42nd Annual Meeting
OF THE

MIDWEST AQUATIC PLANT MANAGEMENT SOCIETY

Grand Geneva Resort and Spa
Lake Geneva, WI

February 28 — March 3, 2022

Program / Abstracts

MISSION

MAPMS is a respected and well organized professional society, providing science-based education and networking opportunities in the management and study of aquatic plants and algae.

The purpose of the Midwest Aquatic Plant Management Society (MAPMS) is to promote science based technologies for the management of aquatic resources by:

- Providing opportunities for educational advancement
- Supporting relevant scientific research
- Facilitating exchange of information
- Promoting the protection and sustainability of aquatic ecosystems
- Expanding and developing public interest in aquatic resources and their sustainable management

VISION

To be the leading regional science-based resource for the sound management of aquatic plants and algae.

MAPMS provides information and assistance required by those who work with the unique ecological, sociological, economical, and regulatory concerns associated with managing aquatic plants in lake systems affected by exotic species, nutrient pollution, use conflicts, and intense recreational demands

STRATEGIC GOALS

- Improve and expand communication with regulators
- Improve and expand communication with students and academia
- Improve our website and internet presence
- Engage membership
- Fundraising

www.mapms.org

Contents

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The opinions expressed by presenters, speakers, discussion panelists, committee members, and exhibitors are those of said individuals and are not necessarily those of The Midwest Aquatic Plant Management Society, its Board of Directors, or sponsors.

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2021	Ryan Thum	Virtual
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2009	Jason Broekstra	Lisle, IL
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1980	Robert Johnson	West Lafayette, IN

HONORARY MEMBERS

Has contributed significantly to the field of aquatic vegetation management. A voting member of the Society for no less than five years. Has actively promoted the Society and its affairs during their membership. Elected by unanimous vote of the Board of Directors. Honorary Members shall hold all rights of active membership in perpetuity.

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Dr. Carole Lembi

Dr. Greg Cheek

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David Isaacs

Joe Bondra

Distinguished Service Award (President's Award) Recipients

Awarded at the President's discretion. Successful completion of a project taking considerable effort and time resulting in advancement of plant management science, educational outreach and performance above and beyond the call of duty as an officer, chair or special representative of MAPMS; or member or non-member achievement in the science of aquatic plant management and/or participation in MAPMS leading to the advancement of its members, goals, and objectives. Award may be used for an individual, agency, corporation, institution, or other organization in recognition of service.

Dr. Michael D. Netherland (2019)

Leah Rust-Essex (2017)

David Isaacs (2014)

Joe Bondra (2012)

Robert L. Johnson Memorial Research Grant Recipients

Grants are competitively awarded to qualified graduate students pursuing a degree in aquatic plant management or related field at any accredited university or college, or independent research which contributes to the mission of the Society. MAPMS considers all applications pertaining to research dealing with aquatic plant management, including ecology or biology of aquatic plants, and chemical, mechanical, or biological control of aquatic weeds. Winners are announced at the annual conference each year. Recipients are required to present their research findings at the annual conference the following year.

Hannah Hoff - Montana State University (2020)

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2022 MAPMS 42nd ANNUAL CONFERENCE

MONDAY, February 28, 2022

1:00 pm - 5:00 pm	MAPMS Pre-Conference Board Meeting	(Geneva Bay)
3:00 pm - 5:30 pm	Conference Registration	(Ballroom Coatroom)
1:00 pm - 5:00 pm	Exhibitor Set-Up	(Maple Ballroom)
5:30 pm - 6:30 pm	Student & New Member Mixer	(Lobby Bar)
6:30 pm - 10:00 pm	*President Johnson invites you to join him for a catered reception with cash bar and games (beer, wine & soda complements of the society)*	(Evergreen II Ballroom)

TUESDAY, March 1, 2022

6:00 am - 7:00 am	Exhibitor Set-Up	(Maple Ballroom)
7:00 am - 8:00 am	Continental Breakfast	(Maple Ballroom)
7:00 am - 5:00 pm	Exhibits Open	(Maple Ballroom)
7:30 am - 4:00 pm	Conference Registration	(Ballroom Coatroom)
8:00 am - 10:25 am	Session A (AVM & Industry Updates	(Salon Ballroom)
10:25 am - 10:50 am	Refreshment Break / Exhibits	(Maple Ballroom)
10:50 am - 12:05 pm	Session B (Water Quality and Restoration)	(Salon Ballroom)
12:05 pm - 1:35 pm	Lunch - On your own	
12:05 pm - 1:35 pm	Past President Luncheon	(Galewood A)
1:35 pm - 3:15 pm	Session C (Watermilfoil Research and MGT)	(Salon Ballroom)
3:15 pm - 3:40 pm	Refreshment Break / Exhibits	(Maple Ballroom)
3:40 pm - 4:55 pm	Session D (Surveys & Fisheries)	(Salon Ballroom)

TUESDAY, March 1, 2022

SESSION - A (Aquatic Vegetation Management & Industry Updates) (Salon Ballroom)

Moderator: Matt Johnson, MAPMS President

8:00 am	Opening announcements and welcome. ***Matt Johnson****, President MAPMS*
8:10 am	Challenges to AVM Management Practice in the Northern US. ***G. Douglas Pullman, Ph.D.****, Aquest Corp*
9:10 am	AERF Update. ***Carlton Layne****, Executive Director, Aquatic Ecosystem Restoration Foundation*
9:35 am	APMS Update. ***Dr. Ryan Thum,*** *President, APMS*
10:00 am	RISE Industry Issues Update. ***Megan Striegel,*** *Manager of Grassroots, RISE*
10:25 am	*BREAK/EXHIBITS* (Maple Ballroom)

SESSION B (Water Quality and Restoration) (Salon Ballroom)

Moderator: Landon Wiet, Director MAPMS

10:50 am	Advancement of Novel Technologies for Phosphorus Mitigation and Water Quality Restoration in Aquatic Systems. ***West Bishop, Ph.D., CLP,*** *Algae Scientist and Water Quality Research Manager, SePRO Corp.*
11:15 am	**STUDENT PRESENTATION:** The Need for Seed: Untangling the Roles of Turbidity, Invader Removals, and Reseeding in Native Macrophyte Restoration. ***Michael Verhoeven,*** *Ph.D. Candidate, University of Minnesota*

11:40 am Development and Utility of Water Quality Models and Nutrient Budgets in Lake Management. ***Patrick M. Goodwin M.S., CLM,*** *Good Aquatics, LLC.*

12:05 pm LUNCH (on your own)
Past President's Luncheon, (Galewood A)

SESSION C (Watermilfoil Research and Management) (Salon Ballroom)

Moderator: Pete Filpansick, Director MAPMS

1:35 pm **STUDENT PRESENTATION:** Hybridization and Invasiveness in Eurasian Watermilfoil (Myriophyllum Spicatum): Is Prioritizing Hybrids in Management Justified? ***Hannah K. Hoff,*** *Research Associate, Montana State University*

2:00 pm **STUDENT PRESENTATION:** Differential Photosynthetic Yield of Northern and Invasive Watermilfoils. ***Natalie Moses****, Graduate Research Assistant, Department of Biological Sciences, Minnesota State University*

2:25 pm **Pre-Recorded:** Advancements in Eurasian Watermilfoil Research and Management in Wisconsin. ***Michelle Nault****, Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources*

2:50 pm Building a Centralized Database of Watermilfoil Strain Geographic Distribution and Herbicide Response for Use in Management Decision-Making. ***Dr. Ryan A. Thum,*** *Associate Professor, Montana State University*

3:15 pm *BREAK/EXHIBITS* (Maple Ballroom)

SESSION D (Surveys & Fisheries) (Salon Ballroom)

Moderator: Reid Morehouse, Director MAPMS

3:40 pm Aquatic Plants in Nebraska: First Statewide Survey Results. ***Kristopher Starr,*** *AIS Program Manager, Nebraska Game and Parks Commission*

4:05 pm Apparent Eradication of Zebra Mussels (Dreissena polymorpha) From an Entire Lake Using Low Doses of Acid-Stabilized Ionic Copper. ***David Hammond, Ph.D,*** *Senior Scientist, Earth Science Laboratories, Inc.*

4:30 pm A Review of the Fishery Response Over Time to Continuous AIS Management in Several Michigan Lakes. ***Paul J, Hausler,*** *Water Resources Practices Leader, Progressive AE*

4:55 pm **ADJOURN**

WEDNESDAY, March 2, 2022

7:00 am - 8:00 am	Continental Breakfast	(Maple Ballroom)
7:00 am - 5:00 pm	Exhibits Open	(Maple Ballroom)
7:30 am - 4:00 pm	Conference Registration	(Ballroom Coatroom)
8:00 am - 9:50 am	Session E (Algae and Cyanobacteria MGT)	(Salon Ballroom)
9:50 am -10:15 am	Refreshment Break / Exhibits	(Maple Ballroom)
10:15 am - 11:55 am	Session F (Emerging Issues: Tools & Species)	(Salon Ballroom)
11:55 am - 1:25 pm	Lunch - On your own	
11:55 am - 1:25 pm	Student/Govt Affairs Lunch	(Loramoor C)
1:25 pm - 3:05 pm	Session G (ProcellaCOR™ Use In WI Lakes)	(Salon Ballroom)
3:05 pm - 3:30 pm	Refreshment Break / Exhibits	(Maple Ballroom)
3:30 pm - 4:30 pm	Session H (Membership Meeting)	(Salon Ballroom)
4:30 pm - 5:00 pm	Exhibit Tear-down	(Maple Ballroom)
6:30 pm - 10:00 pm	**42nd Annual MAPMS Awards Banquet**	(Evergreen II Ballroom)

SESSION E (Algae and Cyanobacteria Management) (Salon Ballroom)

Moderator: Ed Spanopoulos, Director MAPMS

8:00 am Announcements

8:10 am **Pre-Recorded:** Identification and Prioritization of Sites for Targeted Overwintering Cyanobacteria Management: A Preventative Approach. ***Dr. Andrew D. McQueen,*** *Research Biologist, U.S. Army Engineer Research and Development Center*

8:35 am **Pre-Recorded:** Monitoring and management of starry stonewort (Nitellopsis obtusa) in Wisconsin lakes. ***Michelle Nault****, Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources*

9:25 am Turnkey Algae Monitoring and Alerting System for Improved Management Decisions and Timing of Treatments. ***Christopher Lee,*** *CEO, AquaRealTime, Inc.*

9:50 am *BREAK/EXHIBITS* (Maple Ballroom)

SESSION F (ProcellaCOR™ Use In Wisconsin Lakes) (Salon Ballroom)

Moderator: Dave Nicholson, Director MAPMS

10:15 am Evaluating Multiple Cases Studies of Efficacy and Selectivity of ProcellaCOR™ Treatments Targeting Invasive Watermilfoil in Wisconsin. ***Todd Hanke,*** *Aquatic Ecologist, Onterra, LLC*

10:40 am Trends in Efficacy and Selectivity of ProcellaCOR™ Treatments Targeting Invasive Watermilfoil Across Multiple Wisconsin lakes. ***Eddie J. Heath,*** *Aquatic Ecologist, Onterra, LLC*

11:05 am **STUDENT PRESENTATION:** Transformation of Florpyrauxifen-benzyl (Active Ingredient of ProcellaCOR™) Following Application in Northern Wisconsin lakes**.** ***Amber White,*** *Ph.D. Candidate, University of Wisconsin-Madison*

11:30 am Successful Management of Eurasian Watermilfoil on a Northern Wisconsin Lake System Using an Integrated Pest Management Approach. ***Amy Kay,*** *Business Development Leader, Clarke Aquatic Services, Jay Wittman, North and South Twin Lakes Protection and Rehabilitation District*

11:55 am LUNCH (on your own)
Student/Government Affairs Luncheon, (Loramoor C)
Sponsored by AERF

WEDNESDAY, March 2, 2022

SESSION G (Herbicide Applications) (Salon Ballroom)

Moderator: Casey Thompson, Director MAPMS

1:25 pm	Effect of Endothall on Sprouting and Dormant Hydrilla Tubers. ***Clyde Smith,*** *Technical Development Manager, UPL NA*	
1:50 pm	The Use of Flumioxazin for European frog-bit (Hydrocharis morsus-ranae) Control. ***Carter L. Bailey,*** *Aquatic Biologist, Aqua Doc Lake & Pond Management Inc.*	
2:15 pm	**Pre-Recorded:** Improving AIS Control Using Herbicide Enclosures. ***Michelle Nault,*** *Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources*	
2:40 pm	Yellow Floating Heart Eradication Efforts in a Private, Multi-Use Lake. ***Leif Willey, M.S.,*** *Lake and Special Project Supervisor, Aquatic Control, Inc.*	
3:05 pm	*BREAK/EXHIBITS*	(Maple Ballroom)

SESSION H (Membership Meeting) (Salon Ballroom)

3:30 pm	MAPMS Annual Membership Meeting and Election of Officers. ***ALL MEMBERS REQUESTED TO ATTEND***. *Matt Johnson, President MAPMS*	
4:30 pm	Temporarily adjourn, reconvene at banquet	
4:30 pm	Exhibitor tear-down	(Maple Ballroom)

BANQUET (42nd Annual MAPMS Awards Banquet)

6:30 - 7:00 pm	Reception/Silent Auction	(Evergreen II Ballroom)
7:00 - 10:00 pm	**42nd ANNUAL MAPMS AWARDS BANQUET**	(Evergreen II Ballroom)
	**Silent Auction * Box Raffle *Cash Bar *Great Food* **Installation of Officers and Directors*	

THURSDAY, March 3, 2022

MAPMS BOARD OF DIRECTORS MEETING

8:30 am - 1:00 pm	Post Conference Board of Directors Meeting	(Geneva Bay)
	MAPMS members welcome to attend. Please notify a Board Member prior to the meeting so that seating arrangements can be made.	

Oral Presentation Abstracts

Session A
Aquatic Vegetation Management & Industry Updates

Challenges to AVM Management Practice in the Northern US.
G. Douglas Pullman, Ph.D., Aquest Corp
aquest@mac.com

Issues related to AVM management range from those that primarily focus on significant biological/ecological interest to those that have significant bearing on the management of nuisance aquatic communities. There still seems that there are more questions than answers emerging each year related to the practice of AVM management. These can be resolved by a collaborative approach involving lake residents, lake managers, management contractors (herbicides, mechanical, biological and physical). While celebrating nearly 40 years of focus on lake management, these are a few of the most pressing questions.
The central role of biology in lake management.

Definition of the term invasive as it relates to aquatic species and why it should be politically incorrect to insist that invasive species must be exotic.

Variations in strain characteristics and invasive potentials in variable and ebrid watermilfoils

Hybridization in pondweeds and why it is important for lake management

Natural selection and the emergence of more aggressive plant strains

Lake enzymatic preadaptation and herbicide resistance Why does it take longer for dead plants to drop f rom the water column, zombies??

Benthic cyanobacteria, filamentous and macro algae and the role of sediments as the source of the problem.

The role of convection currents in contributing to disappointing treatment outcomes and how to capitalize turn lemons into lemonade.

An observed dispersals mechanism in Starry Stonewort (Nitellopsis obsusa) and can this knowledge improve management.

AERF Update
Carlton Layne, Executive Director, Aquatic Ecosystem Restoration Foundation
layn1111@bellsouth.net

APMS Update
Dr. Ryan A. Thum, President, Aquatic Plant Management Society
ryan.thum@montana.edu

RISE Industry Issues Update
Megan Striegel, Manager of Grassroots, Responsible Industry for a Sound Environment
mstriegel@pestfacts.org

Join RISE (Responsible Industry for a Sound Environment), the national trade association representing manufacturers, formulators, distributors and other industry leaders in the specialty pesticide and fertilizer industry to learn about some coming legislative, regulatory, and judicial opportunities and challenges in the specialty pesticide space, especially impacting the aquatics segment.

Session B

Water Quality and Restoration

Advancement of Novel Technologies for Phosphorus Mitigation and Water Quality Restoration in Aquatic Systems

West Bishop, Ph.D., CLP, Algae Scientist and Water Quality Research Manager, SePRO Corp.
westb@sepro.com

Runoff and internal loading of phosphorus continues to pollute surface waters. While watershed management techniques are important, there are limitations related to the volume, time and cost of treatment and inability to address legacy phosphorus accumulation in waterbodies. This presentation provides an overview of recent advancements and benefits of phosphorus interception and inactivation technologies. One example is a novel phosphorus filtering technology, which is designed for use in flowing waters and may serve as an effective complement to limit nutrient input from runoff. Information regarding the capacity and timing of binding, as well as expected results in field treatments will be covered. Advancements in technologies and programs for *in situ* water and sediment P inactivation will also be covered. Since nutrients are a key driver of eutrophication in freshwater systems, advancement of in-lake management in concert with intercepting nutrients in inflows are critical needs in water resource management.

The Need for Seed: Untangling the Roles of Turbidity, Invader Removals, and Reseeding in Native Macrophyte Restoration.

Michael Verhoeven, Ph.D. Candidate, Wesley Glisson, Daniel Larkin, University of Minnesota Dept of Fisheries, Wildlife, and Conservation Biology & Minnesota AIS Research Center
verh0064@umn.edu

Reestablishment of native plants is a critical component of lake restorations. Paired with water quality improvements and invasive species control, reestablishing native aquatic plants has the potential to boost habitat value, reinforce water quality improvements, and potentially reduce future plant invasions. We'll discuss the forefront of knowledge on native plant restorations, and showcase the results of a four-year MAISRC study aimed at understanding the role that invasive species removal can play in native lake plant revegetation.

Development and Utility of Water Quality Models and Nutrient Budgets in Lake Management

Patrick Goodwin, M.S., CLM, Good Aquatics LLC.
pgoodaquatics@gmail.com

Problems are not actually resolved by modeling. Instead, the solution becomes evident or supportable as a consequence of modeling. Understanding the problem usually requires some data; working in completely abstract terms will rarely provide satisfactory results. Getting data for a lake over a long period of time may be difficult, and the timeframe for making a decision may not allow a lengthy period of study even if the funding is readily available. But if enough data are available, model results can substitute for a long-term data set, and provide an adequate representation of reality that can be used to investigate management options. This presentation will provide an introduction to water quality modeling and nutrient budget development and provide cases studies where models were used to make lake management decisions specifically for addressing harmful algae blooms (HABs).

Session C
Watermilfoil Research and Management

Hybridization and Invasiveness in Eurasian Watermilfoil (Myriophyllum Spicatum): Is Prioritizing Hybrids in Management Justified?

Hannah K. Hoff, Research Associate, Montana State University and Ryan A. Thum, Associate Professor, Montana State University
hannah.hoff@montana.edu

Hybridization can play an important role in the evolution of invasiveness. Eurasian watermilfoil (Myriophyllum spicatum L.) is a widespread aquatic invasive plant species that hybridizes with native northern watermilfoil (Myriophyllum sibiricum Kom.). Previous studies have found mixed evidence for whether hybrid watermilfoil (Myriophyllum spicatum × sibiricum) and pure M. spicatum differ in vegetative growth rate and herbicide response. While several studies have emphasized variation in these traits among M. spicatum × sibiricum genotypes, variation within M. spicatum has not been considered. Therefore, it is unclear how much genetic variation influences invasive traits and management outcomes within M. spicatum, versus between M. spicatum and M. spicatum × sibiricum,. If M. spicatum × sibiricum genotypes are always more invasive than M. spicatum genotypes, simply distinguishing taxa may be sufficient for identifying lake management priorities; however, if significant phenotypic overlap is observed between taxa, distinguishing individual genotypes may be important for tailoring management strategies. We performed replicated trials of a vegetative growth and 2,4-D assay to measure clonal variation in growth rate and herbicide response of M. spicatum and M. spicatum × sibiricum. Our results indicate that M. spicatum × sibiricum exhibits higher average vegetative growth than M. spicatum, regardless of whether it was treated with subsurface applications of 2,4-D. We did not observe interactions between taxon and treatment or between genotype and treatment. Despite differences between M. spicatum and M. spicatum × sibiricum in average vegetative growth, there was substantial overlap between taxa. For example, we found that the fastest-growing genotype of pure M. spicatum did not differ significantly in average growth from the fastest-growing M. spicatum × sibiricum genotype. The potential for overlap between these invasive Myriophyllum taxa suggests that distinguishing and characterizing genotypes may be more informative for management than simply distinguishing between M. spicatum and M. spicatum × sibiricum.

Differential Photosynthetic Yield of Northern and Invasive Watermilfoils

Natalie Moses, Graduate Research Assistant, Department of Biological Sciences, Minnesota State University, Ryan M. Wersal, Assistant Professor, Christopher T. Ruhland, Professor
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Eurasian watermilfoil (*Myriophyllum spicatum*) is one of the most challenging invasive aquatic plant species in Minnesota. Eurasian watermilfoil has hybridized with the native Northern watermilfoil (*Myriophyllum sibiricum*), creating a more complex issue when it comes to invasions. The hybridization of watermilfoil has increased difficulty for management, however, an underlying biological mechanism explaining this difficulty has yet to be determined. In this study, photosynthetic capability of Northern, Eurasian, and hybrid watermilfoil was evaluated using PAM (pulse amplitude modulated) fluorometry to determine if there are intrinsic physiological differences between the strains. It was found that there are varying photosynthetic capabilities between the strains. The strains that were examined also have differing photosynthetic responses to changes in both temperature and light. The three strains of Eurasian watermilfoil tested had temperature optima between 20-25°C, Northern watermilfoil had a temperature optimum of 35°C, while the five hybrid strains ranged from 15-35°C. The light adapted yield capabilities at these temperatures also had slight variation, with the chlorophyll fluorescence yield parameter ranging from 0.459-0.576 in Eurasian watermilfoil, 0.526-0.599 in hybrid watermilfoil, and 0.518 for Northern watermilfoil at their individual optima. These findings indicate that although the many strains of watermilfoil are morphologically similar, they differ in their photosynthetic capacity. These differences could impact overall primary productivity, life history characteristics, and overall invasiveness. All of these factors can be contributing to the documented management failures seen in the lab and field populations.

Advancements in Eurasian Watermilfoil Research and Management in Wisconsin.

Michelle Nault, Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources
Michelle.Nault@wisconsin.gov

In order to better understand the impacts of Eurasian watermilfoil (*Myriophyllum spicatum*) on Wisconsin lakes, Department of Natural Resources staff have worked in close collaboration with numerous stakeholders to compile over 15 years' worth of quantitative data collected on hundreds of waterbodies across the state. This data is being used to help develop and implement plans for strategic and efficient monitoring and management of this non-native aquatic plant. Specifically this presentation will discuss the current statewide distribution, abundance, and genetics of watermilfoil in Wisconsin, the results of a long-term watermilfoil monitoring project, as well as a discussion on the efficacy and selectivity of several currently utilized management techniques. The results may surprise you, and challenge some commonly held beliefs about the ecology and management of this aquatic invasive species.

Building a Centralized Database of Watermilfoil Strain Geographic Distribution and Herbicide Response for Use in Management Decision-Making

Ryan A. Thum, Associate Professor, Greg Chorak, Katie Gannon, Hannah Hoff, Ashley Wolfe, Montana State University, Plant Sciences and Plant Pathology Department
Raymond Newman, University of Minnesota, Department of Fisheries, Wildlife and Conservation Biology
ryan.thum@montana.edu

The COVID-19 pandemic has brought to light the importance of identifying and tracking 'variants' in real time. Similarly, aquatic plant managers increasingly recognize that Eurasian watermilfoil (including hybrids with native northern watermilfoil) is genetically diverse, and that strains can differ in their growth, spread, impacts, and herbicide response. A practical challenge for Eurasian watermilfoil management is developing efficient and effective methods to predict how a specific watermilfoil population will respond to a proposed control tactic (e.g., a specific herbicide) before implementing management. Our approach to this problem entails using genetic techniques to predict herbicide response, and our vision for developing genetic tools to inform management decisions includes a centralized, interactive database of watermilfoil strain geographic distribution and herbicide response to inform management decisions. For example, the identification of herbicide resistant strains, and the locations in which they are found, can be used to inform the choice of herbicide for watermilfoil control in different lakes. We will illustrate the construction and utility of a centralized database using examples of genetic surveys and herbicide screens in Michigan, and illustrate the expansion of the database to a larger geographic area. We will also briefly touch on the identification of specific herbicide resistance genes, and the potential to integrate specific genetic assays into a centralized database for management planning.

Session D

Surveys & Fisheries

Aquatic Plants in Nebraska: First Statewide Survey Results

Kristopher Stahr, AIS Program Manager, Nebraska Game and Parks Commission
kristopher.stahr@nebraska.gov

Aquatic plants provide several vital functions to freshwater ecosystems including cycling nutrients, reducing shoreline erosion, harboring zooplankton and macroinvertebrates, and play a significant role in the life history of many fishes. Successful fisheries management requires that aquatic vegetation be considered along that of typical fisheries metrics to fully achieve management objectives. However, despite its importance, aquatic plant management is seldom recognized as an significant element of fisheries management. In 2021 a structured statewide aquatic plant survey was conducted for the first time in Nebraska. Thirty-six waterbodies were surveyed for aquatic plants across the State from May through October. Prior to each survey, the number of littoral sampling sites was determined for each waterbody based on size. At each site a double-sided metal rake was used to sample plants; sampling extended from the shoreline to 5m offshore. The rake was then retrieved and all plants were identified to species and recorded. This initial survey detected 44 unique plant species in Nebraska waterbodies. The most common native species sampled were Sago Pondweed (Stuckenia pectinata), Coontail (Ceratophyllum demersum), Curly-leaf Pondweed (Potamogeton crispus), Longleaf Pondweed (P. nodosus), and Southern Naiad (Najas guadalupensis). Eurasian Watermilfoil (Myriophyllum spicatum), a highly invasive aquatic plant, was detected in 15 new waterbodies throughout the State. Additionally the invasive aquatic plant Brittle Naiad (N. minor) was documented for the first time in a public waterbody and only the second time on record. These results illustrate the critical need for increased invasive aquatic plant management in Nebraska.

Apparent Eradication of Zebra Mussels (*Dreissena polymorpha)* from an Entire Lake Using Low Doses of Acid-Stabilized Ionic Copper

David Hammond, Ph.D., Senior Scientist, Earth Science Laboratories
James Bland, Environmental Products and Services, Inc.
Shelby Johnson, DePaul University
dhammond@earthsciencelabs.com

In the 35 years since zebra and quagga mussels were introduced to North America, conventional wisdom has held that once they infest a water body nothing can be done. But in 2017, an acid-stabilized liquid ionic copper was used to successfully eradicate quagga mussels from a 30-acre lake in Pennsylvania, with no measurable long-term impacts on non-target species. Total product applied to accomplish the 2017 eradication amounted to 0.44 mg/L as elemental copper, which was remarkable because previous attempts to control mussels had used rates exceeding 1.0 mg/L. Then, in 2019 zebra mussels were discovered in a 30-acre lake north of Chicago, called Valley Lo Lake. By the time of their discovery the mussels were well established, occurring at high densities on boats and rocks around the shoreline. In summer of 2021, the same liquid ionic copper was applied to Valley Lo Lake with the objective to eradicate zebra mussels from the entire lake. Cages containing live adults were used to monitor and estimate mortality. The initial treatment protocol contemplated up to 4 dosing events, but 10 days after the first dose of 0.24 mg/L copper had been applied around the shoreline of the lake, the mortality of adult mussels in cages had already reached 100% and we were unable to find a single live zebra mussel anywhere in the lake, so no additional product was applied. While it is virtually impossible to prove the absence of any survivors (ongoing monitoring in future years will be needed to confirm), it appears the eradication is complete, without major collateral impacts on non-target organisms. The prospect of eradicating zebra mussels from an entire lake with a single dose of just 0.24 mg/L as copper is an exciting development. Factors affecting the project's outcome and effects on non-targets will be discussed.

A Review of the Fishery Response Over Time to Continuous AIS Management in Several Michigan lakes.

Paul J. Hausler, Water Resources Practice Leader, Progressive AE
hauslerp@progressiveae.com

An analysis of existing data obtained from various sources including Michigan Department of Natural Resources - Fisheries Division is examined to attempt to establish outcomes from continuous AIS management in several Michigan inland lakes.

Session E

Algae and Cyanobacteria Management

Identification and Prioritization of Sites for Targeted Overwintering Cyanobacteria Management: A Preventative Approach

Dr. Andrew D. McQueen, Research Biologist, Alyssa J. Calomeni, [1]U.S. Army Engineer Research and Development Center
Ciera M. Kinley-Baird, Aquatic Control, Inc.
Gerard A. Clyde, Jr., U.S. Army Corps of Engineers, Tulsa District
Andrew.d.mcqueen@usace.army.mil

Freshwater cyanobacteria causing harmful algal blooms (HABs) can overwinter in sediments as quiescent cells (akinetes or vegetative colonies) and contribute to bloom resurgences in subsequent growing seasons. Algaecide applications targeting overwintering cells in HAB impacted waterbodies may provide a viable approach to increase the duration between bloom events while decreasing the intensity and severity of blooms. However, this is a novel strategy and there are limited data and resources to inform preventative management. Therefore, the overall objective of this study was to illustrate relevant data needs to support identification and prioritization of sites that contain overwintering cells (and have HAB growth potential) with the goal to inform actionable decisions for mitigation. To achieve this, sediment samples were collected, and overwintering cells were identified and enumerated from three HAB-impacted waterbodies in the central US as pertinent examples. To inform overwintering cell viability and growth potential, laboratory incubation studies were developed based on peer-reviewed literature of environmental conditions (e.g., temperature, light, and nutrients) suitable for overwintering cyanobacterial growth. Overwintering cells were present in sediments at all three of the HAB-impacted waterbodies sampled, with 85% of sites (n=13) containing akinetes or overwintering colonies in sediments, and 54% of sites (n=13) with a growth potential to produce problematic cell densities (>100,000 cells/mL) in the planktonic phase. Identification and prioritization of sites for preventative management should consider multiple lines of evidence: 1) presence and density of overwintering cyanobacteria, 2) growth potential as informed by laboratory incubation studies, and 3) environmental conditions at the sediment water interface (e.g., light intensity and attenuation, temperature, nutrient concentrations). Ongoing research is being conducted to identify effective algaecide treatments for overwintering cells and in-lake demonstration scale experiments are planned.

Monitoring and Management of Starry Stonewort (*Nitellopsis obtusa*) in Wisconsin lakes

Michelle Nault, Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources
michelle.nault@wisconsin.gov

Starry stonewort (*Nitellopsis obtusa*; SSW) was first reported in the U.S. in the 1970's and has since been documented in portions of the eastern Great Lakes as well as various inland lakes throughout the Midwest. In September 2014, Wisconsin DNR staff discovered a small established population of SSW in a southeastern Wisconsin lake, marking the first time this non-native macroalgae had been reported in the state. Since then, SSW has been verified in sixteen inland lakes in Wisconsin, as well as coastal portions of Green Bay and northern Lake Michigan. This presentation will highlight the statewide monitoring and management efforts which have occurred after the initial discovery, including an evaluation of management efficacy following the implementation of a variety of techniques (e.g., chemical control, drawdown, hand-removal, DASH, etc.) to control this new invader.

An Turnkey Algae Monitoring and Alerting System for Improved Management Decisions and Timing of Treatments

Christopher Lee, CEO, AquaRealTime, Inc.
chris@aquarealtime.com

Water managers need a simple and affordable way to remotely detect algae blooms before they progress into full blown HABs. Whereas there exist various sensors and apps that aid in this monitoring, we propose an integrated, affordable, easy to use, and complete alerting and monitoring system that can inform management decisions including timing algaecide treatments, informing beach closures, advising residents to keep dogs and kids out of the water, and other types of management.

The author will present:

- An overview of the usage and application details of the system.
- A summary of costs and maintenance requirements for a typical HAB alarm system.
- A description of new methods to automate remote hardware maintenance.
- Case studies at two locations with side-by-side comparisons of separate monitoring tools over several months.

Session F

ProcellaCOR™ Use In Wisconsin Lakes

Evaluating Multiple Cases Studies of Efficacy and Selectivity of ProcellaCOR™ Treatments Targeting Invasive Watermilfoil in Wisconsin.

Todd Hanke, Aquatic Ecologist Eddie Heath, Tim Hoyman, Onterra, LLC
thanke@onterra-eco.com

Onterra has prescribed and monitored dozens of florpyrauxifen-benzyl (ProcellaCOR™) treatments targeting invasive watermilfoil (Eurasian watermilfoil and hybrid watermilfoil) in Wisconsin Lakes between 2019-2021. This presentation will investigate several case studies related to quantitative analysis of native aquatic plant populations before and after treatment, evaluations of invasive watermilfoil control efficacy, and in situ herbicide concentration monitoring. These monitoring results will aid in the understanding and development of future aquatic plant management strategies that utilize ProcellaCOR™.

Tends in Efficacy and Selectivity of ProcellaCOR™ Treatments Targeting Invasive Watermilfoil Across Multiple Wisconsin lakes

Eddie Heath, Aquatic Ecologist, Todd Hanke Tim Hoyman, Onterra, LLC
eheath@onterra-eco.com

Onterra has prescribed and monitored dozens of florpyrauxifen-benzyl (ProcellaCOR™) treatments targeting invasive watermilfoil (Eurasian watermilfoil and hybrid watermilfoil) between 2019-2021. This presentation compiles quantitative data from dozens of case studies to better understand efficacy and selectivity trends from this herbicide use pattern. Potential lake-wide or basin-wide approaches for ProcellaCOR™ treatment designs will be investigated based on the current understanding of herbicide concentration monitoring data collected in Wisconsin.

Transformation of Florpyrauxifen-benzyl (Active Ingredient of ProcellaCOR) Following Application in Northern Wisconsin lakes

Amber White, PhD Candidate, University of Wisconsin-Madison, Environmental Chemistry & Technology
Christina Remucal, Civil and Environmental Engineering, University of Wisconsin-Madison
Katherine McMahon, Bacteriology, University of Wisconsin-Madison
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Florpyrauxifen-benzyl (active ingredient in ProcellaCOR) is a new herbicide used in the management of invasive plants. Effective herbicide treatments rely on appropriate concentration-exposure times, which can be hard to achieve in aquatic environments with competing degradation processes. While previous studies have identified single-mechanism degradation pathways in lab studies, there is little information about the transformation of florpyrauxifen-benzyl in field studies. We carried out several field intensive studies in Northern Wisconsin to quantify the transformation of florpyrauxifen-benzyl in lakes. Field quantification of florpyrauxifen-benzyl found rapid mixing of the herbicide throughout the lake within 24 hours of application and detection of herbicide up to one-week post application. Additionally, quantification of a degradation product florpyrauxifen acid found generation of the acid product and detection to at least 20 days after treatment. These results suggest considering dissipation/mixing in dosing calculations is likely important for successful treatments. When possible, extended monitoring of the acid product, which is known to have herbicidal activity, and extra monitoring of the native plant community should be considered in management decisions.

Successful Management of Eurasian Watermilfoil on a Northern Wisconsin Lake System Using an Integrated Pest Management Approach

Amy Kay, Business Development Leader, Clarke Aquatic Services, Jay Wittman, North and South Twin Lakes Protection and Rehabilitation District, Michael Hiatt, Aquatic Specialist, SePRO Corp.
akay@clarke.com

For many lakes in the Midwest, the invasive aquatic species, Eurasian watermilfoil (EWM), has been problematic year over year. Integrated Pest Management (IPM) programs have been implemented to reduce populations and provide native plants with the opportunity to flourish. North Twin Lake has been managing EWM since 2007. A location on North Twin Lake near the opening to South Twin Lake proved challenging to manage with traditional Aquatic Plant Management (APM) strategies. Over the course of 10 years, two locations experienced repeated management resulting in similar or expanding acres of EWM year over year. The North and South Twin Lakes Protection and Rehabilitation District (NSTLPRD) decided to pursue an IPM approach. In 2019, they targeted a 14 -acre EWM infestation with a strategy implementing ProcellaCOR (florpyrauxifen-benzyl) due to reported efficacy and selectivity for EWM. A late season survey from the year of treatment showed a drop in EWM frequency of occurrence (FOO) from 57.1% to 6.7%. Diver Assisted Suction Harvesting (DASH) was integrated and used in subsequent years to keep the area free of EWM growth. One year following treatment, EWM had a further decline to 1.9% FOO in the treatment area. NSTLPRD has since used ProcellaCOR followed by DASH to manage another nearby EWM infestation that also had a history of conventional spot treatments. The IPM approach with appropriate aquatic herbicide selection followed by DASH has resulted in the efficacious control of EWM versus the seasonal management once experienced on North and South Twin Lakes. The native plant populations within the treatment areas (water marigold, white water crowfoot, wild celery, Elodea canadensis, clasping-leaf pondweed, water stargrass, flat-stem pondweed, variable-leaf pondweed, slender naiad, small pondweed) showed little impacts beyond native watermilfoil, and despite not being statistically significant, many native species had an increased FOO.

Session G

Herbicide Applications

Effect of Endothall on Sprouting and Dormant Hydrilla Tubers

Clyde Smith, Technical Development Manager, Aquatics, UPL NA
Benjamin Sperry, Research Biologist, US Army Engineer Research and Development Center
William Haller, Professor Emeritus, UF IFAS Center for Aquatic and Invasive Plants
clyde.smith@upl-ltd.com

Endothall is an aquatic herbicide previously thought to have only contact activity. More recent research has revealed that endothall is mobile within some aquatic plants. This has raised questions about the effects of endothall on tuber germination and growth after treatment. Laboratory trials were initiated in 2020 to evaluate the effects of various endothall concentrations on the growth and development of sprouted and dormant dioicous hydrilla tubers. In the first trial, sprouted and dormant hydrilla tuber were treated with 0, 0.5, 1, 2, and 4 ppm endothall for 5 days. Tubers were rinsed daily for 15 minutes with fresh water for the three days following treatment and grown out for 50 days before evaluating biomass. The second trial was evaluated endothall concentrations of 0, 5, 10, 20, and 40 ppm. As in the first trial, tubers were rinsed daily for three days after treatment and grown for 50 days to evaluate vigor and biomass. Results and discussion will be presented at the meeting.

The Use of Flumioxazin for European Frog-Bit (*Hydrocharis Morsus-ranae* L.) Control.

Carter L. Bailey, Aquatic Biologist, AQUA DOC Lake & Pond Management Inc.
cbailey@aquadocinc.com

This case study reveals the overall effectiveness of Flumioxazin for season long control of European frog-bit (*Hydrocharis morsus-ranae* L.). European frog-bit is a widespread invasive species along the coastal areas of Lake Erie, and throughout the Great Lakes region. This plant has the potential to negatively impact the quality and use of a waterbody where it can form dense mats in slow-moving areas, including wetlands, canals, and slow-moving rivers. In 2021 AQUA DOC Lake & Pond Management Inc., was contracted with Erie Metroparks of Sandusky, OH to treat a test plot area (0.20 ac) of European fog-bit in an adjacent wetland along the shores of Lake Erie. Flumioxazin was chosen as the preferred chemistry and the area was treated with a foliar application. The July treatment was found to be highly effective in the control of European Frog-bit. Pre-and post-treatment sampling indicated a near 100% control in the test plot area. Despite Duckweed (*Lemna sp.*) and Watermeal (*Wolffia sp.*) species, non-target wetland plants showed little to no impact. Other regional control methods include hand pulling or manual removal, which has shown mixed results. Flumioxazin should be strongly considered when putting together a European frog-bit control strategy, this tool can be used to replace or supplement manual removal efforts.

Improving AIS Control Using Herbicide Enclosures

Michelle Nault, Lakes and Reservoir Ecologist, Wisconsin Department of Natural Resources
Charles Druckrey, Water Resource Specialist, Marinette County Land Information Department
Michelle.Nault@wisconsin.gov

The Marinette County LWCD has developed a low-cost aquatic barrier to surround targeted invasive plants to reduce herbicide dissipation, improve control, and reduce off-site impacts. See how Marinette County constructs the barriers and learn how they have refined their use during the last two years. The presenters will also share the results of their AIS Control Grant to study the effectiveness of the herbicide enclosure barriers.

Yellow Floating Heart Eradication Efforts in a Private, Multi-Use Lake

Leif Willey, Lake and Special Project Supervisor- Aquatic Control, Inc.
leifw@aquaticcontrol.com

Little Fox Lake is a 12.5 acre private lake association in Brown County, IN. In 2014 a resident intentionally introduced an exotic species, yellow floating heart (Nymphoides peltata) to the lake at their shoreline. The plant quickly exploited its new environment and by 2018 had spread through the shoreline of the entire lake. Management efforts began in 2017 to eradicate the invader. Due to resident's use of the water was a potable supply, herbicide selection was limited. Initial treatments included spot sprays with Clearcast (Imazamox) and Clipper (flumioxazin) to control the patches of growth. In 2018 the treatment program switched to ProcellaCOR (Florpyrauxifen-benzyl). Treatments were highly effective in 2018 and eradication became the end goal.

Annual Business Meeting 2021

Call to order (10:00am) - **Thum**

Roll Call – Goidosik

Ryan Thum (President)
Matt Johnson (President Elect)
Steve Zulinski (Treasurer)
John Goidosik (Secretary)
Dave Nicholson (Director)
Pete Filpansick (Director)
Ed Spanopoulos (Director)
Jake Britton (Past President)
Garrett McClain (Vice President)
Leif Willey (Editor)
Amy Kay (Director)
Landon Wiet (Director)
Casey Thompson (Director)
Gregory Chorak (Student Rep.)

Additions/deletions to the agenda, (motion to accept the agenda):

- Add Finance Report to the Standing Committee Reports. By Laws Chair is Spanopoulos not Zulinski.

Johnson = Motion, **Britton** = second, ***Motion carries***

Review of previous Annual Business Meeting Minutes – 2018 minutes are in the program:

-Nicholson = Motion, **Spanopoulos** = second, ***Motion carries***

Presidential Report:

-**Thum** = Thanked Syngenta and Schutman for the use of their Zoom platform. Directed the membership on how to ask questions, vote, etc. Reminded membership on the Mission and Anti-Trust statements. Discussed the decision regarding the cancellation of the Conference. Little or no cost as a result of the cancellation. Invited the membership to get involved on the Board. Thanked entire BOD for their hard work and dedication. Special thanks given to Matt Johnson, Steve Zulinski, Eddie Heath and Amy Kay

Financial Report (Zulinski) – Treasurer (motion to approve):

-Zulinski = General Fund ending balance (9-30-20) = $50,763.92 (down $2,382.34). Robert L. Johnson Memorial Research Grant ending balance (9-30-20) = $15,135.26 (up $38.98). Thanked Aquatic Control for completely funding the Robert L. Johnson Memorial Research Grant.
-Thompson= Motion, **McClain** = second, ***Motion carries***

Standing Committee Reports:

Nominating (**Britton**): Amy Kay = Vice President, Leif Willey = Editor, Casey Thompson = Director and Reid Morehouse = Director. Each candidate introduced themselves and provided details of their career and involvement. Invited the membership to get involved in some way on the Board. **Thum** = Any nominations from the floor? None provided.
Membership (**Kay**):

-**Kay** = Thanked the membership for participating in the meeting and for their support. Updates to come in the next newsletter.

Editorial (**Willey**):
-**Willey** = Slower year based on the COVID situation. Posted 5 announcements to the website/ Facebook page. Recently found out that our website is not completely compatible with all other devices. Working to understand and rectify. Sent out 12 emails to membership. The 3 least viewed emails were those related to the "call for papers". Grew social media presence to 499 subscribed followers.

By Laws (**Spanopoulos**): (*By-Law change discussion)*
-**Spanopoulos** = Verified that a virtual Annual Conference was acceptable regarding voting and a quorum. Ed read the articles from the By-Laws.

Internal Audit (**McClain**):
-**McClain** = All financial activity was reviewed, and everything is in order.

Governmental Affairs (**Johnson**):
-**Johnson** = Spoke on WOTUS final rule, new administration, Endangered Species Act, Moratorium on future registrations, efforts to amend FIFRA (H.R. 7940 or S. 4406) and EPA draft Biological evaluation on Endangered Species Effects. WI DNR and MI EGLE involvement by the Committee via public comments. Invited the membership to get involved on the BOD.

Exhibits (**Nicholson**):
-**Nicholson** = No report

Publicity (**Kay**):
-**Kay** = Updated MAPMS marketing materials, i.e., booth, slideshow, etc. Excited to be able to get back to displaying at conferences in the future. Amy Giannotti will manage our social media activity moving forward.

Past Presidents Advisory (**Britton**):
-**Britton** = Reached out to all Past President's via email and asked for feedback. Comments were that we were responsible in cancelling the in-person meeting. Also continued to encourage our financial responsibility.

Program (**Johnson**):
-**Johnson** = The Board spent considerable time in discussion to determine the cancellation of the event. Took all the steps needed to gauge the memberships feelings on an in-person vs. virtual meeting vs. no meeting at all. Next year we will be in Lake Geneva and the abstracts submitted this year will be shared with the Program Chair for next year. **Willey** = the call for papers emails were viewed much less than in the past which made it clear that the interest was not there.

Local Arrangements (**Nicholson**):
-**Nicholson** = No report

Student Affairs Committee (**Heath**):
-**Heath** = Received 4 applications for the Robert L. Johnson Memorial Research Grand inclusive of the following Universities: University of Minnesota, University of Wisconsin, Ohio State University and Mississippi State University. The Grant was split 50/50 ($5,000 each) to Michael Verhoeven (University of Minnesota) and Amber White (University of Wisconsin. Currently working to solicit a new Student Representative.

Finance (**Zulinski**):
-**Zulinski** = MAPMS Longevity Fund ending balance (12-31-20) = $73,591.68, up $8,429.89. Robert L. Johnson Memorial Research Grant Longevity Fund ending balance (9-30-20) = $16,141.28, up $395.25. Funds are currently placed in a 24-month Certificate of Deposit at a 2.65% yield. 501c3 work has been delayed due to COVID

Special Committee Reports:

Silent Auction/Raffle (**Wiet**):
-**Wiet** = No report

2023 Time and Place (**McClain**):
-**McClain** = 2023 = 2023 Conference will be at the Amway Grand, dates = (3/13 – 3/15).

Strategic planning (**Filpansick**):
-**Filpansick** = Next Strategic planning session to be scheduled for the Fall of 2022.

Sponsorship (**Britton**):
-**Britton** = Thanked all Diamond level sponsors, (Aquatic Control, SePRO, Syngenta, Cygnet Enterprises and UPL). Thanked all other levels of sponsorship as well as our Sustaining Members.

Filpansick = Motion to accept the Committee reports as presented, **Johnson** = second, ***Motion carries***.

Old Business: No old business

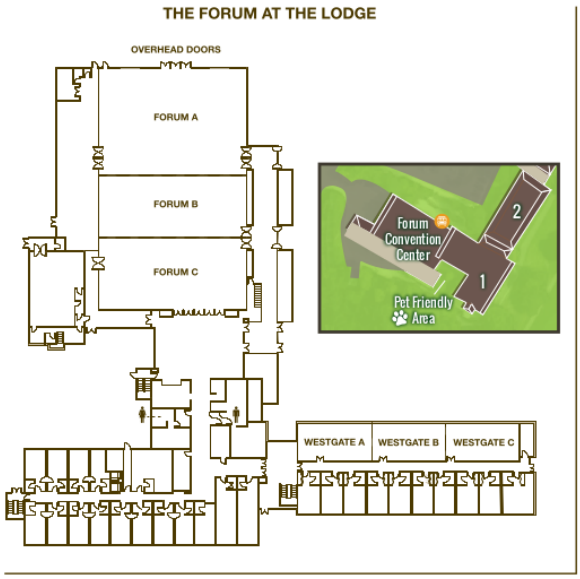
New Business: No new business

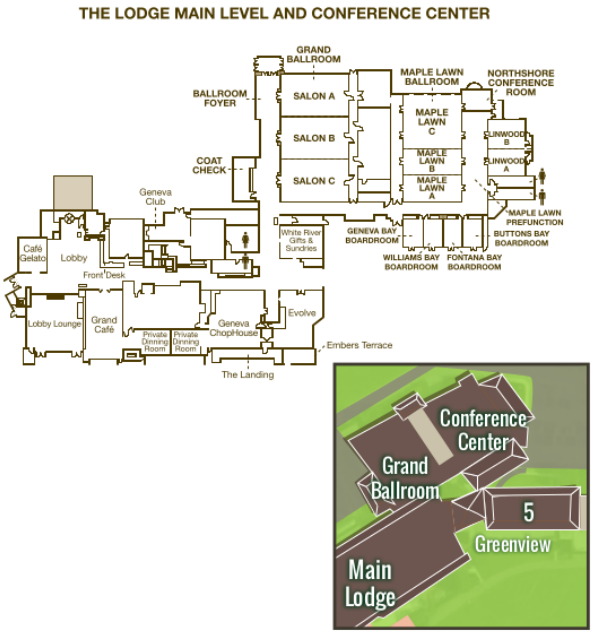
Thum = Recognized all Honorary Members, Past Presidents and Sustaining Members. Announced election winners; Amy Kay = Vice President, Leif Willey = Editor, Casey Thompson = Director, Reid Morehouse = Director. Recognized outgoing Board Members, Kay, Thompson, Willey & Britton.

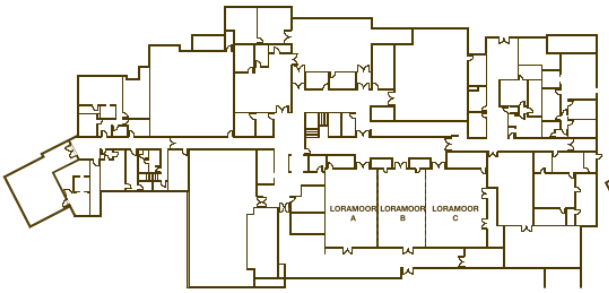
Heath = Announced Student Winners: Robert L. Johnson Memorial Research Grant
= Tie for 1st place ($5,000), and ($5,000).
Michael Verhoeven – University of Minnesota
Amber White – University of Wisconsin.
Thum = Announced and recognized Joe Bondra with the Honorary Member Award.
Thum = Recognized all Committee Chairs and Committee Members. Thum = Introduced and appointed incoming President, Matthew Johnson. Johnson = Thanked Thum and the BOD for their hard work and recognized Thum as outgoing President. Motion to adjourn the meeting: T
Thompson = Motion to adjourn the meeting, **Kay** = second, ***Motion carries***.

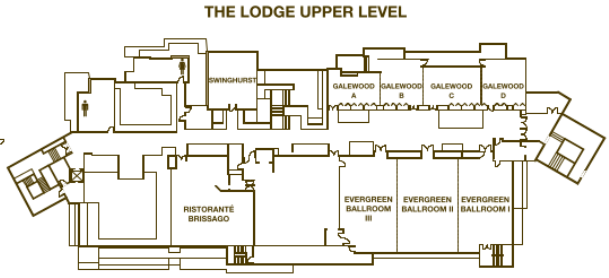
Adjourn (11:21am)

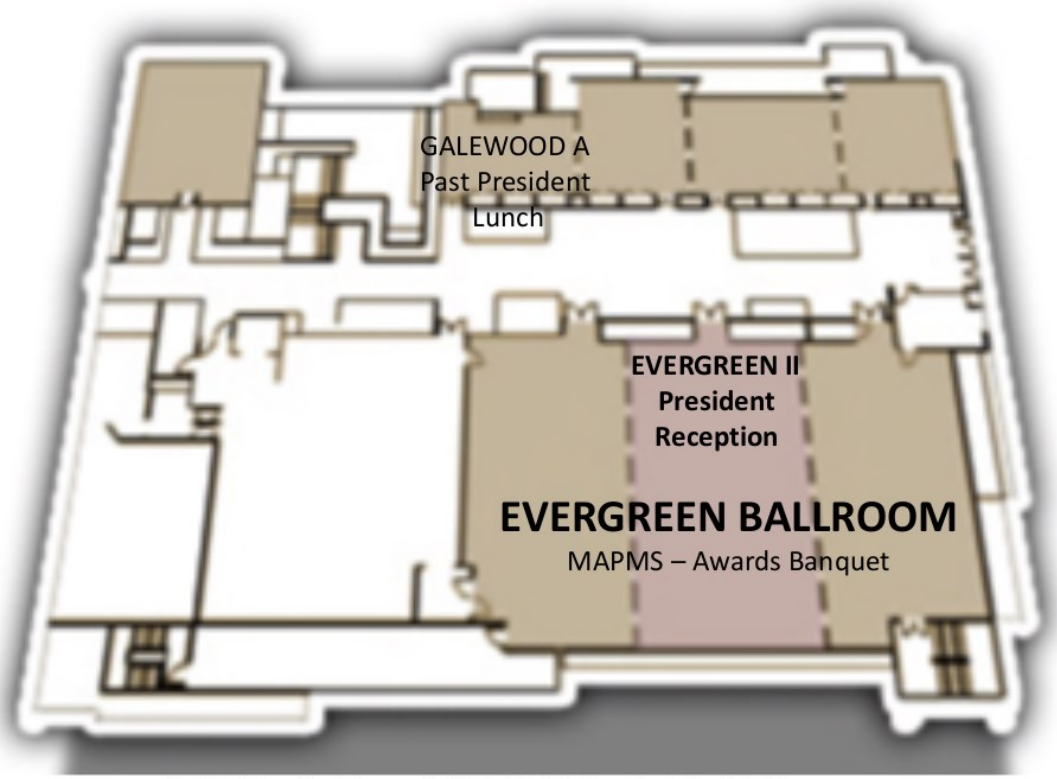
The Grand Geneva Floor Plans



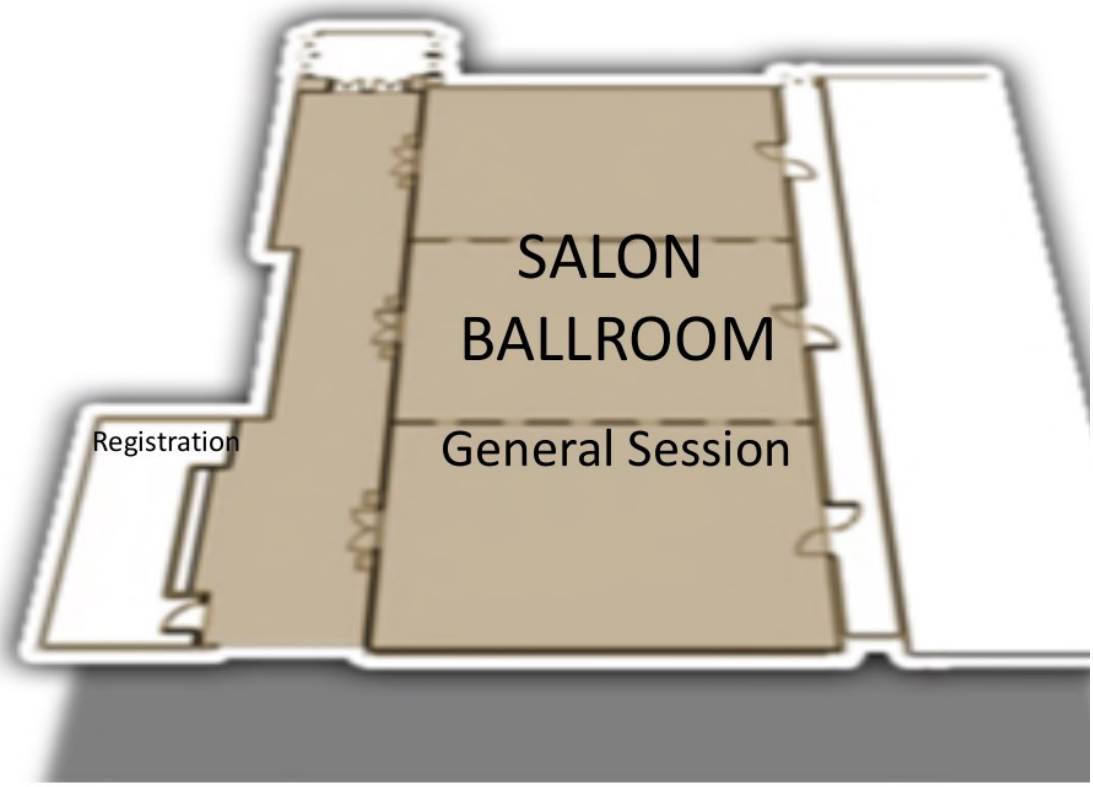




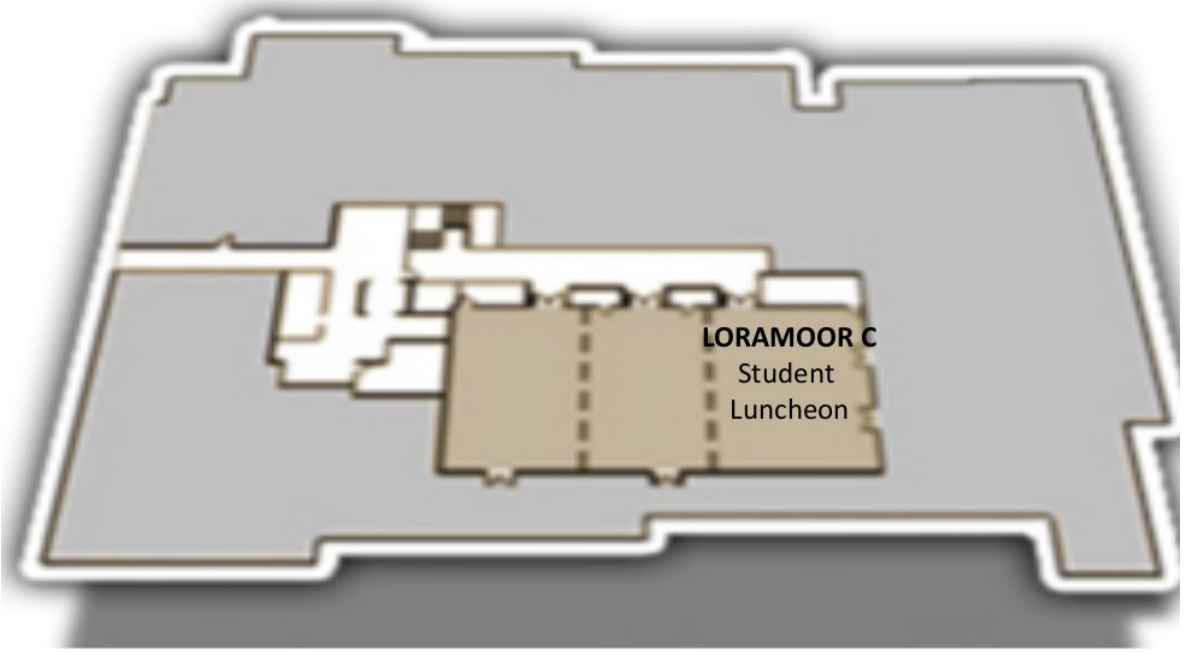




LODGE - UPPER LEVEL



GRAND BALLROOM



LODGE- LOWER LEVEL

Upcoming MAPMS Conferences

43rd Annual Conference

Amway Grand Hotel

Grand Rapids, MI

March 13, 2023 to March 16, 2023

44th Annual Conference

Ohio

Time & Place TBD

MIDWEST AQUATIC PLANT MANAGEMENT SOCIETY