ABSTRACTS AND BIOGRAPHIES FOR PRESENTATIONS AT THE 18th ANNUAL CONFERENCE OF THE

10-12 JANUARY 2017

Wentworth by the Sea
New Castle, New Hampshire

Abstracts and biographies are listed in order of presentation at the conference

Tuesday, January 10, 2017

Aquatic Flora

Wednesday, January 11, 2017

Comprehensive Management

PROCELLACOR™

Water Chestnut Ecology

Thursday, January 12, 2017

Hydrilla

Nutrient Evaluations

Forty Years of Change in the Vascular Aquatic Flora of Ossipee Lake, New Hampshire

C. Eric Hellquist, Ph.D Department of Biological Sciences, State University of New York Oswego

Abstract: Ossipee Lake, Carroll County, is in central New Hampshire near the Maine border in the towns of Ossipee, Freedom, and Effingham. It is the sixth largest lake entirely in the State of New Hampshire. Ossipee Lake (3092 acres) consists of the lake plus Broad Bay (464 acres), Leavitt Bay (176 acres), and Berry Bay (145 acres). The original survey was conducted by C. Barre Hellquist in 1971. At that time the survey included all plants growing along the shore. The present survey reported here describes only the emergent, submersed, and floating vascular plants of the lake, bays, and inlets. A total of 102 species were collected from 41 collection sites during the 2012 survey. Eleven species found in the original survey were not relocated and 23 new species and 4 hybrids were found since 1971.

Speaker Biography: Eric Hellquist is an Associate Professor in the Department of Biological Sciences at the State University of New York Oswego. His research interests are focused on the ecology and floristics of aquatic and wetland plant communities. He and his father, C. Barre Hellquist, are collaborating on this project as well as the aquatic flora of Yellowstone and Grand Teton National Parks.

North American Potamogetonaceae Hybrids

C. Barre Hellquist, Ph.D Department of Biology, Emeritus Massachusetts College of Liberal Arts

Abstract: There are 38 species of Potamogetonaceae present in North America, 36 in the Northeast. Hybrids are extremely common in the family. Hybrids reported, many DNA'd identified from North America, include three in Stuckenia, 37 in Potamogeton. Hybrids are often found in rivers of a slow to medium current. The most common parent species are: P. amplifolius, P. gramineus. P. perfoliatus, and P. zosteriformis. All reported Stuckenia hybrids come from rivers and are more common in western North America. In the northeast S. ×fennica (S. filiformis ×S. vaginata) is the only reported hybrid. Potamogeton ×nitens (P. gramineus ×P. perfoliatus), P. ×hagstroemii (P. gramineus ×P. richardsonii), and P. ×haynesii (P. strictifolius ×P. zosteriformis) appear to be the most commonly reported hybrids. Hybrids often make identification of pondweeds difficult.

Speaker Biography: C. Barre Hellquist received his Ph. D. from the University of New Hampshire studying the effects of water chemistry on the distribution of Potamogeton in New England. He has taught courses and mini-courses on aquatic plants at the Universities of Michigan and Oklahoma Biological Stations and Eagle Hill Research Station. He had studied aquatics throughout the U.S., Canada, Russia and Australia. In the U.S. he has researched the rare Potamogeton clystocarpus from West Texas to the multi-year survey of Yellowstone and Grand Teton National Parks. In recent years he has been particularly interested in the Potamogeton hybrids and Nymphaeaceae of North America and particularly Australia. He has co-authored the description of nine new species and subspecies of Australian waterlilies.

Scientifically-based Technology or Stupid Lake Trick? A Suggestion for Improving Aquatic Plant Management.

John Madsen, Ph.D US Department of Agriculture, Agricultural Research Service

Abstract: For a pharmaceutical drug to be approved for market by the Food and Drug Administration, it must go through a rigorous process of testing that typically spans 15 years. A potential drug must first be tested in animals to evaluate toxicity. If the drug falls within acceptable parameters, three phases of human testing are required: 1) drug safety, 2) drug effectiveness, and 3) general utility. As an industry, aquatic plant management has no generally-accepted guidelines on how to determine whether a particular treatment or process is technically acceptable desirable. To be deemed scientifically-acceptable, a process or treatment should 1) have a known and understood mechanism of control, 2) be documented as low risk to the ecosystem, 3) be of widespread value in the management of aquatic weeds, 4) be predictable and repeatable in efficacy and outcome, 5) compatible with other water uses, and 6) be of general benefit to the lake. All techniques should be backed by peer-reviewed published studies documenting mechanisms, efficacy, and acceptable risk. For instance, biological control agents imported from overseas must be documented to be specific to the target plant species and not impact other plants, but do not have to demonstrate efficacy and predictability before widespread use. Herbicides must go through rigorous testing on toxicity, environmental safety, and ecosystem effects, but likewise only a few states require proof of efficacy for approval. For mechanical and physical control techniques, the principal of Caveat Emptor ("Buyer Beware") predominates. Little scrutiny of the claims, predictability, and safety of mechanical and physical techniques is required, and they are not regulated in most states. As a society of professionals, we need to substantiate our claims with published scientific evidence that we are in fact doing good, and not harm, to the waters that we manage.

Speaker Biography: Dr. John D. Madsen is Research Biologist with the US Department of Agriculture, Agricultural Research Service, Exotic and Invasive Weed Research Unit on the campus of University of California-Davis. Previously, he was a faculty member at Mississippi State University for ten years, and a Research Biologist with the US Army Engineer Research and Development Center. Dr. Madsen has been involved in research on the ecology and management of invasive aquatic plants around the country for over 25 years. Dr. Madsen has a Bachelor of Science degree from Wheaton College, Wheaton, IL, and Master of Science and Doctor of Philosophy degrees in Botany from the University of Wisconsin-Madison.

The Battle for Connecticut's Largest Lake - Controlling Eurasian Water Milfoil with Winter Drawdown, Weevils and Grass Carp.

Gregory Bugbee The Connecticut Agricultural Experiment Station

Abstract: Candlewood Lake is Connecticut's largest lake. It offers excellent recreational opportunities and produces hydroelectric power. Candlewood Lake's Rocky River generating station pumps water into the lake from the Housatonic River during periods of low electricity demand and then releases it when electricity demand is high. This "pump-storage" process offers the advantage of allowing the water level of Candlewood Lake to be lowered for nuisance aquatic plant management and rapidly refilled. In the 1980's Eurasian watermilfoil (Myriophyllum spicatum) became a problem in Candlewood Lake and control was needed. Drawing the lake down during the winter months to expose the milfoil to freezing and desiccation has resulted in varying degrees of control. These drawdowns alternate between shallow (1 m) and deep (3 m) on a yearly basis. In 2007, The Connecticut Agricultural Experiment Station's Invasive Aquatic Plant Program began conducting annual invasive aquatic plant surveys of Candlewood Lake. Deep drawdowns reduce Eurasian watermilfoil coverage and abundance but regrowth after the following year's shallow drawdown results in little long term control. Milfoil weevils (Euhrychiopsis lecontei) were introduced in 2010 without success. In 2015, nearly 4000 grass carp (Ctenopharyngodon idella) were released and there effects are being evaluated. This presentation will detail the results of the CAES surveys and examine efficacy of the management techniques.

Speaker Biography: Associate scientist at the Connecticut Agricultural Experiment Station, New Haven, in the Department of Environmental Sciences. He is the principal investigator in the Invasive Aquatic Plant Program. He has lead aquatic plant surveys of over 250 Connecticut lakes and ponds and directed research projects on invasive aquatic plant control statewide. In addition to his work on nuisance aquatic plants, he oversees the Station's soil testing laboratory which helps citizens reduce the use of fertilizers in watersheds.

An Update on Physical and Biological Control of Invasive European Frogbit

Bin Zhu, Ph.D University of Hartford

Abstract: European frogbit (Hydrocharis morsus-ranae L.) is considered an invasive floating plant in North America from Europe that negatively affects native plants in freshwater ecosystems. This presentation will include a summary of recent studies on this plant and its implication for aquatic plant management. A background information about its biology, growth conditions, and introduce pathway will be introduced. Results from studies on its ecological impacts show European frogbit do have some impacts on benthic invertebrates and submerged plants. European frogbit had positive effects on surface and phytophilous macroinvertebrates and may change population density and increase diversity of benthic macroinvertebrates. It can negatively reduce the growth of submerged plants. Therefore, the scale of negative impacts is not as what we thought before. When three control methods – biological control, hand pulling and shading were studied, results report no effective biocontrol agents are available and hand pulling is more preferable than shading from the perspective of minimizing effects on the macroinvertebrate communities in the lakes. This case study of European frogbit will lead to discussions about the definition of invasive species and some thinking for aquatic plant management: Addition of some species may not represent any real harm and are therefore not considered invasive; Some species capable of causing harm are not necessarily harmful in all cases or can provide some benefits; Some control may be needed to avoid serious harm, but the level of control needed may be low; and early detection and rapid response are desired if introduce species are present.

Speaker Biography: Bin Zhu is an Associate Professor of Biology at the University of Hartford in Connecticut. He received his Ph.D. in biology and MPA from Syracuse University. Dr. Zhu was a post-doctoral associate at Cornell University and a research scientist at the Finger Lakes Institute. His research focuses on ecology and management of invasive species and assessment of water quality using physical, chemical and biological parameters. He has published a number of articles in scientific journals such as Journal of Aquatic Plant Management, Aquatic Botany, Ecosystems, Fisheries, Freshwater Science, and Journal of Great Lakes Research. Currently he is also an Associate Editor for Journal of Plant Ecology and Journal of Aquatic Plant Management.

Aquatic Plant Management on Lake Gaston: A Case Study

Alejandro Reyes North Carolina State University

Abstract: Lake Gaston is an 8,215 ha reservoir on the Roanoke River in Virginia and North Carolina. Since the early 1980's, Lake Gaston stakeholders have been managing aquatic plants, primarily Egeria densa and Hydrilla verticillata through a combination of drawdown, herbicide application and grass carp stocking. Aquatic plant management on Lake Gaston has several challenges including varying desired uses from a diverse stakeholder group and multi jurisdictional regulation due to its geographic location. Despite the above challenges, currently Egeria densa is rarely seen and Hydrilla estimated acreage is the lowest it's been since 1990. During this same time period however, Lyngbya wollei acreage has increased, presenting a new problem for the stakeholders of Lake Gaston. The goal of this presentation is to detail the history of aquatic plant management efforts on Lake Gaston highlighting the unique political regulatory structure and conflicting stakeholder desired uses.

Speaker Biography: Alejandro received his bachelors of science in ecology from SUNY Plattsburgh and is finishing up his Master's in Lake Management at SUNY Oneonta. Currently he is employed as an Extension Associate at North Carolina State University.

Field Demonstration of Selective, Spot Treatment of Variable Water Milfoil with PROCELLACOR™

Mark Heilman, Ph.D SePRO Corporation

Abstract: Variable watermilfoil (Myriophyllum heterophyllum - VWM) is considered invasive in New Hampshire and currently found in 71 NH waterbodies. Integrated management including herbicides has been implemented to prevent aggressive monoculture growth of the plant and minimize associated impacts on ecology and uses of infested sites. PROCELLACOR™ is a novel aquatic herbicide scheduled for federal registration in spring 2017. Due to its favorable environmental profile, PROCELLACOR is classified as reduced risk in its current USEPA review. PROCELLACOR was evaluated in early laboratory screening and found to be extremely active on VWM. In August 2016, a cooperatively-implemented 1-acre field trial following federal guidelines for experimental use was permitted by NH Department of Agriculture to evaluate PROCELLACOR activity in spot application of VWM in an isolated, controlled site within the Hopkinton Flood Control Area operated by the US Army Corps of Engineers. PROCELLACOR was applied on August 8 and monitored for herbicide dissipation and water quality changes using both discrete sampling and automated equipment. 30 point locations within and around the application site were also assessed before treatment for presence and estimated abundance of VWM and other aquatic plants. Additional post-treatment assessments were made at 3 and 6 weeks post application. Prior to treatment, VWM was found at 8 of 9 sampling sites in the area of application with average rake fullness rating of 3.4 (1 – 5 low-high scale). By 3 weeks post treatment, average VWM density rating decreased to 0.8 in the area of application with highly injured remnant biomass. By 6 weeks post treatment, average density rating for treated VWM dropped to 0.6 with remnant milfoil of questionable viability. Dissolved oxygen did not decline in the treated area versus an untreated control area. Water lily and watershield in the treated area were impacted but showed early recovery within 3 weeks post treatment. Lily and watershield immediately outside of the area of application were minimally affected. Other native aquatic plants including several species of bladderwort and Robbins and floating pondweeds appeared tolerant to the treatment. Herbicide concentrations were below 1 ppb at 24 hours after application. PROCELLACOR shows promise as a future component of selective integrated management of VWM.

Speaker Biography: Dr. Mark Heilman is currently the Senior Aquatic Technology Leader for SePRO Corporation. Dr. Heilman received both his BS in Biology (1992) and his Ph.D. in Aquatic Ecology (1998) from the University of Notre Dame. Dr. Heilman has been a research scientist with SePRO Corporation since 2002 and now leads SePRO's development of new technical solutions for management of aquatic invasive species, with an emphasis on aquatic invasive plants. Dr. Heilman received the NEAPMS Aquatic Plant Science Award in 2011.

Response of Eurasian and Hybrid Watermilfoil and Select Native Plants to PROCELLACOR™ Aquatic Herbicide

Michael Netherland, Ph.D US Army Engineer Research and Development Center

Abstract: Selective management of Eurasian watermilfoil (Myriophyllum spicatum - EWM) to restore impacted aquatic habitat has required continuous improvement in strategies to reduce potential non-target impact to desirable native vegetation and minimize any risk to human health and the environment. Multiple lineages of hybrid watermilfoil (HWM) (EWM crossed with native northern watermilfoil – M. sibiricum) have been detected using new genetic methods since ~2000. HWM has also shown reduced sensitivity to multiple registered aquatic herbicides including the auxin-mimic herbicides 2,4-D and triclopyr. PROCELLACOR™ is a new reduced-risk herbicide scheduled for federal registration in spring 2017. PROCELLACOR is a next-generation auxin herbicide with a different binding site of action than currently registered auxin herbicides. Studies were implemented in growth chambers to assess the relative activity of PROCELLACOR and four other auxin herbicides on EWM and a HWM with suspected tolerance to 2,4-D (Hayden Lake, Idaho). The other tested herbicides were 2,4-D, triclopyr, aminopyralid, and aminocyclopyrachlor. PROCELLACOR showed notably greater activity on both EWM and HWM with EC50 values 40 – 409 times lower on EWM and 24-109 times lower on HWM versus the other herbicides. Large-scale mesocosms (6,700 L) with established EWM, HWM, and 6 native submersed aquatic plants were used to further assess concentration-exposure requirements for selective control with PROCELLACOR. The native plants evaluated were two biotypes of tapegrass ('northern' and 'southern' Vallisneria americana), elodea (Elodea canadensis), American pondweed (Potamogeton nodosus), Illinois pondweed (P. illinoensis), and stargrass (Heteranthera dubia). Procellacor was applied at 3, 9, or 27 ppb with different exposure scenarios simulated by dilution with flow-through of untreated water (6-hour or 24-hour turnover versus static). As quantified through one and two-month post treatment harvests of aboveground biomass, PROCELLACOR fully controlled EWM at all rates and dilution scenarios and controlled HWM at all scenarios except 3 ppb with 6-hour turnover. The tested native plants showed good tolerance with impact to stargrass only at the higher test rates and exposures and light growth suppression of elodea at a static exposure to 9 ppb. Results support that PROCELLACOR has promising activity for future selective control of invasive watermilfoils.

Speaker Biography: Dr. Michael Netherland is a research biologist with the US Army Engineer Research and Development Center. He has 28 years of experience in research and management of aquatic invasive plants. He has been stationed at the University of Florida Center for Aquatic and Invasive Plants in Gainesville, FL since 2004. Research has included mesocosm and field projects on a variety of invasive aquatic plants throughout the United States including recent work on monoecious hydrilla, Eurasian and hybrid watermilfoil. Dr. Netherland's research focus has been on linking aquatic plant biology and management information to determine optimal rates, timing, and frequency to meet resource manager needs. Michael Netherland earned a M.S. in Botany from Purdue University and a Ph.D. from the University of Florida.

Evaluation of PROCELLACOR™ Efficacy on Monoecious Hydrilla: Initial Screening, Concentration Exposure Time Trials and Field Studies

Rob Richardson, Ph.D Department of Crop and Soil Science at North Carolina State University

Abstract: Research was conducted at North Carolina State University to evaluate the efficacy of Procellacor on monoecious hydrilla. Separate trials included initial screening, concentration exposure time, and field efficacy. A detailed abstract will be provided if this presentation is selected for the program.

Speaker Biography: Rob Richardson is a Professor and Extension Specialist in the Department of Crop and Soil Science at North Carolina State University. Dr. Richardson conducts applied research in the biology, ecology, detection, and management of aquatic plants. Through his extension appointment, research results are delivered to stakeholders in order to improve environmental conditions and reduce economic impacts from invasive aquatic plants.

Investigations into Water Chestnut (Trapa spp.) --- Genetics and Ecology

Lynde Dodd U.S. Army Engineer Research and Development Center

Co-Authors: Nancy Rybicki (U.S. Geological Survey), Ryan Thum (Montana State University) and Nathan Harms (U.S. Army Engineer Research and Development Center)

Abstract: A suspected new introduction of *Trapa* L. sp. (water chestnut) has been discovered in the Commonwealth of Virginia, USA, within the freshwater reaches of the Potomac River. Observations from 2014 - 2015 detected what was identified as water chestnut, but suspected to be a species other than *Trapa natans* L., which has been present in the U.S. since the latter half of the 19th century. The cryptically spreading species in Virginia has 2-horn fruit as opposed to the typical 4-horn fruit associated with *T. natans* reported in the past in the U.S. and Canada. Given the history and current problems associated with *T. natans*, further investigation into the genetic and ecological characteristics of this "new" introduction of water chestnut are warranted and will contribute to the knowledge base necessary for managers to make decisions about this potentially invasive plant. It is difficult to differentiate species of *Trapa* because the worldwide taxonomic naming convention of *Trapa* has not been settled. Two key characteristic in differentiating species in this genus are the number of barbed horns projecting from the fruit and its width. In 2016, samples of both 2-horn and 4-horn water chestnut populations were collected from several native and introduced locations to determine the extent of morphological and genetic differences among these water chestnut populations. Samples from outside the U.S. included *T. japonica*, *T. incisa*, *T. natans*, and *T. natans* variety *pumila*. In 2017, controlled studies will be conducted with the 2-horn water chestnut from Virginia and the 4-horn water chestnut from the NE U.S. to differentiate their colonizing ability and competitiveness with other ecologically important as well as invasive submersed aquatic vegetation (SAV) species.

Speaker Biography: Lynde Dodd is Research Biologist with the U.S Army Corps of Engineers' Engineering Research and Development Center (ERDC) stationed at the Lewisville Aquatic Ecosystem Research Facility. As a member of ERDC's Aquatic Ecology and Invasive Species Branch, her research includes restoration and invasion ecology of freshwater macrophytes with emphasis in native aquatic and riparian species suitability and restoration implementation techniques. She earned both her B.S in Biology and M.S. in Environmental Science at the University of North Texas.

Effects of Temperature During Dormancy on Viability of Monoecious Hydrilla Turions

Amy Henry North Carolina State University

Abstract: Research was conducted to evaluate the viability of hydrilla turions after differential exposure to three temperature regimes during dormancy. Hydrilla sprouted subterranean turions were planted in six-inch plastic pots and grown in mesocosms in two dissimilar climates in Raleigh, NC and Laurel Springs, NC. The turions were planted in June and allowed to grow and develop in the outdoor mesocosms until November, when any remaining biomass was removed. Each pot was then placed in a plastic bag, and pots were evenly divided into three cold storage areas. The cold storage areas were set at 40, 32, and 26° F. Starting in April, five months after the plants were placed in the cold storage, four pots were sifted monthly to quantify the number of tubers that were produced while growing in the mesocosms. Hydrilla turion length, width, and mass were all recorded, followed by a sprouting viability test. Results from the sprouting test indicate turions from Laurel Springs were viable at both 32 and 40° F, where turions from Raleigh were only viable when they were stored at 40° F. Ten pots remained outside to overwinter in the mesocosms to observe sprouting under ambient conditions. Subterranean turions in Raleigh sprouted two weeks before and ceased sprouting two weeks before the turions in Laurel Springs. A second year of this study is underway, and will be completed in 2017.

Speaker Biography: Amy Henry is a second year Master's Student at North Carolina State University in the Crop and Soil Science Department under the direction of Dr. Rob Richardson. She is looking at the growth and physiology of monoeicous Hydrilla verticillata in cooler climates in comparison to warmer climates. Amy graduated from The Ohio State University with a Bachelor's Degree in Horticulture.

Monoecious Hydrilla: Growth in the Absence of Photosynthesis

Erica Haug North Carolina State University

Abstract: Monoecious hydrilla has become the dominant Hydrilla verticillata biotype in the northeastern United States. If detected early and the management response is rapid, then physical techniques such as bottom barrier and hand-pulling are often utilized as management options. A study was conducted at North Carolina State University to look at aspects of the growth of monoecious hydrilla growth under no-light conditions as they relate to the use of bottom barrier as a management technique. Monoecious hydrilla tubers of approximately equivalent size (9 x 4 mm) were collected after sundown from Shearon-Harris reservoir in the fall of 2015. A single tuber from this collection was placed in each of forty-eight dark growth chambers. Throughout the study the growth chambers and tubers were maintained in no-light conditions. Following differential blackout intervals of two, four, six, eight and ten weeks, plants in each treatment group were dissected into above ground (shoot) and below ground (tuber) material. Plant sections were measured and dried to a constant mass for dry weight analysis in a forced air oven at approximately 60℃ for a minimum of 48 hours. Following dry weight analysis, plants were stored at -4℃. The experiment was repeated in time with starting dates of 9/25/15 and 1/18/16 for the two runs. Average shoot lengths increased to an average of 37 cm by ten weeks. Tuber size remained constant over the ten week period as expected. Despite the increase in total shoot length, total dry weight decreased from an average of 41 mg to an average of 26 mg by the end of ten weeks. Additional results and potential impacts to management will be discussed.

Speaker Biography: Erika completed a Bachelor of Science degree in Biology at McGill University in Montreal, QC. She has worked in the public, private, non-profit and academic sectors of water resource management. Currently, Erika is a PhD candidate in Fisheries, Wildlife and Conservation Biology at North Carolina State University under the direction of Dr. Robert Richardson.

Hydrilla vs. New York

Cathy McGlynn, Ph.D New York State Department of Environmental Conservation

Abstract: The monoecious biotype of the aquatic invasive Hydrilla verticillata was first found in New York in 2008. Since that time hydrilla has been discovered in more than 10 counties throughout the state. Management of these infestations has varied on a case by case basis. Focusing on the more large scale infestations as case studies, this talk will illustrate the different challenges that each has presented and provide updates on the effectiveness of control methods chosen and next steps for particular locations.

Speaker Biography: Cathy has been AIS coordinator for the New York State Department of Environmental Conservation since July 2015. Prior to working with the DEC, Cathy worked as the coordinator for the Northeast Illinois Invasive Plant Partnership where she co-coordinated the Illinois Hydrilla Task Force, co-coordinated the New Invaders Watch Program (regional early detection-rapid response), provided outreach and education about invasive ornamental plants to green industry and its consumers, served on the Illinois Invasive Plant Species Council and Illinois State Pest Analysis of Risk Committee, and led several invasive plant control and management projects. Cathy has also coordinated volunteer monitors for the Hudson River Submerged Aquatic Vegetation Project and was program manager for the NYS Department of State's Significant Coastal Fish and Wildlife Habitat Program. Cathy received her Ph.D. from the Department of Ecology and Evolution at SUNY Stony Brook, her M.E.M. from Duke University Nicholas School of the Environment, and her B.A from Rutgers College.

Insights from Three Years of a Monoecious Hydrilla Control Demonstration Project on the Erie Canal, New York

Michael Netherland, Ph.D US Army Engineer Research and Development Center

Abstract: A demonstration project to control invasive monoecious hydrilla (Hydrilla verticillata) was initiated in 2014 along a 15 mile stretch of the Erie Canal. The proximity of this infestation to the Niagara River and Great Lakes, and potential for eastward conveyance of hydrilla fragments to water bodies across New York was of particular concern to resource managers. In the summer, the canal flows east at rates between 400 and 1000 CFS. The contact herbicide endothall was selected based on coordination with the NY Canal Corporation to reduce flows for a 48 hour period. In 2014 and 2015, endothall was applied at a concentration of 1.5 mg L-1 to ~215 acres across a 7 mile stretch of the western end of the canal. We relied on eastward movement of the treated water to expose the remaining 8 miles of the target area to herbicide. Water sampling in 2014 indicated an unexpected dilution of endothall that resulted in reduced hydrilla control in the far west treated area. The remainder of the canal (13.5 miles) experienced excellent control of hydrilla with a significant reduction of native vegetation. Complex dynamics between the river and western canal resulted in rapid dilution. In 2015, an adaptive strategy to move the treatment block west and treat this area on back to back days, resulted in improved endothall exposure and control of hydrilla in the entire area of interest. Native plants remained significantly reduced. Extensive sediment core sampling associated with this project indicates that annual hydrilla tuber sprouting rates are in excess of 93%. Tubers undergo synchronous sprouting from May to early June, but growth of hydrilla is delayed until July. Despite concerns about hydrilla recovery from late-season sprouting of tubers, we have not observed additional late season tuber sprouting in three years. Current tuber populations are reduced by > 99% compared to initial values. We have established ~ 2000 waypoints to determine hydrilla frequency and distribution along the canal from June through September. Given this sampling density and annual tuber sprouting rates, we have concluded hydrilla has been effectively eliminated from multiple areas of the canal. In July 2016, endothall use was reduced by ~50%, and we focused treatments on areas with known hydrilla beds. Post-treatment hydrilla frequency in September 2016 was 0.2% (5 fragments in 1915 samples). While hydrilla has been contained (no floating fragments observed in 2015 or 2016), strategies for the 2017 treatment will be discussed. The data generated from this demonstration project has significant value to northern resource managers.

Speaker Biography: Dr. Michael Netherland is a research biologist with the US Army Engineer Research and Development Center. He has 28 years of experience in research and management of aquatic invasive plants. He has been stationed at the University of Florida Center for Aquatic and Invasive Plants in Gainesville, FL since 2004. Research has included mesocosm and field projects on a variety of invasive aquatic plants throughout the United States including recent work on monoecious hydrilla, Eurasian and hybrid watermilfoil. Dr. Netherland's research focus has been on linking aquatic plant biology and management information to determine optimal rates, timing, and frequency to meet resource manager needs. Michael Netherland earned a M.S. in Botany from Purdue University and a Ph.D from the University of Florida.

Importance of Nutrient Ratios and Legacy Accumulation in Cyanobacteria Management

West Bishop SePro Corporation

Abstract: Stoichiometric nutrient ratios can be critical in shaping algal assemblages. Relationships with phosphorus (N:P; Si:P) are commonly cited in governing algae types/densities and often targeted in freshwater management programs. Specifically removing P is an important approach in positively shifting nutrient ratios. Understanding sediment P sources is also important in management as exploitation of legacy P is a critical aspect of nuisance algal ecology. This research measured the impact of a specific P mitigation technology (Phoslock) at removing water column P and immobilizing sediment associated P. The shift in N:P ratios and algal assemblage composition were also analyzed. Multiple sites throughout the United States (CA, NC, VA) will be presented where Phoslock was applied. Phoslock was able to significantly ($p<0.005$) decrease total (>80 %) and free reactive (>95 %) phosphorus in the water column and significantly shift potentially releasable sediment phosphorus fractions to residual forms after treatment in field applications. This shift in P availability altered the subsequent N:P ratio as well as the influence of sediment P stores. Algae assemblages either maintained beneficial types (i.e. offset nuisance cyanobacteria from arising) or shifted away from cyanobacteria dominance. Specific targeting of in situ P sources is important to consider in algae management programs. Phoslock can provide an effective and ecologically friendly approach to combat the eutrophication process and restore water quality.

Speaker Biography: West Bishop received his BS from Western Michigan University in 2006 and MS from Clemson University in 2010. West has been with SePRO Corporation over six years as the Algae Scientist and Water Quality Research Manager with a continued focus on advancing the science of algae management and improving water quality.

An Evaluation of Past and Present Aeration Designs: An Ohio Case Study

Patrick Goodwin SUNY, Oneonta

Abstract: Silver Lake, Summit County, Ohio, is a 99 acre dimictic impoundment, constructed in the mid to late 1800's. It is a groundwater-dominated seepage lake that until the early 1970's received varying amounts of wastewater. Legacy nutrients from these periods have maintained the lake eutrophic, despite improvements in the watershed (i.e., diverted septic). The lake continually exhibits dense blue-green algal blooms, low Secchi depth (< 1 m), and summer anoxia below 4 m. Further restoration efforts were initiated in the early 1980's to address legacy nutrients and immediately suppress eutrophication symptoms. A bottom diffused aeration system was chosen to meet these goals and was installed in 1982. The basis of the aeration design reflected research and technology of the time. Results showed improved oxygen availability in the deep area and increase in zooplankton and benthic macroinvertebrates. However, there were also increases in surface chlorophyll-a, phosphorus, and algal biomass, as well as a slight decline in transparency and the continued predominance of blue-green algae. One of the main goals for the project was reduction of blue-green algae and microcystin, which was not achieved with the 1982 aeration design. In 2014, a redesigned aeration system was installed that reflected improved sizing of models and new aeration technology. Results for the redesigned system showed complete lake destratification, significant reductions in chlorophyll and microcystin, improved transparency, and finally a shift from blue-green algae to green algae. Overall, the redesigned aeration system has met stakeholder goals of reduced algal biomass and microcystin.

Speaker Biography: Patrick Goodwin holds a degree in biology from the University of North Florida and is currently perusing a masters degree in Lake Management at SUNY, Oneonta. Patrick has worked as a research biologist for a Florida based Lake management company, Aquatic Systems and for an international aeration company, Vertex Water Features. He has worked on multiple in-lake restoration projects throughout the United States.

A Scientific Test of a Muck Digestion Product

Maxine Verteramo and Ken Wagner, Ph.D Water Resource Services

Abstract: Data collection to be finalized in mid-October. A commercial muck digestion product, Muckaway, was applied to two test plots in one lake with surveyed rebar stakes in the test areas and in control areas to allow assessment of any change in muck depth. Measurements were made every two weeks from early May into October. The change in muck depth and the precision of measurements will be assessed.

Speaker Biography: Maxine Verteramo is an environmental consultant with Water Resource Services of Wilbraham, MA. She holds a MS degree in Lake Management from SUNY Oneonta and has been involved in lake management for about 5 years. Her work has included limnological assessments of lakes and monitoring of management projects. Maxine is also an accomplished painter and uses art to teach environmental awareness for a wide range of audiences. She is a member of NEAPMS and NALMS.