

Binational Great Lakes Aquatic Invasive Species Forum Summary

June 21, 2017

Erie, Pennsylvania

Additional information, including a final agenda, presentations, and an attendee list, is available [online](#).

Wednesday, June 21, 2017

Welcome and Opening Remarks

Erika Jensen, Great Lakes Commission (GLC)

Jim Grazio, Pennsylvania Department of Environmental Protection (DEP)

- Jensen welcomed attendees, reviewed the agenda, and recognized the three other agency partners hosting the event: the Pennsylvania DEP, Michigan DEQ and Ontario MNRF
- Grazio discussed development of the Erie bayfront and changes from its historic uses, including the establishment and subsequent delisting of the Presque Isle Bay Area of Concern

Updates on Great Lakes Regional Initiatives

Moderator: Bob Wakeman, Wisconsin Department of Natural Resources (DNR)

Great Lakes Restoration Initiative Outlook

Matt McKenna, Northeast Midwest Institute (remote presentation)

- Great Lakes Restoration Initiative (GLRI) funding is zeroed out in the President's proposed FY18 federal budget
- Historic funding for GLRI has been steady, receiving approximately \$300 million annually
 - Focus Area 2 (aquatic invasive species (AIS)) funding has also remained steady at around \$55 million annually
- Congress authorized the GLRI at \$300 million annually for five years; these funds also need to be appropriated annually by Congress
- Congress will decide the final federal budget
- In FY17, the Obama Administration requested only \$250 million for the GLRI, but Congress fully funded the program at \$300 million
- One of the largest concerns for the FY18 federal budget are potential cuts to federal agency base budgets
- Restoring proposed funding cuts to agency research programs and the National Sea Grant program are a priority for members of Congress whose districts rely heavily on those programs
- Key FY18 appropriations milestones include:
 - June 15 – EPA Administrator Pruitt testifies before the House Appropriations Subcommittee on Interior, Environment and Related Agencies; Pruitt will likely also testify before the Senate Subcommittee in the coming weeks
 - June/July – House and Senate Appropriations Committees look to markup appropriations bills, including the Interior bill
 - September – Congress will consider a large omnibus appropriations bill or a continuing resolution (CR)
 - Fall/Winter 2017 – If Congress is only able to pass a CR at the end of September, expect a final budget deal to be pushed back until the end of the session
- Support from non-Great Lakes states for GLRI is reflected in the support that different regional programs showed for each other in past funding discussions

Council of Great Lakes and St. Lawrence Governors and Premiers (CGLSLGP) AIS Task Force & Mutual Aid Agreement

Sarah LeSage, Michigan DEQ

- The AIS Task Force is continuing to work on harmonizing regulatory approaches to AIS management in Michigan, Ohio, and Ontario
- Progress has been steady in listing the 16 species on the Least Wanted list, with many jurisdictions taking action to list these species as prohibited
- The AIS Task Force is also working on new initiatives, which will be finalized and announced at the CGLSLGP meeting in October

Council of Great Lakes Fisheries Agencies (CGLFA) - Executive Committee on Invasive Fishes

Todd Turner, U.S. Fish and Wildlife Service (USFWS)

- The Executive Committee on Invasive Fishes was established to provide guidance to multiple jurisdictions on invasive fish issues, with a focus exclusively on fish and not other invasive species
 - The committee was not designed to replace other entities that are also doing work in this area
- The charge of the committee is to coordinate work among the CGLFA members and outside partners as appropriate, prioritize projects, and improve communications between invasive fishery management groups on the Great Lakes
- Initial focuses of the group include:
 - Grass carp as a threat to Great Lakes fisheries
 - Bait fish importation, sale, and distribution as a threat to Great Lakes fisheries
 - Communication and coordination needs for agencies dealing with invasive fish issues
- A survey was recently sent to Great Lakes state DNR fishery authorities to ask general questions about the focus areas; responses will be used to refine the work on the focus areas
 - It is likely that the results of questionnaire will be compiled and publicly available
- The committee will make recommendations to the CGLFA, but will not supersede lake committee or jurisdictional decisions

Update on Great Lakes invader: *Thermocyclops crassus*

Joseph Connolly, Cornell University

- Very few introductions of *Thermocyclops crassus* have been documented in the Western Hemisphere
- In the U.S., it was detected in Lake Champlain in 1991, and the Lake Erie western basin in 2014.
- The Lake Erie detections occurred as part of the US EPA-GLNPO long-term biological monitoring program and underscores the importance of regular sampling
- Subsequent detections of the species in Lake Erie occurred in 2015 and 2016; this species has not been detected in any of the other Great Lakes
 - A range expansion was observed from 2014 to 2016, but population is restricted to the western basin of Lake Erie
 - The population is moving from west to east, and appears to have failed to establish at the mouth of the Detroit River
 - The density of individuals captured is increasing at eastern sampling stations
- Possible explanations for the 2014 detection in Lake Erie include:
 - Introduction via overland transportation from Lake Champlain,
 - Introduction as a ballast water contaminant, or

- Species introduction prior to 2014 that was not previously detected due to low density
- In 2016 one female *T. crassus* specimen was found with egg sacs, leading Cornell researchers to conclude that a breeding population has been established in Lake Erie
- When *T. crassus* was initially detected, it had a very low density of 1 individual per cubic meter, indicating that sampling efforts should include genetic detection techniques to aid in early detection of any range expansion of this species
- Detrimental impacts and invasiveness are unknown at this point and the species should be categorized as a non-native exotic species, rather than labeled as invasive
- This species is the first documented non-native discovery in the Great Lakes since 2006
- *T. crassus* will likely avoid detection in spring sampling efforts given the diapause status of the species at that time of year
- It is possible that historical samples from western Lake Erie contain the species, but the samples are held by several different entities and have not been reprocessed for detection of *T. crassus*.
- USFWS conducted an Ecological Risk Screening Summary and the results are [online](#)
- NOAA-GLANSIS conducted a risk assessment that is out for peer review

Case Studies in Managing Inland Spread of Round Goby

Moderator: Lindsay Chadderton, The Nature Conservancy (TNC)

Michigan-Population Genomics Study

Nick Sard, Michigan State University

- The study is focused on answering the question: What is the most likely vector by which the round goby secondarily spread into Michigan systems from the Great Lakes?
- Round goby was first observed in Lake St. Clair in 1990 and spread rapidly throughout the Great Lakes, eventually present in all of the Great Lakes by 1995
- This study used an approximate Bayesian computation network to compare possible vectors of angler-mediated movement, focusing on the source of the round goby population in the Flint River system
 - 11 models of potential movement were tested
- DNA was extracted from round gobies at the locations being tested as potential source areas for the Flint River population and used to prepare a genetic library to compare to the DNA of specimens captured in the Flint River system
 - The genetic variation within and among the sample collections provides information about colonization history
- The summary statistics of the genetic sampling of the round goby population in the Flint River system showed a lack of genetic diversity, indicating that a small number of individuals established the Flint River population
- Genetic data was simulated for each of the proposed 11 models based on the DNA extractions and compared to the DNA data of the Flint River population to identify the most likely model of introduction
- This analysis supports the assumption that a small number of round gobies were moved from Saginaw Bay into the Flint River, establishing the population there
- Both Local anglers and commercial bait harvesters operating in Saginaw Bay both have statistical support as the source of the Flint River population
 - A commercial bait introduction would be a downstream colonization, while an angler introduction would be an upstream colonization

- It was noted in discussion that an unpublished bait shop study indicated that round gobies weren't found in any commercial bait shops
- Further work will expand this research to the Au Sable and Cheboygan systems, and attempt to identify parallel invasion processes of round goby, rusty crayfish, and zebra mussels

Pennsylvania-French Creek

Casey Bradshaw-Wilson, Allegheny College

- Preliminary research was presented (no finalized results are currently available).
- Round gobies were found in summer 2014 in Lake LeBeouf and are confirmed to move downstream through the French Creek watershed
 - Bait bucket dumping seems to be the likely source of introduction
- In a stream system, round gobies can eat aquatic macroinvertebrates and may not develop teeth for crunching mussel shells
 - Literature suggests that eastern sand darters and other benthic species are impacted by round goby introductions
 - Round gobies may feed on smaller mussels in the creek system as well
- Extensive sampling indicates downstream spread from Lake LeBeouf to LeBeouf Creek into French Creek, and the invasion front has stopped right before a riffle in French Creek
- Males in breeding colors were found in May 2016, and a nest was found in July 2016, indicating that the population is successfully reproducing more quickly than native fish
- Further range expansion is likely facilitated through larval drift downstream, evidenced by the fact that no gobies have been found upstream of the mouth of LeBeouf Creek in French Creek
- A round goby was sighted by a TNC employee further south from invasion front. The specimen was confirmed, but appears to exist in a small population if it is not an aberrant occurrence
 - There is a stream further south from the sighting that would be good habitat for goby
- Prevention and education efforts through the Pennsylvania Sea Grant have been extensive, and a round goby task force is discussing treatment options for French Creek
- Bass and walleye are eating the gobies, but it is unknown what impact that is having to the round goby population
- Round gobies are present in French Creek year-round and are not moving back to Lake LeBeouf to overwinter

Wisconsin-Lake Winnebago

Bob Wakeman, Wisconsin DNR

- Round gobies were recently found in the Fox River system, which flows from Lake Winnebago to Green Bay, and features an extensive lock and dam system
- In 2015, an angler reported catching a round goby just downstream of Lake Winnebago in Little Lake Butte des Morts. This catch was confirmed by Wisconsin DNR Fisheries staff
- Round gobies moved through the lock system in the lower Fox River, indicating the capability to move through the lock system into Lake Winnebago
 - There are also some additional aquatic connections via a paper mill that could bypass the lock and dam system into Lake Winnebago, and monitoring is ongoing
- Staff worked with the Fox River Navigation System Authority (FRNSA), who operate and maintain the lock and dam system on the river, to close Menasha Lock, the primary lock into Lake Winnebago
 - There is a lot of political pressure to reopen the Menasha Lock and DNR staff are continuing to work with FRNSA to identify the best solution

- The Menasha Lock closure will likely be maintained through this boating season, but FRNSA is implementing mechanisms to allow boats to enter Lake Winnebago, including lifting boats out of the water to treat them and the potential for an electric barrier
- Extensive education and outreach about round gobies included watch signs and boat wardens speaking with boaters when conducting inspections
 - A hotline was also set up for anglers to report sightings and captures of round gobies
 - Wisconsin DNR saw a positive public response to outreach messages disseminated through the news media because the message was delivered by a public figure who could connect with the public, rather than a government employee
- When sampling, staff did not have a lot of success trapping gobies with minnow traps
- A standardized angling procedure taken from a scientific paper was successfully used to capture the fish and staff will be using this approach for monitoring in Little Lake Butte des Morts and throughout the rest of the Fox river system
 - The length for standardized angling is ten minutes, and staff can catch three to four gobies in that period
 - Goby populations are present very close to the shoreline, no more than four to five feet out, so sampling efforts are focused on rock riprap along the shoreline
- The largest cost of this project is staff time, as signage cost is minimal

Questions / Discussion

- There may not be round gobies present in bait during recent bait shop surveys, but that doesn't mean organisms were not present in bait shops prior to the goby education and outreach push
- There is some GLRI research indicating round goby DNA was present in bait shops around Lake St. Clair and Lake Erie
- There are no overall round goby collaborative/workgroups existing right now, but is there interest/need/value in creating one?
 - A work group on round goby management could fall under the Great Lakes Executive Committee on Invasive Fishes if the jurisdictions decided to include it
- The inland spread of round gobies in Wisconsin is limited to the first upstream tributary barrier, but the trend of moving organisms through bait buckets is concerning
- Pennsylvania is in the head streams of the Mississippi River; if round gobies continue to move downstream, they will eventually end up in the Mississippi River (if they are not already there)
- USGS and Michigan DNR are working to refine sampling techniques for round gobies
- More widespread use of citizen monitoring protocols for round gobies could aid in inland detection

Case Studies in Aquatic Plant Response and Control

Moderator: Francine MacDonald, Ontario Ministry of Natural Resources and Forestry (MNR)

Starry Stonewort Treatment Efforts and Results

Indiana

Eric Fischer, Indiana DNR

- Where starry stonewort is present in Indiana lakes, it occupies all space where other macrophytes were previously dominant, and even Eurasian watermilfoil has been crowded out
- The state of Indiana is actively searching for starry in the natural lakes where it is known to be regionally present in hopes of containing spread and eradicating populations in small areas

- Almost every small starry stonewort population in Indiana can be traced to a boat ramp or public access point
- There is hope that copper or fluoxin herbicides can effectively limit the growth and spread of starry stonewort
- Because it is an alga, starry stonewort can be temporarily reduced to the point where spread via boats is prevented; however, biomass returns the following spring after treatment
- The herbicide Clipper has limits to where it can be applied because it is less selective; for example, it cannot be used in areas with high plant diversity
- No vegetation was found in fall surveys following two treatments of clipper in Webster Lake; treatments were funded by the Indiana Lake and River Commission
- Indiana DNR was unable to replicate or compare results from a previous Algal Challenge Test that compared herbicide combinations for effectiveness in treating starry populations
 - The test compared main lake treatment and channel treatment techniques to determine differences
 - Several control areas showed a decrease in starry abundance over the year, though some plots didn't show a consistent decrease
 - Large biomass may have caused herbicide to bleed out, preventing effective contact times.

Michigan

Andrew Tucker, TNC

- Studies were funded through the Michigan Invasive Species Grant program in 2014
- Field trials took place within two treatment areas in Gun Lake with a defined perimeter
- One plot was treated with copper sulfate and endothall herbicides, and the second with Komeen crystals and chelated copper herbicides
- There was a reduction in biomass in both of the treatment plots and a similar reduction in the control plot
- During the 2016 trial period, there was no significant difference in mat height or biomass between treated and control areas within visits
- There were, however, significant differences between visits, indicating there may be short-lived treatment effects followed by population rebounds in the treated plots
 - Bed height and biomass growth, however, is highly variable and may cancel out any short-lived treatment effects in a long-term treatment period
- Controlled and replicated in situ studies are needed to assess the short and long-term impacts of control on target and non-target populations
- General population growth trends in the U.S. are consistent with native populations
- Burlap trials for starry stonewort will be a next step for research in southeast Michigan
 - They have been deployed in constructed canals since 2016 in Gun Lake, but a lightweight burlap was used there which had gaps in the weave where sunlight could permeate
 - Using a heavier weight burlap without gaps in the weave may be more effective
- Michigan's starry stonewort strategy guide has been revised and is [available online](#)
- The project showed herbicides are not completely able to depress populations in the long term
- Novel or alternative treatments may be more effective and should be further studied

Minnesota

Tim Plude, Minnesota DNR (remote presentation)

- Lake Koronis and Mud Lake were listed as infested with starry stonewort in 2015
- Seven more water bodies were listed in 2016 in the northern and central portions of the state
- Treatments occurred mostly in the fall, so full monitoring wasn't possible post-treatment
- Lake Koronis Association used an eco harvester combined with a chelated copper treatment, and separate chelated copper treatments for their infestation
 - The eco harvester didn't work well with starry stonewort as the stems didn't wrap around the barrel properly, and so contractors had to use divers to assist the harvester
 - All treatments reduced plant heights in the water column, but it is unknown how much biomass is going to grow back the following season
- Several waterbodies were treated in 2016 and the locations and treatment methods were summarized (*see presentation for more information*)
- Two infestations discovered in 2016 - Moose and Winnibigoshish lakes – were not treated
- The Minnesota Aquatic Invasive Species Research Center (MAISRC) is using Moose Lake and Lake Koronis for research; Moose Lake will serve as a control to compare to active management on Lake Koronis
- MAISRC is also doing lab herbicide trials in labs and studying the phenology of starry stonewort in Minnesota
- Minnesota DNR funded treatment at public access sites in 2016, but was unable to fund as much this year so lake associations are stepping up to fund treatments
- “Starry Trek” was established for outreach and education through a citizen monitoring blitz
- Minnesota DNR set up a small grant program for treatment monitoring, and organized a review team to consult on “pilot” projects when partners propose treatments

Wisconsin

Scott Van Egeren, Wisconsin DNR (remote presentation)

- Starry stonewort was first discovered in southeastern Wisconsin
- Some lakes have dense populations while others are quite sparse
- Populations have also been discovered in Sturgeon Bay, and inland and Great Lakes populations are both present in Wisconsin
- Wisconsin DNR conducted six management evaluations at three lakes
 - Evaluating herbicide concentration consistency over time after application, non-target impacts, and efficacy of treatment methods for starry stonewort
- A copper herbicide (Komeen crystal, granular form) was applied in Little Muskegon Lake as part of a dye treatment study, designed to mimic the flow of herbicides. The movement of the dye showed water bleeding out of the treatment zone after 4 hours; after 8 hours, only half of the sampling areas within the treatment zone had maintained target dye concentrations
- Starry stonewort frequency did not decrease significantly in treatment or in control area after the Komeen crystal treatment in Little Muskegon Lake
 - The top layer of the starry stonewort beds was “burned off” at roughly 1/3 of the sites
 - Reproductive structures remained and *Chara* and *Vallisneria* were impacted as well (non-target impacts)
- A liquid copper herbicide was applied in the Long Lake study areas, with some variety between treatment sites. One site was treated with only the liquid copper herbicide and followed up with

a liquid copper + endothall treatment two weeks later. Another site was treated with a liquid copper + flumioxazin, and followed up with a liquid copper + diquat treatment two weeks later

- There was a significant decrease in Eurasian watermilfoil, elodea, and duckweed populations
- Filamentous algae population increased post treatment
- Starry stonewort populations didn't change significantly
- The Big Muskegon Lake study site was treated with a combination of copper + hydrothol. The concentration of herbicides at the treatment site was less than half of the target three hours after treatment
- Four of the six treatment sites experienced an increase in starry stonewort biomass following treatment, and none of the sites provided long-term (>1 year) control

Questions / Discussion

- New detections of starry stonewort are found in Indiana lakes where routine milfoil treatments are taking place. These discoveries are indicative of a species spread and are not populations that may have been present and not detected due to lack of monitoring, as Eurasian water milfoil treatments take place on a year-after-year basis in the same locations

Hydrilla Treatment Efforts and Results

Pennsylvania-Pymatuning Lake

Brian Pilarcik, Crawford County Conservation District

- Pymatuning Lake is a major stopover for migrating waterfowl and the highest revenue state park in the Pennsylvania state park system
- Hydrilla infestation threatens 6,000 acres of suitable habitat out of the 17,000 acres Lake Pymatuning, a loss of boating access and recreational opportunities, and reduction or loss of Pennsylvania Fish and Boat Commission hatchery operations
- Endothall and fluoridone were used for treatment in 2016 with mixed results; effective in some areas but not in others
- A rotemine dye test was conducted on representative treatment blocks to understand flows in 2017; the results of the dye test were not promising as the flushing rate was much higher than expected, which explained the mixed effectiveness of the herbicidal treatment
- 250 acres are treatable if funding and permits were available
- USFWS did not allow fluoridone treatment on the Pymatuning Lake treatment permit in 2017, so there is a limit on the herbicides available for use as treatment
 - The presence of endangered mussels downstream from Lake Pymatuning didn't allow USFWS to approve the use of fluoridone, but this decision is being discussed further
- Funding is a major shortfall; there are some funds available but not enough for a concerted effort in treatment
- The infestation is generating some traction with the Pennsylvania Invasive Species Council, but the lack of dedicated funding for invasive species in Pennsylvania makes response very difficult
- Hydrilla has not been found on north part of reservoir, where most of the lake is flat, shallow, and conducive to hydrilla growth

Ohio-Cleveland Metroparks

Mark Warman, Hydrilla Project Coordinator, Cleveland Metroparks

- Treatment of hydrilla in the Cleveland Metroparks is a GLRI funded project
- The herbicide Fluoridone has been successful in primarily shallow water bodies, so it was chosen as the herbicide for the Metroparks treatment
- The first introduction into the West Creek Reservation in Parma, OH, was likely an aquarium dump
- The surveillance area for hydrilla was expanded into the Cuyahoga Area of Concern; Metroparks staff will sample outside of the park district to look for other expansions of hydrilla after the peak growing season passes
- No hydrilla tubers have been detected at any sites in Cleveland Metroparks since 2014 except at the original point of introduction
- Metroparks staff will be switching treatment application from the liquid form to the granular form of Fluoridone because the liquid form of the herbicide dissipates in water due to frequent water movement into and out of treatment areas
- The total cost for hydrilla control in the Metroparks from 2011-2016 is \$99,152.47, and is funded 75% by Ohio DNR and 25% by the Metroparks
- Data sharing is an important component of surveillance, and data from the Metroparks activities are being shared with the Great Lakes Early Detection Network, EDDMapS, and the Cooperative Weed Management Area website for the Metroparks
- Within the Metroparks, there is not much outreach for hydrilla beyond signage, but only one of the infested sites is open to boaters, and there only to non-motorized watercraft

Parrot Feather Response in Michigan

Sarah LeSage, Michigan DEQ

- The goal of Michigan's parrot feather response is eradication, and staff are not collecting much data on efficacy of treatment methods
- Michigan uses the incident command system (ICS) to respond to aquatic invasive plants.
- A story map has been developed on locations of invasive aquatic plant species within the state of Michigan to gain public support for activities
- Most of Michigan's parrot feather responses are based on public reports and reports from within Michigan DEQ, but these reports are not necessarily only from the early detection sites.
- Parrot feather is prohibited in Michigan
- Michigan Department of Agricultural and Rural Developed received some state GLRI funding to regularly inspect growers and dealers for prohibited species, and receive plant identification education for inspectors who were previously concerned primarily with terrestrial species
 - Routine inspections based on nursery stock licenses now incorporate prohibited aquatic species and is a good example of how GLRI funds have been used to expand agency work that is then incorporated into general work
- In 2014, the state used instances of non-compliance with state prohibited species laws as an educational opportunity rather than enforcing fines, and consequently the compliance rate has improved since the initial push in 2014
- Michigan conducted four parrot feather responses at different sites
- The population found in Jackson County was reported through compliance water sampling at a trout farm where field staff are not specifically looking for AIS, demonstrating the importance of educating staff outside of the AIS program

- The response team appreciates the structure that ICS provides, that it can be scaled to meet needs of the situation, and that it aligns paperwork and roles/responsibilities across multiple response sites

Invasive phragmites control efforts

Francine MacDonald, Ontario MNRF

- Diquat is the only herbicide approved for overwater use in Canada, so there aren't many tools available when phragmites began invading coastal wetlands
- Phragmites often reinvades previously treated sites because herbicidal treatments must stop at the water's edge, allowing phragmites stands in the water to re-colonize its previous population size in the treated zone
- Phragmites is a direct threat to more than 25% of Ontario's Species at Risk (endangered species)
- The Ontario MNRF applied to Health Canada for emergency permits for overwater application of herbicides to control phragmites
 - The use of herbicides is controversial in Canada, but MNRF had the support of the local community, organizations, and neighboring jurisdictions
 - MNRF also gained the support of the herbicide manufacturer (Monsanto) to implement the project with the herbicide Roundup Custom (glyphosate)
- Aerial application of glyphosate over very remote sites was accomplished via helicopter, and ground application utilized a marsh master purchased by The Nature Conservancy
- All applications met herbicide label requirements and permit requirements, and treatment was conducted in autumn to occur outside of hunting season and other critical life stages for native fauna/flora
- MNRF staff notified residents near the treatment area not to use water during treatment periods, and staff followed up with water quality testing to ensure water was safe for residential use
- Follow-up activities including rolling, cutting, and burning were planned for 2017
 - Not all sites were not conducive to follow-up activities
 - Aerial follow up monitoring indicates close to 95% efficacy in treatment site
 - During routine follow-up activities, Northern pike were found spawning in cut phragmites, showing a return of native fish to a system that was previously inaccessible
- The Roundup application permit was renewed with Health Canada in early June, and MNRF may treat up to 600 hectares of phragmites in a new area
- Drone survey of treatment sites will be conducted and compared to treatment maps provided by aerial applicators using GIS to identify drift and range

Updates on Pathway-Based Prevention Efforts

Moderator: Sarah LeSage, Michigan DEQ

Ballast Water: Technology Testing and Type Approval

U.S. Coast Guard

Lorne Thomas, U.S. Coast Guard (USCG)

- Options for vessel compliance with USCG discharge regulations were reviewed, with approved ballast water management systems (BWMS) being the most popular compliance method
- Temporary compliance through alternate management systems (AMS) recognizes vessels that use IMO approved systems

- Independent labs are utilized to test BWMSs to ensure a consistent independent approach to the U.S. type approval process
- A primary difference between IMO type approval and USCG type approval is the use of the term viable vs. living (respectively) in reference to allowable organisms
 - It is more difficult to measure viability (in terms of reproductive ability) than living/dead, and therefore applications for treatment systems have been denied based on the use of viability as the primary measurement
- It is important to ensure that the system is scalable and can work on various flow rates at the same efficacy
- The Ballast Water Working Group conducts inspections of vessels entering the Great Lakes in Montreal
 - Working group staff are able to determine if treatment systems have significantly failed during onboard inspections
- USCG will also be working with U.S. EPA staff to revise the Environmental Technology Verification protocol used for testing BWMSs
- The next U.S. EPA Vessel General Permit is under development and includes an investigation into how to mitigate risk of interlake transfer through vessels that only transit the Great Lakes (“lakers”)
- Depending on the system, once the water is treated, the treated water needs to sit in order for the chemicals that are used to break down before it can be safely discharged under federal and state water quality standards
- No vessels are entering the Great Lakes with U.S. type approved systems, but Fednav is using an AMS that has been submitted for U.S. type approval

Transport Canada

Colin Henein, Transport Canada

- Canada is signed on to the IMO Convention which enters into force September 8, 2017
- Ships currently are required to exchange ballast water prior to entering the Great Lakes, and will transition to using IMO type approved BWMSs after the Convention enters into force
- BWMS are challenged as fresh, cold water can be more difficult to treat than international marine water
- Transport Canada is working closely with ship owners and other stakeholders to transition ballast water management activities in accordance with the IMO standards
- Due to challenges associated with the transition to ballast water treatment, the IMO is considering starting the transition with an “experience-building” phase:
 - Ship owners will be expected to operate BWMS in good faith
 - If a BWMS system fails to meet the standard despite being utilized properly and being in good condition, ship owners may not be faulted but will still need to take mitigation measures before discharging
 - If approved, this phase will last five years beginning in September 2017
- Ballast water regulations continue to be enforced by Canada and the U.S., and agencies from both nations are moving forward to address interjurisdictional inconsistencies
- The proposed approach to the existing ballast water exchange requirement for the Great Lakes is to continue to require exchange in addition to treatment, but that decision has not been finalized by Canada
- Uncertainty in compliance monitoring is high; for example, the ability to tell the difference between 10 and 11 organisms is difficult

- Port state control allows countries to collect data through voluntary monitoring
 - DFO will continue to monitor for compliance by requesting permission to board vessels outside of an enforcement setting in order to take samples and work with ship owners to determine if treatment systems are effective or not

Recreational activities

MN DNR Lake Service Provider Permit Program

April Rust, Minnesota DNR (remote presentation)

- The program was established by the Minnesota legislature in 2011 and went into effect in 2012
- Lake service providers are businesses that are paid to install, remove, rent, lease, or decontaminate any aquatic equipment (including lawn irrigators)
- The program is mandatory for lake service providers and ensures businesses that move equipment between water bodies are aware of their elevated levels of risk
- The program is a component of the state invasive species management plan
- One permit per business covers the business, owner, and employees who complete certificate training
 - Once training is completed, owners are provided a checklist of activities that must be completed in order to validate permitted activities
 - The permit is good for three calendar years and permittees must have a copy of the permit in their possession while providing lake services
- Employees working on the water or with water-related equipment must complete shorter online certification training
 - This certification is tied to the individual, not the business, so individuals can work at different places and still be covered by the permit
- Initially, the training took a “one size fits all” approach, rather than being tailored to different types of businesses, and it was only offered at the beginning of the field season with no alternative for training mid-season
- A new online training module and app are being offered to provide more flexibility for businesses in training and certification
- Every third year there is a bump in participation due to permit renewals, and thousands of businesses and people are certified every year

Recreational Pathway Modeling

Andrew Drake, Department of Fisheries and Oceans Canada (DFO)

- The objective of the pathway modeling is to develop methods that can be applied to determine baseline ecological risks and management measures that can be implemented with a measurable ecological impact
 - DFO developed two pathway models to simulate spread through the pathway: one for angler mediated movement (primarily through bait fish), and one for aquatic boats
- Propagule pressure can be statistically estimated and extended to simulate the invasion cycle for secondary spread
 - Statistical methods can predict absolute propagule pressure to a given lake in a given year
- For the aquatic recreation model, angling activity is framed as a series of context dependent steps or decisions that result in success or failure to introduce an AIS

- The model can predict the probability that an angler will exhibit a certain behavior and test those probabilities using survey data
 - Data on angler location preferences, dispersal sites, etc. inform the model through the survey data
- The value of the model framework is that it can respond to targeted questions about management variables or changes that will have the greatest probable effect in reducing introductions or propagule pressure
 - If management actions can meaningfully reduce the probability of release, there is a similar reduction in propagule pressure
- The model predicts that reducing bycatch in retail bait shops by 25% would result in a ~25% reduction in propagule pressure; a 40% reduction in bycatch results in a > 40% reduction in propagule pressure; and a 90% reduction in bycatch results in near zero propagule pressure
- The recreational boating pathway model works to estimate the likelihood of secondary spread via overland and in-water spread, assessing risk for three functional groups of AIS over a ten year window:
 - Plankton life stages
 - Direct attachment (molluscs)
 - Entanglement potential (macrophytes)
- Working from the estimate that there are approximately 12 million boating trips in the Great Lakes basin, a model was developed to determine the probability that boater will move an organism from at least one of the AIS functional groups from a launch site
- The model defines propagule pressure by functional group and boat type (power boats, sailboats, and manpowered vessels) to model the general densities in which species are transported
- The functional groups exhibit different levels of invasiveness in the model based on target invaders of those functional groups as reviewed in the literature
 - Target invaders are a group of species within a functional group whose invasiveness is relatively well-understood and combined invasiveness is considered to be representative of the entire group in the model
- Time-based models of spread within the Great Lakes for each of the functional groups over a ten year period describe the range of time for spread between different pairs of lakes
 - E.g. the amount of time it will take for molluscs to spread between Lake Erie and Lake Superior, or the amount of time it will take for macrophytes to spread between Lake Ontario and Lake Erie
- The model shows that the rate of spread is more concerning at upstream lakes within the Great Lakes system, as downstream routes are occurring at rates consistent with natural spread
 - These rates are reliant on assumed rates of spread based on survey data, which can always be improved
- The next step is to understand why lakes in the model with a high probability of introduction and high propagule pressure for a functional group don't have establishment populations for those species yet