2018 Macrophyte Survey Report
Pine River Pond, East Wakefield, NH

INTRODUCTION

As with prior years, SŌLitude Lake Management (SŌLitude) was contracted by the Pine River Pond Association to conduct a macrophyte survey of Pine River Pond in East Wakefield, NH for the 2018 season. The primary focus of the survey was to monitor and document the growth and potential spread of native whorled watermilfoil (*Myriophyllum verticillatum*) that was first observed during the 2014 growing season. Other macrophyte growth observed within the littoral zone was identified and recorded with an approximate location.

The following report will discuss the extent of macrophyte growth documented during the survey, along with attached distribution maps and plant codes for reference.

Lake Description

According to New Hampshire Fish and Game, Pine River Pond is an approximately 570-acre lake located in East Wakefield, NH with average and maximum depths of 15 and 55 feet, respectively. The shoreline of the lake is moderately developed with both seasonal and year-round homes. Water flows into the lake through tributaries, surface water run-off, and groundwater, and outflows into the Pine River which then flows towards Ossipee. The Arthur H. Fox Memorial Dam at the northern end of the lake was built in 1977 and augments the lake system and maintains the size of Pine River Pond. Its watershed (8,200 acres) is relatively small and includes undeveloped, forested hillsides. It is likely that the trophic state of the lake is due, in large part, to the limited development within the watershed. The 15 islands and flats of macrophyte growth provide variable habitat for the biota supported by the lake. The substrate of the lake is generally a mixture of rock and sand with limited areas of organic matter/muck.

METHODS

Day of Survey: September 13, 2018

As with 2017, the entire littoral zone was surveyed using a 16-foot skiff. The littoral zone was determined on site through the use of the most recent New Hampshire Fish and Game bathymetry map, previous knowledge of the lake characteristics, and an on-board sonar system. Real-time sonar allowed for visualization of macrophyte presence or absence. The vegetation growth was assessed visually when possible, and enhanced by the use of a throw-rake when growth was not visible from the boat. Observed macrophytes were identified and recorded to the most appropriate taxon (species level when possible), and relative locations were referenced with a hand-held GPS unit for reporting purposes.

Weather conditions for the survey were near ideal, with some breeze and clouds present throughout the day. Conditions for visual observation with the use of polarized lenses were still optimal.

RESULTS & ANALYSIS

On September 13th, a two-Biologist SŌLitude team performed a general macrophyte assessment at Pine River Pond. As previously determined, the lake supports moderate macrophyte growth to depths of approximately 16-18 feet. While the augmentation of the survey with the sonar unit enables a more accurate representation of present plant growth, seasons of good water clarity also promote deeper macrophyte growth; some years may only enable growth out to 10 feet (as documented in previous survey years).

A total of 35 species of aquatic plants were identified during the survey (Figures 1 & 2) – a species list with reference ID codes is attached to this report. While the increase in richness (number of species) from the 2016 to 2017 surveys was likely due to the identification of bladderwort and pondweed species rather than just the genus, the nature of a visual survey also allows for greater variation in richness year-over-year. Consistent with previous survey years, the plant assemblage was dominated primarily by bladderwort (*Utricularia* spp.) in addition to large-leaf pondweed (*Potamogeton amplifolius*) and grassy bulrush (*Schoenoplectus subterminalis*). In 2017, grassy bulrush was misidentified as a species of spikerush (*Eleocharis* sp.) due to similarities in identifying features. Flowering stalks were present on much of the grassy bulrush during the 2018 survey, which confirmed identification.

Visually, vegetation cover was found at moderate density (50-65%) throughout the majority of the littoral zone, with higher densities in protected and cove-like areas. Rocky areas inhibited macrophyte growth. Scattered, low-density growth was found along the more exposed shoreline areas and at deeper depths. When present, the majority of plant growth was found out to approximately 10-13 feet deep, where specifically bladderwort and large-leaf pondweed were the primary macrophytes found at the deeper locations.

Though appearing considerably similar to vascular aquatic plants, stonewort (*Nitella* sp.) is a macro-algal genus. Stonewort grows much like an aquatic plant, with root-like structures called rhizoids that act as stabilizers for the plant and sediment. Stonewort is just as beneficial as vascular plants in aquatic systems.

Whorled watermilfoil was documented in multiple locations (Figures 2 & 3), located similarly in previous years. The milfoil growth around the quaking bog (pictured) was the densest, but appears unchanged from 2017. Additional growth was noted outside the canal into the quaking bog, where no growth was documented in 2017. The cove adjacent to Lees Way (Area A from 2016) also supported milfoil growth in sparse density throughout the cove. Again, the milfoil growth appears to be growing simultaneous of good native diversity and richness. The area on the northern shore near Sparhawk Terrace from 2017 continues to support whorled milfoil growth; small plants were noted during the survey. The cove near Sparhawk Terrace was not accessible from the lake and the vegetation assemblage is unknown; additional whorled milfoil growth may be supported.

An additional species of native milfoil was documented during the survey – low watermilfoil (*Myriophyllum humile*, abbrev. 'Mu' in Figures 1 & 2). The growth was extremely small and some growth areas were confirmed through the presence of seeds. Other areas of growth did not contain seeds or enough growth for positive identification and could be an additional species of native milfoil (e.g. *M. farwellii* or *M. alterniflorum*). Regardless, the presence of native milfoil is no more concerning than other native vegetation. As with any native species, nuisance level growth can be supported with available conditions such as nutrients or pond characteristics; the milfoil growth was not concerning at the time of the survey.

SUMMARY

- No non-native species were documented within the littoral zone of Pine River Pond.
- General macrophyte distribution, diversity, and richness in the lake are desirable for aquatic biota (fish and wildlife) and recreational pursuits.
- The variation in species identification and richness can be attributed to the type of survey and enhanced survey methods rather than indicative of new species establishment.
- Whorled milfoil growth was densest around the quaking bog and trace or sparse in all other locations. The location at Sparhawk Terrace still contains whorled milfoil growth.
- The extent of littoral zone within Pine River Pond is potentially vulnerable for establishment of non-native, invasive species such as fanwort (*Cabomba caroliniana*), variable milfoil (*Myriophyllum heterophyllum*), Eurasian milfoil (*Myriophyllum spicatum*), southern naiad (*Najas guadalupensis*), or brittle naiad (*Najas minor*) which are common invaders within the state of New Hampshire and Maine.
- A lack of public access is beneficial to avoiding new invasive establishment, however, homeowners coming from surrounding waterbodies should still maintain awareness.

MANAGEMENT RECOMMENDATIONS

The proximity of Pine River Pond to known non-native plant infestations creates a high likelihood of potentially noxious plant introductions. As such, our recommendations remain unchanged; we recommend that the Association continue with the preventative efforts to keep from introducing non-native aquatic species to Pine River Pond, including the annual survey to confirm the lack of non-native species. Employing state trained 'weed watchers' for additional monitoring can be an effective means of documenting seasonal changes and/or issues. Early detection is paramount for the success of preventative management and should remain a priority for the Association and lake residence.

Through proper state-regulated channels, the use of diver hand-pulling can be employed to control the native whorled watermilfoil. The use of hand-pulling inflicts minimal disturbance on the surrounding species, especially in areas like the quaking bog with high native aquatic plant diversity. Due to the nature of whorled milfoil growth, and conversations with NH DES, and other projects involving nuisance native plant control, selective use of herbicide is not feasible. Diver hand-pulling requires a permit from the NH Wetlands Bureau, however, this control activity has the highest probability of being approved by the State, while targeting the milfoil growth where necessary.

We hope you find this information helpful in making your pond management decisions, and look forward to assisting in the continued monitoring of Pine River Pond in the following growing season. If you have any questions or need anything further, please contact our office.

FIGURE 3: WHORLED MILFOIL LOCATIONS
September 13, 2018

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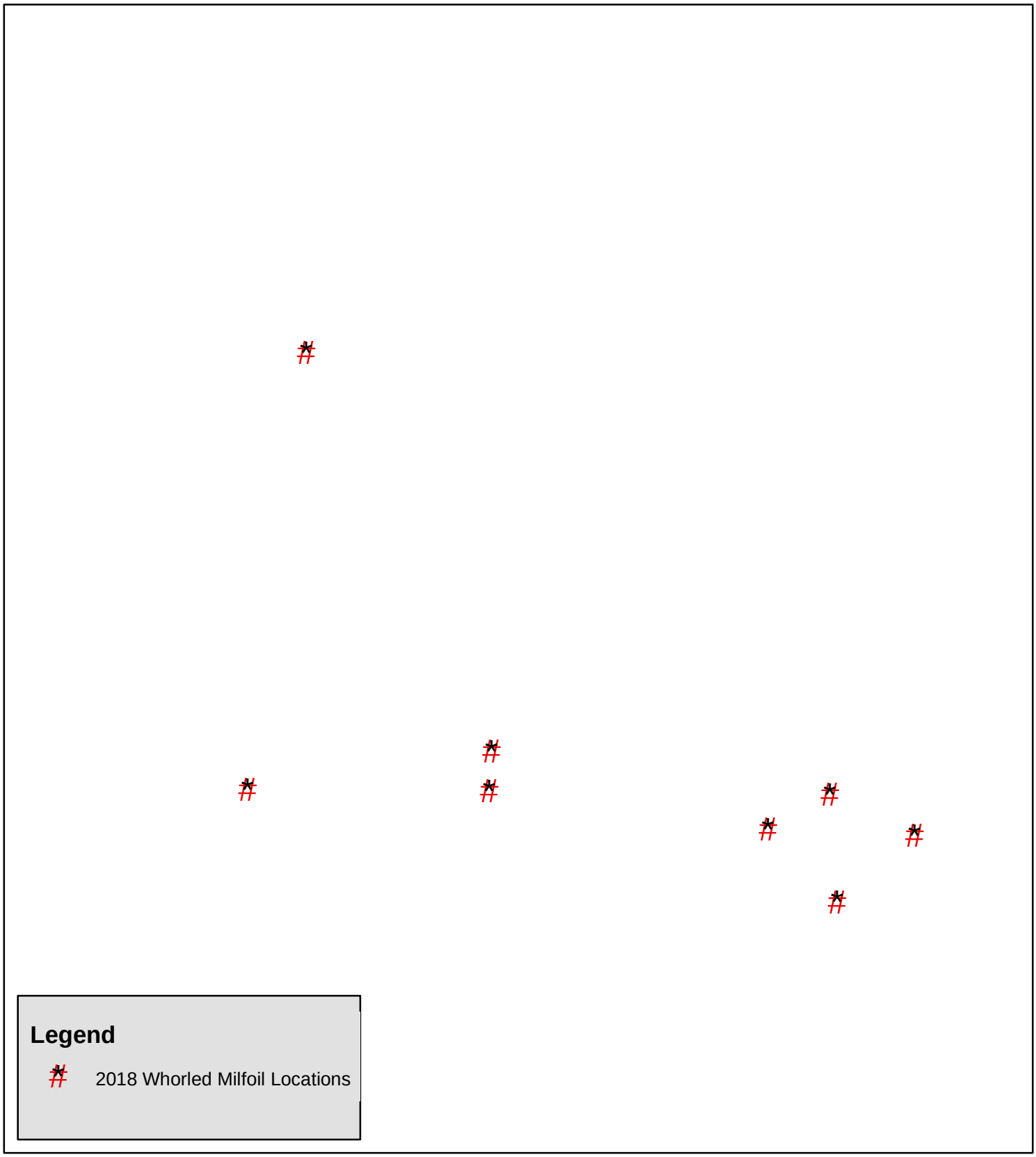

Legend

2018 Whorled Milfoil Locations

Pine River Pond
East Wakefield, NH

Pine River Pond

0 450 900 Feet

1:4,816

Map Date: 10/11/18
Prepared by: BNA
Office: SHREWSBURY, MA

Pine River Pond - Macrophyte Survey
September 13, 2018

ID Code	Common Name	Latin Name
Bs	Watershield	*Brasenia schreberi*
Ch	Water Starwort	*Callitriche heterophylla*
Ea	Spikerush	*Eleocharis sp.*
En	Western Waterweed	*Elodea nuttallii*
Em	Small Waterwort	*Elatine minima*
Eq	Seven-angle Pipewort	*Eriocaulon aquaticum*
F	Aquatic Moss	*Fontinalis sp.*
Ga	Golden Hedge-hyssop	*Gratiola aurea*
Lp	Marsh Seedbox	*Ludwigia palustris*
Mu	Low Watermilfoil	*Myriophyllum humile*
Mv	Whorled Watermilfoil	*Myriophyllum verticillatum*
Nf	Bushy Naiad	*Najas flexilis*
Ng	Slender/Northern Naiad	*Najas gracillima*
Ni	Stonewort	*Nitella sp.*
Pa	Large-leaf Pondweed	*Potamogeton amplifolius*
Pb	Snailseed Pondweed	*Potamogeton bicupulatus*
Pe	Ribbonleaf Pondweed	*Potamogeton epihydrus*
Pg	Variable-leaf Pondweed	*Potamogeton gramineus*
Pn	Floating Pondweed	*Potamogeton natans*
Po	Long-leaf Pondweed	*Potamogeton nodosus*
Pp	Small Pondweed	*Potamogeton pusillus*
Pr	Robbin's Pondweed	*Potamogeton robbinsii*
Sf	Floating Bur-reed	*Sparganium fluctuans*
Sp	Sago Pondweed	*Stuckenia pectinata*
Ss	Water Bulrush	*Schoenoplectus subterminalis*
Q	Quillwort	*Isoetes sp.*
Ug	Creeping Bladderwort	*Utricularia gibba*
Ui	Flatleaf Bladderwort	*Utricularia intermedia*
Um	Small Bladderwort	*Utricularia minor*
Up	Purple Bladderwort	*Utricularia purpurea*
Ur	Little Floating Bladderwort	*Utricularia radiata*
Uv	Common Bladderwort	*Utricularia vulgaris*
V	Tapegrass	*Vallisneria americana*
W	White Waterlily	*Nymphaea odorata*
Y	Yellow Waterlily	*Nuphar variegata*