Northeast Aquatic Research

Protected Aquatic Plant Survey
2023 Report for Staffordville Reservoir (CT)

Prepared for Staffordville Lake Association
December 2023

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Summary

Northeast Aquatic Research (NEAR) conducted a formal aquatic plant survey of Staffordville Reservoir on June 12th, 2023. The survey goal was to locate and map native aquatic plant species and to search for populations of the State of Connecticut protected aquatic species *Potamogeton gemmiparus*[1] (Capillary Pondweed). This species may or may not be affected by herbicide treatments used to manage invasive *Myriophyllum heterophyllum* (Variable-leaf Milfoil) with herbicides.

The survey was conducted consistent with CT DEEP specifications requiring a whole lake meandering survey, requested as a requirement for a permit to treat Variable-leaf Milfoil.

The following information addresses DEEP concerns and provides results from the June 12th, 2023 post-treatment survey. Capillary Pondweed was found at one location in the northwest cove. No other protected aquatic plant species were found during the survey. Additionally, Variable-leaf Milfoil was not located.

Introduction

Staffordville Reservoir is a 149-acre waterbody in the town of Stafford Springs, Connecticut. The reservoir's eastern shoreline is heavily developed with lakefront homes, while the western shoreline contains more forestland, with homes set back from the water.

On August 15, 2022, Water & Wetland administered a ProcellaCOR (active ingredient: Florpyrauxifen-benzyl) treatment to control Variable-leaf Milfoil in Staffordville Reservoir. A total of four gallons of ProcellaCOR EC was applied over a 60.46-acre area (see treatment map in Appendix). Rates of herbicide stayed under 6 ppb during the treatment period.

Botanist Qualifications

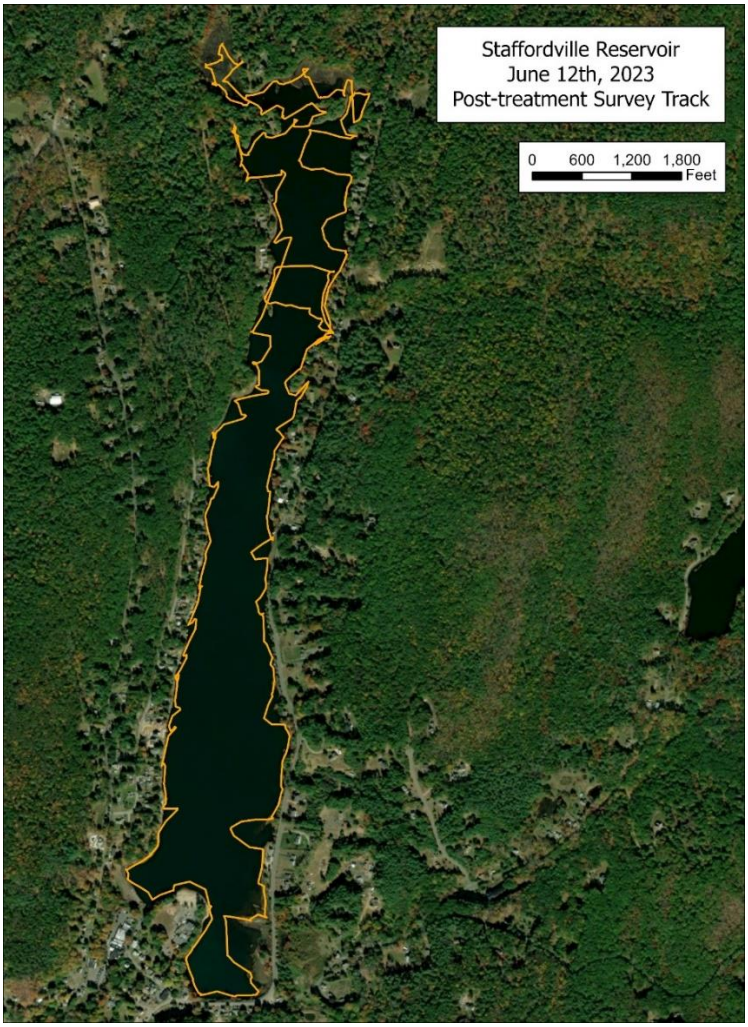
Dr. George Knoecklein led the rare plant survey of Staffordville Reservoir. George received his PhD in limnology in 1997 from the University of Connecticut. George is a Certified Lake Manager. He is a past board member of the New England Chapter of the North American Lake Management and Northeast Aquatic Plant Management Association, and a past President of the Connecticut Federation of Lakes. Beginning in 1997 with the founding of Northeast Aquatic Research, George has conducted hundreds of aquatic plant surveys specifically focused on finding protected species. Species that George has successfully located in CT lakes include: *Potamogeton confervoides, P. friesii, P. hillii, P. ogdenii, P. strictifolius, P. vaseyi, P. gemmiparus, Biden beckii, Eleocharis equisetoides*, *Orontium aquaticum*, *Myriophyllum sibiricum*, *Myriophyllum tenellum* (when it was still listed as a protected species*)*, S*agittaria teres*, and *Schoenoplectus acutus.* George's full CV can be found in the Appendix.

[1] This species was considered, until recently, a sub-species called *Potamogeton pusillus spp. gemmiparus.*

Methods

The June 12th, 2023 survey took approximately four hours to complete. The survey used GPS to locate a series of waypoints designed to sample the different micro-habitats in the littoral zone (Map 1). For the duration of the survey, a high-resolution down-imaging SONAR device provided a constant image of the water column beneath the boat. The image is of high enough resolution to differentiate plants from other objects such as rocks and stumps, as well as to show when nothing is present. In some instances, certain plant species can be differentiated on the SONAR image. The depth sounder showed the presence of plants that were growing on or near the bottom that were not visible from the surface. Waypoints were created using GPS in all locations where plant beds were searched for Capillary Pondweed. Two types of rakes were used to collect plant specimens - a long-handled extendable leaf rake and a 14-tine double-sided garden rake attached to a 10 meter rope.

Map 1. *June 2023 Staffordville Reservoir post-treatment survey track.*



Results

Capillary Pondweed

Capillary Pondweed was identified in one location in the northwest cove of Staffordville Reservoir. Map 2 shows the location of this plant from a whole-lake perspective, while Map 3 gives a close-up of the northwest cove. The plants were found in shallow water of less than 2 feet, within natural breaks of the water lily beds. Other species found at the same location include: *Nitella, Utricularia geminiscapa*, *Eleocharis robbinsii*, and *Potamogeton pusillus*. Capillary Pondweed was previously found in the northwest cove area during the 2022 pre-treatment survey.

Several specimens of narrow-leaved pondweeds were carefully examined because this species is difficult to distinguish from close relatives. Capillary Pondweed is one of a group of narrow leaf pondweeds characterized by very narrow submersed leaves of widths between 0.2 and 0.7 mm. Capillary Pondweed is principally separated from other pusilloid pondweeds by having the narrowest leaves of between 0.2 to 0.7mm (threadlike) in width, long persistent stipules, and nodal glands. Capillary pondweed is distinguished from its closes look-a-likes (*Potamogeton pusillus* (Small Pondweed), and *Potamogeton berchtoldii* (Berchtold's Pondweed)), by lacking the prominent lacunae midrib present in those two species. The remaining pusilloid pondweeds either lack nodal glands or have fibrous stipules. Capillary pondweed can be separated from the equally narrow-leaved adnate pondweeds; *Potamogeton bicupulatus* (Snail-seed Pondweed), and *Potamogeton spirillus* (Spiral Pondweed) by having unattached stipules. All other pondweeds have leaves wider than 3.5mm.

Milfoil

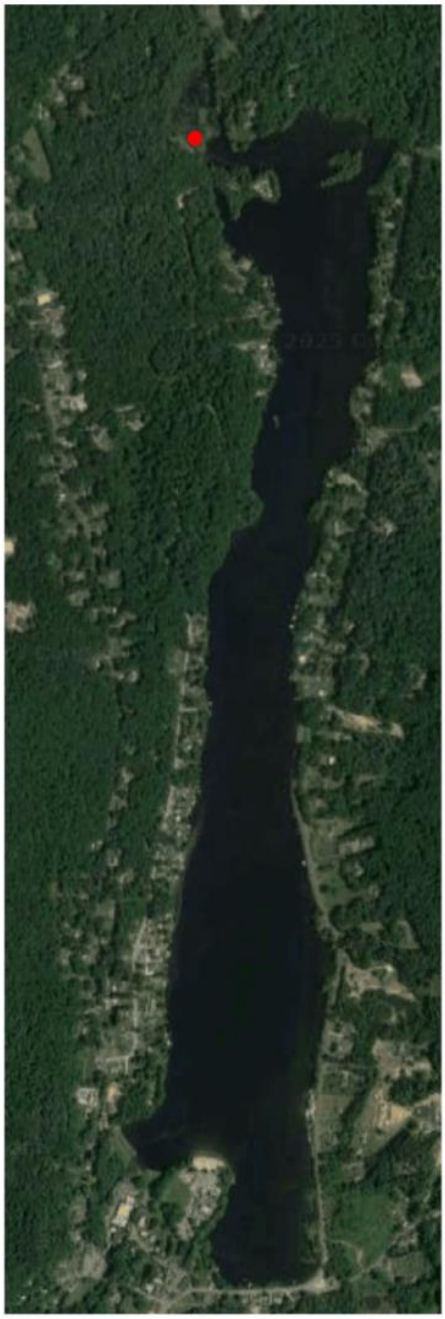
Variable-leaf Milfoil was not found anywhere in the lake in 2023. All locations where Variable-leaf Milfoil had been found in prior years were thoroughly searched, but no Milfoil plants were present.

Other Aquatic Plant Species

During the June 12th survey, we recorded a total of 22 species of aquatic plants, along with Filamentous Green Algae (Table 1). The dominant native species in the lake (those present at greater than 20% of waypoints) were *Nitella sp.* (Stonewort) and *Vallisneria americana* (Tape Grass).

Three species found in the lake have long thread-like leaves similar to Capillary Pondweed: *Potamogeton bicupulatus* (Snail-seed Pondweed), *Potamogeton pusillus* (Small Pondweed), and *Eleocharis robbinsii* (Robbin's Spikerush) (blue highlighting in Table 1). No invasive aquatic plant species were found in the lake during the 2023 survey.

Map 2: *Location of Capillary Pondweed in Staffordville Reservoir found by NEAR on June 12th, 2023.*



Map 3: *Locations of capillary pondweed in the northwest cove of Staffordville Reservoir on June 12th, 2023.*

Table 1. *Aquatic plants found during NEAR's July 7th, 2022 and June 12th, 2023 surveys of Staffordville Reservoir. Green highlight indicates protected species, blue highlight indicates "look-alike" species, red highlight indicates invasive species.*

Scientific Name	Common Name	2022	2023
Brasenia schreberi	Watershield	X	X
Callitriche sp.	Pond water-starwort	X	X
Decodon verticillatus	Swamp loosestrife	X	
Elatine sp.	Waterwort	X	X
Eleocharis acicularis	Needle spikerush	X	X
Eleocharis robbinsii	Robbins' spikerush	X	X
Elodea nuttallii	Nuttall's waterweed	X	X
Fontinalis sp.	Water moss	X	X
NA	Filamentous Green Algae		X
Myriophyllum heterophyllum	Variable-leaf milfoil	X	
Najas flexilis	Slender naiad	X	X

Nitella sp.	Stonewort	X	X
Nuphar variegata	Yellow pond lily	X	X
Nymphaea odorata	American white waterlily	X	X
Pontederia cordata	Pickerelweed	X	X
Potamogeton bicupulatus	Snail-seed pondweed	X	X
Potamogeton epihydrus	Ribbon-leaf pondweed	X	X
Potamogeton gemmiparus	Capillary pondweed	X	X
Potamogeton natans	Floating pondweed	X	
Potamogeton oakesianus	Oakes' pondweed	X	X
Potamogeton pusillus	Small pondweed	X	X
Potamogeton robbinsii	Robbins' pondweed	X	
Proserpinaca palustris	Marsh Mermaidweed	X	
Sagittaria graminea	Grassy arrowhead	X	X
Schoenoplectus subterminalis	Water bulrush	X	
Sparganium eurycarpum	Broadfruit bur-reed	X	--
Utricularia geminiscapa	Hidden-fruit bladderwort	X	X
Utricularia gibba	Humped bladderwort	X	--
Utricularia intermedia	Flat-leaved bladderwort	X	X
Utricularia purpurea	Eastern purple	X	X
Utricularia radiata	Little floating	X	X
Vallisneria americana	Tape grass	X	X

Discussion

Capillary Pondweed was found in four locations during the 2022 survey and in one location during the 2023 survey. The plants were found growing in the vicinity of Capillary Pondweed found in 2022 (**Map 4**). However, no Capillary Pondweed was found in the three more northern locations observed in 2022. It is unlikely that this is an effect of the herbicide treatment, as the treatment was not applied to the northern cove. Additionally, ProcellaCOR essentially targets dicots, which includes milfoils. Pondweeds, however, are monocots.

Map 4: *Locations of capillary pondweed in the northwest cove of Staffordville Reservoir on July 7th 2022 and June 12th, 2023.*

The application of ProcellaCOR targeting invasive Variable-leaf Milfoil appears to have been very effective, as no Milfoil was found during the 2023 survey. All locations where Variable-leaf Milfoil had been found in 2022 were thoroughly searched, but no plants were present.

Recommended Management Plan

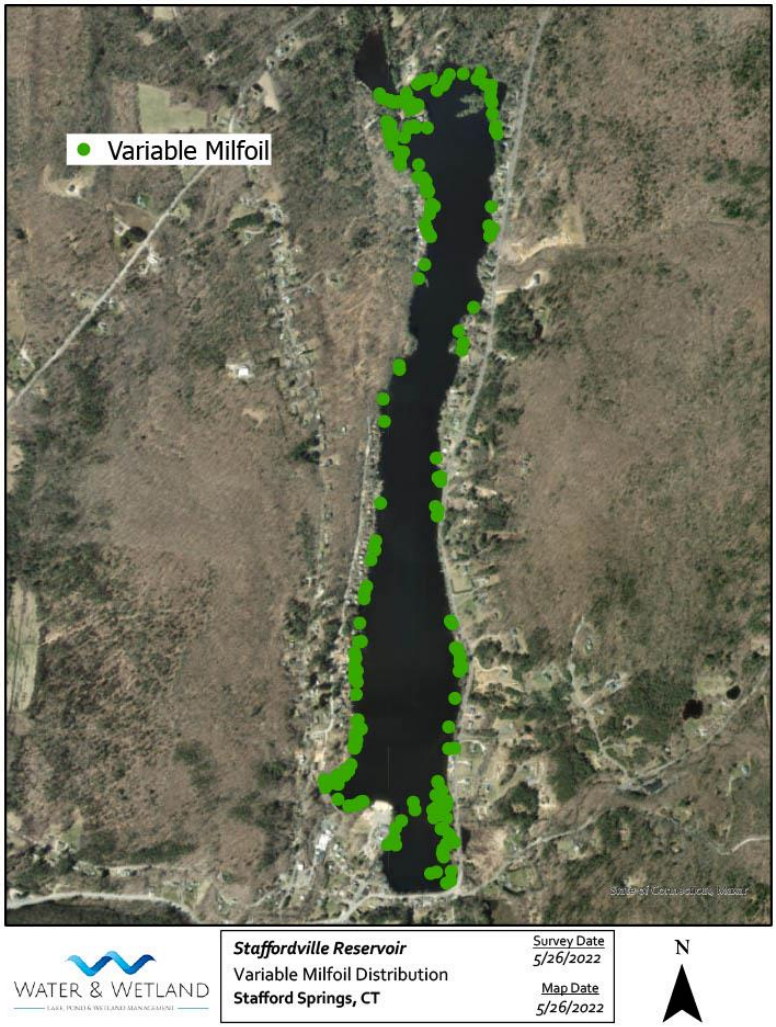
This survey was requested by CT DEEP as a requirement of a permit to treat the invasive aquatic plant Variable-leaf Milfoil with herbicides. Our survey successfully located Capillary Pondweed in one of the locations where it was found in 2022 prior to the herbicide treatment. This indicates that the habitat in that area of the lake is still favorable to Capillary Pondweed. The beds of Capillary Pondweed should be visited in 2024 to verify continued survival.

In 2022, NEAR identified a small amount of Milfoil growing in the area where Capillary Pondweed was found. No milfoil was found here during the 2023 survey. However, as Variable-leaf Milfoil can re-grow (it is not clear if it reproduces from seed, however the plant grows significant numbers of adventitious roots and auto fragments abundantly) it is possible that plants may regrow here in the future. While no Milfoil plants were found this year, it is vital that thorough aquatic plant surveys are conducted every year to search for new growth.

The remainder of the lake was free of Capillary Pondweed so future treatments of Milfoil outside the northern cove can proceed with a limited chance of impacting the Capillary Pondweed within the cove.

Appendix

August 15th, 2022 ProcellaCOR treatment map.



George W. Knoecklein

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EDUCATION

Ph. D., 1997. UNIVERSITY OF CONNECTICUT, Storrs, Connecticut. Major: Limnology. Thesis: *Anaerobic Respiration Dynamics of a Eutrophic Lake*.

M.S., 1981. MICHIGAN STATE UNIVERSITY, East Lansing, Michigan. Major: Limnology. Thesis: *The Vegetation and Hydrology of a Lakeside Wetland.*

B.S., 1978. SOUTHERN CONNECTICUT STATE UNIVERSITY, New Haven, Connecticut. Major: Biology.

A.A.S., 1973. UNITY COLLEGE, Unity, Maine, Major: Fisheries and Wildlife.

C.L.M., 2013. North American Lake Management Society.

EMPLOYMENT

1997 - Present: Principal, Northeast Aquatic Research, LLC

Founder and principal investigator of ecological consulting and research company specializing in:

- Lake diagnostic studies, continued monitoring programs, and aquatic plant management planning for over 30 lakes including: Lake Copake, Queechy Lake, Lake Oscawana, NY; Amston Lake, Andover Lake, Bantam Lake, Crystal Lake, Doolittle Lake, Fisher Pond, South Spectacle Lake, North Spectacle Lake, Quassett Lake, Riga Lakes, Lake Quassapaug, Crystal Pond, Crystal Lake, Highland Lake, Town of Goshen Lakes, West Hill Pond, Hartland Lake, CT
- Aquatic plant surveys, including detection and mapping of invasive and protected species, and evaluation herbicide and other plant management projects.

Selected projects include:

- CT DEEP funded on-going diagnostic/feasibility study and weed management planning for Lower Bolton Lake, Bolton, CT, 2012-2017.
- Rapid response invasive species management program including intensive survey of Coventry Lake for the invasive *Hydrilla verticillata*, Coventry CT, 2015.
- Expert limnological witness for the defense in pond impact litigation, North Granby, CT.
- FirstLight GDF-Suez funded on-going monitoring of trophic status of Candlewood Lake, CT in 2013-2015.
- Planned and implemented intensive hydroraking project for pike fishery habitat remediation at Winchester Lake, Winchester, CT.
- Aquatic plant surveys of VT lakes; Lake Iroquois (2014), Lake Saint Catherine, and Lake Fairlee, 2015.
- Intensive investigation of nutrient budget and trophic status of Mirror Pond on the Storrs campus of University of Connecticut 2013-2014.
- Evaluation of impacts on the ecology of Candlewood Lake from 25 years of winter water level drawdown to control Eurasian milfoil. 2011.

- Intensive evaluations of highly eutrophic; Lake Pocotopaug (East Hampton CT).
- Full aquatic plant surveys in 2010 and 2012 of Johnson' s Pond (Flat River Reservoir, Coventry, RI). Herbicide management plan in 2014-2016, for control or invasive non-native aquatic plants; variable milfoil (*Myriopyllum heterophyllum*), and fanwort (*Cabomba caroliniana*).
- CT DEP funded feasibly study of Hatch Pond with Water Resources Services 2013-2014.
- Diagnostic/feasibility study and weed management plan of Bantam Lake, Morris, CT.
- Organized multi-year (2006-2012) suction harvesting project in Bantam Lake, Morris, CT to remove invasive non-native aquatic plant fanwort (*Cabomba caroliniana*) from state protected aquatic plant beds. Developed herbicide treatment plan for Bantam River, first river treatment in CT, for control of invasive non-native aquatic plant fanwort (*Cabomba caroliniana*).
- Organized multi-year (2008-2010) suction harvesting project to remove invasive non-native aquatic plant variable milfoil (*Myriopyllum heterophyllum*) in state protected aquatic plant beds following DEP Funded Demonstration Project to Evaluate Suction Harvesting as weed removal technique Crystal Lake Ellington/Stafford, CT.
- Evaluation of impacts of proposed winter water level drawdown on MA protected aquatic plant species *Potamogeton ogdenii* in Onoda Lake, Pittsfield, MA.
- Evaluation of impacts of winter water level drawdown on ecology of Highland Lake, Winchester, CT 2008.
- EPA/DEP 319 funded diagnostic investigation of Lake Zoar in 2011.
- Steering Committee for Water Resource Foundation' s Manual: Reservoir Operations and Maintenance Strategies (2010 - 2014).
- EPA/CT DEP 319 funded 5 year diagnostic investigation of Lake Lillinonah, CT, 2006–2010.
- CT DEP funded diagnostic/feasibility study of Hatch Pond, Kent, CT, 2004–2005. Follow-up EPA/DEP 319 funded trophic assessment and watershed loading evaluation 2010-2012.
- Detection/distribution mapping of CT protected aquatic plant species; *Potamogeton fresii* and *Myiropyllum sibiricum* in Lake Wononscoponuc, Salisbury, CT, 2004 and 2007.
- CT DEP funded aquatic plant management study of Pickerel Lake, Colchester, CT.
- Detailed CT DEP funded aquatic plant mapping of Pachaug Pond 2004/2005 repeated in 2009/2010, Griswold, CT.
- Detailed hydrological and nutrient budget for Doolittle Lake, Norfolk, CT.
- Review of proposed aeration on existing trophic characteristics of Lily Pond, Cohasset, MA.
- Intensive diagnostic evaluations of; Nantucket Harbor, Hummock Pond, Miacomet Pond, Long Pond, and Madaket Harbor, on the island of Nantucket, MA. 1998 – 2008.
- CT DEP funded diagnostic/feasibility studies of Lake Hayward (2001), Rogers (2003), Lillinonah (2002-2003), Bashan (2002), Crystal--Ellington/Stafford—(2004),
- Detection / distribution mapping of CT protected aquatic plant species *Potamogeton ogdenii* in Indian Lake, Sharon, CT.
- Detection / distribution mapping of CT protected aquatic plant species *Potamogeton ogdenii* in West Twin Lake, Salisbury. CT.

- Aquatic plant survey and CT protected aquatic plant species *Megalodonta beckii* mapping in Lake Quonnipaug, Guilford,
- Detection / distribution mapping of CT protected aquatic plant species *Megalodonta beckii* in West Twin Lakes, Salisbury. CT.
- Conducted water quality characterization of storm water discharges from Tilcon CT' s Branford Quarry.
- Cooperative involvement in CT DEP funded lake diagnostic feasibility study of Lake Kenosia with ENSR, and ACT, Inc. Responsible for conducting field sampling and data analysis.
- Developed 'Resident Sampling Program' to enable lake residents to collect their own lake monitoring data (managing 10 lake groups as of 2015).

2/85 - 10/97 Research Director, Ecosystem Consulting Service, Inc. Coventry, CT

Directed all phases of limnological evaluations of Connecticut - New York - New Jersey-Massachusetts lakes and reservoirs, including; proposal preparation, contract negotiation, sampling protocol, field collections, data analysis, and report writing.

- Conducted diagnostic/feasibility studies of reservoir systems for CT Water Co., South Cen. Regional Water Auth., and Bridgeport Hydraulic Co.
- Managed limnological investigation of Cedar and Linsley Ponds to determine impact of runoff from Tilcon CT' s Branford traprock quarry.
- Managed preliminary research evaluation of the relationship between tidal flushing dynamics and eutrophication in Nantucket Harbor, Nantucket, MA.
- Directed US EPA Phase III Clean Lakes Restoration Project of Lake Waramaug, CT.
- Conducted bacterial survey of Bicentennial Pond and watershed, Mansfield, CT.
- Managed all aspects of wetland evaluation projects using US ACoE procedures.
- Performed wetland evaluation and impact assessment of the Campus Master Plan for Eastern Connecticut State University.
- Wetland agent to Inland Wetland Agency, Town of Suffield, Connecticut, 1986.

PROFESSIONAL MEMBERSHIPS

Connecticut Federation of Lakes, (President 1999 – 2007)
Northeast Aquatic Plant Management Society (Board of Director 2010 - 2013)
North American Lake Management Society (member since 1986)
New England Chapter of North American Lake Management Society, (Leadership Committee)

SELECTED PUBLIC PRESENTATIONS

NALMS (North American Lake Management Society):

2007 *Understanding Lake Science: Developing a Lake Management Plan.*

2007 *Understanding Lake Stratification: Why we monitor Water Temperature, Dissolved Oxygen and Water Clarity.*

2009 *Stability and Uncertainty in Lake Trophic State.*

NEC-NALMS (New England Chapter of North American Lake Management Society):

2000 *Intensity and Capacity Factors in Lakes.*
2007 *How Much Data Do You Need? Detecting Changes in Lake Trophic State.*
2011 *Invasive Plant Management. Why we care about invasive species.*
2012 *Costs of Lake Management*
2016-2017 Aquatic Plant Identification Workshop

NEAPMS (Northeast Aquatic Plant Management Society):

2001 *Trials and Tribulation of Obtaining an Accurate Aquatic Plant Species List.*
2004 *Addressing Protected Plant Species in Nuisance Vegetation Management Programs.*
2006 *Water Quality Effects Due to a Continuous Lake-wide Milfoil (Myriophyllum heterophyllum x pinnatum) canopy in a shallow CT lake.*
2012 *Evaluation of the Effects of Water Level Drawdown on the Ecology of Candlewood Lake.*

CO-AUTHORED PAPERS:

Kortmann, R.W. and G.W. Knoecklein. "*Aeration Technologies and Depth-Selective Flow Configuration for Lake Management, Habitat Restoration, and Supply Water Quality*." Proceedings New Jersey Academy of Science; April, 1989.

Kortmann, R.W. and G.W. Knoecklein. "*Fishery Management vs. Lake Management: Compatibility Issues*." Proceedings of the New York State Department of Environmental Control, Division of Fish and Wildlife Conference, May 1989.

Kortmann, R.W., G.W. Knoecklein, and C.H. Bonnell, 1994. "*Aeration of Stratified Lakes: Theory and Practice*" . Lake and Reservoir Management Journal, 8(2):99-120.