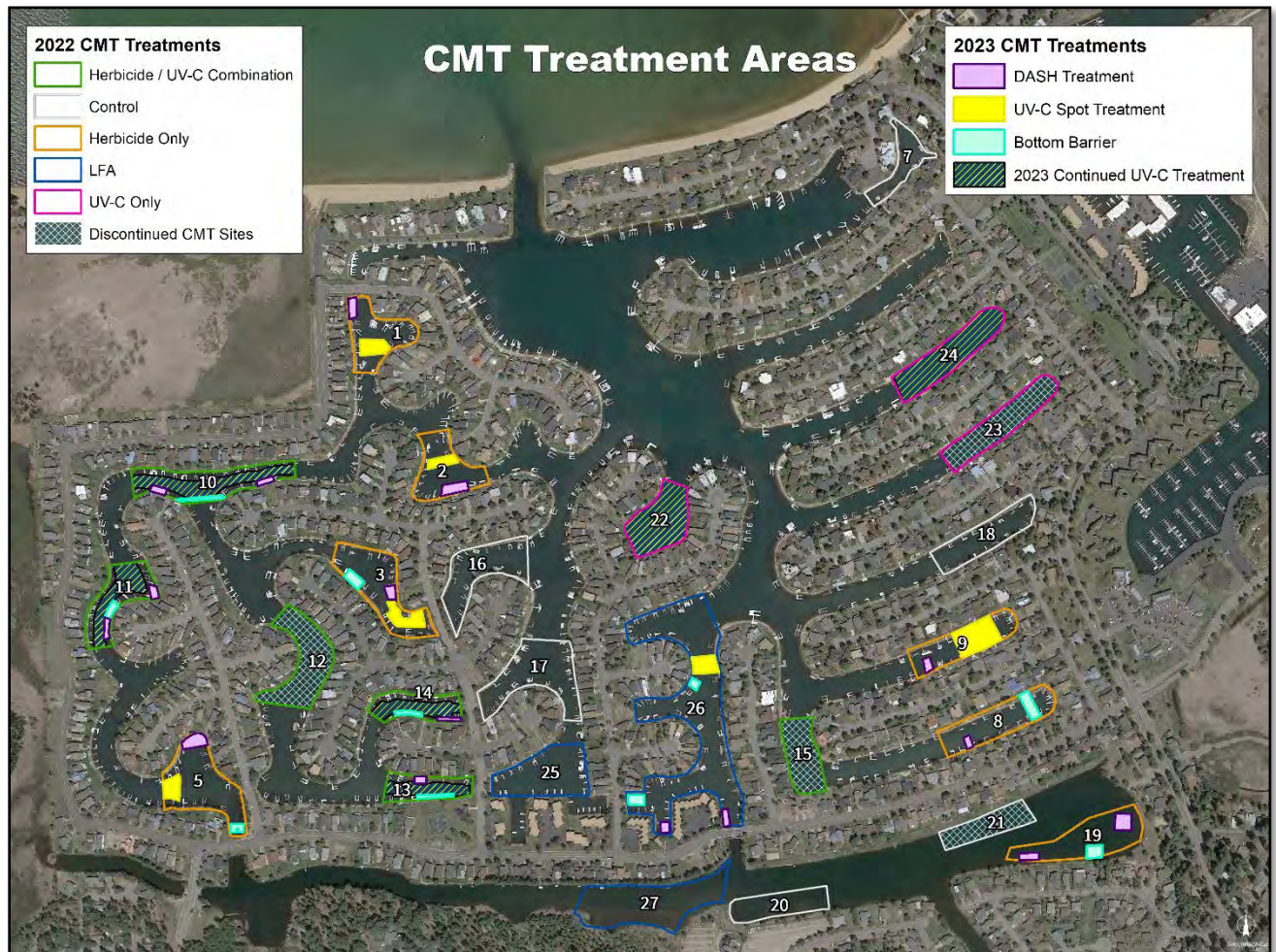
	Percent Area Covered								Average Biovolume							
	2015	2016	2018	2019	2020	2021	2022	2023	2015	2016	2018	2019	2020	2021	2022	2023
East Lagoon	85%	90%	78%	87%	41%	93%	93%	92%	51%	44%	28%	27%	20%	21%	24%	25%
West Lagoon	89%	92%	90%	80%	79%	83%	89%	74%	63%	53%	72%	59%	67%	40%	31%	33%
Lake Tallac	N/A	89%	78%	91%	65%	79%	97%	95%	N/A	50%	66%	57%	51%	30%	45%	37%

Data from 2017 was not included in the table as equipment challenges led to incomplete hydroacoustic data collection at the time of the 2017 Macrophyte Survey (BioBase 2015a, 2015b, 2016a, 2016b, 2016c, 2018a, 2018b, 2018c, 2019a, 2019b, 2019c, 2020, 2021, 2022, 2023).

4.4 Control Methods Test (CMT) Treatments

Species composition and biovolume results have varied over the course of the annual macrophyte studies due to changing environmental conditions and cultural practices, as well as the CMT activities in 2022 and 2023. Environmental variables include plant population dynamics and morphology, water temperature, water (lake) level (e.g., lower water levels reduce total ‘space’ for the plants to grow, thereby resulting in higher biovolume percentages), and seasonal weather patterns which can alter species growth, timing, composition and biovolume. Cultural practices such as aquatic weed harvesting, bottom barriers, and nonpoint source pollution could also impact composition and biovolume if sampling occurred within or adjacent to these cultural practices. No harvesting or bottom barrier placement took place within the boat restricted areas for 2022 herbicide treatments shown in Figure 13.

In 2022, the CMT treatments began with a prescribed set of (“Group A”) control methods: UV-C, LFA, and two types of aquatic herbicides. These treatments introduced additional effects on conditions in the lagoons. Figure 13 shows the CMT treatment types and locations. The figure also displays areas in which herbicides may have affected results of the 2022 Macrophyte Survey. The results from Environmental Science Associates’ (ESA) surveys of macrophytes inside the treatment polygons shown in Figure 13 should provide additional information on the effects of the various control methods (see <https://tahoekeysweds.org/> for published reports). Outside the turbidity curtains, other treatment types such as LFA and UV-C could also have affected data collected next to these treatment types. The reduction in biovolume in the West Lagoon may be attributable to these treatment activities as well as the relatively larger volume (or water column ‘space’) within which the aquatic plants had room to grow compared to low water years. ESA has been collecting more intensive data on a regular basis throughout the growing season within the CMT treatment areas during 2023. The data ESA collects is summarized in a yearly report which includes rake fullness, biovolume, percent composition, and frequency of occurrence in CMT sites throughout the Tahoe Keys. ESA’s Tahoe Keys Lagoons Annual Macrophyte Control Efficacy Monitoring Report will be found in Appendix E of the Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 2.

Figure 13. CMT Treatment Areas in 2022 and 2023

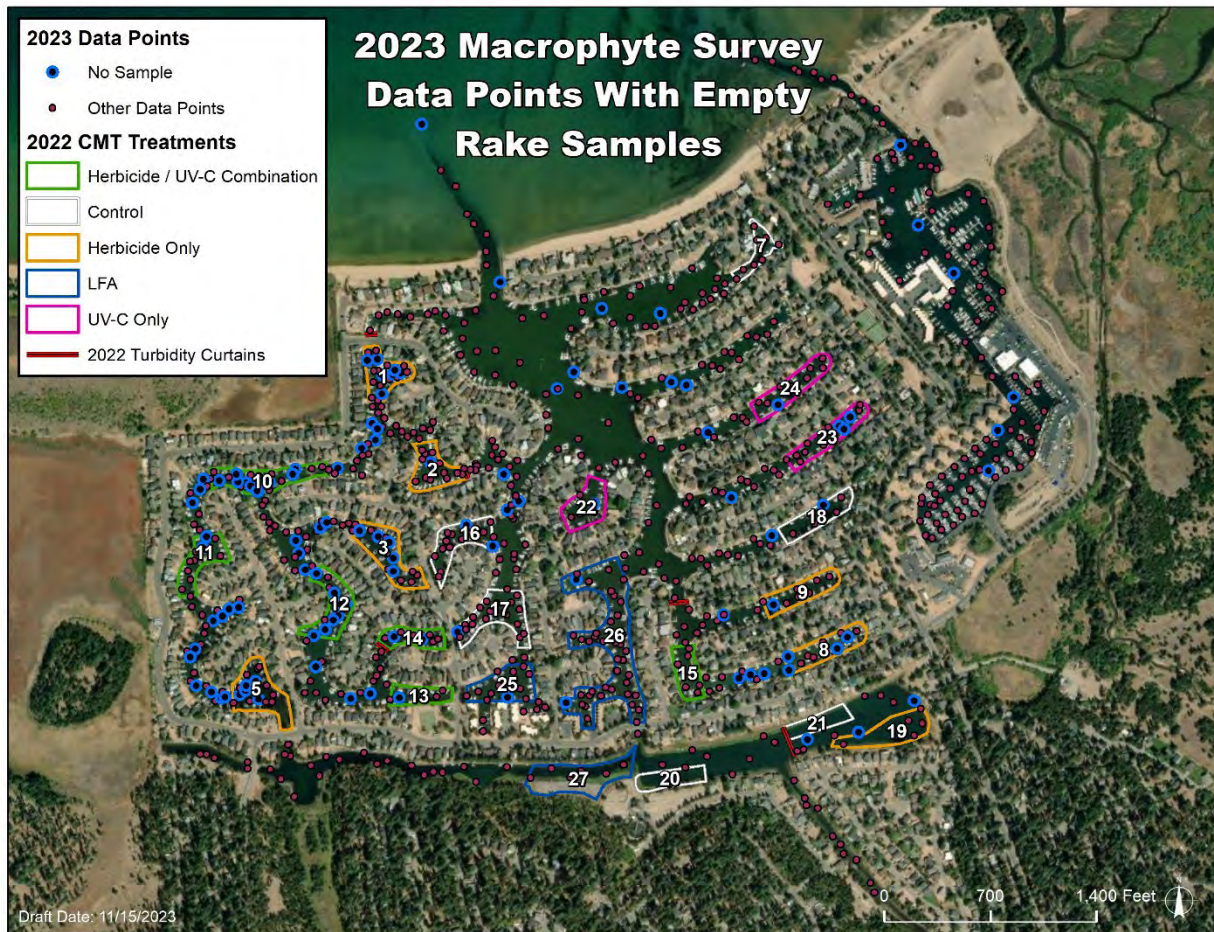
5.0 CONCLUSIONS

Non-native Eurasian watermilfoil, along with the native (but nuisance) coontail, are no longer the only dominant species. Coontail is still the dominant species in the deeper areas of the lagoons, while the dominant species in the shallow areas has changed. Past surveys found that Eurasian watermilfoil was dominant in the shallow areas but is becoming displaced by curlyleaf pondweed. Eurasian watermilfoil's historical dominance in the shallow areas has waned in response to various factors including high lake water levels, increased competition from curlyleaf pondweed, and effects from the CMT treatments.

A significant result of the 2023 survey is the number of rake samples that came up with no vegetation. In many of these samples, vegetation disintegrated upon retrieval or was unrecognizable. The number of survey samples that included no vegetation increased from 3 points in 2021 to 34 points in 2022. In 2023, the number of samples with no vegetation further increased to 112 as shown in Figure 14.

The empty rake (no-sample) points occur most frequently in the CMT treatment areas. 92% of the no sample data points occurred in the West Lagoon. 89% of the no-sample data points were behind the turbidity curtains where CMT treatments occurred. TKPOA will continue to conduct annual surveys to track changes in plant populations in future years in accordance with its WDR permit.

Another interesting result of the 2023 survey was that water smartweed (*Persicaria amphibia*) is appearing in the West and East Lagoons. In past surveys, smartweed only occurred sporadically in Lake Tallac. Occurrences of smartweed can be seen in the composition map in Appendix B. This species, like coontail, is native, but can become a nuisance plant very quickly if left unimpeded.

Figure 14. Data Points with Empty Rake Samples

6.0 LIST OF PREPARERS

The following individuals prepared the text presented in this report.

<u>Name</u>	<u>Education</u>	<u>Role</u>
Rick A. Lind	M.A. Geography (Water Resources) UC Davis	Principal-in-Charge
	B.A. Geography (Natural Resources) CSU Sacramento	
Jeremy Waites	M.S. Coursework, Forestry Auburn University, Alabama	Primary Author, Data Analysis, GIS Mapping, Data Collection
	B.S. Forestry Auburn University, Alabama	
Summer Abel	B.S. Environmental Science and Management UC Davis	Co-author, Document Editing, Data Analysis, Data Collection
Rayann La France	B.S. Criminal Justice CSU Sacramento	Document Editing, Formatting

TKPOA Staff including Kristine Lebo, Meghan Hoffmann, Erin Harkins, Moire Breslin, and Katie Terwilliger provided equipment, boat transportation, and assisted in plant identification and data collection.

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Appendix A

TKPOA 2023 Aquatic Macrophyte Survey Data Points

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
1	7/10/2023	0	0	50	0	50	0	0	0	0	0
2	7/10/2023	10	90	0	0	0	0	0	0	0	0
3	7/10/2023	5	95	0	0	0	0	0	0	0	0
4	7/10/2023	0	80	20	0	0	0	0	0	0	0
5	7/10/2023	50	0	30	0	20	0	0	0	0	0
6	7/10/2023	0	90	10	0	0	0	0	0	0	0
8	7/10/2023	0	0	0	0	0	0	0	0	0	0
9	7/10/2023	40	50	0	0	0	10	0	0	0	0
10	7/10/2023	10	30	10	0	50	0	0	0	0	0
11	7/10/2023	0	0	5	0	90	5	0	0	0	0
12	7/10/2023	10	90	0	0	0	0	0	0	0	0
13	7/10/2023	0	10	0	0	0	0	0	0	0	0
14	7/10/2023	0	0	99	0	1	0	0	0	0	0
15	7/10/2023	90	5	0	0	5	0	0	0	0	0
16	7/10/2023	0	0	50	0	25	0	0	0	0	0
17	7/10/2023	0	5	95	0	0	0	0	0	0	0
18	7/10/2023	0	0	5	0	95	0	0	0	0	0
19	7/10/2023	0	80	20	0	0	0	0	0	0	0
20	7/10/2023	10	80	10	0	0	0	0	0	0	0
21	7/10/2023	40	40	20	0	0	0	0	0	0	0
22	7/10/2023	0	0	10	90	0	0	0	0	0	0
23	7/10/2023	40	0	50	0	10	0	0	0	0	0
24	7/10/2023	40	50	10	0	0	0	0	0	0	0
25	7/10/2023	0	90	5	0	0	5	0	0	0	0
26	7/10/2023	0	80	0	20	0	0	0	0	0	0
27	7/10/2023	5	0	90	0	0	5	0	0	0	0
28	7/10/2023	10	5	85	0	0	0	0	0	0	0
29	7/10/2023	0	0	0	0	100	0	0	0	0	0
30	7/10/2023	100	0	0	0	0	0	0	0	0	0
31	7/10/2023	0	0	100	0	0	0	0	0	0	0
32	7/10/2023	95	0	0	0	5	0	0	0	0	0
33	7/10/2023	0	0	0	0	0	0	0	0	0	0
34	7/10/2023	100	0	0	0	0	0	0	0	0	0
35	7/10/2023	20	80	0	0	0	0	0	0	0	0
36	7/10/2023	40	60	0	0	0	0	0	0	0	0
37	7/10/2023	40	0	0	30	0	30	0	0	0	0
38	7/10/2023	100	0	0	0	0	0	0	0	0	0
39	7/10/2023	30	0	60	0	0	10	0	0	0	0
40	7/10/2023	0	80	10	0	5	5	0	0	0	0
41	7/10/2023	0	0	0	0	100	0	0	0	0	0
42	7/10/2023	20	30	50	0	0	0	0	0	0	0
43	7/10/2023	0	0	0	0	100	0	0	0	0	0
44	7/10/2023	0	0	0	50	50	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
45	7/10/2023	5	0	90	0	0	5	0	0	0	0
46	7/10/2023	50	0	0	0	50	0	0	0	0	0
47	7/10/2023	10	10	70	0	5	5	0	0	0	0
48	7/10/2023	90	0	5	0	0	5	0	0	0	0
49	7/10/2023	5	0	90	0	0	5	0	0	0	0
50	7/10/2023	0	0	0	0	0	0	0	0	0	0
51	7/10/2023	95	0	5	0	0	0	0	0	0	0
52	7/10/2023	90	0	0	0	5	5	0	0	0	0
53	7/10/2023	90	0	0	5	0	5	0	0	0	0
54	7/10/2023	0	0	0	0	0	0	0	0	0	0
55	7/10/2023	0	90	0	0	5	5	0	0	0	0
56	7/10/2023	90	0	0	0	0	10	0	0	0	0
57	7/10/2023	0	0	0	100	0	0	0	0	0	0
58	7/10/2023	5	90	0	0	5	0	0	0	0	0
59	7/10/2023	0	0	0	100	0	0	0	0	0	0
60	7/10/2023	40	40	0	0	20	0	0	0	0	0
61	7/10/2023	0	100	0	0	0	0	0	0	0	0
62	7/10/2023	0	0	0	0	50	50	0	0	0	0
63	7/10/2023	50	5	0	0	50	0	0	0	0	0
64	7/10/2023	40	0	0	0	30	30	0	0	0	0
65	7/10/2023	35	60	0	0	0	5	0	0	0	0
66	7/10/2023	0	0	90	5	0	5	0	0	0	0
67	7/10/2023	0	0	0	0	0	0	0	0	0	0
68	7/10/2023	0	0	90	0	0	10	0	0	0	0
69	7/10/2023	0	0	0	0	0	0	0	0	0	0
70	7/10/2023	0	0	90	10	0	0	0	0	0	0
71	7/10/2023	50	0	0	50	0	0	0	0	0	0
72	7/10/2023	40	0	30	0	20	10	0	0	0	0
73	7/10/2023	100	0	0	0	0	0	0	0	0	0
74	7/10/2023	0	0	60	0	10	10	20	0	0	0
75	7/10/2023	0	0	0	0	0	0	0	0	0	0
76	7/10/2023	0	5	95	0	0	0	0	0	0	0
77	7/10/2023	45	0	5	0	0	0	0	0	0	0
78	7/10/2023	30	0	0	0	30	0	40	0	0	0
79	7/10/2023	5	90	0	0	0	5	0	0	0	0
80	7/10/2023	0	20	60	0	0	20	0	0	0	0
81	7/10/2023	100	0	0	0	0	0	0	0	0	0
82	7/10/2023	70	10	0	0	0	20	0	0	0	0
83	7/10/2023	0	90	5	0	5	0	0	0	0	0
84	7/10/2023	50	20	10	0	0	20	0	0	0	0
85	7/10/2023	0	40	60	0	0	0	0	0	0	0
86	7/10/2023	0	0	0	100	0	0	0	0	0	0
87	7/10/2023	0	0	100	0	0	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
88	7/10/2023	0	0	0	50	0	50	0	0	0	0
89	7/10/2023	0	0	20	0	0	80	0	0	0	0
90	7/10/2023	0	100	0	0	0	0	0	0	0	0
91	7/10/2023	0	0	100	0	0	0	0	0	0	0
92	7/10/2023	0	0	100	0	0	0	0	0	0	0
93	7/10/2023	0	0	100	0	0	0	0	0	0	0
94	7/10/2023	0	0	0	0	10	80	0	0	0	0
95	7/10/2023	0	0	100	0	0	0	0	0	0	0
96	7/10/2023	0	0	0	0	0	0	0	0	0	0
97	7/10/2023	0	0	50	0	0	50	0	0	0	0
98	7/10/2023	0	0	100	0	0	0	0	0	0	0
99	7/10/2023	0	0	100	0	0	0	0	0	0	0
100	7/10/2023	0	0	95	0	0	0	0	5	0	0
101	7/10/2023	5	0	95	0	0	0	0	0	0	0
102	7/10/2023	0	0	100	0	0	0	0	0	0	0
103	7/10/2023	30	0	40	0	0	30	0	0	0	0
104	7/10/2023	0	0	0	100	0	0	0	0	0	0
105	7/10/2023	0	0	100	0	0	0	0	0	0	0
106	7/10/2023	0	0	100	0	0	0	0	0	0	0
107	7/10/2023	0	0	100	0	0	0	0	0	0	0
108	7/10/2023	0	0	100	0	0	0	0	0	0	0
109	7/10/2023	0	0	60	0	0	40	0	0	0	0
110	7/10/2023	0	0	50	0	0	50	0	0	0	0
111	7/10/2023	0	0	95	0	0	5	0	0	0	0
112	7/10/2023	0	0	100	0	0	0	0	0	0	0
113	7/10/2023	0	0	40	0	30	30	0	0	0	0
114	7/10/2023	0	0	0	100	0	0	0	0	0	0
115	7/10/2023	0	0	0	0	0	0	0	0	0	0
116	7/10/2023	0	0	100	0	0	0	0	0	0	0
117	7/10/2023	0	0	100	0	0	0	0	0	0	0
118	7/10/2023	0	0	0	0	0	0	0	0	0	0
119	7/10/2023	0	0	0	0	100	0	0	0	0	0
120	7/10/2023	0	0	0	0	0	0	0	0	0	0
121	7/10/2023	0	0	40	0	0	60	0	0	0	0
122	7/10/2023	0	0	100	0	0	0	0	0	0	0
123	7/10/2023	0	0	0	0	0	0	0	0	0	0
124	7/10/2023	0	0	0	0	0	0	0	0	0	0
125	7/10/2023	0	0	0	0	0	0	0	0	0	0
126	7/10/2023	0	5	95	0	0	0	0	0	0	0
127	7/10/2023	0	0	0	0	0	0	0	0	0	0
128	7/10/2023	0	0	0	0	0	100	0	0	0	0
129	7/10/2023	50	0	10	0	40	0	0	0	0	0
130	7/10/2023	0	0	0	0	0	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
131	7/10/2023	0	0	100	0	0	0	0	0	0	0
132	7/10/2023	5	0	10	0	80	5	0	0	0	0
133	7/10/2023	0	0	100	0	0	0	0	0	0	0
134	7/10/2023	0	0	100	0	0	0	0	0	0	0
135	7/10/2023	0	0	0	0	0	0	0	0	0	0
136	7/10/2023	0	0	0	0	0	0	0	0	0	0
137	7/10/2023	0	0	0	0	0	0	0	0	0	0
138	7/10/2023	0	90	10	0	0	0	0	0	0	0
139	7/10/2023	0	0	0	0	0	0	0	0	0	0
140	7/10/2023	0	0	100	0	0	0	0	0	0	0
141	7/10/2023	0	95	5	0	0	0	0	0	0	0
142	7/10/2023	0	0	90	0	10	0	0	0	0	0
143	7/10/2023	0	0	90	0	10	0	0	0	0	0
144	7/10/2023	0	20	50	0	0	30	0	0	0	0
145	7/10/2023	0	0	0	0	0	0	0	0	0	0
146	7/10/2023	0	0	0	0	100	0	0	0	0	0
147	7/10/2023	0	0	100	0	0	0	0	0	0	0
148	7/10/2023	0	0	95	0	0	5	0	0	0	0
149	7/10/2023	0	0	0	100	0	0	0	0	0	0
150	7/10/2023	0	0	0	0	0	0	0	0	0	0
151	7/10/2023	0	0	0	0	0	0	0	0	0	0
152	7/10/2023	30	0	70	0	0	0	0	0	0	0
153	7/10/2023	0	0	50	0	50	0	0	0	0	0
154	7/10/2023	0	0	0	0	0	0	0	0	0	0
155	7/10/2023	0	0	20	0	0	80	0	0	0	0
156	7/10/2023	0	0	0	0	0	0	0	0	0	0
157	7/10/2023	0	0	0	0	0	100	0	0	0	0
158	7/10/2023	0	100	0	0	0	0	0	0	0	0
159	7/10/2023	0	0	0	0	0	0	0	0	0	0
160	7/10/2023	0	0	0	0	100	0	0	0	0	0
161	7/10/2023	0	0	0	0	0	0	0	0	0	0
162	7/10/2023	0	0	0	0	0	0	0	0	0	0
163	7/10/2023	0	60	40	0	0	0	0	0	0	0
164	7/10/2023	0	0	0	0	0	0	0	0	0	0
165	7/10/2023	0	0	100	0	0	0	0	0	0	0
166	7/10/2023	0	0	100	0	0	0	0	0	0	0
167	7/10/2023	0	0	0	0	0	0	0	0	0	0
168	7/10/2023	0	0	95	0	0	5	0	0	0	0
169	7/10/2023	0	0	0	0	0	0	0	0	0	0
170	7/10/2023	0	0	100	0	0	0	0	0	0	0
171	7/10/2023	0	0	0	0	0	0	0	0	0	0
172	7/10/2023	0	0	50	0	0	0	0	0	0	0
173	7/10/2023	0	0	10	0	0	90	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
174	7/10/2023	0	0	100	0	0	0	0	0	0	0
175	7/10/2023	0	0	0	0	0	0	0	0	0	0
176	7/10/2023	0	0	90	0	0	10	0	0	0	0
177	7/10/2023	0	0	50	0	0	50	0	0	0	0
178	7/10/2023	0	0	0	0	0	0	0	0	0	0
179	7/10/2023	0	0	50	0	0	50	0	0	0	0
180	7/10/2023	0	0	0	100	0	0	0	0	0	0
181	7/10/2023	0	0	50	0	0	50	0	0	0	0
182	7/10/2023	0	0	100	0	0	0	0	0	0	0
183	7/10/2023	0	0	100	0	0	0	0	0	0	0
184	7/10/2023	0	0	100	0	0	0	0	0	0	0
185	7/10/2023	0	0	50	0	0	50	0	0	0	0
186	7/10/2023	0	10	40	0	0	50	0	0	0	0
187	7/10/2023	0	0	100	0	0	0	0	0	0	0
188	7/10/2023	0	0	40	0	50	10	0	0	0	0
189	7/11/2023	0	0	0	0	0	0	0	0	0	0
190	7/11/2023	0	0	0	0	100	0	0	0	0	0
191	7/11/2023	0	0	0	0	0	0	0	0	0	0
192	7/11/2023	0	0	0	0	0	0	0	0	0	0
193	7/11/2023	0	0	0	0	0	0	0	0	0	0
194	7/11/2023	0	0	100	0	0	0	0	0	0	0
195	7/11/2023	0	0	100	0	0	0	0	0	0	0
196	7/11/2023	0	0	0	0	0	100	0	0	0	0
197	7/11/2023	0	0	0	0	0	0	0	0	0	0
198	7/11/2023	0	0	100	0	0	0	0	0	0	0
199	7/11/2023	0	0	0	0	0	0	0	0	0	0
200	7/11/2023	0	0	100	0	0	0	0	0	0	0
201	7/11/2023	0	0	95	0	0	5	0	0	0	0
202	7/11/2023	0	0	0	0	0	0	0	0	0	0
203	7/11/2023	0	0	0	0	0	0	0	100	0	0
204	7/11/2023	0	0	0	0	0	0	0	0	0	0
205	7/11/2023	0	100	0	0	0	0	0	0	0	0
206	7/11/2023	0	0	0	0	0	0	0	0	0	0
207	7/11/2023	0	0	0	0	10	90	0	0	0	0
208	7/11/2023	0	0	0	0	0	0	0	0	0	0
209	7/11/2023	0	40	50	0	5	5	0	0	0	0
210	7/11/2023	0	0	0	0	0	0	0	0	0	0
211	7/11/2023	0	100	0	0	0	0	0	0	0	0
212	7/11/2023	0	0	0	0	0	0	0	0	0	0
213	7/11/2023	0	5	95	0	0	0	0	0	0	0
214	7/11/2023	0	0	0	0	0	0	0	0	0	0
215	7/11/2023	0	0	75	0	5	0	0	0	0	0
216	7/11/2023	0	0	0	0	0	100	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
217	7/11/2023	0	70	30	0	0	0	0	0	0	0
218	7/11/2023	0	5	90	0	0	5	0	0	0	0
219	7/11/2023	0	0	0	0	0	0	0	0	0	0
220	7/11/2023	0	5	95	0	0	0	0	0	0	0
221	7/11/2023	0	5	10	0	80	5	0	0	0	0
222	7/11/2023	0	5	85	0	0	10	0	0	0	0
223	7/11/2023	0	0	0	0	0	0	0	0	0	0
224	7/11/2023	0	0	0	0	0	0	0	0	0	0
225	7/11/2023	0	0	0	0	0	0	0	0	0	0
226	7/11/2023	0	0	50	0	0	50	0	0	0	0
227	7/11/2023	0	0	25	25	0	50	0	0	0	0
228	7/11/2023	0	0	100	0	0	0	0	0	0	0
229	7/11/2023	0	0	50	0	10	40	0	0	0	0
230	7/11/2023	0	0	100	0	0	0	0	0	0	0
231	7/11/2023	0	0	90	0	10	0	0	0	0	0
232	7/11/2023	0	0	95	0	0	5	0	0	0	0
233	7/11/2023	0	0	90	0	5	10	0	0	0	0
234	7/11/2023	0	0	0	0	0	0	0	0	0	0
235	7/11/2023	0	0	90	0	0	10	0	0	0	0
236	7/11/2023	0	0	90	0	0	10	0	0	0	0
237	7/11/2023	0	0	0	0	0	0	0	0	0	0
238	7/11/2023	0	0	0	0	0	0	0	0	0	0
239	7/11/2023	0	0	0	0	5	95	0	0	0	0
240	7/11/2023	0	0	0	0	0	0	0	0	0	0
241	7/11/2023	0	0	15	0	5	80	0	0	0	0
242	7/11/2023	0	0	100	0	0	0	0	0	0	0
243	7/11/2023	0	0	5	0	0	95	0	0	0	0
244	7/11/2023	0	0	50	0	0	50	0	0	0	0
245	7/11/2023	0	0	95	0	0	5	0	0	0	0
246	7/11/2023	0	0	0	0	0	0	0	0	0	0
247	7/11/2023	0	0	90	0	0	10	0	0	0	0
248	7/11/2023	0	0	0	0	0	0	0	0	0	0
249	7/11/2023	0	0	0	0	100	0	0	0	0	0
250	7/11/2023	0	0	0	0	0	0	0	0	0	0
251	7/11/2023	0	0	0	0	0	0	0	0	0	0
252	7/11/2023	0	0	100	0	0	0	0	0	0	0
253	7/11/2023	0	0	100	0	0	0	0	0	0	0
254	7/11/2023	0	0	0	0	0	0	0	0	0	0
255	7/11/2023	0	0	5	0	5	90	0	0	0	0
256	7/11/2023	0	0	5	0	0	95	0	0	0	0
257	7/11/2023	0	0	0	100	0	0	0	0	0	0
258	7/11/2023	0	0	20	0	0	80	0	0	0	0
259	7/11/2023	0	0	0	0	100	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
260	7/11/2023	0	0	0	0	0	0	0	0	0	0
261	7/11/2023	0	0	100	0	0	0	0	0	0	0
262	7/11/2023	0	0	5	0	0	95	0	0	0	0
263	7/11/2023	0	0	100	0	0	0	0	0	0	0
264	7/11/2023	0	0	0	0	0	0	0	0	0	0
265	7/11/2023	0	0	95	0	0	5	0	0	0	0
266	7/11/2023	0	0	0	0	0	0	0	0	0	0
267	7/11/2023	0	0	50	0	0	50	0	0	0	0
268	7/11/2023	0	1	95	0	0	5	0	0	0	0
269	7/11/2023	0	0	0	0	0	0	0	0	0	0
270	7/11/2023	0	0	0	0	0	0	0	0	0	0
271	7/11/2023	0	0	0	0	0	0	0	0	0	0
272	7/11/2023	0	0	0	0	0	0	0	0	0	0
273	7/11/2023	0	0	0	0	0	0	0	0	0	0
274	7/11/2023	0	0	50	0	0	50	0	0	0	0
275	7/11/2023	0	0	0	0	0	0	0	0	0	0
276	7/11/2023	0	0	0	0	0	0	0	0	0	0
277	7/11/2023	0	0	90	0	0	10	0	0	0	0
278	7/11/2023	0	0	90	0	0	10	0	0	0	0
279	7/11/2023	0	0	0	0	0	0	0	0	0	0
280	7/11/2023	0	0	90	0	10	0	0	0	0	0
281	7/11/2023	0	20	30	0	10	40	0	0	0	0
282	7/11/2023	0	0	100	0	0	0	0	0	0	0
283	7/11/2023	0	0	70	0	15	15	0	0	0	0
284	7/11/2023	0	0	40	0	50	10	0	0	0	0
285	7/11/2023	0	0	0	0	0	0	0	0	0	0
286	7/11/2023	0	50	10	0	0	40	0	0	0	0
287	7/11/2023	0	0	0	0	0	0	0	0	0	0
288	7/11/2023	0	90	5	0	0	5	0	0	0	0
289	7/11/2023	0	100	0	0	0	0	0	0	0	0
290	7/11/2023	0	100	0	0	0	0	0	0	0	0
291	7/11/2023	0	90	0	0	0	10	0	0	0	0
292	7/11/2023	0	100	0	0	0	0	0	0	0	0
293	7/11/2023	0	100	0	0	0	0	0	0	0	0
294	7/11/2023	0	0	0	0	0	0	0	0	0	0
295	7/11/2023	0	0	0	0	0	100	0	0	0	0
296	7/11/2023	0	100	0	0	0	0	0	0	0	0
297	7/11/2023	0	0	0	0	0	0	0	0	0	0
298	7/11/2023	0	10	0	0	0	90	0	0	0	0
299	7/11/2023	0	40	30	0	0	30	0	0	0	0
300	7/11/2023	0	100	0	0	0	0	0	0	0	0
301	7/11/2023	0	100	0	0	0	0	0	0	0	0
302	7/11/2023	0	95	0	0	0	5	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
303	7/11/2023	0	0	0	0	0	0	0	0	0	0
304	7/11/2023	0	100	0	0	0	0	0	0	0	0
305	7/11/2023	25	0	25	0	50	0	0	0	0	0
306	7/11/2023	0	20	80	0	0	0	0	0	0	0
307	7/11/2023	50	20	0	0	0	30	0	0	0	0
308	7/11/2023	20	30	10	0	0	40	0	0	0	0
309	7/11/2023	0	100	0	0	0	0	0	0	0	0
310	7/11/2023	0	100	0	0	0	0	0	0	0	0
311	7/11/2023	0	100	0	0	0	0	0	0	0	0
312	7/11/2023	0	100	0	0	0	0	0	0	0	0
313	7/11/2023	0	100	0	0	0	0	0	0	0	0
314	7/11/2023	10	50	20	0	0	20	0	0	0	0
315	7/11/2023	0	100	0	0	0	0	0	0	0	0
316	7/11/2023	0	60	0	0	40	0	0	0	0	0
317	7/11/2023	0	100	0	0	0	0	0	0	0	0
318	7/11/2023	0	100	0	0	0	0	0	0	0	0
319	7/11/2023	30	40	20	0	0	10	0	0	0	0
320	7/11/2023	0	100	0	0	0	0	0	0	0	0
321	7/11/2023	0	100	0	0	0	0	0	0	0	0
322	7/11/2023	0	100	0	0	0	0	0	0	0	0
323	7/11/2023	100	0	0	0	0	0	0	0	0	0
324	7/11/2023	90	0	5	0	0	5	0	0	0	0
325	7/11/2023	0	100	0	0	0	0	0	0	0	0
326	7/11/2023	50	50	0	0	0	0	0	0	0	0
327	7/11/2023	0	100	0	0	0	0	0	0	0	0
328	7/11/2023	90	10	0	0	0	0	0	0	0	0
329	7/11/2023	0	100	0	0	0	0	0	0	0	0
330	7/11/2023	0	100	0	0	0	0	0	0	0	0
331	7/11/2023	50	50	0	0	0	0	0	0	0	0
332	7/11/2023	0	100	0	0	0	0	0	0	0	0
333	7/11/2023	0	100	0	0	0	0	0	0	0	0
334	7/11/2023	90	10	0	0	0	0	0	0	0	0
335	7/11/2023	0	100	0	0	0	0	0	0	0	0
336	7/11/2023	0	0	0	0	0	0	0	0	0	0
337	7/11/2023	70	30	0	0	0	0	0	0	0	0
338	7/11/2023	40	0	60	0	0	0	0	0	0	0
339	7/11/2023	0	100	0	0	0	0	0	0	0	0
340	7/11/2023	0	100	0	0	0	0	0	0	0	0
341	7/11/2023	95	5	0	0	0	0	0	0	0	0
342	7/11/2023	70	20	0	0	10	0	0	0	0	0
343	7/11/2023	0	100	0	0	0	0	0	0	0	0
344	7/11/2023	40	0	0	0	20	40	0	0	0	0
345	7/11/2023	0	0	95	0	0	5	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
346	7/11/2023	0	0	0	0	0	0	0	0	0	0
347	7/11/2023	0	100	0	0	0	0	0	0	0	0
348	7/11/2023	0	100	0	0	0	0	0	0	0	0
349	7/11/2023	0	100	0	0	0	0	0	0	0	0
350	7/11/2023	0	75	0	20	0	5	0	0	0	0
351	7/11/2023	0	0	0	0	100	0	0	0	0	0
352	7/11/2023	0	100	0	0	0	0	0	0	0	0
353	7/12/2023	0	0	100	0	0	0	0	0	0	0
354	7/12/2023	0	0	8	2	0	0	90	0	0	0
355	7/12/2023	0	0	50	50	0	0	0	0	0	0
356	7/12/2023	70	0	0	0	0	30	0	0	0	0
357	7/12/2023	1	0	0	0	0	0	99	0	0	0
358	7/12/2023	30	0	0	0	50	20	0	0	0	0
359	7/12/2023	80	0	15	5	0	0	0	0	0	0
360	7/12/2023	0	0	0	0	0	5	95	0	0	0
361	7/12/2023	0	0	90	0	0	10	0	0	0	0
362	7/12/2023	0	0	20	20	20	0	40	0	0	0
363	7/12/2023	0	0	30	0	60	10	0	0	0	0
364	7/12/2023	0	0	90	0	5	5	0	0	0	0
365	7/12/2023	0	0	0	10	90	0	0	0	0	0
366	7/12/2023	0	0	0	0	100	0	0	0	0	0
367	7/12/2023	0	0	0	0	0	0	0	100	0	0
368	7/12/2023	10	30	60	0	0	0	0	0	0	0
369	7/12/2023	10	0	90	0	0	0	0	0	0	0
370	7/12/2023	0	0	0	0	0	0	0	100	0	0
371	7/12/2023	0	95	3	0	0	2	0	0	0	0
372	7/12/2023	0	15	50	5	30	0	0	0	0	0
373	7/12/2023	20	30	40	0	0	10	0	0	0	0
374	7/12/2023	0	0	0	0	0	0	0	0	0	0
375	7/12/2023	20	20	60	0	0	0	0	0	0	0
376	7/12/2023	0	0	100	0	0	0	0	0	0	0
377	7/12/2023	80	0	0	0	20	0	0	0	0	0
378	7/12/2023	0	100	0	0	0	0	0	0	0	0
379	7/12/2023	0	100	0	0	0	0	0	0	0	0
380	7/12/2023	0	0	10	80	0	0	0	0	0	0
381	7/12/2023	0	100	0	0	0	0	0	0	0	0
382	7/12/2023	0	40	60	0	0	0	0	0	0	0
383	7/12/2023	0	100	0	0	0	0	0	0	0	0
384	7/12/2023	0	40	0	10	0	10	40	0	0	0
385	7/12/2023	0	0	0	100	0	0	0	0	0	0
386	7/12/2023	0	100	0	0	0	0	0	0	0	0
387	7/12/2023	10	0	0	0	0	0	0	0	0	0
388	7/12/2023	0	0	0	0	0	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
389	7/12/2023	0	100	0	0	0	0	0	0	0	0
390	7/12/2023	0	80	10	0	0	10	0	0	0	0
391	7/12/2023	0	0	0	0	100	0	0	0	0	0
392	7/12/2023	0	80	10	0	0	10	0	0	0	0
393	7/12/2023	0	0	0	0	100	0	0	0	0	0
394	7/12/2023	30	40	30	0	0	0	0	0	0	0
395	7/12/2023	10	0	80	10	0	5	0	0	0	0
396	7/12/2023	0	0	90	10	0	0	0	0	0	0
397	7/12/2023	0	5	50	40	0	5	0	0	0	0
398	7/12/2023	0	0	90	0	10	0	0	0	0	0
399	7/12/2023	0	10	90	0	0	0	0	0	0	0
400	7/12/2023	10	0	30	0	0	60	0	0	0	0
401	7/12/2023	0	30	30	10	30	0	0	0	0	0
402	7/12/2023	0	100	0	0	0	0	0	0	0	0
403	7/12/2023	0	0	0	0	0	0	0	0	0	0
404	7/12/2023	95	0	0	0	0	5	0	0	0	0
405	7/12/2023	30	40	30	0	0	0	0	0	0	0
406	7/12/2023	0	100	0	0	0	0	0	0	0	0
407	7/12/2023	20	30	40	0	0	10	0	0	0	0
408	7/12/2023	5	0	90	5	0	0	0	0	0	0
409	7/12/2023	0	90	5	0	0	5	0	0	0	0
410	7/12/2023	0	0	0	0	0	0	0	0	0	0
411	7/12/2023	10	90	0	0	0	0	0	0	0	0
412	7/12/2023	0	100	0	0	0	0	0	0	0	0
413	7/12/2023	0	100	0	0	0	0	0	0	0	0
414	7/12/2023	0	100	0	0	0	0	0	0	0	0
415	7/12/2023	0	100	0	0	0	0	0	0	0	0
416	7/12/2023	0	0	0	0	60	0	0	0	40	0
417	7/12/2023	0	20	0	0	60	0	0	0	20	0
418	7/12/2023	10	20	0	0	0	0	0	0	70	5
419	7/12/2023	0	0	0	0	0	0	0	0	50	50
420	7/12/2023	0	100	0	0	0	0	0	0	0	0
421	7/12/2023	0	50	0	0	0	0	0	0	50	0
422	7/12/2023	0	10	0	0	0	0	0	0	60	30
423	7/12/2023	0	0	0	0	0	0	0	0	100	0
424	7/12/2023	0	100	0	0	0	0	0	0	0	0
425	7/12/2023	0	10	0	0	0	0	0	0	50	40
426	7/12/2023	0	100	0	0	0	0	0	0	0	0
427	7/12/2023	0	95	0	0	0	0	0	0	0	5
428	7/12/2023	0	0	0	0	0	5	0	0	20	75
429	7/12/2023	0	100	0	0	0	0	0	0	0	0
430	7/12/2023	0	100	0	0	0	0	0	0	0	0
431	7/12/2023	0	95	0	0	0	0	0	0	5	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
432	7/12/2023	0	95	0	0	0	0	0	0	5	0
434	7/12/2023	0	50	0	0	0	0	0	0	50	0
435	7/12/2023	0	75	0	0	0	25	0	0	0	0
436	7/12/2023	0	100	0	0	0	0	0	0	0	0
437	7/12/2023	0	99	0	0	0	0	0	0	1	0
438	7/12/2023	0	50	0	0	0	0	0	0	50	0
439	7/12/2023	0	100	0	0	0	0	0	0	0	0
440	7/12/2023	0	60	0	0	0	0	0	0	40	0
441	7/12/2023	0	80	0	0	0	0	0	0	20	0
442	7/12/2023	0	100	0	0	0	0	0	0	0	0
443	7/12/2023	0	100	0	0	0	0	0	0	0	0
444	7/12/2023	0	100	0	0	0	0	0	0	0	0
445	7/12/2023	0	40	0	0	0	0	0	0	60	0
446	7/12/2023	0	70	0	0	0	0	0	0	30	0
447	7/12/2023	0	0	0	60	0	0	0	0	40	0
448	7/12/2023	0	80	0	0	0	0	0	0	20	0
449	7/12/2023	0	50	0	0	0	0	0	0	50	0
450	7/12/2023	0	100	0	0	0	0	0	0	0	0
451	7/12/2023	0	100	0	0	0	0	0	0	0	0
452	7/12/2023	0	85	0	0	0	0	0	0	15	0
453	7/12/2023	0	40	0	0	0	0	0	0	0	0
454	7/12/2023	0	100	0	0	0	0	0	0	0	0
455	7/12/2023	0	50	0	0	0	0	0	0	50	0
456	7/12/2023	0	100	0	0	0	0	0	0	0	0
457	7/12/2023	0	10	0	0	0	0	0	0	90	0
458	7/12/2023	0	100	0	0	0	0	0	0	0	0
459	7/12/2023	0	60	0	0	0	0	0	0	30	0
460	7/12/2023	0	100	0	0	0	0	0	0	0	0
461	7/12/2023	0	60	0	0	0	0	0	0	30	0
462	7/12/2023	0	100	0	0	0	0	0	0	0	0
463	7/12/2023	0	0	0	0	0	0	0	0	20	80
464	7/12/2023	0	0	0	0	0	0	0	0	0	100
465	7/12/2023	0	0	0	0	0	0	0	0	0	0
466	7/12/2023	0	30	0	0	0	0	0	0	30	40
467	7/12/2023	0	0	0	0	0	0	0	0	100	0
468	7/12/2023	0	0	0	0	0	0	0	0	90	10
469	7/12/2023	0	0	0	0	0	0	0	0	0	0
470	7/12/2023	0	60	0	0	0	0	0	0	40	0
471	7/12/2023	0	0	0	0	0	0	0	0	0	100
472	7/12/2023	0	100	0	0	0	0	0	0	0	0
473	7/12/2023	0	100	0	0	0	0	0	0	0	0
474	7/12/2023	0	80	0	0	0	0	0	0	20	0
475	7/12/2023	0	95	0	0	0	0	0	0	5	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
476	7/12/2023	0	95	0	0	0	0	0	0	5	0
477	7/12/2023	0	0	0	0	0	0	0	0	0	0
478	7/13/2023	0	0	0	0	0	0	0	0	0	0
479	7/13/2023	0	0	5	0	0	0	95	0	0	0
480	7/13/2023	0	0	0	0	100	0	0	0	0	0
481	7/13/2023	0	0	0	100	0	0	0	0	0	0
482	7/13/2023	0	0	0	100	0	0	0	0	0	0
483	7/13/2023	0	0	95	0	0	5	0	0	0	0
484	7/13/2023	0	0	90	0	5	5	0	0	0	0
485	7/13/2023	0	1	95	0	0	5	0	0	0	0
486	7/13/2023	0	0	0	0	0	0	0	0	0	0
487	7/13/2023	5	25	25	25	0	10	0	0	0	0
488	7/13/2023	30	0	60	0	0	10	0	0	0	0
489	7/13/2023	20	40	5	0	40	0	0	0	0	0
490	7/13/2023	0	0	0	0	100	0	0	0	0	0
491	7/13/2023	0	0	10	0	50	40	0	0	0	0
492	7/13/2023	10	80	0	0	0	10	0	0	0	0
493	7/13/2023	0	0	80	10	10	0	0	0	0	0
494	7/13/2023	0	0	90	0	0	10	0	0	0	0
495	7/13/2023	0	20	0	20	50	10	0	0	0	0
496	7/13/2023	90	5	0	0	0	5	0	0	0	0
497	7/13/2023	0	90	0	0	0	10	0	0	0	0
498	7/13/2023	0	0	5	5	0	90	0	0	0	0
499	7/13/2023	0	100	0	0	0	0	0	0	0	0
500	7/13/2023	95	2	3	0	0	0	0	0	0	0
501	7/13/2023	0	100	0	0	0	0	0	0	0	0
502	7/13/2023	0	100	0	0	0	0	0	0	0	0
503	7/13/2023	0	100	0	0	0	0	0	0	0	0
504	7/13/2023	0	100	0	0	0	0	0	0	0	0
505	7/13/2023	5	95	0	0	0	0	0	0	0	0
506	7/13/2023	0	100	0	0	0	0	0	0	0	0
507	7/13/2023	0	0	0	0	100	0	0	0	0	0
508	7/13/2023	0	0	0	0	0	0	0	0	0	0
509	7/13/2023	95	5	0	0	0	0	0	0	0	0
510	7/13/2023	0	100	0	0	0	0	0	0	0	0
511	7/13/2023	10	50	40	0	0	0	0	0	0	0
512	7/13/2023	0	5	0	0	0	0	0	0	0	0
513	7/13/2023	0	0	0	0	0	0	0	0	0	0
514	7/13/2023	0	100	0	0	0	0	0	0	0	0
515	7/13/2023	0	100	0	0	0	0	0	0	0	0
516	7/13/2023	40	0	60	0	0	0	0	0	0	0
517	7/13/2023	50	50	5	0	0	0	0	0	0	0
518	7/13/2023	0	100	0	0	0	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
519	7/13/2023	20	0	40	0	40	0	0	0	0	0
520	7/13/2023	0	40	0	0	50	10	0	0	0	0
521	7/13/2023	0	0	50	0	50	0	0	0	0	0
522	7/13/2023	0	60	40	0	0	0	0	0	0	0
523	7/13/2023	0	0	50	0	50	0	0	0	0	0
524	7/13/2023	0	0	90	5	0	5	0	0	0	0
525	7/13/2023	0	0	100	0	0	0	0	0	0	0
526	7/13/2023	10	30	0	0	0	0	10	0	0	0
527	7/13/2023	0	90	0	0	0	5	0	5	0	0
528	7/13/2023	0	100	0	0	0	0	0	0	0	0
529	7/13/2023	60	20	20	0	0	10	0	0	0	0
530	7/13/2023	0	0	60	0	0	40	0	0	0	0
531	7/13/2023	0	95	5	0	0	0	0	0	0	0
532	7/13/2023	60	40	0	0	0	0	0	0	0	0
533	7/13/2023	0	100	0	0	0	0	0	0	0	0
534	7/13/2023	50	0	40	0	0	0	10	0	0	0
535	7/13/2023	0	100	0	0	0	0	0	0	0	0
536	7/13/2023	0	0	50	0	50	0	0	0	0	0
537	7/13/2023	90	5	5	0	0	0	0	0	0	0
538	7/13/2023	0	0	0	0	0	0	0	0	0	0
539	7/13/2023	0	0	0	0	0	0	0	0	0	0
540	7/13/2023	0	20	0	0	10	50	20	0	0	0
541	7/13/2023	0	0	0	0	100	0	0	0	0	0
542	7/13/2023	0	0	100	0	0	0	0	0	0	0
543	7/13/2023	0	0	0	0	0	0	0	0	0	0
544	7/13/2023	0	0	0	0	0	0	0	0	0	0
545	7/13/2023	60	20	10	0	0	10	0	0	0	0
546	7/13/2023	0	100	0	0	0	0	0	0	0	0
547	7/13/2023	0	80	20	0	0	0	0	0	0	0
548	7/13/2023	20	70	0	0	0	10	0	0	0	0
549	7/13/2023	0	100	0	0	0	0	0	0	0	0
550	7/13/2023	0	0	0	0	100	0	0	0	0	0
551	7/13/2023	50	0	40	0	0	20	0	0	0	0
552	7/13/2023	0	0	0	50	0	40	10	0	0	0
553	7/13/2023	10	0	50	0	0	40	0	0	0	0
554	7/13/2023	0	0	10	10	0	80	0	0	0	0
555	7/13/2023	0	100	0	0	0	0	0	0	0	0
556	7/13/2023	0	100	0	0	0	0	0	0	0	0
557	7/13/2023	90	5	0	0	0	5	0	0	0	0
558	7/13/2023	50	0	25	0	0	25	0	0	0	0
559	7/13/2023	0	0	0	0	0	0	0	0	0	0
560	7/13/2023	40	60	0	0	0	0	0	0	0	0
561	7/13/2023	100	0	0	0	0	0	0	0	0	0

TKPOA 2023 Aquatic Macrophyte Survey Data Points

Point ID	Date	MySp	CeDe	PoCr	PoFo	NiSp	EICA	PoRi	FiAl	BrSc	MyQu
562	7/13/2023	0	100	0	0	0	0	0	0	0	0
563	7/13/2023	0	80	20	0	0	0	0	0	0	0
564	7/13/2023	100	0	0	0	0	0	0	0	0	0
565	7/13/2023	0	100	0	0	0	0	0	0	0	0
566	7/13/2023	0	0	0	0	0	0	0	0	0	0
567	7/13/2023	95	0	0	0	0	5	0	0	0	0
568	7/13/2023	0	100	0	0	0	0	0	0	0	0
569	7/13/2023	95	0	0	0	5	5	0	0	0	0
570	7/13/2023	0	0	0	0	100	0	0	0	0	0
571	7/13/2023	100	0	0	0	0	0	0	0	0	0
572	7/13/2023	80	0	0	0	0	20	0	0	0	0
573	7/13/2023	0	100	0	0	0	0	0	0	0	0
574	7/13/2023	0	50	0	50	0	0	0	0	0	0
575	7/13/2023	0	95	5	0	0	0	0	0	0	0
576	7/13/2023	97	2	1	0	0	0	0	0	0	0
577	7/13/2023	0	99	0	0	0	1	0	0	0	0

Appendix B

Species Composition Maps

Figure B-1. Coontail Composition Map

Figure B-2. Eurasian watermilfoil Composition Map

Figure B-3. Curlyleaf Pondweed Composition Map

Figure B-4. Leafy Pondweed Composition Map

Figure B-5. Elodea Composition Map

Figure B-6. Nitella Composition Map

Figure B-7. Water Smartweed Composition Map