MAY 2022 | VOL. 1

THE NOR'EASTER

A Newsletter from the Northeast Aquatic Plant Management Society

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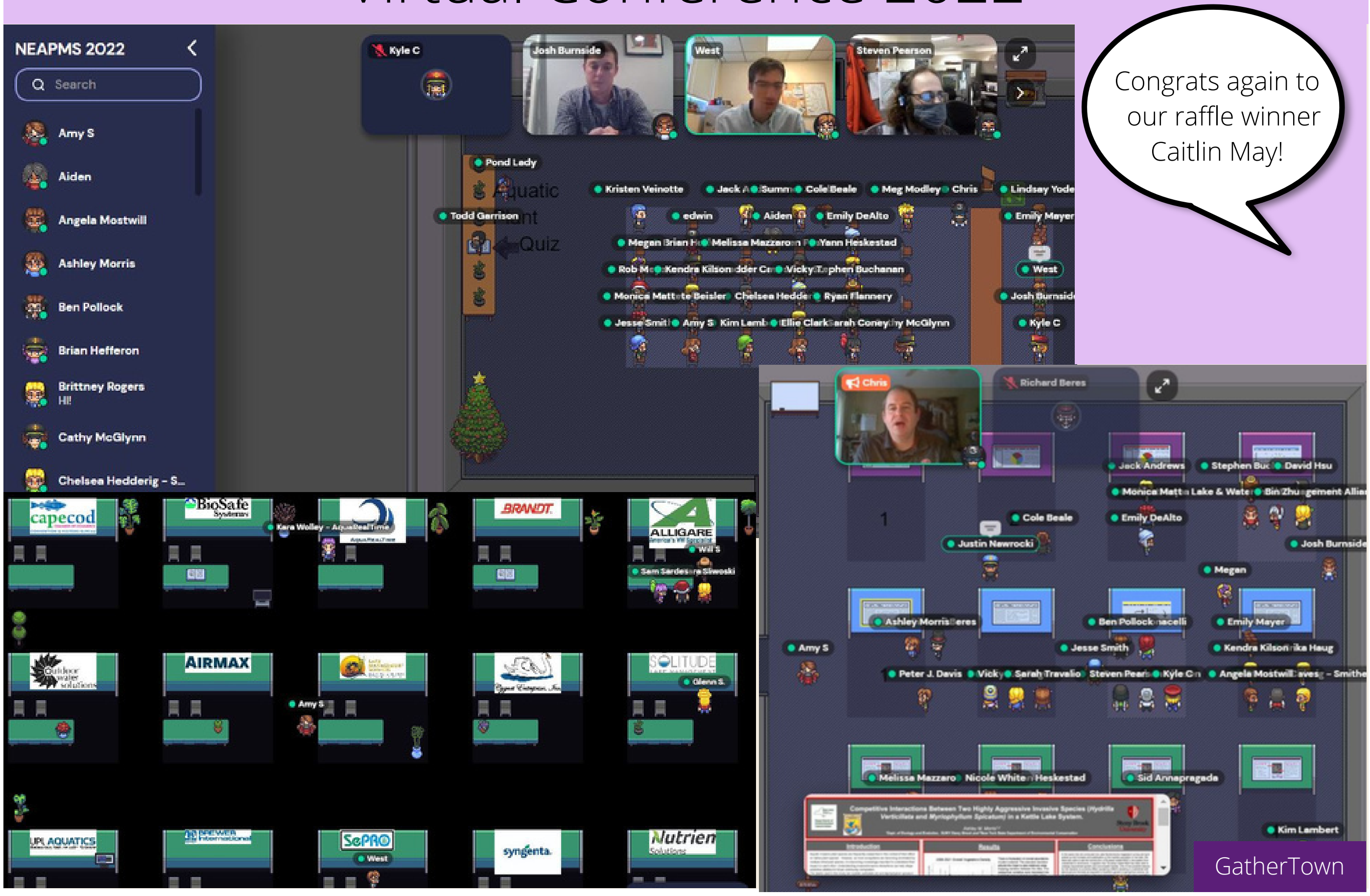
Cover Photo Credit: Chris Mikolajczyk

The purpose of the Society shall be to promote appropriate management of aquatic vegetation, to provide for the scientific and educational advancement of members, to encourage scientific research in all facets of aquatic plant and algae management, to promote an exchange of information among members, and to extend and develop public interest in the discipline.

Mission Statement, adopted January 9, 2019.

2022 Directors

Virtual Conference 2022



The President's Message

Dear NEAPMS Members,

I write this as I look out my window at the soft rain falling and the snowdrops and daffodils in bloom. I am reminded that spring is a time for reinvention. As a society, we began reinventing ourselves in 2021 with our first remote annual meeting. We improved upon that for our second remote meeting by including workshops, exhibits, and social interactions via Gather. Town. Our efforts paid off as more than two hundred people registered for the conference. In keeping with our reinvention theme, we offered the first NEAPMS webinar series in February, and more than one hundred people signed on to learn about watercraft inspection steward programs.

In addition, our website has been re-designed and moved to a new host (thanks, Chris Borek). We have working groups focused on new uses for our website, including a central location for state AIS spread prevention protocols and an unpublished data repository. Another working group is busy organizing a pilot NEAPMS Plant Camp that will take place in Cold Spring, NY, from September 13-15th of this year. Registration for Plant Camp went live on our new website on May 2nd. We are growing and deepening the services and opportunities we provide to our members and hope to make lasting change for present and future professionals and academics who work in aquatic plant management and harmful algal bloom research and control. Please stay tuned for new chances to connect with members and learn more about relevant topics.

Happy Spring, everyone!!

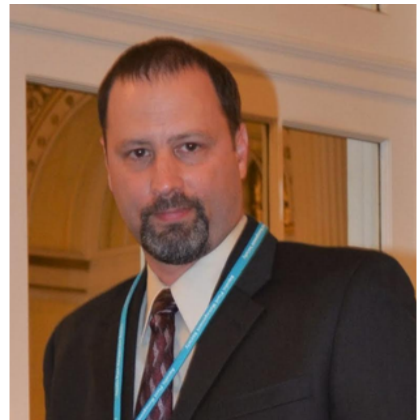
Cathy

"We improved our second remote meeting by including workshops, exhibits, and social interactions via Gather.Town."

NEW BOARD MEMBER:

Dr. Rob Richardson

Dr. Richardson is a Professor and Extension Specialist with responsibilities for aquatic and non-cropland weed science. Since 2005, he has directed the aquatic plant management projects at North Carolina State University. Rob has many years of experience in aquatic plant management and advises aquatic managers across the US as well as internationally. Rob is a Past President of the Aquatic Plant Management Society, Past Editor of the Journal of Aquatic Plant Management, servers of an active member of the following associations: North Carolina Vegetation Management Association, the South Carolina Aquatic Plant Management Society, and the Weed Science Society of North Carolina. He currently serves as an Aquatic Plant Management subject matter expert to the U.S. Environmental Protection Agency Office of Pesticide Programs.



Dr. Rob Richardson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NEW BOARD MEMBER:

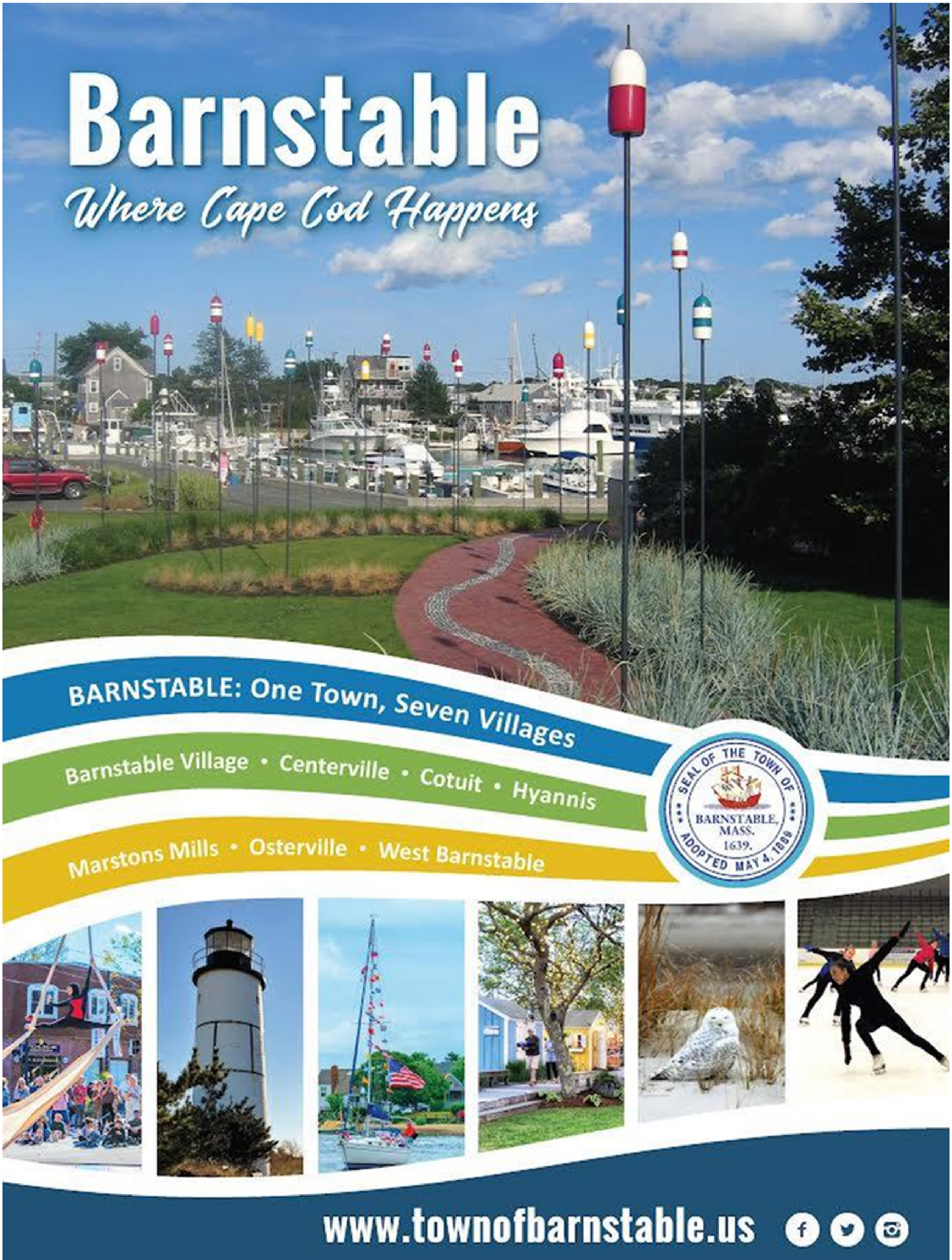
Josh Burnside

Josh is a Territory Manager and Aquatic Specialist with Black Lagoon Pond Management, working alongside long-time board member Chris Borek since 2014. In his current role, Josh oversees clientele and projects in the mid-Atlantic region ranging from the Eastern Shore of Maryland to Northern New Jersey, specializing in the niche pond and aeration markets. Josh received his BS in Environmental Sciences from Delaware Valley University (College at the time) in 2013, where he also served as a three-year Captain of the Men's Soccer team.


Josh Burnside

Growing up on the lakes and local farm ponds of Bucks County, Pennsylvania, Josh quickly found a passion for all things aquatic at a young age. The importance of aquatic plant management struck a chord when his home lake (Lake Towhee, Haycock Township, PA) became inundated with water chestnut, essentially ceasing most recreational activity on the lake. Along with NEAPMS, Josh is an active member of the Pennsylvania Lake Management Society. He is currently President-Elect after serving as Eastern Regional Director, President-Elect, President, and Past President while also running the organization's applicator accreditation program. Influenced by the knowledge acquired through both societies, Josh looks to give back to these organizations that have shaped much of his professional career.

When not working on the water, Josh can be found in his free time hanging out on the beaches of Sea Isle City, New Jersey, with his wife, Samantha, and daughter Maeve or trail running throughout most of the mid-Atlantic.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AUSTRALIAN RIBBONWEED – A NEW INVASIVE WEED TO THE SACRAMENTO – SAN JOAQUIN RIVER DELTA

By Dr. John Madsen

A new invader was found in the Sacramento-San Joaquin River Delta (hereafter "Delta") by California State Parks, Division of Boating and Waterways ("CDBW"). The new weed is Australian ribbonweed, *Vallisneria australis* S.W.L. Jacobs and Les. First described as V. gigantea, the taxonomic name has been revised to V. australis (see photos). It has multiple common names, including ribbonweed, eel grass, and others. Native to Australia, it has been spread to New Zealand, Europe, and North America. Ribbonweed is widely sold in both aquatic gardening and aquarium trades.

Biologist examines sample of Australian Ribbonweed

Ribbonweed forms fertile seed pods, but the predominant form of spread is vegetative by stolon fragments. It forms nuisance growths in irrigation canals in Australia, and invades lakes and rivers in Europe and New Zealand. In New Zealand, it is ranked as a major weed. Ribbonweed is an herbaceous perennial submerged weed with long strap-like leaves, up to 10 feet long and 2 inches wide. It has leaves that are substantially larger than the North American V. americana, and possesses a rounded leaf tip. It is dioecious, forming separate plants that produce either pollen-bearing or ovule-bearing flowers.

In the Delta, it was found in 2018 at the northern end of the Delta in the Sacramento River. It has since been found in a number of other locations in that region. California Department of Food and Agriculture has rated Australian ribbonweed as a weed of medium concern. They have proposed a B pest weed rating in a report in October 2021, with further action pending.

Currently, no U.S. or California herbicide efficacy information is available. Studies in Australian irrigation canals and studies in New Zealand found diquat (Reward), the dipotassium salt of endothall (Aquathol-K), and the dimethylalkylamine salt of endothall (Hydrothol 191) to be effective for control of ribbonweed. Initial trials in California by CDBW did not find diquat to be effective, but further research is needed.

"Currently, no US or California herbicide efficacy information is available [on Australian Ribbonweed]."

Dense amounts of Australian Ribbonweed present along the shoreline of Sacramento-San Joaquin River Delta.

THE TRAVELING HAB LAB: EMPOWERING CITIZEN SCIENTISTS TO PROTECT NEW JERSEY'S WATER RESOURCES

By Melissa Mazzaro and Dr. Meiyin Wu

Montclair State University's New Jersey Center for Water Science and Technology (NJCWST) is pleased to announce that it will be hosting the Traveling HAB Lab, an environmental education program that aims to surge environmental awareness of harmful algal blooms (HABs), water quality, and water conservation. As HABs increase in frequency and duration across the nation, the public is becoming increasingly impacted by water-pollution, including water-use restrictions caused by HABs. The health of the public, their animals, and local wildlife are also at risk from HABs due to the exposure of cyanotoxins. Additional negative effects of HABs to aquatic ecosystems put local wildlife at further risk. Concerns about HABs and their negative impacts will not wane any time soon, as the increase in frequency and duration of HABs is predicted to continue with climate change.

The Traveling HAB Lab is an innovative mobile education model that will bring an interactive educational experience about water science, HABs, and other water quality related issues to students and communities. Our goal is to empower residents to protect New Jersey's valuable water resources, increase awareness of the serious health risks caused by acute exposure to HAB events, and provide knowledge of the damage HABs cause to ecosystems. The Traveling HAB Lab will be the first of its kind in New Jersey. Participants will have access to state-of-the-art technology to learn about water issues by using scientific equipment designed to detect and evaluate harmful algal blooms.

Building on the expertise and resources from NJCWST, the Traveling HAB Lab will be equipped with instruments used by professional water scientists in the field and provide participants with an unprecedented opportunity to use these instruments. The program will empower participants to become active environmental stewards in their communities and assist in monitoring and mitigating HABs.

It is essential to educate the public to identify HABs and take actions to reduce water pollution and future blooms. Bringing STEM education to underserved communities is especially critical, as they are often impacted with contamination and pollution while lacking access to sufficient information to avoid/reduce exposure. Underserved schools also lack scientific instruments and high-quality STEM activities that can elevate the level of science learning and motivate students to pursue STEM fields for careers. With the Traveling HAB Lab, we hope to inspire future water scientists to help alleviate and solve future water issues, keeping our drinking and recreational waters safely available for future generations to use. By bringing vital information and awareness about urgent water quality issues into underserved communities, the Traveling HAB Lab will be promoting environmental justice.

"Our goal is to empower residents to protect New Jersey's valuable water resources, increase awareness of the serious health risks caused by acute exposure to HAB events, and provide knowledge of the damage HABs cause to ecosystems."

THE TRAVELING HAB LAB: EMPOWERING CITIZEN SCIENTISTS TO PROTECT NEW JERSEY'S WATER RESOURCES (CON'T)

By Melissa Mazzaro and Dr. Meiyin Wu

Appearances at outreach events will give students and community members an understanding of water quality issues in their immediate environments and help foster environmental stewardship. Outreach events will be used to recruit participants to become citizen scientists that will work to monitor HABs, reduce pollution in surrounding waters, and improve water quality throughout New Jersey. The goal is to build local volunteer groups interested in protecting the environment, the health of their people, as well as the economies of their lake/coastal communities. Initially, the Traveling HAB Lab will serve New Jersey residents. However, we hope to one day expand the Traveling HAB Lab to other regions, as HABs and other water quality issues are a widespread problem that affects us all.

Melissa Mazzaro speaks with students about HABs.


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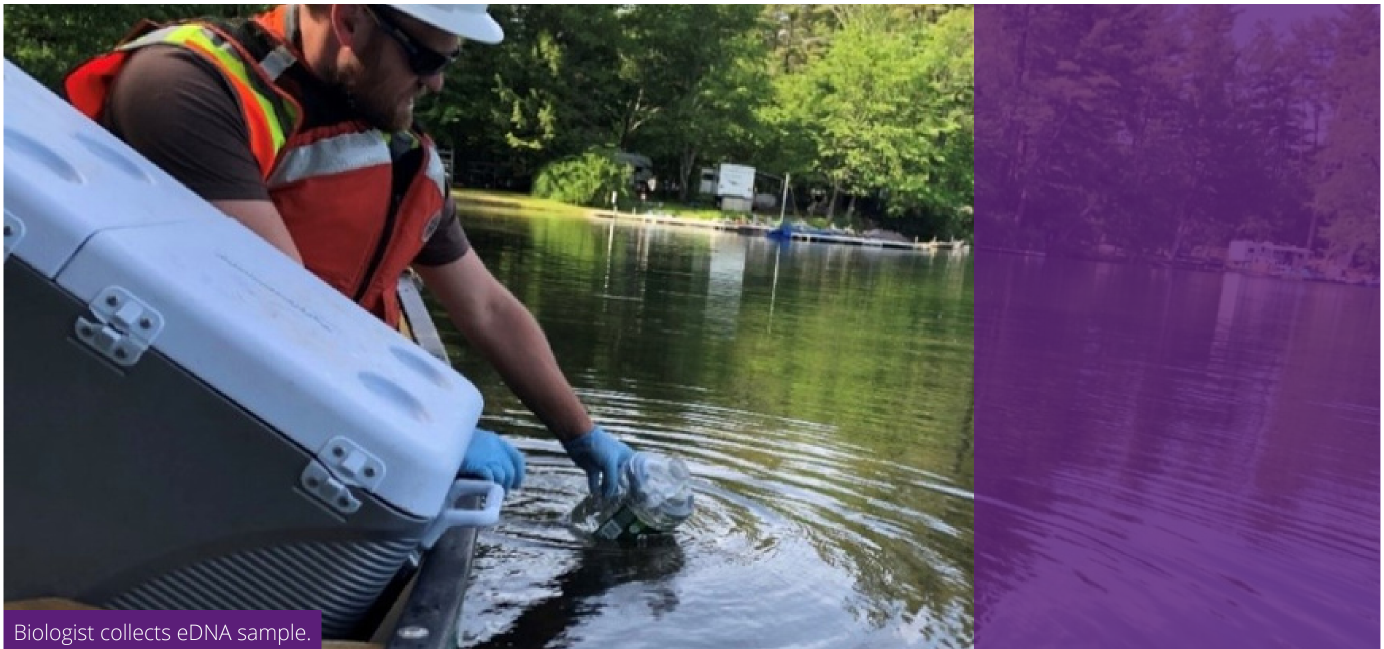

Biologist collects eDNA sample.

2021 MASS. UPDATE

By Kara Sliwoski, Water Resources Scientist

The Department of Conservation and Recreation (DCR) was busy in 2021 as things got back on track following 2020. Staff have primarily been working from home, with the Boston office closing next spring for consolidation. Despite some changes to the physical workspace, DCR's budget has been largely unchanged and the agency has continued to receive important funding for aquatic invasive species work. They have also been able to continue with necessary hiring adding Kara Sliwoski to the team who is working as a Water Resources Scientist for the Lakes and Ponds Program.

DCR has been proceeding with aquatic plant management work using both chemical and mechanical treatments as appropriate. Water chestnut management has been ongoing in the Charles, Mystic and Nashua Rivers. DCR has also been continuing to collaborate and partner with other groups through its matching fund program, including developing a plan to address water chestnut on the Connecticut River. Cyanobacteria blooms have also continued to be an issue in many MA lakes.

Through the 2021 season, staff worked to obtain permits for management of the Lower Basin of the Charles River (approximately 700 acres) and are currently working to obtain permits to manage the upstream Lakes District portion of the Charles River (approximately 250 acres). Once all permits are authorized, the project will allow for coordinated and consistent management of both portions. The Charles River has been plagued with aquatic invasive plant growth for decades which has only been historically managed in small, localized areas, primarily for water chestnut growth.

In 2020 DCR began working on a two-part eDNA project focusing on zebra mussels and hydrilla. Staff continue to search for zebra mussels in the Berkshires and Western MA, which are the most high-risk areas due to the water chemistry of the waterbodies and proximity to infestations in nearby states. However, to date there have been no new detections beyond the initial detection in Laurel Lake in Lee and Lenox in 2009. An exciting advancement to the project has been the successful development of a new assay for hydrilla analysis.

"The Charles River has been plagued with aquatic invasive plant growth for decades [..]"

2021 MASS UPDATES (CON'T)

In collaboration with other state agencies and entities throughout New England, staff have continued to survey and evaluate the hydrilla infestation within the Connecticut River, in an effort to develop an appropriate and coordinated management strategy.

In August of 2021, a single snakehead fish was caught by an angler in Canton, MA and the MA Division of Fisheries and Wildlife (MassWildlife) took the lead on responding. MassWildlife determined it was likely a pet released after growing too large for its aquarium. This is the 5th of the invasive species to be found in MA waters since 2002. Additional information can be found at: https://www.mass.gov/news/invasive-snakehead-caught-in-canton.

In 2021, with the assistance of a Federal Aquatic Nuisance Species Task Force Grant, staff implemented use of iPads by Boat Ramp Monitors (BRMs) at seven monitored priority lakes in the state parks system. Each summer, the BRMs inspect vessels that are entering or exiting a waterbody to ensure no AIS are being transported. Utilizing iPads and Survey123, species presence/absence, last waterbody entered and when, photographs and other qualitative data were recorded in real-time, which allowed for monitoring and rapid response if an organism was identified. All data are displayed live on a dashboard for staff to analyze and export as needed. Staff worked closely with DCR Watershed GIS Director Erica Tefft to develop and manage this monitoring tool.

Hydrilla infestation in Connecticut River

Plant Quiz!
Test your identification skills, answer on bottom of page 23.

NORTHEAST LAKES SEDIMENT CORE CHRONOLOGY PROJECT

By: Sylvia Lee, Biologist, EPA

In Washington, D.C., aquatic ecologists in the Office of Research and Development (ORD) of the U.S. Environmental Protection Agency (U.S. EPA) conduct research broadly supporting the U.S. EPA's mission and responsibilities as defined by the Clean Water Act. The Sediment Core Chronology project is a collaboration with northeast states and ORD's Dr. Sylvia Lee, a biologist, to support water quality goals for lake aquatic life condition in a regionally consistent approach not limited by state boundaries. Northeast state water monitoring agencies have been collecting sediment cores from lakes as part of national surveys and state monitoring programs. Paleolimnologists use sediment cores to understand how lakes have changed over decades, hundreds, or even thousands of years (https://diatoms.org/news/webinar-diatoms-and-paleolimnology). Sediment cores contain numerous clues or proxies that can be studied, such as nutrients and cyanotoxins (Edlund et al. 2017, Henao et al. 2020). Paleolimnologists also use the remains of diatoms (https://diatoms.org/what-are-diatoms) in sediment cores as biological indicators (Figures 1-2). The northeastern lake sediment diatom dataset includes cores taken between 1991 and 2018 from 607 lakes, totaling 1327 core samples from Maine, Vermont, Massachusetts, New Hampshire, Connecticut, Rhode Island, New York, and New Jersey.

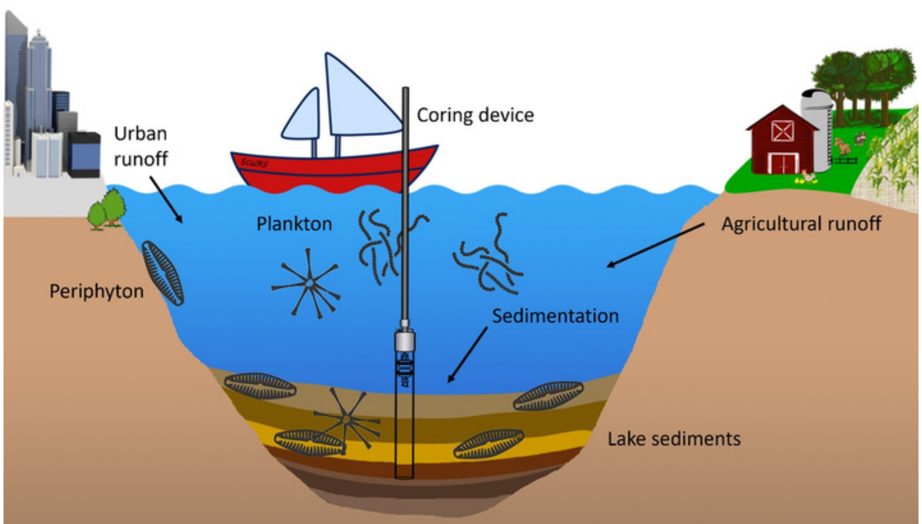

Figure 1. A schematic of how a lake's sediments accumulate chemical and biological information over time and a sediment core used to infer the lake's history (modified from an image developed by Alaina Fedie for the St. Croix Watershed Research Station; https://scwrs.wordpress.com/category/paleolimnology)

Analysis of lead-210 isotope concentrations from multiple intervals throughout a sediment core to determine the age of sediments is ideal for estimating how far back in history the intervals represent (e.g., Figure 3). To conserve resources and freezer space, however, only the tops and bottoms of the cores are available. The tops of sediment cores represent lake conditions during one or more growing seasons leading up to the sampling date. Estimating the time represented by the bottom layer of sediment cores is difficult because of variations in sediment accumulation rate (SAR). For lakes with relatively low SAR, the bottom of a 40 cm long core can usually be associated with a time before significant anthropogenic disturbances (e.g., pre-industrial development) and could be a useful reference point in comparison to the top of the core to gauge how much impairment has occurred in a lake.

Hab bloom in Lake Superior. Sourced MPR News

"[..] tops of sediment cores represent lake conditions during one or more growing seasons[..]"

Figure 2. Diatoms under a light microscope (courtesy of diatoms.org).

By contrast, a lake with more rapid SAR may require a core that is much longer than 40 cm to reach sediments old enough to represent least disturbed conditions. A study by Baud et al. (2021) developed an equation to predict core length to reach pre-industrial (1850 AD) conditions based on variables that are the strongest predictors of SAR, including altitude and the averages of cropland, temperature, and precipitation from 1850 AD to the present. However, it is not known how easily this equation could be applied to northeast lakes. Baud et al. (2021) developed the SAR equation using a global dataset, which included only about 30 lakes from the northeastern U.S. (Figure 4). Moreover, human impacts on the northeast started well before 1850 AD, so it would be useful to know if the equation could be extrapolated to estimate core lengths that correspond to indigenous times (about 1700 AD).

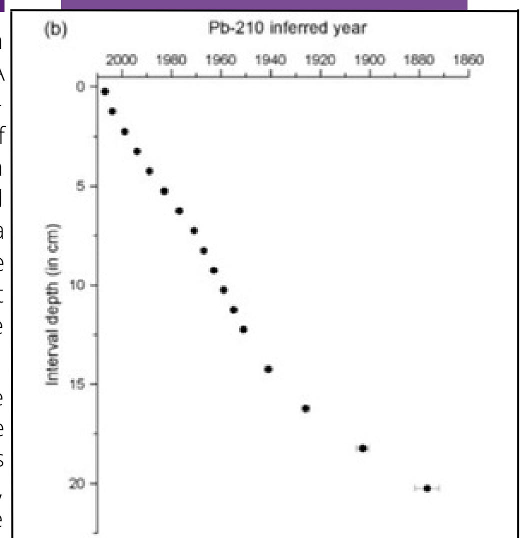

Figure 3. Lead-210 (Pb-210) inferred year and sediment interval depth. Example is from a study of Big Moose Lake, New York by Arseneau et al. 2011 https://doi.org/10.1139/f2011-003.

Fortunately, numerous studies of lakes in the northeastern U.S were conducted in the past to understand long-term trends such as lake acidification and eutrophication. The studies included biological and chemical profiles of sediment cores at multiple intervals used to develop chronological models to relate core depths to times in the past (e.g., Figure 3). Many of these models are also conveniently available in an online database called Neotoma (https://neotomadb.org/). A preliminary search of Neotoma resulted in about 350 northeast lakes with chronological models. Currently, researchers are working on comparing the SAR equation results to existing models to learn how best to estimate the time represented by the bottom layers of sediment cores in our dataset of 607 lakes. The project will also identify knowledge gaps (i.e., types of lakes lacking sediment core chronology information) to inform whether it is necessary to take new sediment cores for multi-interval age analysis or deeper cores to sample older sediments.

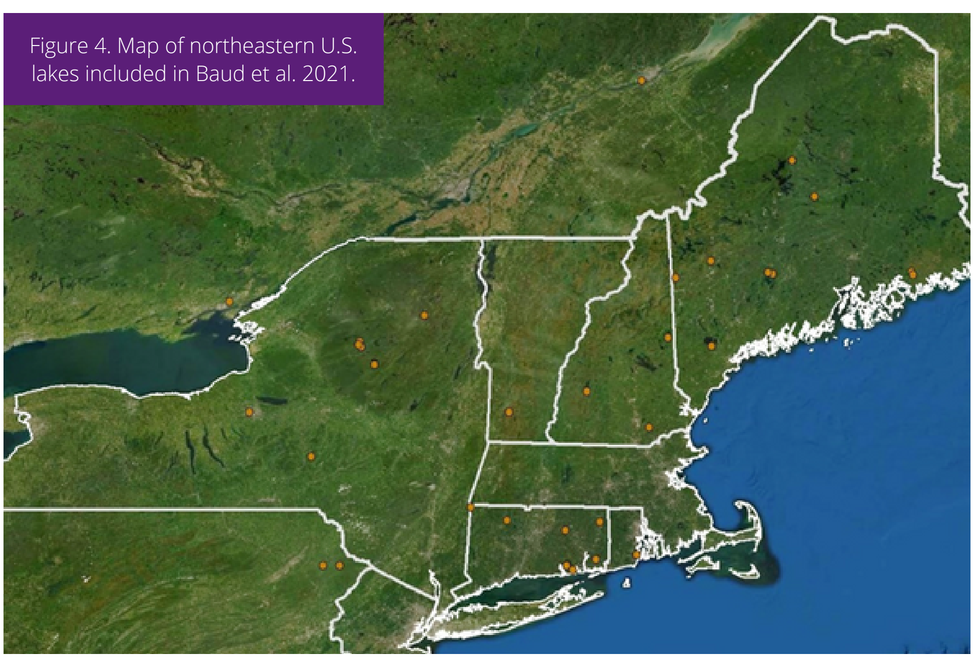

Figure 4. Map of northeastern U.S. lakes included in Baud et al. 2021.

"[..] equation to predict core length to reach pre-industrial (1850 AD) conditions based on variables that are the strongest predictors of SAR [..]"

This project is part of a larger effort by the Northeast Lakes Sediment Diatom Collaborative using sediment diatoms to interpret a wide range of stressors on aquatic life to support the development of biocriteria. Potential stressors include eutrophication, watershed alteration, and climatic change. For more information, contact Sylvia Lee at lee.sylvia@epa.gov.

Disclaimer: The views expressed in this article are those of the author and do not necessarily represent the views or the policies of the U.S. Environmental Protection Agency.

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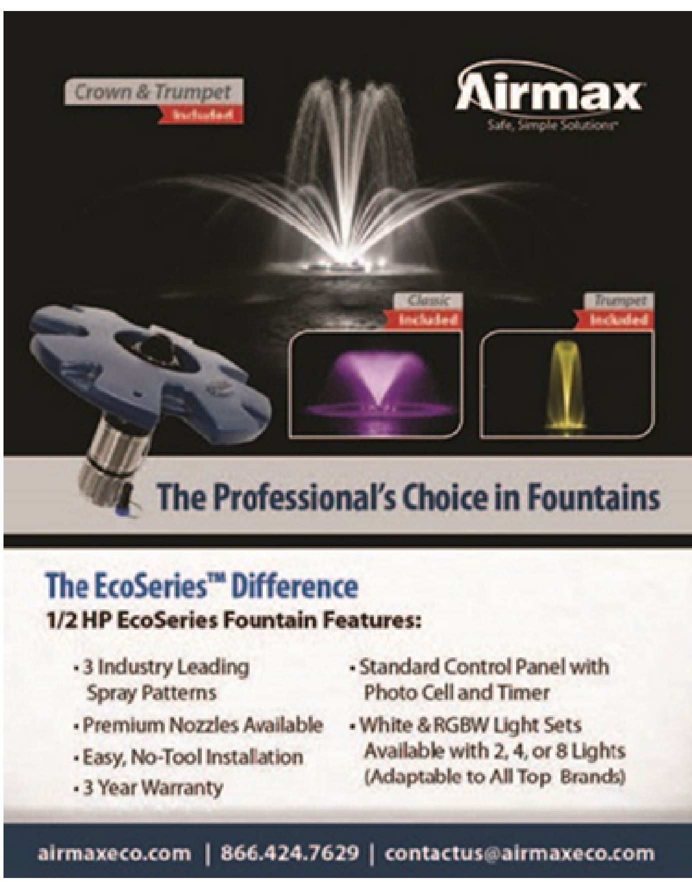

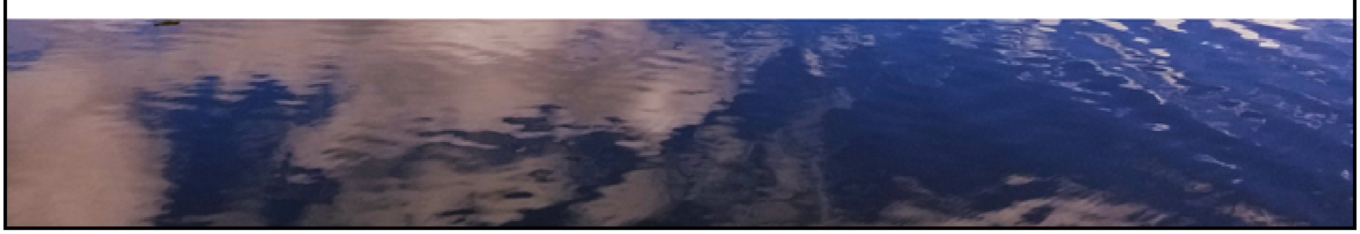

NEAPMS SCHOLARSHIP UPDATE

Kyle Clonan

Kyle plans to defend his master's thesis, Downstream Transport of Cyanobacteria in the Raritan Basin Water Supply Complex, at Montclair State University in May 2022. Results have shown a difference in persistence among cyanobacteria genera during fluvial transport from upstream HAB lakes and reservoirs to downstream drinking water intakes. There is also evidence that cyanobacteria can successfully travel further during periods of higher discharge, regardless of water temperature, nutrient levels, or turbidity. This is likely due to decreased travel time, though higher release also dilutes cell abundance. Kyle will be presenting his findings at the Joint Aquatic Sciences Meeting in Grand Rapids, MI, on May 20th, 2022.

Kyle was the recipient of the NEAPMS 2021 graduate student scholarship and is the current NEAPMS Student Director. He is grateful for the society's support of his research and education. Kyle's thesis is part of a more extensive study between the United States Geological Survey, the New Jersey Water Supply Authority, the New Jersey Department of Environmental Protection, and Montclair State University. The team tracks the transport of cyanobacteria and cyanotoxins throughout the Raritan River Basin using a mix of continuous and discrete sampling methods. The sites were outfitted with continuous water quality sondes and SPATTs (Solid Phase Adsorption Toxin Tracking passive samplers) for cyanotoxins. At the same time, discrete samples were collected for regular water quality parameters, phytoplankton assemblages, four cyanotoxins, Microcystin, Saxitoxin, Cylindrospermopsin, and Anatoxin-a, phytoplankton assemblages, and other parameters specific to HAB monitoring. Kyle enjoyed presenting his preliminary results at the 2022 NEAPMS conference. He looks forward to updating the society on the conclusion of his thesis and findings from the more extensive study at the 2023 conference.

Past Student Directors
Kara Foley (2019)
Emily Mayer (2020)
Kyle Clonan (2021 - current)

PRELIMINARY REVIEW OF AQUATIC MACROPHYTES VS. ROAD SALTS

Emily Mayer, Watershed Scientist

According to scientists at the Cary Institute of Ecosystem Studies our lakes and ponds are likely to become salinized within the next 50 years due to heavy applications of road salt (NaCl - Sodium Chloride) during the winter months. Current research suggests that long-term applications of road salt can alter biodiversity and macroinvertebrates, but impacts on plants and other freshwater organisms remain relatively unstudied. Increased salt levels may provide an opportunity for some invasive species to thrive in suitable conditions and may affect the growth patterns or quality of aquatic macrophytes.

Ecologist Flora Krivak-Tetley (2017), at Dartmouth College, salt can negatively impact the ecosystem balance before any negative or lethal effects start to appear within the plant community. As a result some native species may decrease over time if there are no solutions to decrease the use of road salt.

In one of the first large-scale analyses to investigate the degree of increasing salt levels in freshwater lakes, the Global Lake Ecological Observatory Network (GLEON) looked at chloride levels in 371 lakes. The team examined the chloride levels and linked these statistics with watershed impervious surface coverage – such as roads and parking lots, which are typically close to lakes. Results showed that even having a total of 1% of these surfaces around a lake could increase salinization. The team estimated that at least 7,770 lakes in the North American Lakes Region are experiencing increasing salinity due to road salting. In addition, the team noted that salty freshwater coming from stream beds and soils in drainage basins could release various chemicals, such as poisonous metals and nitrogen-containing compounds. The study suggests that when these chemicals travel together, they have a more severe effect on the aquatic plants' ecosystem than when they are separate contaminants.

In a recent study conducted by the University of Florida, scientists exposed aquatic plants to different sources of salt to determine which source was likely to result in the tissues of aquatic plants reaching the salinity seawater. Their results concluded tolerance in two freshwater aquatic plants, H. *verticillata* and V. *americana*, differed (Tootoonchi and Gettys, 2019), but both plants were impacted by road salt (NaCl).

Data from the University of Toronto (2021) estimates that two-thirds of freshwater aquatic life is affected by salinization, even under ideal climate conditions. This fraction increases during the winter and spring seasons due to increased chloride concentration resulting from road salt (Lawsona and Jackson, 2021). Another study conducted in Poland by Szklarek, Górecka and Wojtal-Frankiewicz (2022) revealed that road salt increases the levels of chloride entering the groundwater, which can lead to increased chloride concentrations in rivers and lakes. The effect of increased chloride levels appears to reduce the biodiversity of aquatic macrophytes mainly due to differences in their ability to regulate the intake of increased chloride concentrations and maintain the balance of salt and water inside the plant (Szklarek, Górecka and Wojtal-Frankiewicz, 2022). Multiple other studies confirmed that high salinity inhibits macrophytes' regulation processes leading to lethal effects (Karraker and Gibbs, 2011).

"[..]our lakes and ponds are likely to become salinized within the next 50 years due to heavy applications of road salt"

Research suggests that aquatic plants' tolerance to Sodium Chloride can be improved by applying other elements like Magnesium and Calcium (Srivastava et al., 2013; Chen et al., 2017). In addition, Sulfur-containing compounds have been reported to improve aquatic plants' tolerance to salinity. Sulfur is a fundamental and necessary component of plants' amino acids, vitamins, antioxidants, and fatty acids. Vitamins play an essential role in abiotic stress tolerance in plants. Although vitamins studies have received more attention recently, it is still a relatively new topic. Khan et al. (2014) state that Sulfur metabolites, including amino acids and vitamins, maintain the physiological and molecular processes and prove their effectiveness in salt stress tolerance. Also, Sulfur-containing compounds have been reported to improve aquatic plants' tolerance to salinity by regulating genes associated with molecular processes, where these genes are switched on when salinity is increased (Khan et al., 2014). These findings suggest that using Sulfur compounds could potentially reduce the toxic effects of salinity in freshwater plants. However, there is still much to be learned understanding the effectiveness of Sulfur in salt tolerance pathways, and more research is needed to clarify its role in increased salinity conditions.

Nature-based solutions have been investigated to provide the best ways to manage elevated salinity. For example, some freshwater halophytes, "salt-loving" aquatic plants were found to reduce the negative impact of high levels of road salt by absorbing sodium in their aboveground tissues (Suaire et al., 2016). However, Suaire et al. (2016) suggested that these halophytes may not have the same tolerance to sodium chloride. Another study showed that cattail Typha *angustifolia* has the potential to remove sodium and chloride from water and store it in the aboveground and underground tissues of the plant when salinity is increased (Guesdon, de Santiago-Martín and Galvez-Cloutier, 2016).

increased chloride levels are only one factor that contributes to the stress that aquatic plants experience. Often, aquatic systems experience various stressors throughout the seasons that influence their tolerance to salt.

While research mainly focuses on elevated chloride as a stress factor, more studies are required to understand the effect of multiple stressors that aquatic systems experience and the impact of these stressors individually. Studies so far confirm that a main adverse effect of increased salinity from road salt is favoring the growth of some species over others. Over time, this effect can severely disturb the balance of aquatic plant ecosystems. It is apparent that further research investigating the effects of road salt on freshwater aquatic plants in both the laboratory and the field is critical to our ability to manage aquatic ecosystems.

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Announcements

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