Joint Meeting of the Great Lakes & Mississippi River Basin Aquatic Nuisance Species Panels
April 14-15, 2015
Madison, WI

Meeting Summary
Approved October 5, 2015

Joint Panel Meeting - Tuesday, April 14, 2015

Welcoming Remarks and Call to Order
Greg Conover, Mississippi River Basin Panel (MRBP) Chair, U.S. Fish and Wildlife Service (USFWS)
John Navarro, Great Lakes Panel (GLP) Chair, Ohio Department of Natural Resources (DNR)
Bob Wakeman, Wisconsin DNR

Conover and Navarro welcomed everyone to the Joint Meeting of the Great Lakes and Mississippi River Basin Aquatic Nuisance Species (ANS) Panels, and thanked those who worked to organize the meeting. They emphasized the importance of working together on shared issues, and the power of a shared message from the large geographic representation covered by the GLP, and the MRBP. Wakeman welcomed the group to the University of Wisconsin and Madison, WI.

Navarro called the meeting to order and reviewed the agenda. There was a round of introductions.

Building Consensus in the West
Joanne Grady, USFWS

Grady presented about "Building Consensus in the West," a multi-state approach to watercraft inspection and decontamination programs. This effort started in 2011, when western states noticed a flux of boats being moved, and concerns grew about the lack of associated oversight. Many people wanted the federal government to stop boats from moving out of contaminated lakes, so a partnership was established to communicate with agencies that write and enforce laws. In 2012, a workshop in Phoenix, AZ brought together AIS experts, legislators, and law enforcement to discuss the issue. The result was a 26-point action plan with the aim of addressing recreational boat movement as a pathway for spreading AIS. Grady emphasized the dual needs of protecting waters from AIS and not discouraging boaters. The long-term goal of the partnership is reciprocity among states regarding inspections and decontamination; an inspection conducted in one state would be recognized as sufficient, and duplicate inspections could be avoided. Currently there are no reciprocal agreements among states.

The National Sea Grant Law Center was instrumental in developing model legislative provisions that are applicable to all 50 states. Sixty-two percent of states have legal provisions addressing the trailed recreational watercraft vector. Weaknesses of western programs include the high expense, and individuals moving their boats at night or at the edges of the boating season may be able to pass through without inspections.

Phase two of the partnership is currently underway, and includes model legislation, regulations, and protocols. The western AIS coordinators have developed standards, such as the classification of waterbodies, containment and prevention protocols, inspection and decontamination protocols, trainings, and seals and receipts standardization. More information is available at the Sea Grant website: http://seagrant.oregonstate.edu/sites/default/files/invasive-species/building-consensus-denverii-workshop-summary.pdf

Montana received grant funds to sample waters for evidence of dreissenid mussels. Waters free from evidence of mussels for three years will be de-listed. The Pacific States Marine Fisheries Commission (PSMFC) is updating their Watercraft Inspection Training manual as well as their Uniform Minimum Protocols and Standards. The 100th Meridian Initiative Dry Time Estimator gives estimates of the dry-time needed after decontamination based on source location, humidity, and temperature. No agency is required to mandate these dry times in their states, but some western states may apply these dry times to boaters from out of state, possibly by impounding the boats. Many lakes will require decontamination. If a boater has made a good effort to clean their watercraft, the decontamination will be free. However, if the boat has not been previously cleaned, the owner will be billed for the decontamination. The ultimate goal is to develop a multi-state reciprocal approach to watercraft inspection and decontamination certification, and seals such that states accept seals from low-risk boats without additional decontamination. Colorado, New Mexico, and Wyoming completed a trial in 2014. This trial showed the importance of establishing standard protocols and regulations. The Federal Land Managers

Committee developed two action plan goals, including determining the responsibilities of federal agencies with regard to the movement of invasives on and off of federal lands, and establishing consistent regulations for federal agencies.

At the AIS Summit: Boat Design and Construction in the Consideration of AIS, AIS and decontamination experts met with boat manufactures from the American Boat and Yacht Council (ABYC). Boat manufacturers were unaware of some of the decontamination measures, including 140°F water being pumped through the boats' systems. Many lubricants and seals on boats are rated to 120°F. There are only a few known instances where decontamination efforts have caused damage to boats, and the manufacturers pledged to honor warrantees. The AIS community has been invited to present about inspection and decontamination at two large boat shows to be held later this year. Additionally, a new chapter is being developed for boat and trailer manuals that focuses on AIS and decontamination. The Mussel Mast'R ballast filter is an example of a new product that could reduce the effort required for some types of decontamination. Unfortunately, the federal government can neither endorse a particular product nor require anyone to accept a product. So, despite using this product, boaters may still need to undergo normal decontamination procedures at some locations. This emphasizes the need to maintain partnerships and support the industry leaders that set industry standards.

Next steps for Building Consensus in the West include improving manuals and online courses for inspectors, developing model regulations, conducting outreach and in-reach, building stronger partnerships with industry leaders, and hosting a summit in 2016 to monitor progress, expand the conversation further east, and gather more support.

Great Lakes Mississippi River Interbasin Study (GLMRIS) and Brandon Road Actions
Jeff Heath, United States Army Corps of Engineers (USACE)

Heath focused on a recent feasibility study to identify options and technologies to prevent the spread of AIS between the Mississippi River and Great Lakes basins. The goal is to prevent the two way transfer of species, mitigate adverse impact to waterway uses, and engage stakeholders along the 1500 miles shared by the Great Lakes and Mississippi River basins. Aquatic pathways outside of Chicago Area Waterways (CAWS) included 36 possible locations and 18 locations with likelihood for potential transfer, with the highest probability at an intermittent aquatic pathway at Eagle Marsh in Fort Wayne Indiana. Asian carp have been detected within 25 miles of this site. USACE is developing long term solutions for this location and the Indiana DNR has implemented an interim measure to prevent AIS transfer. The CAWS was a significant focus for this study because of the navigational use for commercial and recreational purposes, and its importance to the water supply and flood risk reduction. The CAWS is also the primary connection between the basins. The report presented a range of alternatives that included conceptual design, general mitigation requirements, and a range of cost estimates. However the report did not provide a ranking of plans, just a comparison to support decision making. Additional analysis is required before implementation but the plans were formulated by identifying connections, evaluating species, and assessing available controls. The report identified 39 AIS of concern and the risk of each crossing the basin divide. Risk was determined by the probability and consequences of each species; probability was based on pathway, arrival, transit, colonization and establishment factors; consequences were based on environmental, economic, and social factors. Each species was then rated as high, medium, or low risk for a specific pathway. For the species with the highest, available technologies were reviewed to determine their effectiveness for preventing transfer. Most of the technologies under consideration have only been tested in lab settings, resulting in questions about their application in a heavily used waterway. Examples of current technologies assessed were a GLMRIS lock, electric barrier with engineered channel, ANS treatment plant, screened flow gates, and a physical barrier. The applicability of these technologies to swimming, floating and hitchhiking species was considered. The alternative plans were divided into 5 categories; no new actions, nonstructural controls, structural control technologies, buffer zone, and hydrologic separation, with many of the alternatives using multiple methods.

The first alternative is sustained existing activities; this is a baseline alternative that includes the continued operation of electric barriers, interagency monitoring and response, and focused efforts on population control through fish harvesting, as well as the research and implementation of Asian carp controls. This alternative could be implemented immediately and would incur no new direct costs. The second alternative could also be implemented immediately and includes continued monitoring and non-structural controls, such as chemicals, public awareness, cleaning watercraft, inspection enforcement, and ballast water control. These controls are effective as complements to other alternatives and could be implemented at a cost of $69 million annually. The third alternative is flow bypass, which involves single, two-way control points at the basin divide with two AIS locks and water diversions through two treatment facilities, in addition to the creation of three storm water reservoirs to mitigate flood risk. This diversion is supplemented by a GLMRIS lock feature.

This alternative could be implemented in 25 years and would cost $15.5 billion. The fourth alternative is a CAWS buffer zone with multiple one-way control points. Inflow would be controlled at the Chicago lakefront and Brandon Road Lock and Dam (BRLD), and the majority of the CAWS flow regime would be preserved, with the CAWS serving as the buffer zone. This requires three ANS locks, treatment plants at the locks, and two reservoirs for flood control. Mitigation would be a significant part of this alternative with a large flood risk requiring reservoirs and conveyance tunnels. This alternative could be implemented in 10 years and costs $7.8 billion. The fifth alternative is lakefront hydrologic separation that would require water to be treated and pumped around 4 barriers in the CAWS. Because the water would be pumped around the barriers there would be significant mitigation issues, such as flood risk, water quality, and navigation. Until all the barriers are complete, there would be no significant reduction in risk. This option would take 25 years and $18.5 billion to implement. The sixth alternative is a mid-system hydrologic separation with two barriers and similar issues and risk reduction to lakefront hydrologic separation. Significant water quality issues related to stagnant water and sediment are possible. This option would take 25 years and would cost $15.5 billion. The seventh and eighth alternatives are both hybrid options. The seventh keeps the Cal-Sag open, and combines technology and barrier features. This option minimizes the impacts to users and allows phased implementation. The Chicago Sanitary Ship Canal (CSSC) would be closed, and ANS locks would be required to allow ships though. The timeline would be 25 years at a cost of $15.1 billion. The eighth alternative is to close the Cal-Sag and keep the CSSC open. This option would also include ANS locks, treatment systems, and reservoirs, and allow phased implementation. Significant flood and water quality issues would need to be addressed. The timeline would be 25 years at a cost of $8.3 billion. Additional considerations for these alternatives include water quality, flooding, navigation, recreation, the need for adaptive management as new AIS threaten the basins, and a shared responsibility for control.

A feasibility study at BRLD is also moving forward to compare the reduction of risk to estimated costs. BRLD was selected because it is a pinch point that would not require a reservoir for flood water control. This option would be very effective at reducing upstream spread because it has a lock that would effectively control both floating and swimming AIS, though the potential for hitchhiking AIS would need to be explored through another alternative. This proposal would minimize adverse impacts on water quality, flood control, navigation, and recreation. However questions remain about how to use these technologies in a lock or engineered channel. Additionally, these solutions only consider the one-way transfer of AIS. BRLD could be the proving grounds for an engineered channel and lock to determine a more specific efficiency ratio.

There was discussion about one-way control measures, since the original intent of control technologies was to prevent ANS from moving between both basins. The study on two-way technology will be complete in three years, but data will start to be released in 1-2 years. Currently hydrologic modeling is taking place and researchers are looking for pockets where there are vulnerabilities in the current technology.

Washington Update: NISA Reauthorization and AIS Legislation
Allegra Cangelosi, Northeast-Midwest Institute

Cangelosi provided a review of historical AIS legislation. The Great Lakes Task Force led the effort to gain enactment of the Non-indigenous Aquatic Nuisance Prevention and Control Act in 1990, and the National Invasive Species Act (NISA), which reauthorized it in 1996. Attempts in 2002 and 2007 to reauthorize NISA were unsuccessful. AIS affect transportation, use of water, environmental and human health, and other issues, so multiple committees have a stake in AIS legislation which makes the reauthorization process cumbersome.

The 2007 version, called the National Aquatic Invasive Species Act (NAISA), included commercial ship regulation by the United States Coast Guard (USCG), but also proposed that United States Environmental Protection Agency (EPA) should have some jurisdiction over AIS standard setting. The NAISA legislation stalled when the question of Clean Water Act (CWA) jurisdiction was debated in court; proponents of CWA jurisdiction asserted that NAISA legislation could undermine their case. However, NAISA also covered management of other vectors, like live food, and would have re-authorized the regional panels, and created a screening process (both white and black lists) for species of interest at the US borders. However, dissent regarding language about intentional introduction of species caused controversy in the Fisheries Committee. The question of what would be the consequences to individual states for not acting on EDRR issues arose, along with the role of federal government. If the states were unwilling, or unable, to react it was felt that actions would not truly be rapid responses. In addition, the issue of different parts of the country having different AIS of concern became a challenge.

Currently the Vessel Incidental Discharge Act (VIDA) is under consideration. It was motivated by vessel owners concerned about being regulated by two separate federal programs (NISA and the CWA), as well as individual states. This legislation would place sole regulatory jurisdiction in the hands of the USCG, removing jurisdiction from the CWA and the states. As a practical matter, under the current complex regulatory regime involving many sources of regulations, the regulatory agencies at the state and federal level are conforming their regulatory systems to avoid conflicts. Still, ship owners are concerned about the possibility of future conflicts without a formal unified system in place.

Decisions about standards and environmental protection are the sole responsibility of the Coast Guard, though EPA may advise. States could nominate a state standard for national acceptance, but could not implement their own standards if they deemed it necessary to protect their waters. There are many Mississippi River basin co-sponsors of this legislation, although the congressional leads are not from the Mississippi or Great Lakes basins.

The Defending our Great Lakes Act, which focuses on the transfer of AIS from the Mississippi River to the Great Lakes through CAWS is also being considered this year. This is a one-way view of the problem that focuses on species indentified in GLMRS, including Asian Carp. Other potential legislation is the Great Lakes Restoration Initiative (GLRI), the Great Lakes Ecological and Economic Protection Act of 2015, and the Great Lakes and Fresh Water Algal Bloom Information Act of 2015. Overall, appropriations are critical for action to take place through any form of legislation.

Cangelosi noted that appropriations around regional panels have remained static while the number of panels and the issues they address have grown. The original authorization was $300,000 annually for one panel, which is now for six panels. There is also $1 million annually for state management plans that is now divided among 42 states.

Washington Update: Invasive Species Caucus
Scott Cameron, Reduce Risks from Invasive Species Coalition

Cameron provided two hand-outs that included the current Congressional Invasive Species Caucus (ISC) members and a press release about a proposed Asian Carp bill. In an effort to promote more private-sector and environmental engagement in AIS issues at the federal level, Cameron established the Reduce Risks from Invasive Species Coalition (RRISC). The group's primary target for educational messaging is Congressional members, with a goal of promoting awareness of AIS issues and cost-effective strategies to reduce risks.

The ISC was founded in June 2013, and currently has about 30 members. Both founding members, Congressman Benishek and Congressman Thompson, were worried about aquatic weeds and recreational use in their own lives and districts. Because Congressional staff are extremely busy, much of the research and information on specific issues needs to come from the outside; the RRISC is providing the necessary forum for educating congressional staff on AIS issues.

The number of members in the caucus is important for getting the attention of leadership. Currently, the ISC does not have many members from Great Lakes or Mississippi River basin states. When encouraging legislators to join caucuses, the level of interest generated from the home state is very significant. Letters from state fish and game leadership to members of Congress are often persuasive. There is bipartisan support on invasive species issues and House and Senate party alignment makes the passage of legislation more likely. Unfortunately, multiple committees often have jurisdiction over a topic, which can slow down legislation. With this in mind, it is easier to seek narrow fixes, rather than broad legislation, since narrow topics are more likely to be only within the jurisdiction of one committee. Additionally, legislation that is short and easy to understand is much easier to move than an all-inclusive, complicated piece of legislation. Currently there is no Senate counterpart to the ISC, although there are individual senators who have shown interest. Cameron noted that GLP and MRBP members were the best entities to encourage their congressional delegations to join the ISC by sending a letter, calling or emailing. A bipartisan and geographically diverse group is very compelling to Congressional leadership.

During a discussion about funding needs, the idea of instituting a fee or tax at the federal or state level that would target user groups, such as one associated with the purchase of aquarium plants, was brought up. Currently, there is not much concern that the Panel funding is from an expired authorization. The presumption is that an annual appropriation for activities under the act serves as approval. Operating programs continuing to exist with expired authorizations is common.

Grass Carp Update
Moderator: Greg Conover, MRBP Coordinator, USFWS

Conover introduced the session and speakers.

Overview of Mississippi Interstate Cooperative Resource Association (MICRA) report and recommendations
Steve Shults, Illinois DNR

Shults presented an overview of the MICRA report from 2012-2014 with recommendations on the use of grass carp in the United States. The project objectives were to summarize legal use of diploid introductions in the US, summarize the practices of triploid production, analyze the effectiveness of certification of triploids, summarize shipping practices, summarize inspection and enforcement, compile state regulations, identify potential contamination, and recommend actions for risk reduction. As part of this process, there was a recommendation for an independent review of grass carp regulations. To ensure the adequate representation of stakeholders, the steering committee was co-chaired by the MRBP executive committee, state AIS coordinators, USFWS National Triploid Grass Carp Inspection and Certification Program (NTGCICP) inspectors and administrators, the National Association of State Aquaculture Coordinators, and commercial producers and distributors of triploid Grass Carp.

HDR, a company subcontracted by MICRA, conducted interviews and facility inspections, and reviewed regulations, inspection procedures, and triploid certification records. A full copy of the results can be found on the MICRA website. The review highlights that some states allow diploid grass carp, some allow triploid grass carp, and some do not allow any grass carp. There are 393 producers and distributors overall, with producers primarily located in states that have regulations for triploids. In the last ten years, about 5 million grass carp were stocked, primarily in lakes and ponds, with another significant number in private waters. Each of the seven states that allow the stocking of diploids border at least two other states that only allow triploids. The most important part of a national grass carp policy strategy is the development of consistent regulations to remove diploid grass carp from the commercial supply chain.

MICRA developed eight recommendations for a national policy strategy. The first recommendation is to remove the diploids from the supply chain, reduce the number of facilities that have those diploids, and as a result reduce the risk of their escape. This recommendation requires that all states participate, and it cannot completely eliminate the possession of diploids. Diploids are needed to produce triploids, and locations where they have already been stocked would need to be grandfathered in. The second recommendation is to create minimum standards for states that allow triploid production to address the exemptions created in the first recommendation. The third recommendation addresses the consistency of the regulations. Many states allow the import of certified triploids but often do not specify the kind of certification required. This recommendation is to adopt the USFWS certification or one that is similar. The fourth recommendation is to increase random inspections and enforcement in states that allow legal triploid importation. The NTGCICP does not have enforcement authority and can only issue a Ploidy Release Authorization, so the inspection authority falls to the states. The recommendation would ensure that diploids are not included in the triploid supply chains, but would require expanded legislation and increased fees. The fifth recommendation is to improve regulations for the live fish shipping industry, requiring that no diploids are in the same shipment with triploids. This would also require additional authorization and fees. The sixth recommendation is to modify the USFWS NTGCICP to engage the states and national grass carp distributors to prevent shipments from being contaminated. This recommendation also addresses the exemption for aquaculture use in first recommendation by requiring that all triploids be purchased from producers participating in NTGCICP. The seventh recommendation is that USFWS should work with states, producers, and other partners to develop reliable field test for rapid determination of ploidy for quality control and random inspections to support enforcement programs. The eighth recommendation is to increase information and outreach about NTGCICP, grass carp regulations, and best management practices. Each state regulates species and shipments differently, which results in private individuals relying on shippers for information. Land grant and Sea Grant Extension programs are a possibility for helping to facilitate this outreach.

After a question, it was noted that MICRA has not developed an official position on the use of diploid carp in aquaculture. It was also noted that the USFWS may need congressional authorization for expanded authority for some of the recommendations, particularly related to enforcement; however, this is a small item to add to an existing program rather than the development of a new program. Currently, the only Congressional authority for the USFWS program is for the collection of fees, so expanding the scope of the Program, as recommended by MICRA, will be a question the USFWS

leadership must consider. Finally, it was noted that the MICRA report did not address the economic value of the grass carp industry as this was outside the scope of the project.

Southern Illinois University (SIU) GLRI Project
Duane Chapman, MPBP Research and Risk Assessment Committee Chair, US Geological Survey (USGS)

Grass carp were captured in small numbers in the Great Lakes soon after 1980, however, evidence of reproduction was only found recently, and the fish captured were thought to be triploid escapees. Now, researchers have the ability to use fish eyes to determine the polidy of a fish without getting a heparinized blood sample from a live fish, so it has been possible to check. Recently, six fish were captured in the Sandusky basin, and were found to be diploids (only four were used in the JGLR publication, because the other two were obtained later, although captured earlier). Microchemistry shows that the six fish lived their entire lives in the Sandusky basin, indicating reproduction in the Great Lakes basin. None of the six fish had any shared parentage, meaning there were at least twelve diploids spawning in 2011. Since then, researchers have been working with Dr. Greg Whitledge, and have captured fish in Michigan, Illinois, and Indiana. Less than half of the fish captured in Lake Erie were diploid.

There are consistently different carbon and oxygen signatures for aquaculture and wild fish. According to this data, it appears that the diploid fish found in Lake Erie are not aquaculture escapees. The fish found in Sandusky were aged at more than one year old, making them 2011 spawn. Additional data showed that none of the diploid fish other than the six fish captured in the Sandusky were spawned in the Maumee or the Sandusky rivers, though it is unclear where they were spawned. In the Lake Michigan basin, only one of the diploids captured was the result of wild reproduction; the others were likely produced in aquaculture and escaped. The one Lake Michigan basin grass carp that was the result of wild reproduction was captured in the CAWS was more than 20 years old, and may have come through before the electric barrier was installed in the CAWS.

Modeling of Asian carp recruitment that was developed before grass carp reproduction was found in the Sandusky basin accurately predicted that recruitment. The Sandusky River appears to be an ideal river for egg transportation in some years, but not every year, depending on timing of hydrograph and temperature. After reviewing all of the rivers in the Great Lakes basin, the model indicates the Maumee River is a borderline recruitment site, despite previous assumptions that it would be ideal. None of the grass carp captured to date were spawned in the Maumee River

A question was raised about the locations of grass carp captures. Chapman noted that a small number have been captured in all the Great Lakes, but the majority were captured in Lake Erie or its tributaries and in waters connected to southern Lake Michigan. It was also noted that at least two small hatcheries that have produced diploid grass carp outside the mid-south area, where most fish are produced, might not show the same micro-chemical signal as the other production facilities. It might be important to determine the micro-chemistry from these sites to ensure the diploids did not originate there.

Department of Fisheries and Oceans (DFO) Binational Risk Assessment
Greg Conover, MICRA/MRBP Coordinator

A binational risk assessment was initiated in 2014, by Canada's DFO Asian Carp Program, coordinated by the Great Lakes Fishery Commission (GLFC), endorsed by the Asian Carp Regional Coordinating Committee, and in partnership with the USGS and USFWS. The purpose is to provide a binational, science-based assessment of the current level of risk from grass carp to the Great Lakes, and share that information to help inform decisions about management and preventing introductions. The intention is to use the results to evaluate the current state of knowledge, and provide sound information to managers and decision makers based on the best research available. The process involves determining the probability of introduction, combined with the magnitude of ecological consequences, to assess the overall risk. The probability of introduction relies upon arrival, survival, establishment, and spread of the species. The deliverables from the project include government reports, advisory documents such as a peer-reviewed Risk Assessment Document and Science Advisory report, and primary publications including fact sheets. The results of the ecological risk assessment will help to focus prevention efforts at high risk entry points, indentify vulnerable areas for early detection, inform rapid response, and indentify key control points. The risk assessment will be sent out for scientific peer review in April 2015, with a meeting for reviewers to be held in June 2015, and a final release for the document in September 2015.

A question was raised about the USFWS's ability to list grass carp as injurious under the Lacey Act if the results show that they are a significant risk. Conover indicated that the results would be used by USFWS to consider the next steps within their agency. Conover added that from MICRA's perspective it would be better for the states to work together to prohibit diploids rather than having grass carp listed by the USFWS as Injurious Wildlife under the Lacey Act. The majority of states choose to allow the use of grass carp and state regulations to prohibit diploid grass carp would be more effective for the continued commercial use of triploid grass carp than a federal Lacey Act listing would be. It was also noted that generally reservoirs have not been studied for recruitment, but recent research shows that rivers do not require much flow for recruitment.

Great Lakes Surveillance Efforts and GLP Priorities
Lindsay Chadderton, TNC, GLP Research Coordination Committee Chair

Most of the grass carp captured in the Great Lakes basin in the last few years have been in lower Lake Michigan and Lake Erie. eDNA evidence has been found in the CAWS, indicating grass carp may be more common than previously thought. A risk analysis of climate suitability suggests that the lower Great Lakes are highly suitable for grass carp, and that highly-productive coastal fringe habitats and coastal wetlands are especially at risk. Grass carp could also cause significant negative impacts on amphibians, invertebrates, aquatic plants, pH, and water chemistry. Evidence shows recruitment in the system and that grass carp presence is not just precipitated by releases. The GLP has been working on a set of recommendations, and the Council of Great Lakes Governors listed grass carp as a "least wanted" species. The public sale of diploids has been prohibited across the basin, but sales of triploids are allowed in some places with a permit.

From a policy perspective, a national grass carp program should be strengthened, and the GLP wants to ensure that regulations are synchronized in terms of how triploids are certified, shipped, and stocked; ensure there are routine random inspections to encourage compliance; and improve overall understanding of the current state of shipping and stocking. From a management perspective it is important to prevent further introductions, and understand the prevalence, distribution, and suitability of recruitment of grass carp in the basin. From a research perspective, it is important to quantify past stocking efforts to understand if distribution patterns reflect stocking or other factors; determine the extent, origin, and nature of any recruitment to maximize the information returned from grass carp that are caught; and age fish through microchemistry to determine how are they reproducing and their life history. Additionally, movement studies are important to determine the vulnerability of fish in specific locations and to better understand pathways of legal and illegal importation of diploid grass carp. There is also a desire to maximize coordination among research and agency groups to develop guidance documents.

After a question, it was noted that, while it is a legitimate concern, current data does not indicate that grass carp affect resources for migratory waterfowl on a widespread basis. Chadderton also explained that previous Canadian studies of tributaries focused on length, but a new study based on a more complete model will be ready in the near future. Illinois is incentivizing commercial fishers catching black carp with $100 per submitted carp. The MI DNR has a reimbursement program for grass carp caught through commercial fishing in Lake Erie. This program has resulted in 22 fish over the past few years, and the DNR is looking at moving forward with a telemetry study and micro-chemistry analysis to assist in answering some priority questions. In the future, micro-chemistry will need to be determined for appropriate tributaries that might be spawning habitat.

Addressing Organisms in Trade Invasion Pathways
Moderator: Tim Campbell, UW-Extension / Wisconsin DNR

Campbell introduced the session and emphasized the different but cohesive nature of the three presentations.

Biological Supply and Freshwater Invasive Species: A Crayfish Case Study from the Pacific Northwest
Eric Larson, Shedd Aquarium

A recent review paper published by Ruben Keller and David Lodge focused on organisms in trade in the Great Lakes basin, and showed that often, organisms were not labeled or were inaccurately labeled. Larson's work centered on organisms potentially introduced through biological supply, and reviewed the extent of the problem and the possible solutions, such as using native species.

In 2001, red swamp crayfish were found in Oregon; between 2007 and 2009, 100 lakes were surveyed in the Puget Sound lowlands and red swamp crayfish were found in 11, along with several other nonnative crayfish. Red swamp crayfish is a successful global invader as a result of spread from the pet trade. During the surveys of Puget Sound, rusty crayfish were also found. This was the first record of rusty crayfish in the West, however, Larson believes they were previously misidentified. Most of the possible pathways for invasion, such as bait shops, pet trade, or live seafood trade, appeared unlikely. It became apparent that schools were using crayfish as part of their curriculum. Many teachers believed they were native crayfish because the biological supply companies were based in the state. It also became apparent that many teachers were releasing the crayfish at the end of the year. Concurrently, schools were asked to provide information about releases through a Sea Grant project. This information showed that the releases were primarily happening in grades 2, 4, and 6 as part of live scientific observation. About 1/3 of teachers indicated they release animals, and about 60% of schools were using live animals, with some using as many as 600 per semester. 40% of teachers said they would not euthanize animals after use under any circumstances. Some animals were adopted by students at the end of the school year and the parents signed waivers agreeing not to release the animals. In larger, wealthier school districts, some of the organisms were being re-used through "science distribution centers" that are able to keep organisms over the summer. Rural or poor school districts were unable to support a distribution center, and were more likely to rely on direct shipments without oversight.

Although there are concerns with teachers and students releasing these organisms, the states and school districts are responsible for choosing the science curricula. Many curricula require these specific species which are easily obtained from biological supply companies. This resulted in a regulatory impasse in the state of Washington, it was noted that the organisms should not be shipped or possessed, but the schools were bound by the current curriculum that required them. To solve this, the use of a native crayfish was considered instead. The signal crayfish is the only crayfish native to Washington; however the species has a lot of genetic diversity and is not native everywhere in the Northwest. A pilot program was initiated to assess the ability to use the signal crayfish in classrooms. It was possible to acquire native signal crayfish through commercial harvesters who would not have normally been interested in harvesting the smaller crayfish needed for the classroom. The signal crayfish were able to survive shipping only if they were packaged in water, which increased the shipping cost and handling time. Using a typical classroom set up, without aeration and filtration, about 34% of the native crayfish survived over a 45 day period, compared with 57% of the rusty crayfish. The teachers were unhappy with the high morbidity, and that the crayfish were only available during certain times of the year.

Overall, commercial harvesters are providing invasive organisms to biological supply companies, science distribution centers, or schools, which then provide them to teachers and students, who might release them to local water bodies. At all levels of interaction, there are opportunities to provide more information to prevent introductions. This could include more information in curricula about invasive species, asking biological supply companies to provide more information, and discouraging the practice of annually releasing classroom animals. Oregon Sea Grant worked to develop an AIS toolkit for teachers and improve outreach programs.

Assessing the Internet trade of AIS for the Great Lakes
Erika Jensen, Great Lakes Commission

This project was part of a 2012 GLRI grant to review the internet trade of AIS. The Internet had previously been identified as a pathway for organisms in trade, but because it is large, changing, and hard to track, it had not previously been well studied. A Minnesota study identified several plants and species of concern being sold or contaminating other stock that was sold, but the issue had not yet been viewed broadly or comprehensively. Many questions remained about AIS on the internet, including who is selling them, what is for sale, where are the websites and physical locations, how many organisms are sold, do websites include information about invasive species or regulations? The objective of the project was to develop a software system to automate searching the web for species of concern to make the process more efficient, answer the questions posed previously, and make tools available to stakeholders for them to gather information for educational or enforcement purposes regarding this pathway.

This project focuses on Great Lakes AIS but the tool is applicable to other regions. The species being searched for include those covered under US, Canadian, state, and provincial regulations; watch lists, including GLMRIS, the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS), and the Council of Great Lakes Governor's "least wanted' list; risk assessments; and other species identified by AIS experts. The final list includes 166 species, and an outside contractor was hired to develop the software system. The system, called the Great Lakes Detector of Invasive Aquatics in

Trade (GLDIATR), was developed and has been running for several months. The GLC will continue to maintain GLDIATR, gather results, and refine the software's algorithm. Jensen is currently working on outreach to stakeholders to communicate the findings to date, as well as outreach to the sellers.

Additional analysis of data gathered over a 30 day period was conducted. During this time, 58 species from the original list of 166 were found, including 40 plants, 11 fish and 7 other types of organisms (mollusks, crustaceans, etc). Of the species found, 49 are regulated within the Great Lakes basin. All of the top 15 species found for sale are plants, with yellow flag iris being the most common. Some of the species found for sale are actively being managed in Great Lakes states such as Brazilian elodea in Indiana or parrot feather in Michigan. 209 unique websites were found selling at least one species, with eBay and Amazon hosting the most sale pages. 133 of the sites selling these species will ship to the Great Lakes region, and 62% of sellers were located in the U.S. Some sites have shipping restrictions, but 59% of sites indicate they will ship to the Great Lakes region. Ohio, Florida, and California were the top three physical locations of sellers, with Ohio and New York as the top two in the Great Lakes region. Only one website had the correct shipping restrictions listed based on state regulations. Other sites did list shipping restrictions, but they were not accurate.

GLDIATR has confirmed that internet trade of species is a problem, and there are both domestic and international sources of organisms. This is a good warning tool to look for emerging species and confirm whether or not they are in trade. The GLC will continue to review findings, conduct outreach to sellers, work with partners in the Great Lakes region to take action where there are potential violations, improve GLDIATR, and use the finding to direct future work.

After questions, several members suggested states may be willing to add in requests on their state GLRI funding applications to help support GLDIATR for the next several years, because they feel it is a useful tool for their staff. Jensen noted that she has been working to share information with state stakeholders, including law enforcement staff, and that appropriate law enforcement contacts will be notified prior to GLC sending out outreach communications to sellers. It was also noted that GLDIATR can be used for a variety of purposes, including law enforcement, research, risk assessment, outreach, and others. Additionally the GLDIATR system was developed so other users could use the system on their own hardware and change the species list to suit their needs. The current system is focused on Great Lakes species, but the technology can be adapted by other regions. Additionally, the system accounts for synonyms and misspellings of species names, but cannot account for blatant misidentification by sellers.

Making Habitattitude Work for Wisconsin
Tim Campbell, UW-Extension / Wisconsin DNR

Campbell explained the continuum of pet release and that there are many things that could happen before the release of a pet. Often, a consumer thinks about getting a pet, potentially does research on that pet, visits the pet store, and gets a pet. Habitattitude could impact that purchase, and pre-consumer rules and regulations can keep unsuitable pets from the consumer in the first place. There are a variety of reasons that people cannot care for pets once they have them, and preventing pet release requires a lot more than just giving people recommendations about not releasing them; capacity must be built throughout the whole system. Campbell hosted a workshop for humane societies, zoos, pet shop owners and anyone that might play a part in pet amnesty. He found that many pet stores are unable to take unwanted pets because they do not have the space, money or expertise to care for the pet. In addition, many pet store owners feel that unwanted pets are not their responsibility. Larger pet stores do not usually sell prohibited species, and do not sell species that they think will come back to the store or be released, and they do not feel they can take in pets that come from other sources. Smaller stores often have well trained staff that can be better at matching customers with pets. The Habitattitude program works to provide messaging and simple steps to prevent pet release, such as ensuring that a consumer chooses the right pet in the first place.

There are few alternatives for release, however Kingdom Animalia Exotic Animal Rescue (KAEAR) in Green Bay is one example. This organization has a network of people to adopt pets out to and the ability to hold them for some amount of time. Campbell and KAEAR hosted several successful pet amnesty days that took in unwanted pets and also served the larger function of garnering media interest and raising awareness about the issue.

Overall, Habitattitude has a place in pet stores to help customers select the right pet and initiate conversations about how to take care of those pets. However, issues remain in the system because euthanasia is unacceptable to many pet owners and the capacity for amnesty might not exist everywhere. To solve these problems, pet return networks could be

developed or hobbyist clubs or humane societies could be engaged to build capacity. Also, pet store employee training is necessary to assess the capability of a consumer.

Bob Wilshire at the Invasive Species Network in Montana commented that he has been working with small pet stores in Montana to remove hurdles for pet shops with small amounts of funding. Another comment was made that large pet stores are often unable to accept returns, particularly for specialty fish, because they are interested in more mainstream merchandise and cannot take care of specialty items. There was a question about the ability of small stores to re-home animals more easily but Campbell noted that small stores are usually at capacity and the general public should not be encouraged to burden them.

Action Items from Joint Committee Breakout Sessions

Information/Education/Outreach

- GLP and MRBP will individually pull regional AIS/Recreational Water User surveys together and then convene to decide if the a single suite of standardized questions should be developed and/or the issue should be brought up to the ANSTF to share with other panels.
- Cook-Hildreth will follow up on the 1Mississippi campaign and report back to the committees. She will look for opportunities to include messaging on AIS.
- GLP will share the Index of Outreach Products with MRBP and maintain an updated version. MRBP will continue internal discussions and determine potential steps forward.
- MRBP will continue planning a workshop for regional Attorneys General to learn about AIS issues, and will coordinate with D. Jensen to consider hosting the workshop in conjunction with the Midwest Invasive Species Conference (October 2016).

Research Coordination and Risk Assessment

- Current research needs include:
    - improved Asian carp harvest tools
    - how to decontaminate boats without damaging them
    - improved uses for eDNA
- GLP and MRBP will refine the Research Needs document and return it to the members of both panels. All members are invited to provide input. The committees will then share a short-list of research needs based on that feedback.
- GLP and MRBP will continue working on individual projects and will coordinate between panels as appropriate.

Policy Coordination/Prevention and Control

- GLP and MRBP will individually compile existing best management practices and protocols regarding voluntary watercraft decontamination actions and share between panels.
- Interested panel members will participate in discussions organized by GLC and Naturesource Communications to identify what is needed regarding NISA reauthorization. Members will also promote participation in the Congressional Invasive Species Caucus among their own legislators.
- MRBP will follow up on the issue of needing to be more vocal and active in discussions regarding two-way ANS transfer between the basins.
- Pending approval of the GLP grass carp priorities document, GLP and MRBP will submit a joint letter to the ANSTF regarding the four shared recommendations in the MICRA report and GLP document.

Great Lakes Panel Meeting - Wednesday, April 15, 2015

Call to Order

John Navarro, Ohio Department of Natural Resources (DNR), Great Lakes Panel (GLP) Chair

Navarro called the meeting to order, welcomed participants, and briefly reviewed the topics covered during the joint meeting the previous day. He thanked E. Jensen and Great Lakes Commission (GLC) for supporting the meetings, and HDR for sponsoring the joint panel reception. There was a round of introductions and a quorum was confirmed. Navarro reviewed the agenda, which was approved with no changes.

GLP Business

John Navarro, Ohio DNR, GLP Chair
Erika Jensen, GLP Coordinator

The November 2014 meeting summary was reviewed and approved with no changes.

ACTION ITEM: Staff will update and post the final November 2014 meeting summary to the GLP website.

Plans were discussed for the fall 2015 meeting to be held in Ann Arbor, MI. Members are welcome to notify E. Jensen of date conflicts in November. E. Jensen proposed the GLP host the Aquatic Nuisance Species Task Force (ANSTF) for the 2016 spring meeting in Chicago. It was noted that the panels have never all met together, but the day before the fall ANSTF meeting, the panel coordinators and principals meet. Members agreed there should be more sharing across the regions. While the international conference on aquatic invasive species (AIS) helps serve that function, the panels seemed more collaborative when new panels were being created. The panels could look into establishing liaison positions among themselves to help facilitate communication and sharing, and there could be a recommendation to the ANSTF to host an all-panel meeting or formalize liaison positions.

E. Jensen reviewed key action items from the November meeting including:

GLP Executive Committee and Staff

- Information and Materials: Send the link to Great Lakes BIOTIC Symposium website, the link to the available Ecological Risk Screening (ESR) summaries on the U.S. Fish and Wildlife Service (FWS) website, the binational response exercise after action report, information on use of Sport Fish and Wildlife Restorations funds for AIS related activities, The Aquatic Nuisance Species Task Force (ANSTF) letter to United States Geological Survey (USGS) on the Nonindigenous (NAS) Database, and information on the U.S. Army Corps of Engineers (USACE) scope of work for Brandon Road. Update and post the final April 2014 meeting summary to the GLP website. *Complete*
- Grass Carp Priorities and Recommendations: Integrate revisions and send a revised version to the full GLP for review and approval. *This document was sent out with a 10 day approval period, once comments are addressed, it will be complete.*
- Meetings: Plan joint meeting with the Mississippi River Basin Panel (MRBP) for April 14-16, 2015 in Chicago. *The meeting location was changed to Madison; complete.*
- GLP Meeting Format: Assess possible changes in the GLP meeting format or methods of doing business, based on GLP member input regarding current strengths and weaknesses of GLP operations. Develop a survey or other mechanism for GLP member input. *Ongoing; the executive committee is still considering options for these changes. The Policy and Research Committees met together at the spring 2015 meeting.*

Great Lakes Panel Members

- Provide final review and input for Information/Education Committee inventory document. *Complete*
- Provide input to aquatic nuisance species (ANS) control technology matrix to inform discussions on Chicago Area Waterway System (CAWS)/Great Lakes Mississippi River Inter-basin Study (GLMRIS). *Complete*
- Remove references to the national ANS hotline on websites, outreach materials, and/or take other actions as needed, because the hotline will soon be out of service. *Ongoing*
- Provide comments regarding the next steps for the USACE work at the Brandon Rd. during the Public Scoping Comment period. *Complete*

Information/Education Committee

- Distribute the following information/materials: YouTube link from Matt Smith focusing on waterfowl hunter best practices for reducing the spread of AIS, link from Greg Hitzroth about new Canadian Asian carp website, information on TakeAim.org, and the executive summary for the Kawishiwi survey. *Complete.*
- Committee members are invited to review the outreach inventory. *Ongoing*
- Committee members should send their input on the GLAI booklet. *Ongoing*
- Committee members should send their comments regarding the Priorities Document. *Ongoing*
- Convene a committee conference call to discuss next steps on the outreach inventory, the GLAI booklet and the priorities document. *Partially complete*

Policy Coordination Committee

- Consider a letter to ANSTF Co-Chairs on what next steps should be considered to address interbasin transfer of AIS based on ANS control technology matrix. *Not complete, discussed in committee*
- Incorporate revisions to Grass Carp Priorities Document as discussed with the committee at Nov. 19 meeting. *Complete*
- Consider a joint recommendation on grass from the GLP and MRBP as a possible outcome from the joint spring meeting. *In progress*
- Hold a conference call/webinar for committee members and other interested parties to discuss reauthorization of the National Invasive Species Act. *Complete with additional action needed*
- Request a briefing from the Council of Great Lakes Governor's (CGLG) AIS Task Force on their regulatory analysis once it is complete. *Not complete, discussed in committee*
- Request USACE briefing on Brandon Road announcement at spring GLP meeting. *Complete*

Research Coordination Committee

- Grass Carp Priorities Document. *Complete, being finalized*
- Research Priorities Document. *Ongoing*
- Priority Species List. *Ongoing*
- Schedule two hour quarterly calls/webinars with the committee. *Ongoing; one webinar was held following the fall 2014 meeting*

Invasive Crayfish Detection, Response and Management

Moderator: Sarah LeSage, Michigan Department of Natural Resources (DNR)

Rusty crayfish in Sparkling Lake

Gretchen Hansen, University of Wisconsin (UW) – Madison, Center for Limnology

Sparkling Lake, located in northern Wisconsin, is 150 acres, 60 feet deep in the middle, and mostly sandy. It is part of the UW long term ecological research network (LTER), which consists of seven lakes that have been monitored since 1981 for fish communities, water chemistry, and other factors. Rusty crayfish invaded Sparkling Lake sometime before 1981, and the removal project began in 2001. The initial removal program consisted of intensive trapping with baited traps and a change in fishing regulations to increase the number of crayfish predators in the system. Trapping removal ended in 2008, but the fishing regulations remained in place until 2014.

The goals of this project were to determine if the rusty crayfish populations could be reduced, if the negative impacts on aquatic plants were reversible, and if the balance between fish and rusty crayfish could be modified to a point where the fish control the rusty crayfish population. Researchers intensively trapped from 2001 until 2008, by pulling in 100-300 traps per day, resulting in 1,300-15,000 trap days per year. This effort resulted in the removal of 91,930 crayfish, which reduced the population by 99%. The removal also increased the native population of northern crayfish by 100 times. Currently, more native crayfish are being caught than rusty crayfish. The results indicate there is not a significant re-invasion of rusty crayfish, and removal is possible. However, the removal requires significant effort - with two full-time employees pulling traps every day in a small lake.

One primary question of the study was regarding ecosystem response after crayfish numbers were reduced. Rusty crayfish severely reduce macrophyte cover in lakes, which negatively impacts fish and benthic invertebrates. In this study, as rusty crayfish populations decreased, the percent of macrophyte cover increased dramatically, especially in deeper water. Sunfish (*Lepomis spp.*) populations increased throughout the removal by several orders of magnitude. Other fish

species, such as smallmouth bass and rock bass, did not see a change, though no change was expected. The invertebrate population was impacted by rusty crayfish feeding and habitat destruction, but their response to rusty crayfish removal was complicated. In near-shore cobble habitat, mayflies decreased while snails increased. In soft macrophyte habitat, snails showed a mixed response, and dragonfly and scud populations decreased. The decline in abundance was surprising, because rusty crayfish eat invertebrates, and many lab studies associate higher populations of rusty crayfish with a decrease in invertebrate populations. However, the observed results were attributed to changes in fish consumption; bass eat a lot of crayfish, so as the crayfish populations declined, the bass began eating more invertebrates. Overall, the negative effects of rusty crayfish appear reversible, but unexpected results appeared, due to changes in fish consumption.

One confounding factor of this study was changing water levels. During the study period, water levels dropped to the lowest levels ever observed. Rusty crayfish use cobble habitat in shallow water, and as lake levels dropped more cobble was left dry and unusable. Crayfish, especially juveniles, depend on cobble for refuge from predators, so decreasing water levels additionally controlled rusty crayfish by decreasing the number of surviving juveniles. It was hypothesized that there are alternative stable states for rusty crayfish populations that are heavily influenced by water levels, sunfish populations, and available cobble.

Overall it appears possible to reduce rusty crayfish populations, but many ecosystem results never recover and there may be some unexpected responses. Drought may provide an opportunity for control. Possibilities for future research are to determine a population level than can be maintained and predict how long it will last.

A question was raised about the ability to extrapolate a lower trapping rate with a potentially longer timeframe. Hansen indicated that the decline in the population was strongest in the first few years but, this study continued intensively trapping afterwards. It is likely that a lower level of effort is possible, but it may depend on the amount of cobble habitat available. A question was raised about the hypothesis that predatory fish could control populations and how that accounted for the initial invasion. Hansen stated that during the initial invasion it was possible that there were fewer sunfish, the water levels were high, and there was a lot of refuge for juvenile crayfish. A question was raised about the effectiveness of the different control techniques. Hansen indicated that trapping only influences adult populations but is necessary to reduce adult populations and therefore reduce production of juveniles. However, fish predation removed more biomass and was more effective at removing juveniles.

<u>An Integrated Pest Management Approach to Contain, Control, and Potentially Eradicate Red Swamp Crayfish</u>
Heidi Bunk, Wisconsin DNR

Red Swamp Crayfish (RSC) are adaptable to different habitats, reproduce several times in a summer, outcompete many native fish, burrow far underground, and quickly reach a size that prevents fish from controlling them. In August 2009, “giant red lobsters” were reported in Germantown, WI. RSC were found in a six-acre pond, a nearby police pond, and a flooded wetland between the two. Initially a containment fence was installed to block the inlets and outlets but the crayfish were able to dig under it. UW-Madison also installed 150 traps which caught over 2,000 crayfish in two months. The DNR investigated the use of biocides, but because of longer permit times on other biocides, they used an application of bleach at 50 parts per million in November 2009, at the six-acre pond. The treatment focused on burrows and resulted in many dead crayfish. However, 120 crayfish were caught the following spring. As a result of this infestation and treatment, reported sightings of RSC increased. While most were of white river crayfish, one population of RSC was found in San Peorio Park in Kenosha that was a close to the Pike River and Lake Michigan. The DNR began trapping RSC and conducted a spring treatment with bleach. Bleach was somewhat effective, but did not kill all the crayfish. The preferred insecticide, pyronol, is not labeled for use in standing water, so the DNR worked to get an emergency exemption. Pyronol has short term effects and biodegrades quickly, so bioassay work and avoidance tests were used to determine the concentrations necessary for control. It was determined that 25-50 micrograms per liter was sufficient to kill RSC, RSC did not avoid treated areas, and when they encountered treated areas RSC were dead within 15 minutes. In August 2010, San Peorio Park pond was drawn down and two rounds of shoreline treatment were conducted. A September excavation of burrows along the shoreline revealed live RSC. Overall, bleach, pyronyl, and trapping are good tools, but were not effective for eradication.

Because previous methods did not result in eradication, the DNR applied for an EPA grant to physically manipulate the ponds. DNR received a grant for $287,000 to fill the police pond, the wooded channel connected to the police pond, the San Peorio Park pond. After filling, monitoring continued and no RSC were found the following spring or summer. The

DNR also conducted a fish diet study in the unfilled pond, and determined that fish stocked after chemical treatments were helpful, and those greater than 14 inches were eating RSC.

At the unfilled pond, the DNR used rocks to armor the banks, then completed a pyranol treatment both in-water and on the shoreline. They used 410-420 micrograms per liter, significantly more than needed for a lethal dose, and the pond maintained a lethal dose of chemical for 2-2.5 weeks. The DNR then did bioassay monitoring with native crayfish, and set traps in 2014, to monitor for RSC. It was determined that integrated pest management was necessary for this project, including trapping, predatory bass stocking, chemical treatments, and habitat destruction, along with agency partners involvement and buy in from residential and elected officials.

Several questions were raised. Bunk indicated that the chlorine killed everything in the pond, so it was re-stocked twice after treatments. Bunk noted that there were political obstacles to filling ponds, especially one used for fishing, but the DNR worked with the parks department, turned the fishing pond into a playground, and established another fishing pond nearby. Bunk also hypothesized that the RSC could have been classroom releases or intentionally stocked for food. Bunk also responded that the source of the remaining RSC being found may be ones with burrows further up the bank above the armoring. The total project cost over four years was about $750,000.

Sampling Techniques for Crayfish in Lotic and Lentic Environments
Eric Larsen, Shedd Aquarium

Larsen focused on lentic and lotic system crayfish sampling techniques. He has a book chapter in the process of being published that he can share with interested panel members. The chapter includes crayfish sampling techniques for four habitats: lakes and wetlands (lentic), terrestrial (burrowers), caves (stygobitic), and rivers and streams (lotic).

In lakes and wetlands sampling usually relies on baited traps, sometimes supplemented by habitat structures, visual searches, by-catch, and throw traps in vegetated habitats. While baited traps are very common, this method is biased towards larger males that are more active and aggressive. Baited traps can result in a sample with 90% males even when the sexes are evenly represented in the system; this ratio is especially true when the males are reproductively active. In the Great Lakes basin, modified Gee minnow traps are common, but the diameter of the openings (commonly 4-6 cm), and the design can affect catch both in terms of size and species. Trap catch is highest around midnight, but crayfish can exit the trap overnight before they are pulled, and large males may defend the trap as habitat, affecting catch numbers. Catch can also be impacted by temperature, season, and lunar phase. Catch rates are higher at warmer temperatures, and temperature has a larger impact than lunar phase. Ideal habitats are species dependent, and to take a representative sample, both cobble and softer substrate should have traps. There is a tendency to sample in shallow areas, but crayfish have been caught in water as deep as 100 meters. Traditionally, the type of bait used varies by region, however, a study conducted in 1986, found little effect of bait type on catch. Overall, baited traps are biased towards adult males, so additional trapping methods such as habitat bundles that allow crayfish to colonize them will result in better size and sex distribution in the sample. Another sampling option in lentic systems is direct observation by divers and snorkelers; night searches with dive lamps can be productive, and this method has a lower size/sex bias. However, crayfish can be hard to find, and this method requires certified divers with expensive equipment. Crayfish also fowl gillnets and other fishing and sampling gear, so bycatch can be monitored for relative abundance and the spread of species.

In lotic systems, the sampling methods most commonly used are baited traps, snorkeling and diving, quadrat sampling or kick seine, electrofishing, and D-frames or dip nets. A quadrat sampler is one square meter, is placed in 15 cm of substrate, and is disturbed for 3-5 minutes. This disturbance results in density and habitat associations but is heavy, labor intensive, and may restrict the number of sites sampled. Kick seining requires positioning a meter seine downstream of a person disturbing the substrate. This method is lighter and faster than quadrat sampling and, while it may be less accurate, it results in the ability to sample more sites. Electrofishing is generally effective but not often used, and may be less effective than other methods, because crayfish in burrows or in the substrate are not sampled. Overall size bias is small using the quadrat and hand collection, but electro fishing is the least biased for size, and mark-recapture population estimates are more precise than serial depletion.

Researchers are now looking at eDNA as a possibility for crayfish surveys. Detection probability increases with abundance but can be affected by lake clarity. This method can detect crayfish at low abundances and may be better for terrestrial or cave surveys so that habitat is not destroyed. Researchers are currently interested in seeking signal crayfish because this

species is a successful global invader. An eDNA assay was developed and tested in Lake Tahoe and the researchers have been soliciting samples from the Great Lakes region. A question was raised about a lower detection rate for crayfish in burrows, and Larson answered that this method is especially effective for terrestrial burrowers because water or soil can be sampled from the burrow chambers and tested. There was also a question about the success of eDNA throughout the year and Larsen confirmed that there is better success for eDNA during, and just after, the molt. It will be valuable to see how eDNA might be affected by life history.

Rusty crayfish control on native fish spawning reefs in N. Lake Michigan
Lindsay Chadderton, The Nature Conservancy

This study, conducted by the Nature Conservancy, Michigan DNR, Central Michigan University, and Smith Root, focused on small spawning reefs for species like lake trout, herring, and whitefish in Little Traverse and Grand Traverse bays. The goal was to determine if egg survivorship could be influenced by reducing invasive predators. Predation on eggs and fry are linked to predator density, so researchers suppressed crayfish and round goby on the spawning reefs during egg laying and larval recruitment. The researchers also characterized the effectiveness of seismic guns. It was assumed that crayfish were most active from July to September, and re-colonization would be minimal in the cooler winter months.

Large and small seismic guns were tested on crayfish for lethality and behavioral changes, and appeared ineffective. Intensive removal with baited Gee minnow traps, tangle nets, and scuba divers was conducted later in the season. Approximately 4,000 crayfish were removed over 6,000 trap days, but there were no indications of a significant population reduction. It was noted that crayfish were present on the reefs year round, they had transient home ranges, and re-colonization was occurring year-round despite temperature differences. The low catch per unit effort (CPUE) was attributed to the possible timing of life history events. The highest capture rate was expected in late summer, but did not occur. Instead, peak abundance appeared immediately prior to spawning. Additionally, there was a significant increase in the capture of females over time which was consistent with reduced female activity in midsummer and a possible indication of delayed spawning or molt.

Alternative capture methods are needed to replace standing minnow traps and hand removals. Additionally, removal should occur immediately prior to spawning to be most effective. Overall, it was determined that development of barriers was necessary to prevent re-colonization. Control efforts could be enhanced by biological controls that could increase native predator densities. Hand removal by divers was much more effective than minnow traps. The CPUE with divers was 2-3 times as high as traps, but manual removal is very labor intensive. The project team is working with an engineering firm to develop a crayfish barrier or better trap or tangle net with a lower escape rate. New designs will be tested during summer 2015.

A question was raised about by-catch associated with the traps. Chadderton responded that there are tradeoffs between catching crayfish and the risk of bycatch. They are working to use small enough mesh sizes to reduce catch on larger fish but do not want the crayfish to be able to climb out.

LeSage summarized the session and applauded the crayfish research conducted to date. She emphasized that the role of the crayfish in terms of benthic predation has been underestimated, and the GLP may want to facilitate a discussion around developing protocols or recommended procedures. This is an idea with broad interest and the species is important in the ecosystem. The GLP could bring in relevant groups to present and possibly set priorities.

Committee Reports

Information/Education Committee (I/E)
Doug Jensen, Chair, I/E Committee

D. Jensen reported on updates and new products, projects and campaigns from members. The GLWQA index that was developed will continue to be updated, improved, and made available on the GLP website. The I/E committee is also working to update the AIS Invasions booklet and may be asking for input from members of other committees. Many outreach products have been developed by members, including water garden materials, outreach to waterfowl hunters, a drain campaign for boaters, towels for wiping down non-motorized boats, waterproof pouches, and other branded materials. Stop Aquatic Hitchikers! (SAH) is co-branding with Clean Drain Dry to expand their message, emphasize the

steps needed, and manage roadway regulations. A HACCP workshop will be conducted this summer. USGS is phasing out the AIS reporting hotline, but reports can be submitted online. Some data collected will be available for use, and plant reporting will be available. In a joint action with the MRBP Education and Outreach committee, each panel will compile their current survey questions and develop a suite of standard questions.

COMMITTEE ACTION ITEMS:

- Contact members for the following materials
    - Stop Aquatic Hitchhikers! branded materials or design files (D. Jensen)
    - Organisms in Trade fact sheet (Campbell)
- Pull together Great Lakes regional survey instruments in existence and share with MRBP
- Enhance the Index of Outreach Materials to be more consistent and searchable

Research Coordination Committee
Lindsay Chadderton, Chair, Research Coordination Committee

The research committed explored two key items in addition to the joint priority session with the Policy Coordination Committee. The research committee is interested in supporting a gap analysis to see where current investments and research are across the basin; including GLRI, state, federal, public, and private dollars. The group wants to use that data to determine how funding is allocated, and if that lines up with the research priority documents. The goal is to develop a report to identify gaps in funding and help direct where collaboration may be needed. The group will conduct additional work to scope this effort over the next six months, and will have a report at the next meeting. The research committee also explored collaboratives and the possible role for the committee or panel to establish and drive collaboratives. The group discussed possible topic areas that warrant a more active role from the panel. Over the next six months, the committee will discussion and develop criteria for topics that might warrant a collaborative.

COMMITTEE ACTION ITEMS:

- Scope a funding gap analysis
- Develop criteria for forming a collaborative to focus on priority issues

Policy Coordination Committee
Sarah LeSage, Chair, Policy Coordination Committee

The Policy committee discussed the concerns of the MRBP about the lack of two-way solutions at the Chicago Area Waterway System (CAWS). They also discussed how the GLP could provide support, and suggested the panel draft a letter reaffirming what is authorized under GLMRIS regarding two-way solutions. Because there was no federal representation in the room it was unclear if representatives of federal agencies would be able to participate in the letter or if they could abstain. Navarro and Wakeman also offered to communicate information to the CAWS Advisory Committee through their participation on behalf of the GLP. The CAWS Advisory Committee is looking to have final recommendations drafted by June. At the last CAWS meeting there was an interesting discussion considering cost-share options, and the lack of information surrounding issues like GLMRIS locks. There was consensus that the group needed more real life examples and more robust engineering design. TNC is also working on a report with USGS outlining more specific treatment options and will share the information with the panel. The members of the Council of Great Lakes Governors (CGLG) AIS Task Force, recently signed a mutual aid agreement. Also Ontario is leading the CGLG on a jurisdictional analysis to harmonize regulatory and statutory issues and promote regional consistency. This analysis will review risk assessment, inter-jurisdictional response, and communication, and will result in a comprehensive document that includes enforcement activities and education and outreach. Their next meeting will be in Quebec City in June.

COMMITTEE ACTION ITEMS:

- Continue representing GLP interests on the CAWS advisory Committee, including working on solutions to two-way AIS transfer (Navarro and Wakeman)
- Schedule a briefing on the TNC-USGS report on AIS lock treatment options

Joint Research and Policy Committee Report
Sarah LeSage, Chair, Policy Coordination Committee
Lindsay Chadderton, Chair, Research Coordination Committee

The joint meeting between the Policy and Research Committees was organized to further discussion initiated during the last panel meeting about how the panel can increase its effectiveness on priority issues and the crossover between research and policy priorities. The discussion began with an analysis of the most important issues the two committees could work on together, and the members ranked proposed ideas. The three ideas that ranked the highest were economic cost-benefit analysis, risk assessment, and invasive macrophyte control. The cost-benefit analysis discussion focused on specific investments from prevention to management, the social acceptance of management, what management would look like in terms of issues such as ballast water, and additional programmatic appropriations. The proposed risk assessment would look at both species and pathways. The executive committee will consider these ideas and how to incorporate these issues into the next panel meeting.

ACTION ITEMS:

- GLP members should continue to provide input to E. Jensen to further refine the three priority areas: economic cost-benefit analysis, risk assessment, and invasive macrophyte control
- Consider changes to the format of future meetings to focus on priority issues

Aquatic Plant Management: New Incursions
Moderators: Lindsay Chadderton, TNC; and Sarah LeSage, Michigan DNR

Chadderton and LeSage introduced the session and highlighted efforts around the basin.

Water Soldier Control and Eradication in Ontario
Francine MacDonald, Ontario Ministry of Natural Resources (MNR)
Matt Smith, Ontario Federation of Anglers and Hunters (OFAH)

Water soldier is an invasive perennial native to Europe that was first detected in Ontario in the Trent Severn Waterway in 2008. The plants are able to spread quickly and grow densely. They root in shallow, slow-flowing waters. The introduction of water soldier has a high potential risk to biodiversity, and was identified in 2013, by the COGL as a "least wanted species," a priority for prevention and response. The Trent-Severn Waterway is a manmade waterway that connects Lake Ontario to Georgian Bay, and the water soldier was found in a reservoir lake that was shallow with significant sediment deposits. The plants reproduce vegetatively by turions and offsets, with 8-10 offsets per plant. For the first five years of observation there were no flowers, but flowers emerged in 2014.

In Ontario, there is no agency responsible for addressing AIS, so while the Trent Severn Waterway is a federal waterway there is no federal aquatic plant management program. There are also legislative gaps regarding import, sale, possession and transport of aquatic invasive plants, which allows water soldier to be sold legally in Ontario. Additionally, water soldier had no history of management in North America at that time, so there was little control information available. The OMNR established an inter-agency working group to provide technical and field support to guide the response that included MNR, Ontario Ministry of Environment and Climate Change (MOECC), the U.S. Army Corps of Engineers research and development center, OFAH, Trent University, and Parks Canada.

The first plants, found in 2008, resulted in immediate responses in 2009, and 2010, when MNR applied for an emergency label extension for chemical use, in conjunction with manual removals. However, the results of these efforts were unclear in terms of eradication. Some initial success with herbicide was seen, but treatments did not seem as effective in deeper water. After the direct control efforts, MNR continued public outreach to partners and other agencies, developed policy to prevent possession and sale of water soldier, worked to get a permanent label extension for the chemical diquat, and developed a five-year plan for management. During summer 2014, surveillance of the treatment areas along a 15 kilometer stretch of river was completed. Water soldier was widely distributed in the Trent River, 140 hectares of Lake Seymour, and 8 hectares of Crowe Bay. In September of 2014, there was a public notice released in conjunction with meetings to get feedback on the use of herbicide as a primary control tool. Diquat is the only herbicide registered for use in aquatic habitats in Canada, and the use of herbicide is generally not looked upon favorably. However, there was overwhelming support for the control of water soldier with herbicide.

In October 2014, treatments started on approximately 50 hectares of the infestation. With the goal of containment, the MNR focused on treating the largest populations and preventing downstream dispersal. The fall timing helped reduce non-target effects, because other plants were dormant. Also, because diquat is a contact herbicide, it is best to apply it during vulnerable life stages, such as when plants are also being impacted by cold. However, weather in the fall can be unpredictable, and large rain events impacted water flow. Additionally, shallow site conditions made it challenging for applicators to get to some work areas. The treatment took four to five days, and monitoring started the week after treatment. A full assessment will be conducted in spring 2015, to assess the effectiveness of the herbicide treatments. Lessons learned from this experience include the need for stronger involvement and responsibility from federal agencies, public engagement and support are essential for control projects, and there should be additional alternative herbicide options for invasive plant management. Additionally, there is a need for further research on the reproductive strategies and plant biology of water soldier.

Successful Eradication of Yellow Floating Heart in Two Ponds Adjacent to Delvan Lake
Heidi Bunk, Wisconsin DNR

Yellow floating heart is an aggressive non-native plant that was found in 2007 in Walworth County, Wisconsin in two storm water drains. Yellow floating heart produces pods that can hold 30-40 seeds which germinate on exposed mudflats. Water draw-downs help the seeds germinate, and established plants can create a monoculture that impedes boating and shades out other plants. Once established, the plants are able to spread from broken root pieces.

The 2007, infestations were found in a condo complex close to Delavan Lake. The infestations were found by a chemical applicator, who attempted treatments of glyphosate, diquat, and copper twice in 2007, and 4 times in 2008, costing $2000. These treatments were found to be unsuccessful and were discontinued in August 2008. In September 2008, DNR staff spent 32 hours hand-pulling the flowering plants and then manually removed biomass and root structures in October.

In 2009, plants were found again, and the landowners applied for grant money to control the infestation. Many partners were involved in the attempt to eradicate the plant from the ponds, and prevent the introduction of the plants into Delavan Lake. The project received two cost-share rapid response grants from the DNR. The grants were a 75% cost share program with a $20,000 maximum per grant and included a partnership with the Town of Delavan. First, the ponds were de-watered and the sediment was removed down to the clay liner that was installed when the ponds were built. Then a new liner was installed. The team took precautions against spreading seeds and plant material by not wearing boots on the new liner and power washing all equipment before adding new material. Additionally, all the materials from the pond were disposed of in a spoil pit which was capped to prevent re-infestation. The total cost of the project was $54,150, not including DNR or Walworth County staff time.

The ponds were monitored every two weeks in 2010. A few plants were found and removed, and no new plants have been found since. Yellow floating heart was found at five additional ponds. The DNR used the same methods with success in three ponds, the fourth has been controlled through hand pulling, and the fifth has been experimenting with treatment options without success.

Questions were raised about yellow floating heart's response to chemical treatments. Bunk responded that there was only one chemical found to be effective in Europe, and it was only labeled for terrestrial use in the U.S. They tried diquat in the first year but it was not effective in the second. There was another question about the recommended strategy for an inland lake. Bunk indicated that, for small infestations, hand pulling might work, but bigger infestations would probably require hydraulic dredging. A question was raised regarding landowner and neighbor interactions. Bunk explained that most of the neighbors were supportive, except the neighbor who had transplanted the plant initially.

Hydrilla in Tonawanda Creek/Erie Canal
Mike Greer, U.S. Army Corps of Engineers (USACE)

The Tonawanda Creek project was intended to serve as a demonstration project to develop innovative technologies for hydrilla control. The project also aimed to develop support for rapid response by sharing lessons learned and engaging partners in New York. Greer provided a fact sheet, and requested input from those who were interested in participating in a collaborative focusing on hydrilla control.

This project focused on two infestations of monecious hydrilla. Previously, the USACE had only controlled diecious hydrilla in the southern states. The infestations were in close proximity to the Niagara River, and had a direct connection to Lake Ontario, posing a high risk of spread. Additionally, the plant is very fragile, can break apart easily, and is able to establish new populations from fragments, therefore preventing hand pulling or dredging. This project was supported with funding from the Great Lakes Restoration Initiative (GLRI) and the Aquatic Plant Control Research Program.

The project area, in the Tonawanda canal, was 15 miles long and included a relatively concentrated stretch of infestations. The plants were found in large dense mats, approximately 300 feet wide, along the canal banks where the water is shallow. Tonawanda Creek naturally flows out to the Niagara River, and in the summer, water is drawn from the Niagara River into the Tonawanda canal to maintain the water level. In the winter that connection is closed and the water is drawn down. The main infestation area was treated with Endothall at the maximum label rate in near shore areas, assuming lower concentrations would kill hydrilla as the chemical dispersed in the system. The oxbows and spot treatment areas also had maximum label rate applications. All of the treatments were completed in a single day, and the canal was held at a constant level for 48 hours. After the canal was opened and water started flowing to the east, there was a secondary treatment throughout the system and the herbicide mineralized quickly. The treatment area closest to the Niagara River had flowing water throughout the treatment and therefore did not respond as effectively to the herbicide. A second treatment of that section was conducted one month later, but still did not result in control. New treatment plans will be executed in 2015.

Hydrilla tuber densities were reduced by over 90%, and biomass was reduced by 100% at four sites. The plants have not started to produce new tubers yet, and the existing biomass can be killed in late July or early August before new tubers are produced. The control was very effective; the overall frequency of the plant in the canal was reduced from 33% to 4%. Unfortunately, most of the native plants in the waterway were also killed during treatments, except for some *Elodea* populations. It is believed that the most common plant, *Vallisneria*, is so abundant that it will re-establish.

This study will result in a Great Lakes-specific risk assessment of hydrilla because the cost of $500,000 per year and time frame of 5-8 years is not viable for many locations. USACE is also interested in exploring the broader economic and ecological impacts of hydrilla to better inform how funds are spent. To understand the risk of this plant, the probability and consequences of establishment must be known, along with additional information about plant biology and dispersal. Greer is interested in panel members who are experts and who would like to sit on a two-year advisory committee to participate in this assessment. Hydrilla has been identified 10 miles from Lake Erie on a heavily used recreation water body. Several resources are available online at stophydrillany.org and stophydrilla.org

Greer responded to a question about monecious hydrilla forming turions; the hydrilla at this site reproduced through tubers or fragments, but fragments are probably killed by the cold. A question was raised about why the native plants died, and Greer responded that they applied the herbicide at the maximum rate and the native plants should have survived. Perhaps that expectation was based on the herbicide being tested in a different climate. There will be additional studies that grow plants together to help inform concentration rates for future actions. The long-term treatment and monitoring plan is to spend five-to-six weeks per year monitoring the beds, particularly looking for tubers. USACE has a five-year plan to monitor, treat, and re-evaluate progress each year. Those interested in the advisory committee can contact Greer directly.

Michigan European Frog-bit Response
Sue Tangora, Michigan DNR

Six species on the Michigan early detection watch list were found during the DNR's project; this presentation focused on European frogbit (EF). EF primarily reproduces through turions that develop later in the season and start new plants. The plant also grows quickly through stolons that form new plants, and the roots fill a large portion of the water column. EF is normally found in slower moving waters and is often caught in cattails in rivers or lake edges. EF chokes out native vegetation, limits sunlight penetration for other plants, limits dissolved oxygen, creates a significant amount of material that decomposes in the fall, reduces recreational values, impacts spawning habitat, and blocks drains and streams. EF has been found in New York, Vermont, Washington, and Southeast Michigan, but had spread further north in Michigan than anticipated.

At the beginning of the field season in 2011, the MI DNR verified the locations of EF in Southeast Michigan, and reviewed potential reports of other locations. In 2013, they verified reports in the northern Lower Peninsula and eastern Upper Peninsula and initiated the incident command system to coordinate their response and begin mechanical and herbicide treatments. In 2014, the DNR expanded their surveys to determine the extent of the infestations, and continued testing additional herbicides.

The goal of this project was to improve control methods and contain possible further spread. Tangora believes that local eradication will be possible over a period of time. Mechanical treatments were tested, and were successful for small infestations to remove plant material, and to engage volunteer and community groups. In 2013 and 2014, over 8500 pounds of EF were collected. Mechanical removal is more effective when done prior to the development of turions. The DNR also studied the effectiveness of three herbicides; imazapyr, triclopyr, and diquat, which are all currently approved for aquatic use in Michigan.

The Michigan Invasive Species Grant Program listed EF as a priority species, and multiple projects have been funded to map and treat EF. Partners have been important from the beginning; volunteers from Cooperative Weed Management Areas have been notified of infestations and those leaders are important in helping with surveys and control.

A question was raised about cost estimates for removals. Tangora responded that they had not broken down the costs since sometimes EF was treated with another species. Tangora responded to a question about the rapid response plan, noting that the DNR has a plan, which was developed in conjunction with other quality of life agencies. A flow chart and decision tool are used for each sighting.

Hydrilla Eradication and Starry Stonewort in Indiana
Eric Fischer, Indiana DNR

Fisher presented information on hydrilla and starry stonewort projects conducted by the Indiana DNR. In Lake Manitou in northern Indiana, a hydrilla project required eight years of treatment and $2.3 million for eradication at a cost of $2,900 per acre. Because Lake Manitou is less than 40 miles from Great Lakes basin water and there are approximately 4,000 water bodies within a 75 mile radius of the infestation, the target was to prevent expansion. Hydrilla was originally discovered in 2006, and the Indiana DNR took quick action by closing the lake and surveying all the nearby lakes to ensure there were no additional infestations. With eradication, not management as the goal, the DNR performed a lake-wide application of the chemical Sonar, at six parts per billion for 180 days per year. The treatment area has contracted and currently only the northern half of the lake is actively managed. As a result of treatment, the native plant community was entirely suppressed. The goal moving forward is to establish native plants in the southern half of the lake. The treatments have evolved to target chemical applications to keep the concentration high in the areas where tubers continue to be found. Extensive surveys are conducted to monitor the tuber banks. By 2011, the DNR found that the tuber bank was below 1%. Most of the tubers were gone after the first few years, but in the colder clay-rich soils along the edges, tubers were still producing viable plants. The surveys also included a diver survey that discovered 20 hydrilla plants in 2012, 4 in 2012 and 0 in 2014. However, the DNR will continue funding treatment for one more year to suppress the plant community, and then will increase surveys.

Starry stonewort has been rapidly spreading in Michigan. However, in Indiana it has only been found in eight lakes. Starry stonewort was found in 2008 in Indiana's 3000 acre Lake Wawasee. There were 15 acres of infestation in 2009, 56 acres in 2011 and 159 acres in 2012. Starry stonewort colonizes by fragments, grows in dense mats, and is susceptible to a range of copper mixes. The plants were not treated in 2008, because the lake is heavily used by boaters, and the infestations spread quickly as a result of the delayed response. Treatment began in the fall of 2009, but the strategy was ineffective and challenging. Natique was the first herbicide used, but the DNR later changed the treatment plan to use Cutrine and Hydrothol. They also completed a trial of Komeen Crystal in 2013. The current herbicides seem to be effective though the optimal timing is still somewhat unknown. The DNR did learn that repeated treatments are needed for suppression and avoiding rapid spread. In 2014, they surveyed 200 acres and much of it was treated, with a focus on boat ramps and heavily used canals. Treatments of starry stonewort at Wall Lake were much more effective because the DNR was able to start treatment earlier and treat buffer areas around solitary plants. The goals for 2015 and 2016 are to continue prioritizing funding for Cutrine Ultra and Hydrothol treatments. The DNR is also working with plant control companies to test different chemicals and applications, and is partnering with a university to determine better treatment options. Research is important because starry stonewort affects aquatic plant communities, nutrients, dissolved oxygen,

water clarity, fish populations, and aquatic habitat. Overall, early reporting of infestations is important in every state so that control strategies can be implemented early, and so there is a clear picture of what's happening in the basin.

A question was raised regarding fishery data for the hydrilla treatment sites. Fisher responded that there was data taken every 4-6 years, and that Indiana has an aquatic vegetation management plan for almost every lake.

Aquatic Plant Management: Advances in Management of Established Species
Moderators: Lindsay Chadderton, TNC; and Sarah LeSage, Michigan DNR

Eurasian Water Milfoil (EWM) management in Wisconsin
Michelle Nault, Wisconsin DNR

Macrophyte research has a strong history in Wisconsin with standard protocol development and the collection of baseline data. There has been a focus on lakes with EWM to ensure current science drives management techniques. EWM has been in the United States since the 1940's and in Wisconsin since the 1960's. This study looked at 100 Wisconsin lakes with EWM and found, contrary to popular opinion, that most lakes in Wisconsin had 10% or less EWM cover. Often EWM is portrayed as completely taking over the lake and while this is true for some lakes, there are many where this is not true. Nault questioned what was driving the statewide diversity of infestations and if it was dependent on time or management. The DNR began a long term study to collect standardized data on the distribution, ecology, and management of EWM in a subset of lakes for 10 years. This created a baseline statewide dataset on EWM populations and management effects on both new, and established, infestations. They were expecting to see a decline over time in established populations that were managed, variation from year to year in unmanaged established populations and that new infestations could be suppressed over time. The result of this information was an EWM factsheet and information on long term temporal and spatial EWM trends.

When studying the unmanaged northern lakes and forests it seems that different lakes have different responses and the introduction of EWM does not necessarily mean a lake will be taken over. The managed lakes responded to treatment fairly similarly and highlighted the effectiveness of control. However, the impacts of herbicide on native plants in managed lakes are still unknown. The herbicide monitoring program collected data on exposure and concentration of herbicides with the goal of reducing non-target impacts and providing recommendations for improving control. Concentration exposure time trials allowed the researchers to test a wide range of herbicide rates and concentrations by changing time, temperature, and application rates for different species. However, some implementation considerations also include different goals, scales, timing, products, formulations, rates, flowages, lake types, target and non-target plant species, and integrated pest management techniques which highlighted that there is not a one-size fits all solution. They also developed criteria for large scale treatments at greater than 10 acres or greater than 10% of the littoral zone. For these treatments, dissipation results in significant lake-wide concentrations and effects are anticipated on a lake-wide scale.

Nault also assessed large scale treatments by looking at 2, 4-D concentrations and exposure times. She found that with large scale treatments, the herbicide is in contact with the plants for a longer exposure time, so a lower rate of herbicide can be used. Exposure time is driven by dissipation and degradation of the herbicide within the system. Dissipation is physical movement within the water column and is dependent on the treatment area relative to the lake size, wind, water flow, and water depth. Degradation is the breakdown of herbicide into inert components through microbial or photolytic processes. Nault found that two-to-three days after treatment, the herbicide had moved uniformly throughout the lake; shallow lakes had complete vertical mixing, but stratified lakes only mixed above the thermocline in the top of the water column. In degradation models, the half lives ranged from 4 days to 57 days.

In terms of milfoil control, hybrid water milfoil showed a lower susceptibility to herbicides as compared to EWM. While there was a high level of control at target concentration rates, there was also high damage to native plants. Also, there was concern about the mortality of monocots in this study, when previously 2, 4-D was thought only to be effective on dicots. Overall, herbicide dissipation is rapid and a treatment area of 10% or more results in whole-lake effects. 130 lakes in Wisconsin have hybrid water milfoil, and there are multiple strains. This is an area for further research into other herbicides and integrated pest management.

How genetic methods can influence the way we assess watermilfoil
Syndell Parks, Grand Valley State University

EWM is widely managed, frequently using 2, 4-D. In the mid to late 1990's, researchers and managers started to see a difference in the effectiveness of control in the field; plants displayed faster re-growth, were not controlled by herbicide, and were hardier. These changes reduced the predictability of control efforts, and suggested a change, such as hybridization. In the early 2000's, hybrid species were confirmed through genetic sequencing. Researchers studied the ecology and genetics in the field, and found that the hybrid plants were physically indistinguishable from the other two strains. As a result, researchers developed a genetic rapid assay to identify the plants and used it as the basis for lab work.

Further investigation revealed that hybrid water milfoil (HWM) grew much faster and, in a two-to-three week period, could grow almost twice as fast and produce up to three times as many braches. Managers found that HWM was not as sensitive to the chemicals typically used to treat EWM. Researchers developed conceptual lab models to help explain the variability of treatment success in the field affecting EWM and not HWM. The co-occurring EWM and HWM hypothesis helped explain the variable control seen in the field; EWM could be successfully treated and HWM was expanding into the areas where EWM was dying back. Therefore, knowing if HWM is present is important to be able to effectively plan management. Researchers began a field study at Michigan's 20,000 acre Houghton Lake, to track changes in HWM populations, versus parental water milfoil, following treatment. They hypothesized that HWM would be less impacted by treatment, resulting in lower overall control. The lake was treated with 2, 4-D in 2014, and monitored at 996 points before and after treatment. This data was used to measure the distribution and abundance of the plants. When EWM and HWM were grouped together, a 27% reduction in population was seen after treatment. If those results were parsed, a 93% reduction in EWM, and only a 24% reduction in HWM was seen, which greatly skewed the overall reduction. This indicates that managers should change treatment strategies to target the HWM, since EWM was being effectively controlled. Houghton Lake is already dominated by HWM, likely because of a long-term treatment regime for EWM. If the lake had been monitored in the past, it may have been possible to change the management of milfoil earlier or when the hybrids started increasing. More research is still needed to improve control methods and additional field studies will be conducted to examine what may contribute to limited die back. Additionally, population modeling will be used to seek long-term, affordable, management strategies.

Indiana EWM strategy and whole lake intensive search and treat trial
Eric Fisher, Indiana DNR

Due to time constraints, this presentation was postponed.

Aquatic Plant Management Discussion: Needs, Gaps, Priorities, and Next Steps
Moderator: Lindsay Chadderton, TNC

Chadderton prompted GLP members to consider how the GLP could help move best management practices across the basin. Many agencies spend significant time and effort managing aquatic plants. Individual members talk amongst themselves, but members were asked to consider if the GLP could facilitate these discussions or if a collaborative would be beneficial. Comments, suggestions, and discussion included the following:

- A number of macrophyte related management concerns were raised related to herbicide rotation; regulation of species; and the lack of communication between regulators and decision makers, and managers and contractors. The need to connect macrophyte treatment and research was highlighted as a knowledge and communication gap.
- There is a need for a database to communicate control information, such as type of herbicide used, concentration, and exposure, as well as lab studies. A system could link that information to field data for feedback and adaptive management.
- There is a need to compile funding information and conduct a cost-benefit analysis to show what has been done, what is needed, and show savings from AIS management.
- Funding information would be helpful to show the return on investment for AIS treatments and stimulate additional funding. GLP members believe there is data available in the basin; it needs to become publicly available to help justify funding needs.

- There was some concern that the GLP might not be the correct mechanism for compiling this information, because the GLP cannot address issues quickly. A collaborative might be more appropriate to tackle these issues. However, the GLP could initiate the process because the right players, including end users, participate in the GLP.
- The GLP could also alter course, and focus on two or three key issues with each of the committees also focusing on those issues, instead of using a third of the meeting time for break-out sessions.
- The benefit of this new system would be to develop products more frequently, rather than creating large products around issues like aquatic plant management.

ACTION ITEM: The executive committee will explore these ideas and talk with the committees over the next few months to have a product or clear set of ideas by the next panel meeting.

Public Comment

The floor was opened for public comment. None were received.

Emerging issues and announcements

Navarro will communicate with other panel leaders at the next ANSTF meeting about inter-panel communication, and a possible meeting between all panels.