A Strategic Plan to Address Spiny Water Fleas

In the Northern Lakes Region

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Spiny Water Flea (Bythotrephes longimanus) Photo by Jake Walsh

April 2016

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We would like to thank those who reviewed drafts of this Strategic Plan and provided comments and contributions toward its improvement. Special thanks are deserved by Jake Walsh (University of Wisconsin Madison, Center for Limnology), Mitigation and Enhancement Fund, Wisconsin Department of Natural Resources, Friends of the Gile Flowage, Stormy Lake Association, the Lake Gogebic Improvement Association, and Carol Warden (AIS Specialist, UW Trout Lake).

With warm regards,
Dean Premo and Angie Stine
White Water Associates scientists
(April 2016)

WHITE WATER
ASSOCIATES, INC.

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WHY A STRATEGIC PLAN?

For those of us who appreciate the lakes and streams of the north woods, the discovery of an aquatic invasive species (AIS) is viewed as a tragedy and evokes a strong desire to fix the problem. For those who own property on the water body, the discovery has economic ramifications because property values may be affected. Water recreation activities can be impacted. Our initial focus is often on the newly affected water body; but, in fact, AIS invade not just a single lake, but an entire waterscape because a new invader has created an outpost from which it can more easily colonize nearby water. Because of this threat, our approach to AIS must take a broad perspective – a landscape view. This strategic plan addresses spiny water fleas (*Bythotrephes*) in the large landscape of lakes in northern Wisconsin and Michigan's Upper Peninsula (UP), an area we refer to as the *northern lakes region* throughout this document. The fact is that spiny water fleas already occur in this region. This puts all lakes in the region at risk of invasion. Our focus in this plan is to minimize that risk.

The audience for this plan includes those who are concerned with the quality of the lakes. This includes landowners, recreationists, natural resource professionals, educators, law enforcement, lake and stream associations, watershed organizations, businesses and organizations involved with tourism and outdoor recreation (such as bait dealers and shops, dive shops, marinas, tourism councils, etc.), invasive species organizations, and many others.

A hopeful fact is that humans are the principal means by which spiny water fleas move from one water body to another. This is "hopeful" because, through education, humans can become informed participants in preventing additional spread. If spiny water fleas establish a population in a water body, there is no technique currently known to eradicate them. Our best option and necessary priority is to contain existing populations. The goal of this plan is to establish strategies to stop the spread of spiny water flea populations into uninfected waters.

This plan is one product of a project funded by Wisconsin Department of Natural Resources (WDNR) Aquatic Invasive Species Control Grant. We initiated the project for response to spiny water fleas in Stormy Lake (Vilas County, Wisconsin), Gile Flowage (Iron County, Wisconsin), and Lake Gogebic (Ontonagon and Gogebic Counties, Michigan). Additional funding for the Lake Gogebic component of the project came from the Bond Falls Mitigation and Enhancement Fund (Upper Peninsula Power Company). The broadly scoped project included research, planning, education, and response components. Since our area of interest includes two states and several counties and other jurisdictions, plan implementation requires earnest cooperation between these entities. The project for which this strategic plan is a

product, has an associated research component that will further our understanding of spiny water fleas in northern inland lakes. At the time this project was initiated, we realized the importance of quickly increasing our knowledge of spiny water flea ecology. The research component took as its premise the fact that spiny water fleas are being introduced to inland water bodies by humans (usually unknowingly).

Graduate student Jake Walsh (University of Wisconsin Madison, Center for Limnology) with separate funding from the WDNR, has investigated the impact and management of the spiny water flea in the invaded lakes of Wisconsin including four Yahara Chain Lakes near the city of Madison (Lakes Mendota, Monona, Waubesa and Kegonsa), two Northern Wisconsin lakes (Stormy Lake and the Gile Flowage) and Lake Gogebic in the Upper Peninsula of Michigan. Carol Warden (AIS Specialist) from the UW Trout Lake Research Station conducted zooplankton monitoring on Stormy Lake, the Gile Flowage, and Lake Gogebic and also helped with other segments of Walsh's research. Working closely with the WDNR (Iron and Vilas County DNR), lake associations (Friends of the Gile Flowage, Stormy Lake Association and Lake Gogebic Improvement Association), and a private consulting firm in Northern Michigan (White Water Associates), the research hopes to contribute to a better understanding of the impact of the spiny water flea and improve our strategies for limiting its spread in the region.

Since there are no methods for eradication or control, understanding spiny water flea impacts is essential to managing invaded systems. Walsh's research regularly monitored zooplankton communities and water clarity of the six invaded Wisconsin Lakes and Lake Gogebic (Michigan), to lend insight into how invaded food webs are changing after the spiny water flea invasion.

Walsh's research investigated early detection methods. The spiny water flea is a particularly difficult invader to detect early in newly invaded lakes due to high spatial and seasonal variability in its abundance. To improve detection methods Walsh evaluated the detection probability of currently employed and known zooplankton net haul methods at times of low spiny water flea densities in lakes. He also investigated a detection method that is effective regardless of seasonal or spatial variability by searching for tail spines and resting eggs in sediment samples (Exhibit 1).

Exhibit 1. Jake Walsh taking a sediment core from Wisconsin's Gile Flowage. Photo: Carol Warden

Finally, some of Walsh's research effort was directed at identifying spiny water flea transport vectors. By simulating recreational activities on various types of watercraft, Walsh conducted thorough inspections to identify where spiny water fleas are most likely to escape current decontamination efforts. Integrating this information with current research on the most effective decontamination solutions (conducted by Dr. Branstrator at the University of Minnesota-Duluth) will hopefully reveal the most effective tools and techniques for minimizing the spread of spiny water fleas in Wisconsin and Michigan. Jake Walsh (2015) is working toward a model to predict lake susceptibility to *Bythotrephes* invasion and investigating the potential to incorporate a model of *Bythotrephes* abundance as well. Being able to predict abundance in addition to susceptibility gives us a considerably more useful tool for predicting a lakes' vulnerability to negative impacts by *Bythotrephes*. This work is scheduled to wrap up the summer of 2015 and an online tool will follow shortly after. The tool would be found at the following website alongside tools for zebra mussels, rusty crayfish, round gobies, and rainbow smelt: http://www.aissmartprevention.wisc.edu/

We feel a sense of urgency with this effort. When we began in 2012, there were only two lakes in northern Wisconsin with documented spiny water flea populations. Recently, additional spiny water flea locations have been documented in Wisconsin (Star Lake, Vilas County, 2013, Butternut Lake, Forest County, 2014, Trout Lake, Vilas County, 2014, and Ike Walton Lake, Vilas County, 2015). Exhibit 2 displays a map of the northern Wisconsin Lakes with the spiny

water flea present with a few noted in the Upper Peninsula. Exhibit 3 displays a map of research conducted by Kerfoot et al. (2011) that illustrates presence/absence of spiny water fleas in lakes of the Great Lakes region. In this study, presence or absence was determined by evaluating the sediment for spines and resting eggs. With each additional spiny water flea population the risk to other waterbodies increases. We must collectively act now to minimize this dispersal. The ecological and economic impacts are largely unknown and potentially enormous. Humans are the cause. Humans are the answer. What can you do? This plan will answer that question. Our children and grandchildren depend on our responses. This strategic plan is comprised of eight sections (including this one), each headed by a question. This is an adaptive plan that we assume will be modified as time passes.

Exhibit 2. Waterbodies infected with spiny water fleas.

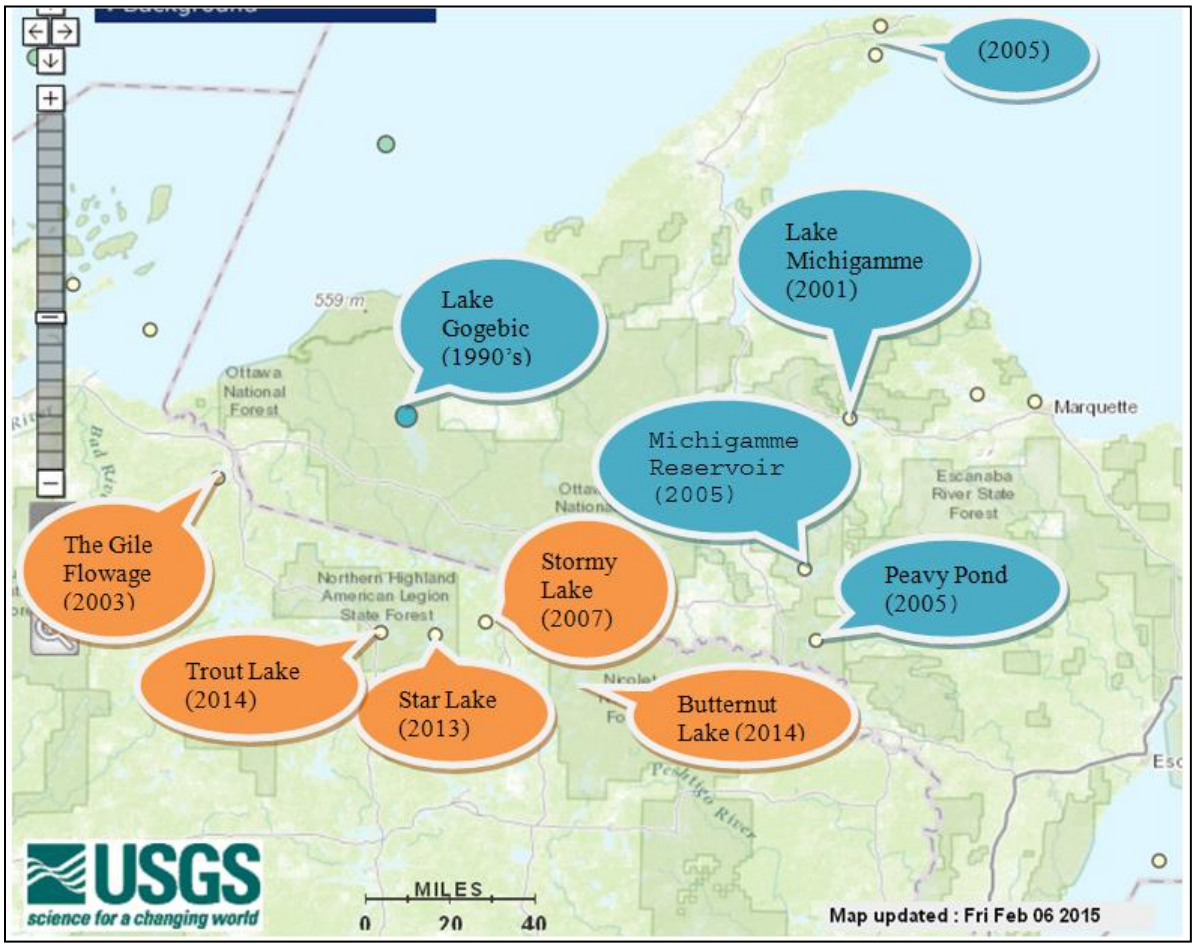
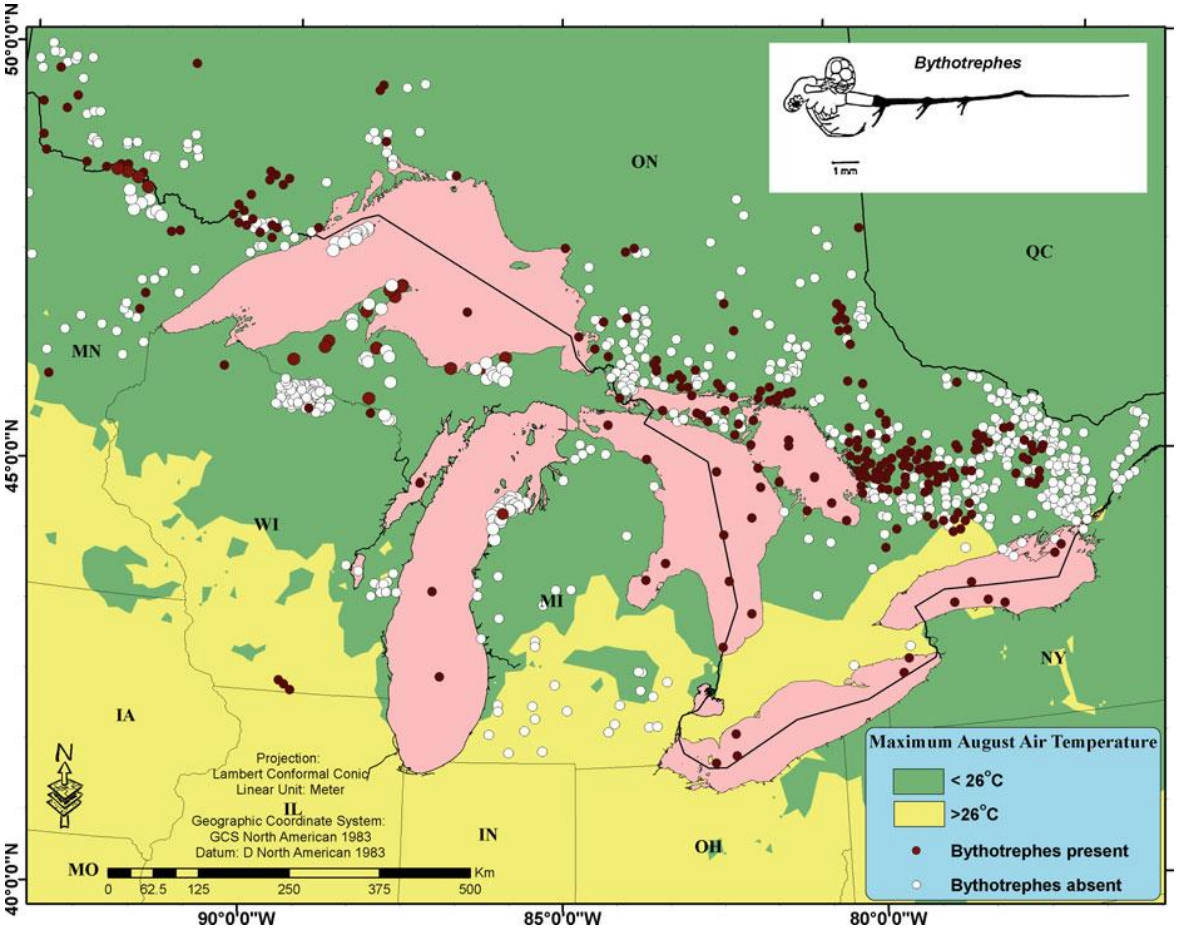


Exhibit 3. Presence/absence of spiny water fleas of the Great Lakes region (Kerfoot et al. 2011).



WHY SHOULD THE SPINY WATER FLEAS CONCERN US?

The spiny water flea is predatory zooplankter in the genus *Bythotrephes* (byth-o-TREH-feez). A spiny water flea has an exceptionally long, sharp, barbed tail spine and a balloon-like egg (brood) pouch. The overall length (head to tip of tail) is about half inch long and this makes spiny water fleas much larger than most other zooplankton native to the northern lakes region. *Bythotrephes* is native to Europe and possibly was introduced to North America by ballast water from ocean going ships. It first appeared in Lake Huron in 1984. Since then populations have exploded in the Great Lakes and many inland lakes.

The rapid spread and great abundance of spiny water fleas is in part due to their reproductive cycles. Spiny water fleas are active in waters from late spring until late autumn (Berg 1991). As water temperature increases, individuals hatch from "resting" eggs that have overwintered on the lake bottom (Berg 1991). An individual spiny water flea may live for several

days to a few weeks. Spiny water flea populations consist mainly of females (Berg 1991). A female produces eggs that remain unfertilized. The eggs are carried in her brood pouch until they develop into female offspring (Berg 1991). This cycle of asexual reproduction (requiring no fertilization) continues as long as the water temperature is neither too hot nor too cold and food is abundant (Berg 1991). When the environment deteriorates, or when water temperature and sunlight decline in the late summer and early autumn, the number of males and sexually reproductive females present in the population increase (Jarnagin 2000). With males present sexual reproduction can occur and produces fertilized eggs (Berg 1991). The diapausing "resting eggs" are dense and rapidly sink to the bottom, where they overwinter to form a seed bank that founds the next season's population (Jarnagin 2000). The adult spiny water flea dies following reproduction (Berg 1991). Spiny water flea "resting eggs" can withstand many environmental stresses. In the *Great Lakes Echo*, Hopps (2013) quotes University of Minnesota researcher Donn Branstrator, "You can put them in chlorination for a few days, and they can survive that. You can put them to salt water or warm temperatures, and they survive that. They're really durable. They're believed to be the life state that helps facilitate dispersal from one location to the next."

Spiny water fleas are predators that feed on smaller planktonic animals (for example, native water fleas). Spiny water fleas compete with native planktivores and fishes for this food source and the food web can be altered because of this competition. The most noticeable effects are on populations of native water fleas in the genera *Daphnia* and *Leptodora*. In the article *A Plague of Fleas,* Goodrich (2014) quotes Michigan Technological University Professor Charles Kerfoot, "*Bythotrephes* is having as much impact on the plankton communities as quagga mussels have had in Lake Huron and Lake Michigan. We expect it will have cascading effects up to the fish, but right now, we can see a major collapse of the plankton community." Tail spines protect *Bythotrephes* against young of the year, but not larger fish (Kerfoot et al. 2011). Once ingested by fish, spiny water flea spines may cause damage to the digestive tract of fish (Kerfoot et al. 2011). In the *Great Lakes Echo*, Hopps (2013) quotes Branstrator, "The bigger fish that do consume the spiny water fleas have a big difficulty in passing that spine, so that spine gets hung up in the stomach like a ball and needles. In some of the fish, the spines were penetrating the stomach wall, and the stomachs looked like a pincushion with a bunch of spines sticking out of it." Resting eggs can survive passage through the digestive tract of fish predators, a trait that enhances their dispersal abilities (Kerfoot et al. 2011). This implies that minnows taken from *Bythotrephes*-infested waters and used for bait in another lake can deficate viable eggs into the new lake (Kerfoot et al. 2011). Dispersal by recreational fishing is linked to use of bait fish,

diapausing eggs defecated into live wells and bait buckets, and *Bythotrephes* snagged on fishing line, anchor ropes, and minnow seines (Kerfoot et al. 2011).

Potential Impacts

Spiny water fleas can have important impacts on the freshwater ecosystem, altering it in both obvious and subtle ways. Spiny water fleas can:

- Alter and redirect food web pathways,
- Deplete the food supply for native zooplankton,
- Reduce food supplies for small baitfish and young game fish (e.g., bass, walleye, and yellow perch),
- Easily spread between waterbodies on angling equipment, mud on anchors and rope, bait buckets, in live wells, and bilge water,
- Reproduce rapidly and form large populations,
- Create conditions favorable to noxious algal blooms, and
- Impact recreational angling and commercial fishing (spines catch on fishing line and other equipment, clog fishing nets, and foul trawl lines).

In an article called *Invasive Spiny Water Flea Found in Trout Lake* (2014) on the UW-Madison Center for Limnology website, Jake Walsh mentions that the spiny water fleas negatively impact water quality. Walsh has spent several years researching the impacts of spiny water fleas in Lake Mendota in Madison. In Lake Mendota, spiny water fleas eat the native water fleas in the genus *Daphnia* that would otherwise be eating the planktonic algae. The result is more algae in the water column and reduced water clarity. "After the spiny water flea invasion was detected in 2009," Walsh says, "summer and fall *Daphnia pulicaria* populations were reduced by 93% and the average Secchi depth, a measure of water clarity, declined by a full meter."

HOW DO INVASIVE SPINY WATER FLEAS MOVE TO OTHER PARTS OF THE WATERSHED?

Spiny water fleas originally traveled to North America in the ballast water of transoceanic ships. When the ballast was emptied in the Great Lakes, spiny water fleas were released into an environment ripe for their colonization. Adults and/or resting eggs may have hitched a ride on a sediment-incrusted anchor, a damp rope or live wells that may have been used. From the original introduction, these spiny water fleas, primarily moved from one body of water to another along

pathways that are either natural (for example, water connections between lakes) or human-influenced (such as roads along which recreationists and their boats and trailers might travel).

Some type of vector(s) facilitates the transport of viable spiny water fleas along human-influenced pathways. Likely vectors are sometimes unexpected. Boats, canoes, kayaks, engines, and boat trailers are among the more obvious. Less obvious vectors include live bait containers and bait, anchors and ropes, fishing equipment (down riggers, line, and nets), SCUBA gear, mud on waders, research equipment (such as plankton nets and aquatic plant rakes), fish management equipment (such as nets, trucks, and hoses for planting fish), float planes, recreational fun equipment (lifejackets, tubes, and ski rope), and even pets that might swim in a spiny water flea infected lake. Water taken from a "dry hydrant" for fire-fighting purposes might carry an aquatic invasive species to a new location.

It is strategic to focus attention on the pathways that emanate from known spiny water flea source waters. These waters allow the opportunities for transfer of spiny water fleas to uninfected sites. Spiny water flea adults are sensitive to exposure to air and sunlight but the resting eggs are more durable and can survive through winter on lake bottoms and can be transported long distances on boats and equipment if they stay moist. Shorter transportation distances increase the likelihood of a viable introduction to a new water body. With regard to understanding and minimizing the dispersal of spiny water fleas, several questions are germane:

- How do recreationists and other people use the source water bodies?
- After leaving a source water body, where do people go next?
- What is the basic understanding of recreationists and other surface water users regarding AIS?
- How do recreationists and other surface water users behave with respect to minimizing AIS transport?

It is also important to understand the vulnerability of water bodies within the watershed to infestation by invasive spiny water fleas. The popularity of a lake influences its likelihood of exposure. Chemical/physical characteristics of the water body determine its risk for successful colonization. Spiny water flea prefer well-oxygenated ($\geq$ 2.4mg/L), cool-temperature (10-24°C), low-salinity (0.04-0.06g/L) conditions (Branstrator et al. 2013). Lakes with appropriate characteristics for spiny water flea colonization might be given higher priority for prevention and monitoring efforts. *A Vulnerability Assessment of Wisconsin's Inland Lakes to the Invasive Aquatic Predator Bythotrephes* (Braun et al. 2009) indicates lakes within a 50 mile radius of a source lake may be more vulnerable to the spiny water flea than others due to their proximity to

infected waters. Star Lake (Vilas County, Wisconsin) was listed as one of these lakes vulnerable to infection by spiny water flea. In 2014, spiny water fleas were documented in Star Lake.

HOW CAN WE STOP MOVEMENT OF INVASIVE SPINY WATER FLEAS BETWEEN WATER BODIES?

In order to stop the movement of spiny water fleas to new locations it is crucial that we intercept and sanitize the vectors that humans move from one water body to another. There are several tools to assist in this endeavor and they can be organized in the following three categories: (1) laws, regulations, and agreements, (2) education and information, and (3) techniques and equipment for cleaning and decontamination. Each of these categories is described in this section.

Laws, Regulations, and Agreements

Although we must rely in large part on the good intentions and conservation-minded behavior of recreationists with respect to preventing movement of aquatic AIS, laws and regulations are essential tools. Traffic signs remind us of laws that, for the most part, we voluntarily respect. For example, most of us obey a "STOP" sign whether a police officer is in view or not. We not only feel an obligation to be law-abiding, but we also tend to avoid the risk of a fine or ticket. In recent years, laws and regulations have been drafted to control the spread of AIS. These are useful in that they provide additional incentive to recreationists and others to practice "safe recreation" – that is, taking care not to infect water bodies with AIS. The threat of a significant fine for plant fragments on boats or un-drained live wells helps alert people to the importance of the issue and reminds them that resource agencies and law enforcement treat these topics very seriously.

The prevention and control of aquatic invasive species requires laws, regulations, policies, and programs at various levels of government. Because of the many ways AIS can travel and the importance of transportation to their movement, a consistent regulatory approach and program implementation is needed at both the state and federal levels.

At the federal level, the National Invasive Species Act (overseen by the US Coast Guard) is responsible for regulating ballast water. The Office of Law Enforcement of the US Fish and Wildlife Service is responsible for enforcing the injurious wildlife provisions of the Lacey Act. This law authorizes the Secretary of the Interior to list as "injurious" any wildlife deemed to be harmful "to human beings, to the interests of agriculture, horticulture, forestry, or to wildlife or the wildlife resources of the United States." It prohibits import and interstate transport of any live

specimen of a listed species without a permit from the U.S. Fish and Wildlife Service. The maximum penalty for violating the injurious wildlife provisions of the Lacey Act is six months in prison and a $5,000 fine. This includes crustaceans. The National Invasive Species Information Center (USDA) has a site that has links to Wisconsin's and Michigan's existing laws and regulations that address prevention and control of AIS (http://www.invasivespeciesinfo.gov/laws/wi.shtml#.UPcYS_L55iQ).

In 2001, Wisconsin adopted Act 109: s. 30.715 which states that, "Placement of boats, trailers, and equipment in navigable waters. No person may place or use a boat or boating equipment or place a boat trailer in a navigable water if the person has reason to believe that the boat, boat trailer, or boating equipment has any aquatic plants or zebra mussels attached; a law enforcement officer may order the person to remove plants or zebra mussels, or to remove or not place the boat in the water." Fines can be substantial under this law. In Wisconsin, the spiny water flea is classified as "prohibited invasive species," meaning it is unlawful to transport, possess, transfer, or introduce it within the state.

In 2009, Michigan passed a law prohibiting a person from placing any boat, boating equipment, or boat trailer with aquatic plant material attached in Michigan waters. This includes all types of aquatic vegetation, not only invasive species. An exception is made for wild rice. Violation can result in a fine. The law gives law enforcement officers the authority to order the removal of aquatic plants from boating equipment.

Along with laws, it is important to have law enforcement agencies engaged with educating and enforcing AIS prevention and laws. WDNR wardens, Michigan DNR conservation officers, Wisconsin Water Guards, and other law enforcement officials perform education and law enforcement duties to protect Wisconsin and Michigan lakes, rivers, and waterways. Continuing education of these important players is crucial in preventing the spread of AIS. Wisconsin has initiated a Water Guards Program through which "Deputy Conservation Wardens" perform education and law enforcement duties to protect Wisconsin's water bodies. Their main efforts are aimed at ensuring compliance with Wisconsin's laws relating to preventing the spread of aquatic invasive species and aquatic diseases. In Michigan, Department of Natural Resources Conservation Officers are responsible for protecting all natural resources and the environment, as well as the health and safety of the public. These officers are a unique class of law enforcement, whose duties include enforcing regulations for outdoor recreational activities such as ORV use, snowmobiling, boating, hunting, and fishing. They are empowered to arrest those who commit felonies, misdemeanors, and civil violations of Michigan Law. They also educate on the topic of recreational safely and conduct public outreach program activities. CBCW in Wisconsin has

added a violation report form to fill out so they can contact a regional water guard or warden with information such as make/model of the boat and registration number and vehicle license numbers. Many recreationists feel as though enforcement of the Wisconsin and Michigan laws with regard to AIS transport could be more rigorous in order to elevate the profile of this kind of recreational violator.

Over the course of our work on this spiny water flea project, we have noted that decontamination practices are varied and have changed as more research was conducted. Some organizations followed one decontamination protocol while others did something different. We feel it is important for there to be greater communication and cooperation between resource agencies, university researchers, consulting scientists, and other groups when it comes to developing and sharing standard operating procedures for decontamination of equipment and monitoring.

Education and Information

Education and outreach have been important to limiting the movement of AIS to other waterbodies. Surveys and data indicate that education can be extremely effective in preventing the spread of invasives, but the battle will not be won with a statewide educational approach alone. Individuals have to think about how they can make a difference and help to educate others in efforts to help prevent the spread of spiny water fleas. During the course of our work on this project, it has been surprising to us how few anglers know about spiny water fleas even though they may fish and boat spiny water flea waters. On a hopeful note, the recent discovery of spiny water fleas in Trout Lake, Vilas County, Wisconsin (2014) was made by a concerned citizen that was aware of the spiny water flea. Carol Warden (AIS Specialist UW Trout Lake), states "It's so important to have citizens who are aware and volunteers out there looking for things like this. They can be our eyes and ears for when the DNR and the Center for Limnology can't be out on the water." Warden also says that the new discovery highlights the importance of continuing many education and outreach programs, like Clean Boats, Clean Waters.

The Clean Boats, Clean Waters (CBCW) program has been active for many years in both Michigan and Wisconsin. The CBCW program has made great strides in improving its data collection and in understanding what educational materials and outreach techniques are working. Boaters are getting the message about draining water from their boats and looking for aquatic plants and animals before leaving the landing. Improvement needs to occur in using live bait and releasing unwanted bait into water (viable resting eggs may be in the gut of baitfish and transferred to another lake when the baitfish eliminates). An effective technique to prevent

transfer of spiny water fleas is to allow boats and other equipment to dry for at least five days if other forms of decontamination are not used. Most boaters are not going out of their way to wash their boat if there is not a sprayer handy at the landing and many are not flushing the motor's cooling system with tap water after each use. The CBCW handbooks for Michigan and Wisconsin are available on-line. Friends of the Gile Flowage has created a brochure and has four boat landing informational kiosks specific for the flowage to educate on aquatic invasives (see Appendix E). As part of this project, we have developed a brochure directed at the northern lakes regoion by drawing from brochures that specifically address the spiny water flea (see Appendix F). For the northern lakes region, see the following links:

- CBCW Michigan Handbook: http://www.miseagrant.umich.edu/downloads/cbcw/11-722-CBCW-handbook-WEB.pdf (see example inspection report form in Appendix B);
- CBCW Wisconsin Handbook: http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/programs/cbcw/forms.aspx (see example inspection report form in Appendix B);
- Friends of the Gile Flowage AIS brochure: (see example in Appendix E) https://drive.google.com/file/d/0B75MzL2b1_KCTmdoSTdOT1hkdmM/edit?usp=sharing
- Spiny Water Flea Brochure: (see example in Appendix F)

The CBCW program staff gathers information at boat landings from recreationists regarding their behaviors with respect to decontamination and travel to and from lakes. Information regarding the lake where a boat was last used and where it is likely to go next is important in understanding the pathways for AIS.

The WDNR has teamed with the University of Wisconsin-Extension (UWEX) and other partners to saturate the boat landings with volunteers and paid watercraft inspectors to educate boaters and other water patrons over the Fourth of July week (a time of very high recreational use of water bodies). As part of this initiative, press releases and outreach materials are provided along with rewards to boaters who practice prevention steps. A "Landing Blitz" towel is also given to recreationists who follow the correct preventive steps.

The Michigan Sea Grant program has been working with the bait trade to help understand the potential for the spread of AIS. They are teaching the bait industry to use the Aquatic Nuisance Species Hazard Analysis and Critical Control Point (HACCP) approach for preventing the spread of AIS through bait-related activities. This course is designed to train fish farmers,

bait harvesters, management agencies, researchers, and enforcement personnel in the use of HACCP fundamentals to control the spread of AIS while maintaining viable baitfish and aquaculture industries and allowing appropriate field activities for fishery researchers, managers, and enforcement personnel (Gunderson and Kinnunen 2006). Wisconsin also has a "Bait Dealer Project" started in 2010 that works with bait dealers to spread the word about AIS and help educate patrons on AIS prevention and bait laws. In 2012, the WDNR launched an effort to recruit bait shop owners to assist in sharing AIS prevention strategies and materials with their customers. It is thought that these points of contact for recreationists can be influential advocates. This campaign was developed with the University of Wisconsin-Madison's Life Science Communications Department.

Workshops on AIS and on volunteer monitoring are effective educational opportunities and are hosted by the various organizations. Wisconsin County AIS coordinators often host these workshops. The Western Peninsula Invasives Coalition (WePIC) is a Michigan-based organization covering areas such as Lake Gogebic (www.wepic.org). This cooperative covers 2.6 million acres, and includes over 700 lakes, and 150 boat access in Gogebic, Iron, and Ontonagon Counties and the Ottawa National Forest. WePIC efforts are directed at prevention, containment, and management of AIS in the region.

It is important to target education programs to young people as well as adults. The WDNR has educational resources for K-12 including links to handbooks, songs, publications, public service announcements, PowerPoint presentations, and videos. Having a website for your lake association or organization is a useful tool to educate people on what is in your lake or how to stop invasives from establishing.

Radio, television, and printed media are also resources for educating people. They address AIS prevention, source lakes, and news. Social media is also a great way to educate citizens on AIS issues.

Focus groups have been a strategic part of learning what is working and what is not with regard to AIS education and prevention. The WDNR contracted with the University of Wisconsin Survey Center to host five focus groups of transient boaters and anglers across Wisconsin in 2012 to gain information on prevention strategies and recommendations.

Signage has been the most frequently used means of helping boaters learn about aquatic invasive species and ways to minimize the possibility of transport. Another effective educational product is the dissemination of brochures on procedures of cleaning your boat. Exhibit 4 displays newly built education kiosk at Gile Park. Exhibit 5 is a close up photo of the educational kiosk at Gile Park. Exhibit 6 shows the most current WDNR signage.

Exhibit 4. Completed Gile Park educational kiosk (Techtmann, 2015).

Exhibit 6. Current WDNR Boat Landing Sign (WDNR 2014).

Exhibit 5. Close up of sign at Gile Park (Techtmann, 2015).

Techniques and Equipment for Cleaning and Decontamination

Laws, regulations, and education are all important precursors for getting recreationists to adopt "safe" practices with regard to transporting AIS. In addition, several techniques and types of equipment have been found useful in that regard. For example, an effective way to stop the spread of spiny water fleas is to wash boats and equipment using a high-pressure washer with water heated to at least 122°F. It is most effective if the contact is five minute in duration. There are boat sprayers being used in the northern lakes region and some are being used at the lakes that already have spiny water fleas. Through the Iron County Conservation District, Iron County, Michigan has a portable boat sprayer with a filtration system. The Ottawa National Forest also has the same kind of boat sprayers as does Lake Gogebic (SWF present) at the Bergland Boat Landing. Hagerman Lake in Iron County has a permanent boat wash station. Sunset Lake (Iron County, Michigan) has a boat wash station, although the water is not heated.

If a portable boat sprayer is not available, a car wash is a suitable alternative to clean your boat. In the absence of a boat sprayer or car wash, the boat and trailer can be sanitized by allowing your boat and equipment to dry for at least 5 days (depending on the time of year) before entering another water body. It is important for recreationists to understand that some of the simplest and the least expensive measures that take only minutes will make the biggest difference in the fight to stop invasives. The following steps are effective, efficient, and economical to reduce the spread of AIS:

- **INSPECT** and **REMOVE** aquatic plants and animals, including gelatinous or cotton batting-like material from lines, especially where they meet a swivel, lure or downrigger ball connection (a helpful check list see Appendix B);
- **DRAIN** water from the boats, motors, live wells and all equipment before leaving access;
- **NEVER MOVE** live fish or bait water away from a waterbody;
- **DISPOSE** of unwanted live bait, worms, and fish parts in trash;
- **BUY** minnows from a State bait dealer. [1]
- **RINSE** boat, trailer and equipment (anchor/rope) with hot and/or high-pressure water, AND/OR
- **DRY** for five days or more before use. Open up areas that may have a lid to dry out. Use a towel to dry out your live well or areas that may hold standing water. If you are using a canoe/kayak dry the inside and outside using a towel.

[1] *The WDNR website describes bait laws: http://dnr.wi.gov/topic/Invasives/boat.html.*

In a 2015 email correspondence with Angie Stine (White Water Associates), researcher Jake Walsh summarized the latest decontamination research conducted by Donn Branstrator (Walsh 2015). In the following bullets, we capture Walsh's summary.

- Donn Branstrator (U. of MN – Duluth) has done quite a bit of work looking at survivorship of resting eggs under different physical and chemical stressors.
- The most reliable method for decontaminating boats and equipment of resting eggs is desiccation. Eggs will die after only a few days of dry conditions, however ensuring dry conditions in areas of equipment and boats that hold water for longer time periods could take longer than just a few days. For example, exposure to desiccation at 17°C (62.6 °F) for more than 6 hours will dramatically reduce hatching success, however ensuring that all possible egg-carrying areas on boats and equipment will clearly take more than 6 hours.
    - Relatively (to other cladoceran zooplankton) low tolerance to desiccation (tolerance for < 4 hrs) could be a factor in why *Bythotrephes* has spread more slowly than zooplankton with more desiccation tolerant resting stages. This means that if we can control how long we dry out boats, trailers, and equipment, we could have a solid chance at dramatically reducing the speed at which *Bythotrephes* in spreading. This is particularly true for lake-rich regions like the Northern Highlands Lake District.
- A combination of intense heat and drying is likely the best option for sediment sampling equipment (see Branstrator 2013, Limnology and Oceanography).
    - Exposure to 50°C (122 °F) for 5 min should render all eggs unviable.
    - If greater than 50°C (122 °F) can be reached, the time of exposure should be shorter (however, it may be worth investigating heat's effect on expensive research equipment).
    - So for equipment like zooplankton nets or Ekman grabs, heating should be followed up by dry conditions for 6 hrs; however the heat should be effective at killing resting eggs.
    - It would be difficult to heat boats and trailers to 50°C (122 °F), highlighting the need to dry boats and trailers for the appropriate length of time.
- It is very important to follow decontamination protocol for any equipment used to sample for *Bythotrephes*. This is particularly true for the sediment where hardy resting eggs are waiting to hatch. Eggs in the sediment may be among the primary

pathways of spreading *Bythotrephes* due to their wide range of tolerance to physical and chemical stresses.

- Bleach, salt, vinegar (or other acids), and freezing are not reliable methods of killing resting eggs. In fact, trying to dry out equipment in sub-freezing conditions could increase the probability of egg survival.

If you must enter another body of water within 5 days, wash your boat, trailer, anchor, rope, downriggers, waders, etc. with hot water (sustained exposure to 122 °F for 5 min, or shorter durations at higher temperature-eliminate hatching of resting eggs (Branstrator et al. 2013) first. Then dry. Flush your motor's cooling system, live wells, bilge and other boat parts that get wet. Consider having alternative anchor ropes, nets, equipment, nets, and other equipment. A suggestion for lake home owners is to designate a boat to use in a spiny water flea infected waterbody and have another boat to use on other waterbodies.

Some suggestions noted by Kerfoot, Michigan Technological University, handouts for Isle Royal National Park Lakes are as follows: paddlers, hikers, anglers, and staff wipe down all equipment (canoes, kayaks, paddles, fishing gear, etc.) when leaving infested Lake Superior waters and traveling to un-infested inland lakes. When possible, equipment should be decontaminated with hot water. Another suggestion is to change fishing line if you have used it in infested waters and plan to fish in un-infested waters. Research has also indicated that resting eggs from the spiny water flea, even after passing through the guts of fish, were intact and viable (Kerfoot et al. 2011). Because of this, it is very important that fish from one body of water should not be released into a different body of water.

The Clean Boats Clean Waters program documents boat inspections and collects information on the recent history of boat use. Several example forms used in the inspection process can be seen in the Appendix B.

HOW DO WE DETECT WATER BODIES NEWLY INFESTED WITH SPINY WATER FLEAS?

A crucial component to the strategic plan is monitoring lakes for new populations of spiny water fleas. Some types of monitoring can be done by anyone that uses the water. We all need to be on the lookout for the spiny water fleas and other AIS during our recreational pursuits. Schools can get involved by adopting a lake. Citizen Lake Monitors can add AIS monitoring to the water quality monitoring routine. You can be a volunteer with the WDNR and join them in

spiny water flea monitoring on a lake in the area. New discoveries of the spiny water flea are often easily made by anglers since a clump of spiny water fleas clinging to a fishing line is a fairly obvious sign (appear like a fuzzy ball of cotton and may cause problems reeling in the line, Exhibit 7). Routine monitoring where you are specifically looking for spiny water fleas is the best way to monitor a lake. The Wisconsin DNR has a Water Flea Monitoring Protocol that describes the standardized sampling techniques and the reporting procedures. (http://dnr.wi.gov/lakes/forms/protocols/SpinyWaterflea_MonitoringProtocol.pdf). Standardizing this procedure helps ensure an accurate AIS infestation database.

There are four methods that have been used in monitoring for spiny water fleas: (1) weighted line, (2) plankton tow sampler monitoring the water column, (3) sediment analysis, and the presence of *Bythotrephes* spines or (4) resting eggs in fish stomachs. It is important to note that spiny water flea densities can change throughout the open water season and their location in a lake may change due to wind and water temperature. This has implications when it comes to monitoring for spiny water fleas. The technique of dragging a weighted line behind a boat or the using a fishing line takes advantage of the fact that adult spiny water fleas stick these surfaces and are detectable by an observer without needing special magnification. An advantage of this approach is that an observer can efficiently cover a large area. This monitoring approach should be conducted every three weeks or so throughout the open water season to ensure thoroughness. A more scientific approach is monitoring the water column using a plankton tow.

A plankton sampler is another monitoring technique used to determine the presence spiny water fleas and can also be used to estimate population densities. A commercially made net can be purchased for this type of monitoring. If economy demands it, plans for homemade samplers are available that call for materials such as a coffee can, a nylon stocking, and small plastic bottle (Yan, 2012). Systematically sampling for spiny water flea requires a bit more training and specialized equipment. A 0.5-1 meter diameter, 250 micron mesh plankton net is the plankton tow net of choice. Typically, three samples are collected from a given lake on each of three dates between June and September (a total of nine samples per lake). The water temperature

Exhibit 7. A clump of spiny water fleas attached to a fishing line.

should be 54 degrees or above. The plankton net is lowered vertically into the water and slowly brought to the surface where the sample is flushed into a bottle. The sample is preserved until it is examined for the presence of spiny water flea at a later date. Other agencies, such as the Great Lakes Indian Fish &Wildlife Commission (GLIFWC), also monitor for spiny water flea presence/absence in lakes in this region using a plankton tow.

Jake Walsh (2015) suggests a combination approach (examining both the water column and the sediment) to monitor a water body for spiny water fleas. His approach is summarized in the following bullets.

Water Column Sampling for Spiny Water Fleas (Exhibit 8)

- Oblique or horizontal tows that tow the net through large volumes of water are the most effective method to capture *Bythotrephes* in the water column.
    - In lakes with relatively low zooplankton biomass, more water can be filtered at a time. For example: a 200m horizontal tow in Lake Mendota fills our 0.5 L zooplankton cup, but would likely be a more effective method for less productive lakes like Stormy Lake.
- Because *Bythotrephes* is more abundant in the late summer and early fall, sampling should be focused to this time of the year.

Exhibit 8. Carol Warden sampling for spiny water fleas (Photo: Kreitlow 2012).

Sediment Sampling for Spiny Water Fleas (Exhibit 9)

- Because *Bythotrephes*' can be so variable in the water column within a year, it's useful to investigate other detection methods that can be used alongside traditional zooplankton net tows.
- We've had success finding preserved *Bythotrephes*' tail spines in lake sediments.

- Using an Ekman grab, we can sample a large amount of lake sediment and search for tail spines. Resting eggs are small (<0.5 mm), round orange/brown spheres, which can be easily mistaken for other small round spheres in sediment samples – tail spines are significantly easier to identify as belonging to *Bythotrephes*.
- Searching through sediment can be time consuming, so we have come across a few tips for speeding up the process:
    - Should be able to use a 1000 um filter to filter out smaller sediment particles and reduce the amount of material to sift through
        - This may not retain small spine fragments (e.g. single barbs from the barb pairs along the tail spine), you could sacrifice time for accuracy by reducing the filter size to 500 um (very little *Bythotrephes'* material should be smaller than 0.5 mm).
    - In most lakes, we're only interested in the top several cm of the water column (10 cm at the most, depending on lake sedimentation). You can open the top of the Ekman and subsample the top layers of the sediment to "concentrate" potential spine evidence in the sediment. You can take multiple Ekman grabs to get the same amount of material.
- It is very important to follow decontamination protocol for any equipment used to sample for *Bythotrephes*. This is particularly true for the sediment where hardy resting eggs are waiting to hatch. Eggs in the sediment may be among the primary pathways of spreading *Bythotrephes* due to their wide range of tolerance to physical and chemical stresses.

Quick Early Detection Survey Method

1. Eckman grab of surface sediment
2. Filter out fine particles
3. Separate chitinous material (spine evidence, resting eggs)
4. ID spines and spine fragments

Exhibit 9. Eckman Dredge (Walsh 2014).

It is also possible to discover spiny water fleas by examining the contents of fish guts. The spines from *Bythotrephes* are sharp and when ingested by a fish tend to puncture the intestine. Remnants of the spine can be located when cleaning your fish.

Citizen Lake Monitoring is active in both Michigan (the Citizen Lake Monitoring Program) and Wisconsin (the Citizen Lake Monitoring Network). Their goal is to collect high quality data, to educate and empower volunteers, and to share this data and knowledge. The volunteers measure water clarity, using the Secchi Disk method, as an indicator of water quality. Volunteers may collect water chemistry, record temperatures, and dissolved oxygen data, map plants, and look for aquatic invasives such as the zebra mussel and Eurasian water milfoil. Data is entered into a database for analyzing trends and distributions. Baseline data is important for any lake. If AIS does end up in a lake, it is nice to have water quality data from before and after the invasion. If you would like to become a volunteer to be included in Citizen Lake monitoring, contact the Wisconsin DNR (for Wisconsin lakes) and for Michigan lakes, contact the Michigan Lakes and Streams Association or the Michigan Department of Environmental Quality.

A program called *Invading Species Watch Program* in Ontario is a free volunteer program that does lake monitoring for aquatic invasive species. It is a partnership between the Ontario Federation of Anglers and Hunters and the Ontario Ministry of Natural Resources. The program's objectives are to:

1. Establish a provincial volunteer network to track the spread of spiny water flea (*Bythotrephes longimanus*) and zebra mussels (*Dreissena polymorpha*) in Ontario waters;

2. Update Ontario distribution maps and an international database that tracks the spread of aquatic invasive species in North America;
3. Increase local awareness of aquatic invasive species and encourage greater public involvement in preventing the spread to inland lakes;
4. Provide participants with early identification of the presence of aquatic invasive species, thus providing an opportunity to initiate protection systems to minimize impacts.

The program offers local residents, cottagers, and property owners the unique opportunity to monitor their lakes for the presence of aquatic invasive species such as spiny water flea and zebra mussels at minimal cost. A monitoring kit is provided to a volunteer and they sample their lake using a plankton tow and the sample is collected and then preserved and looked at by a biologist at a later date. They then decontaminate the equipment and it is sent to the next volunteer to monitor their lake. The details of this program can be found at (http://www.invadingspecies.com/get-involved/invading-species-watch-program/.)

Mentioned earlier in this document, Jake Walsh is also working toward a model to predict lake susceptibility to *Bythotrephes* invasion and is investigating the potential to incorporate a model of *Bythotrephes* abundance as well. Being able to predict abundance in an addition to susceptibility gives a considerably more useful tool for predicting a lakes' vulnerability to negative impacts by *Bythotrephes*. This work should be completed the summer of 2015 and will be available online in a tool alongside tools for zebra mussels, rusty crayfish, round gobies, and rainbow smelt (http://www.aissmartprevention.wisc.edu/mappingtool.php).

HOW DO WE RESPOND IF WE FIND A NEW POPULATION OF SPINY WATER FLEAS?

In the event of a new discovery of spiny water fleas, a *rapid response plan* helps to guide and organize actions. Setting the stage for effective rapid response involves education and awareness activities that serve to (1) engage volunteer lake monitors, (2) identify Rapid Response Coordinator(s) and form rapid response team(s), (3) identify sources of funding, and (4) form new lake associations. The Rapid Response Strategy for northern lakes region is illustrated in Appendix A and described in outline form in this section. Having a rapid response strategy minimizes guess work in trying to determine what should be done. It is essential that proper evaluation and notification is implemented in each situation. The Rapid Response Strategy is a road map for appropriate response to a suspected discovery of a spiny water flea. Here is how it goes:

1. Spiny water fleas are suspected.
2. Collect the suspect spiny water fleas (place in jar with rubbing alcohol) and contact the Rapid Response Coordinator. Given that two states and several counties are included in northern lakes region, we suggest that a Rapid Response Coordinator be identified for each county. For example this might be a county AIS coordinator in Wisconsin counties. See Appendix C for contacts. For proper collection and transport of the sample, follow the Aquatic Invasive Monitoring – Spiny Water Flea WDNR guidelines pg. 10-28 to 10-24 f. Attach to the specimen container the collector's name, lake and county name, GPS coordinates (if available), and a sketch map of where the specimen was found.
3. The Rapid Response Coordinator identifies the sample or sends it to a region biologist. In Wisconsin, the Rapid Response Coordinator should contact the WDNR Lakes Coordinator.
4. If the sample is identified as spiny water flea, complete an incident report: (http://dnr.wi.gov/lakes/forms/3200-126-animalincident.pdf) (also found in Appendix D).
5. Does the find represent a new site? – Rapid Response Coordinator determines if the spiny water flea has been reported in the waterbody in the past. Various sources for this information include www.wepic.org or http://nas.er.usgs.gov/queries/stco.aspx; in Wisconsin go to http://dnr.wi.gov/lakes/invasives/AISByWaterbody.aspx
6. The Rapid Response Coordinator informs responsible resource agencies. Appendix C provides contacts. For example, in Wisconsin there are AIS coordinators, a statewide AIS specialist, and the WNDR Lakes Coordinators. In Michigan contact WePIC, MDNR, and/or MDEQ.
7. The Rapid Response Coordinator convenes a Rapid Response Team to help respond to the situation. This could include lake association members, agency staff and others.
8. Conduct field study to determine if spiny water fleas are established reproducing population.
9. If not established – keep monitoring and reporting. At the present time, chemical or biological controls are not feasible on lake-wide basis for spiny water fleas. If future discoveries change this status, then investigate the status of chemical and/or biological control techniques and permitting requirements.

    If established: Monitor and report – in Wisconsin follow the WDNR Aquatic Invasive Monitoring Protocol. Inform Responsible Agencies; Call 877-STOPANS or enter information on http://nas.er.usgs.gov/AlertSystem/default.aspx; Contact lake association and/or riparian owners; prepare a press release. Page 10-34.

    http://dnr.wi.gov/lakes/forms/protocols/SpinyWaterflea_MonitoringProtocol.pdf

10. Education and Response
    a. Volunteers at landings would help stop the spread. Let people know to wash their boat, trailer, and equipment or to dry it for 5 days since the spiny water fleas are in the lake.
    b. A high pressure heated boat sprayer would minimize invasive from entering or leaving the lake.
    c. Brochures are very helpful so that people can read the info when the fish are not biting or while relaxing in their boat. Brochures should include maps or la list of AIS-infected lakes in the region and provide tips on preventing AIS spread.
    d. Notice sign stating that the spiny water flea is indeed in this lake and to take precautionary measures. A sign when leaving stating "Thank You for decontaminating your boat, you have helped stop the spread of spiny water fleas to other lakes."
    e. Press Release letting the public know that the invasive is spreading and we need to do something about it.
    f. Public Meeting – education dealing with whether there is anything that can be done and addressing issues of how we can help stop the spread of AIS.
    g. Monitor satellite lakes – lakes in the area that maybe the same boat owner would frequent. Determine those lakes that have public boat access and water temperature levels that are low enough to maintain a population of spiny water fleas.
    h. Survey boaters to see where they travel and if they are educated in watercraft inspections and decontamination procedures.
    i. Document the response effort with pictures and routine reports.

DO WE KNOW EVERYTHING WE NEED TO KNOW?

We do not! Therefore ongoing research on spiny water fleas is essential. This strategic plan is "adaptive" in that as we learn more about spiny water fleas we can adjust our approach as to how to respond to their presence in northern lakes region and elsewhere. Careful observation and diligent research will advance our ability to respond to these aquatic invasive animals.

Spiny water fleas are spreading and our ability to understand the impacts or hinder the spread of these aquatic invasive fleas is limited by what we know about their ecology. Research will address that limitation. Each waterbody may respond differently to an invasive species and we are just beginning to learn about those differences. Spiny water fleas truly threaten the water

resources in northern lakes region. Agencies need to develop a plan for allocating research resources to strengthen the science to manage invasive spiny water fleas and their effects. Research is also crucial to rehabilitation and restoration of impacted waters. Increased coordination between agencies within affected watersheds will improve the complementary use of funding and research topics. Available funding plays a major role in developing new ways to combat aquatic invasives. Prevention, prediction, early detection and rapid response all need improvement.

In response to the threat to the lakes and rivers in Wisconsin, the WDNR has increased its support of local efforts to prevent the spread of introduced aquatic invasives by creating the Aquatic Invasive Species Prevention and Control Grants. There are Education, Planning, and Prevention Grants and also Aquatic Invasive Species Control Grants. More information can be found at the WDNR link: http://dnr.wi.gov/lakes/invasives/Grants.aspx. At this time, Michigan's resources for research and management projects on invasive spiny water flea are more restricted although there are resources available for education and volunteer efforts directed at stopping the spread.

WHAT DO WE DO NEXT?

It is important that this strategic plan leads to actions that serve to minimize the spread of invasive spiny water fleas to new water bodies. With that in mind, we offer the following list of actions to be undertaken by responsible stewards in the inland lakes of northern lakes region.

Action 1: Work with law enforcement to ensure rigorous enforcement and education occurs.

Action 2: Establish a standard boat sprayer protocol. Make sure the person staffing the sprayer is properly educated regarding invasive spiny water flea dispersal. Make sure they are educating the patron on what to do if there isn't a sprayer around and how to clean their boat on their own. A checklist should be used for each inspection. For self-service boatwash stations, provide clear and thorough instructions for proper use and decontamination.

Action 3: Identify strategic audiences within the landscape for education on the spread of spiny water fleas and how to protect our native ecosystems (for example, bait shops, bait dealers, marinas, sporting good stores, boater safety education, offices that sell fishing licenses, fishing organizations, and lake associations).

Action 4: Evaluate existing signage at infested water bodies and, where needed, install updated/new signs. Ensure that there are signs at all infested water bodies and also at lakes most susceptible to invasion.

Action 5: Create a brochure specific to areas around spiny water flea infested lakes describing cleaning procedure for invasives and what lakes have invasives, specifically spiny water fleas.

Action 6: Organize a media campaign with public service announcements in order to expand public awareness.

Action 7: Organize a spiny water flea monitoring program that enlists volunteers and increases monitoring in the area.

Action 9: Establish protocols and standard operating procedures for decontamination that is used by all agencies to address spiny water flea transport (including resting eggs).

Action 10: Identify target lakes that are most susceptible to spiny water fleas, based on geography, recreational use, and water chemistry. Implement monitoring on those lakes along with baseline monitoring for water quality and possibly zooplankton identification.

Action 12: Identify suitable Rapid Respond Coordinator(s) for the northern lakes region and organize Rapid Response Team(s).

Action 13: Continue research on spiny water fleas.

Action 14: Seek funds for implementation of this strategic plan.

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Appendix A
Rapid Response Flow Chart

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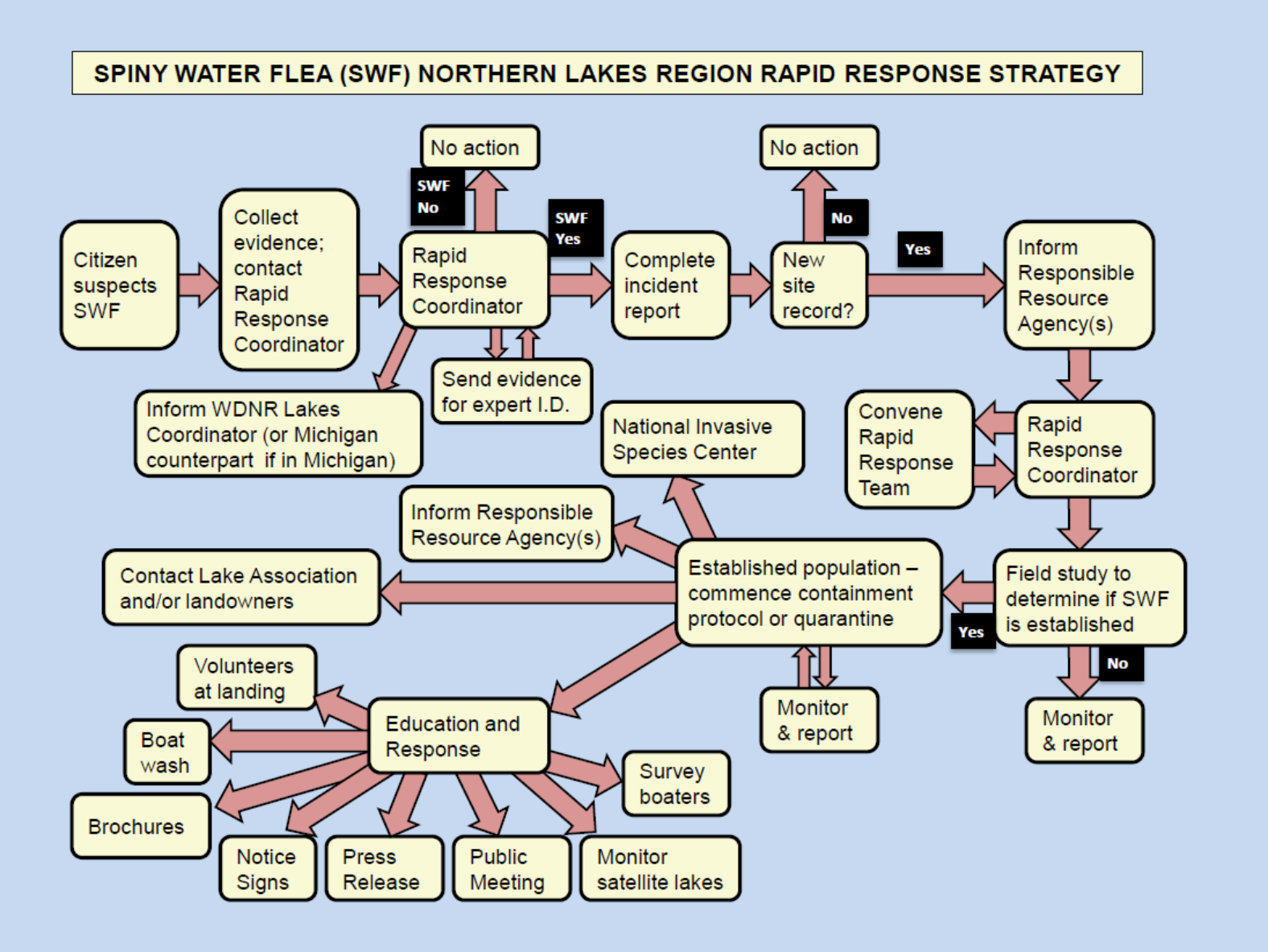
SPINY WATER FLEA (SWF) NORTHERN LAKES REGION RAPID RESPONSE STRATEGY
Citizen suspects SWF
Collect evidence; contact Rapid Response Coordinator
Rapid Response Coordinator
SWF No
No action
SWF Yes
Send evidence for expert I.D.
Inform WDNR Lakes Coordinator (or Michigan counterpart if in Michigan)
Complete incident report
New site record?
No
No action
Yes
Inform Responsible Resource Agency(s)
Convene Rapid Response Team
Rapid Response Coordinator
National Invasive Species Center
Inform Responsible Resource Agency(s)
Contact Lake Association and/or landowners
Established population – commence containment protocol or quarantine
Field study to determine if SWF is established
Yes
No
Monitor & report
Monitor & report
Volunteers at landing
Boat wash
Brochures
Education and Response
Survey boaters
Notice Signs
Press Release
Public Meeting
Monitor satellite lakes

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Appendix B
Example Forms

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CLEAN BOATS CLEAN WATERS

Watercraft Information Report

Notice: Information requested on this form will be used to track and evaluate public awareness and education efforts for watercraft inspection. Personal information, including names of staff or volunteers, is not intended to be used for other purposes but may be made avaliable to requesters.

PLEASE PRINT

Volunteer Name:	Waterbody Name:	Date:
Landing Location:	County:	City/Twp/ Village:

	Watercraft Information										Boater Information												
	State	Personal	Pontoon	Fishing	Pleasure/Ski	Sailboat	Kayak/Canoe	Other	Last Used		Source of Prior AIS Knowledge						Prevent AIS		Inspect Today		AIS Found		# Contacts
Time									Date	Location	PSA	News	Display	Pub	Sign	Other	Y	N	Y	N	Y	N	
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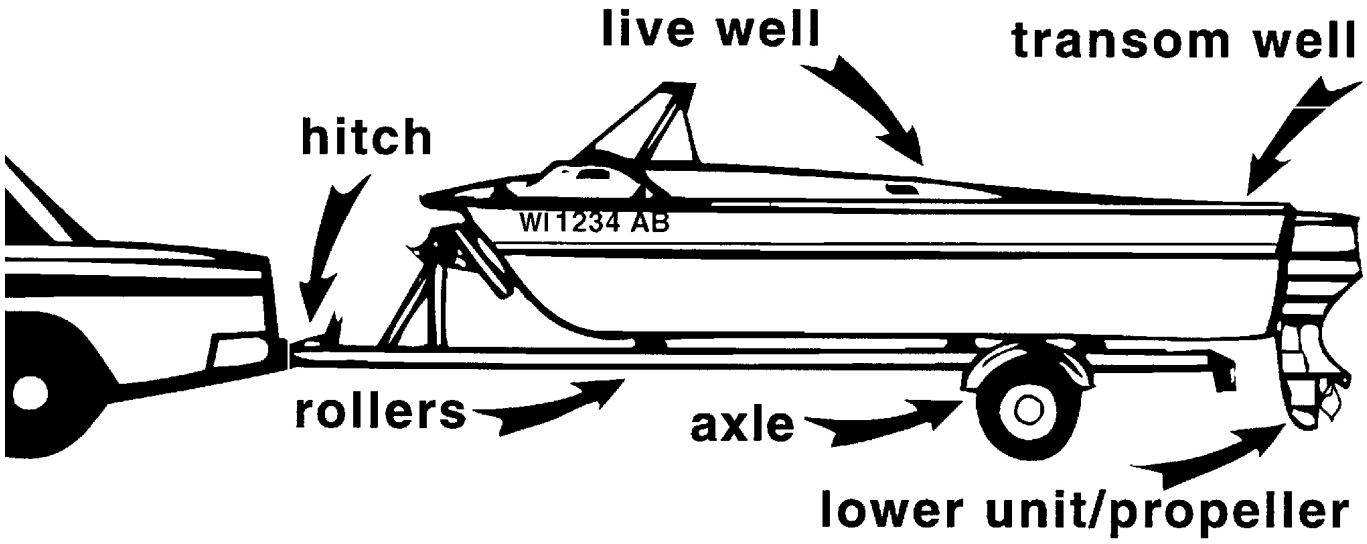
Comments/Notes:

Question Boaters Ask (use back of this page):

Watercraft Check Points



Trailer:

- ❑ Axle
- ❑ Bunks
- ❑ Frame
- ❑ License Plate
- ❑ Lights/wiring
- ❑ Rollers
- ❑ Spare Tire
- ❑ Wheels
- ❑ Winch Rope

Boat:

- ❑ Floor
- ❑ Hull
- ❑ Livewell
- ❑ Transom Well

Motor:

- ❑ Intake Pipe
- ❑ Prop
- ❑ Lower Unit

Boat Accessories:

- ❑ Anchor
- ❑ Bow Line
- ❑ Ladder
- ❑ Tow Rope
- ❑ Transducer

Other Accessories:

- ❑ Bait Bucket
- ❑ Fishing Line
- ❑ Landing Net
- ❑ Tackle

Clean Boats, Clean Waters Watercraft Inspection

Appendix C
Key Personnel Contact List

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Area	Organization	Contact	Phone	Email	Address
State of Wisconsin	UW Sea Grant Institute	Phil Moy (statewide support on AIS)	608-263-5133	pmoy@aqua.wisc.edu	1975 Willow Dr., 2nd Floor Madison, WI 53706-1177
State of Wisconsin	WDNR	Brenda Nordin (Grt Lks Outreach & Monitoring)	920-424-7885	Brenda.nordin@wisconsin.gov	
Iron County, WI	WDNR	Kevin Gauthier, Sr., Water Resource Mgt. Specialist	715-356-5211	Kevin.GauthierSr@wisconsin.gov	Woodruff Service Center 8770 Hwy J Woodruff, WI 54568
Iron County, WI	Iron County	Heather Palmquist	715-561-2234	lakes@ironcountywi.org	
Iron County, WI	WDNR	Lawrence Eslinger (Fisheries Biologist)	715-476-7847	Lawrence.eslinger@wisconsin.gov	
Vilas Co., WI	WDNR	Kevin Gauthier, Sr., Lakes Mgt. Coordinator	715-356-5211 ext 214	Kevin.GauthierSr@wisconsin.gov	Woodruff Service Center 8770 Hwy J Woodruff, WI 54568
Vilas Co., WI	Vilas County	Cathy Higley (Invasive Species Coordinator)	(715) 479-3738	cahigl@co.vilas.wi	330 Court Street Eagle River, WI 54521
Vilas Co., WI	WDNR	Steve Gilbert (Fisheries Biologist)	715-356-5211	Stephen.Gilbert@Wisconsin.gov	8770 Highway J Woodruff, WI 54568
Keweenaw	KISMA	Meral Jackson		Meral.jackson@macd.org www.kisma.org	
Gogebic and Ontonagon Co., MI	MDNR	George Madison (Fisheries Biologist)	906-353-6651	madisong@michigan.gov	MDNR West Lake Superior Management Unit Baraga, MI 49908
State of Michigan	MDEQ	Sarah LeSage (AIS Program Coordinator)	517-241-7931	lesages@michigan.gov	
Ontonagon Co., MI	Ontonagon Conservation District	Ann Hruska (District Admin.)	906-774-8441	ann.hruska@mi.nacdnet.net	102 North Hooper Street, Kingsford, MI 49802
Baraga, Co., MI	MDNR	George Madison (Fisheries Biologist)	906-353-6651	madisong@michigan.gov	427 US-41 North Baraga, MI 49908
Iron Co., MI	Iron Co Conservation District	Jen Ricker (Administrator) Also WePIC	906-875-3765	ironconservationdistrict@gmail.com	2 South 6th Street, #15 Crystal Falls, MI 49920
Gogebic Co., MI	Gogebic Conservation District	Jim Finley (Administrator)	906-663-4512	info@gogebic.cd@gmail.com	Natural Resources Center 500 N. Moore St. Bessemer, MI 49911
Western U.P., MI	Western Peninsula Invasives Coalition	Ian Shackleford	906- 932-1330 ext 331	ishackleford@fs.fed.us	USFS, Ottawa National Forest, E6248 US 2 Ironwood, MI 49938
Upper Peninsula, MI	Michigan Sea Grant	Ron Kinnunen (U.P. AIS contact)	906-226-3687	kinnune1@msu.edu	710 Chippewa Square Suite 202 Marquette, MI 49855
Western U.P., MI	MDNR	Mark Mylchreest (Fisheries Biologist)	906-875-6622	mylchreestm@michigan.gov	1420 Highway US-2 West Crystal Falls, MI 49920
Wisconsin & Michigan	White Water Associates, Inc	Angie Stine (Aquatic Biologist)	906-822-7889	angie.stine@white-water-associates.com	P.O. Box 27, 429 River Lane, Amasa, MI 49903

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Appendix D
Aquatic Invasive Animal Incident Report

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State of Wisconsin
Department of Natural Resources
Wisconsin Lakes Partnership

Aquatic Invasive Animal Incident Report

Form 3200-126 (R 02/10)

The purpose of this form is to notify DNR of a new species of AIS in a waterbody. Only use if you found an aquatic invasive species on a lake where it hasn't been found previously.

To find where aquatic invasives have already been found, visit: http://dnr.wi.gov/lakes/ais.

Notice: Information on this voluntary form is collected under ss. 33.02 and 281.11, Wis. Stats. Personally identifiable information collected on this form will be incorporated into the DNR Surface Water Integrated Monitoring System (SWIMS) Database. It is not intended to be used for any other purposes, but may be made available to requesters under Wisconsin's Open Records laws, ss. 19.32 - 19.39, Wis. Stats.

Primary Data Collector

Name	Phone Number	Email

Monitoring Location

Waterbody Name	Township Name	County	Boat Landing (if you only monitor at a boat landing)

Date and Time of Monitoring or Discovery

Monitoring Date	Start Time	End Time

Information on the Aquatic Invasive Animal Found (Fill out one form for each species found.)

Which aquatic invasive did you find? ☐ Zebra Mussel ☐ Quagga Mussel ☐ Spiny Waterflea ☐ Freshwater Jellyfish
☐ New Zealand Mud Snail ☐ Banded Mystery Snail ☐ Chinese Mystery Snail ☐ Rusty Crayfish ☐ Red Swamp Crayfish

Where did you find the invasive animal?

Latitude:	Longitude:

Measurements from where the invasive was found (optional)

Water Temperature Degrees F / Degrees C (circle one)	Dissolved Oxygen (mg/l)

Estimated percent cover in the area where the invasive was found (optional)

Substrate cobble, %	Substrate muck, %	Substrate boulders, %	Substrate sand, %	Bottom covered with plants, %

If you found Zebra Mussel(s)

Water depth where Zebra Mussels were found _____ Feet / Meters (circle one) | Total Number of Zebra Mussels Found _____

What were the Zebra Mussels attached to?

☐ Dock/pier ☐ Dam ☐ Rocks ☐ Plants ☐ Boats or Gear ☐ Plate Sampler(s) ☐ Logs, acorns, pine cones or other woody structure
☐ Other: _____

Size of Largest Zebra Mussel Found	Size of Smallest Zebra Mussel Found (individual measurements on back of page)

Voucher Sample

Did you collect a sample (voucher specimen) and bring it to your local DNR office? If so, which office?

☐ Rhinelander ☐ Spooner ☐ Green Bay ☐ Oshkosh ☐ Did not take sample to a DNR office
☐ Fitchburg ☐ Waukesha ☐ Eau Claire ☐ Superior ☐ Other Office: _____

Please collect up to five specimens and bring a copy of this form, along with the sample and a map showing where you found the suspect invasive species to your regional AIS or Citizen Lake Monitoring Coordinator at the DNR.

While field collecting, specimens can easily be kept alive in a bucket or other container with just about 1/2 inch of water in the bottom. Freeze specimens at the end of the day in a ziploc bag without water. If freezing is not possible for a long period of time preservation in rubbing alcohol (except for Jellyfish - leave fully in water) is sufficient.

For DNR AIS Coordinator to fill out

AIS Coordinator or qualified field staff who verified the occurrence: _____

Statewide taxanomic expert who verified the occurrence: _____
(for list see http://dnr.wi.gov/invasives/aquatic/whattodo/staff/AisVerificationExperts.pdf)

Was the specimen confirmed as the species indicated above? ☐ Yes ☐ No	If no, what was it?
Museum where specimen is housed: _____	Museum Specimen ID:

Have you entered the results of the voucher in SWIMS? ☐ Yes ☐ No

AIS Coordinator: Please enter the incident report in SWIMS under the Incident Report project for the county the AIS was found in. Then, keep the paper copy for your records.

Length of Zebra or Quagga Mussels from Sample (if applicable)

If more than 20 zebra or quagga mussels are found, measure 20 mussels chosen randomly from the sample. If less than 20 mussels are found, measure all mussels.

Number	Length (mm)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Note: All initial discoveries should be placed in rubbing alcohol until verification by an expert is obtained.

Appendix E
Friends of the Gile Flowage Brochure

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Only You Can Stop These Aquatic Invaders that threaten the Gile Flowage

Eurasian Water Milfoil

Spreads like quackgrass from tiny fragments left on a boat motor, trailer, or other equipment. It forms dense vegetative mats, chokes out beneficial aquatic plants, and makes boating and fishing difficult. It is a serious threat to the Flowage if it become established here.

Spiny Water Flea This tiny crustacean eats the food baby game fish need to survive, yet it is too prickly to be eaten by most fish. It is a serious threat to the Flowage's fishery and any other lakes it might spread to.

Purple Loosestrife A pretty purple invader that chokes out beneficial native wetland plants that provide food and cover for fish and wildlife. It spreads by seeds and roots.

Chinese Mystery Snail Found in the Gile Flowage, it may threaten native mollusks if it spreads to other lakes.

Don't let these or other aquatic invaders hitch-hike a ride on your equipment to infest more lakes!

BE A FRIEND OF THE FLOWAGE
Help us get R.I.D. of aquatic invasive species that threaten boating, fishing, and recreation

BEFORE LAUNCHING.. BEFORE LEAVING...

Remove all aquatic plants and animals from your boat, motor, trailer, and equipment.
If possible power wash your equipment and let dry.

Inspect your equipment. Make sure an invader isn't hitch-hiking a ride with you to infest another lake.

Drain live well and dispose of unwanted live bait on shore and away from the boat landing.

Make sure your catch isn't an aquatic invasive hitch-hiker! Get R.I.D of them!

BRING HOME A TROPHY GILE FLOWAGE EXPERIENCE... NOT AN AQUATIC INVADER

For more information contact the Friends of the Gile Flowage, Box 227, Montreal, WI 54550

The "Be A Friend of the Flowage" Campaign to stop the spread of invasive species into and out of the Gile Flowage is made possible with support from:

BoatUS Foundation
"Funded by a grant from the BoatU.S. Foundation"

WISCONSIN DEPT. OF NATURAL RESOURCES

The Towns of Carey and Pence

FRIENDS OF THE GILE FLOWAGE

Photo credits: Aquatic invasive species photos: Michigan Sea Grant Program- Dave Brennen and M. Walter, www.miseagrant.umich.edu,; Boat inspection & draining livewell-Deb Rose,MNDNR; Spiny water flea -GLSGN.; Ice fishing photo-NOAA. Back cover-Judy Tronvig, front cover-

Flowage Map Inside

WELCOME TO THE GILE FLOWAGE

Be A Friend... Help Us Stop the Spread Of Aquatic Invasive Species

And keep the Flowage's Fishing, Boating, and Recreation *GREAT!*

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Appendix F
Spiny Water Flea Brochure

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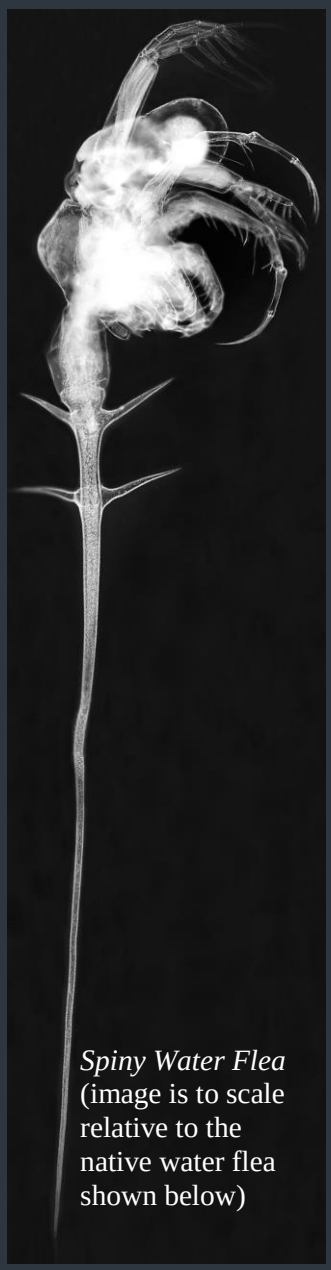
Spiny Water Flea



Spiny Water Flea (image is to scale relative to the native water flea shown below)

The spiny water flea (*Bythotrepes longimanus*) is an aquatic invasive species that is colonizing inland lakes of northern Wisconsin and Michigan's Upper Peninsula. This species of zooplankton is native to Northern Europe and Asia. First discovered in Lake Huron in 1984, they were probably transported there by ship ballast water. Spiny water fleas have since flourished throughout the Great Lakes and have invaded a large number of inland lakes in the northeastern U.S. and eastern Canada.

The spiny water flea belongs to a group of tiny crustaceans collectively called cladocerans ("water fleas"). Most native water fleas are crucial components of the aquatic food web where they feed on single celled algae (phytoplankton). The native water fleas act to prevent dense algal blooms and are themselves eaten by native fishes in vast numbers (they are the "krill" of the freshwater ecosystem. In contrast to most native water fleas, the spiny water flea is a predator that eats tiny zooplanters including native water fleas. They have the potential to alter the entire zooplankton community by their foraging. They directly compete with small fish for the native water flea food source. Many fish (young fish and minnows) cannot eat spiny water fleas because of the spine

Magnification is helpful in identifying the spiny water flea. Individuals are about ¼ to ½ inch (5-13 mm) in length. They have a long barbed tail with one to four pairs of barbs running down it. Since they are small and rather transparent, they tend to go unnoticed. However, they can be present in large numbers and sometimes accumulate on fishing lines and downrigger cables (see photo in upper right corner). When this happens anglers are likely to take note and may be the first to identify a spiny water flea population in a lake. Monitoring for spiny water fleas sometimes involves dragging a fishing line through the water. Sometimes a plankton tow net is used (see photo at right).

Spiny water fleas on a fishing line

Spiny water fleas produce through parthenogenesis, commonly known as asexual reproduction. This means that males are not required and populations can explode in number. Through sexual reproduction, spiny water fleas produce overwintering eggs.

Boats and equipment can transport spiny water fleas and their eggs to new water bodies. The resting eggs survive long after the adults are dead. They overwinter and can survive extreme environmental conditions. Over-wintering eggs can even withstand being passed through the digestive system of a fish. Care must be taken not to transport water, mud, vegetation, or fish between water bodies so that the spiny water flea is not accidentally transported to a new lake.

A plankton net

Spiny Water Flea – Infestations and Prevention

The History of the Spiny Water Flea Invasion in Northern Wisconsin and the Western Upper Peninsula

Gile Flowage, Iron County Wisconsin

First found in 2003. Random mass die-off in 2004.

Stormy Lake, Vilas County, Wisconsin

First found in 2006. Native zooplankton populations have decreased. In 2008 – lake had the lowest Secchi reading (water clarity) in a 15 year history.

Lake Gogebic, Gogebic/Ontonagon Counties Michigan

First found late 90's. Established population. 2010 – Portable boat wash available with paid inspectors.

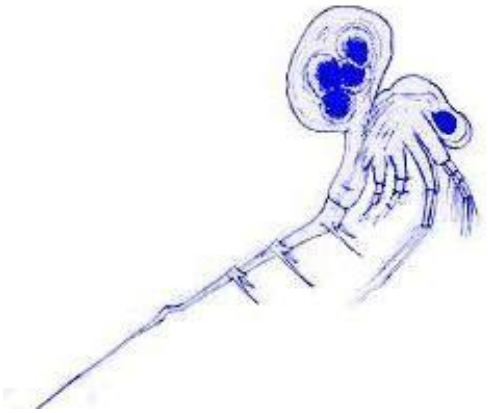
Lake Superior and a few other lakes are infested with the spiny water flea in Wisconsin and Michigan. It is best to assume any water body that you visit could potentially have an aquatic invasive species.

For each outing you should ***INSPECT, DRAIN, DRY!***

Spiny water fleas have spread from Lake Superior to inland lakes in the region. Spiny water fleas are present in northern Wisconsin: Gile Flowage (Iron County), Stormy, Star and Trout Lakes (Vilas County), Butternut Lake (Forest County), and a few southern Wisconsin lakes. Spiny water fleas are also present in Lake Gogebic (Gogebic and Ontonagon Counties, Michigan), several lakes in Keweenaw County, Michigan, and Lake Michigamme (Marquette County, Michigan).

Scientific literature shows that the spiny water flea is limited to regions where water temperature ranges between 4 and 30 ° C and salinity values between 0.04 and 8.0%, but it prefers temperatures between 10 and 24 ° C and salinity between 0.04 and 0.4% (Grigorovich et al. 1998). Spiny water flea frequent deeper waters during the day and come closer to the surface at night to feed.

Once spiny water fleas have established in a lake, there is no known way to eradicate them.



STOP AQUATIC HITCHHIKERS!™

Prevention Steps

INSPECT and ***REMOVE*** aquatic plants and animals, including gelatinous or cotton batting-like material from lines, especially where they may meet swivel, lure or downrigger ball connection from boat, trailer and equipment.

DRAIN water from the boats, motors, live wells, and bilge.

NEVER MOVE live fish away from a waterbody. Fish may have resting eggs in them. DISPOSE of unwanted live bait, worms, and fish parts in trash.

RINSE boat, trailer and equipment with hot (at least 122 °F) and/or high-pressure water, ***AND/OR DRY*** for 5 days or more before use.

This brochure was made as part of a Wisconsin Department of Natural Resources Aquatic Invasive Species Control Grant awarded to the Friends of the Gile Flowage. Project partners include the Stormy Lake Association, Lake Gogebic Improvement Association, and White Water Associates, Inc.

WHITE WATER ASSOCIATES, INC.

WISCONSIN DEPT. OF NATURAL RESOURCES

FRIENDS OF THE GILE FLOWAGE