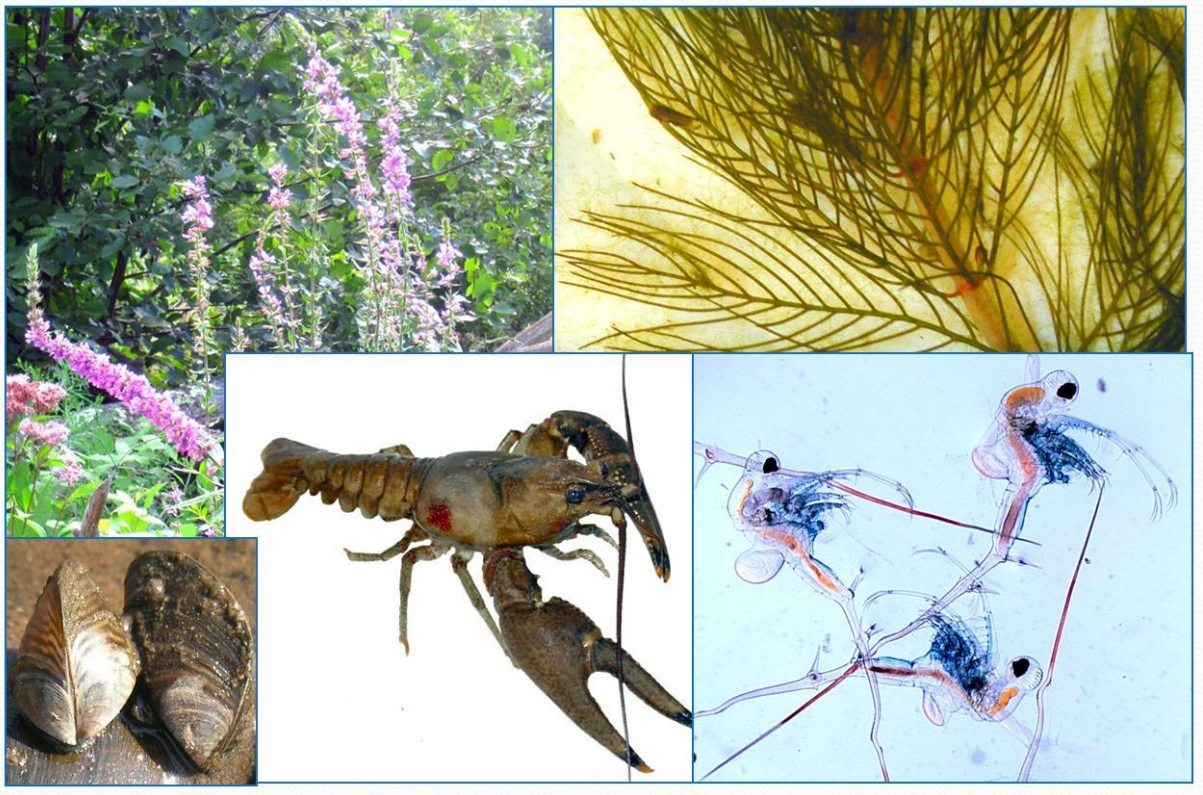
Hagerman Lake
(Iron County, Michigan)

Aquatic Invasive Species Report



WHITE WATER
ASSOCIATES, INC.

Date: 2019

INTRODUCTION

White Water Associates, Inc. has been retained by The Hagerman Lake Property Association (HLPOA) to conduct an Aquatic Invasive Species (AIS) Survey on Hagerman Lake every other year with 2018 being the most recent survey. The survey monitored Hagerman Lake for AIS using the Wisconsin Department of Natural Resources (WDNR) Early Detection monitoring protocol. This approach assesses the lake as to its vulnerability to AIS and documents aquatic invasive species as detected. The Citizen Lakes Monitoring Program also had a volunteer monitor for AIS in 2017 using the Exotic Plant Watch protocol. Education is an important component of stopping the spread of aquatic invasive species.

AQUATIC INVASIVE SPECIES EARLY DETECTION MONITORING

In order to determine presence of AIS in Hagerman Lake, White Water Associates biologists followed the *Aquatic Invasive Species Early Detection Monitoring Standard Operating Procedure* (WDNR, 2014). This procedure outlines several types of monitoring techniques, including: boat landing searches, sample site searches, targeted searches, waterflea tows and/or a Ponar dredge, and a meander search. The Hagerman Lake Survey took place August 30, 2018.

Five sites around the lake shoreline were searched along with a meander search in between sites. Hagerman Lake has a public boat landing which was also searched. Four of the five shoreline sites were randomly selected and are identified in Table 1 and depicted on Map 1. Snorkeling was not used to search for AIS due to the high water clarity. A long rake was used to collect any suspicious aquatic plants for closer inspection and identification. A D-net was used to collect invertebrate animals to look for AIS. Any invasive species observed were recorded. In the event of a new AIS record, specimens are collected for verification. No shoreline sites had confirmed AIS. We did observe an iris at Site 2 that could be the aquatic invasive yellow iris. It was not the flowering season at the time of the AIS survey so the plant was not positively identified.

Spiny water fleas are an aquatic invasive zooplankton that is found in a few lakes in Michigan and Wisconsin. They can be monitored by way of plankton tow nets or by an examination of sediment for dead waterflea exoskeleton fragments. In Hagerman Lake, a zooplankton net (Exhibit 1) was used to collect any suspect invasive spiny water fleas or fish hooks waterfleas. In addition, a Ponar dredge was used to collect sediment sample. The

zooplankton sample was brought back to the lab to look for spiny water fleas under magnification. The sediment sample was brought back to the lab and filtered to look for spiny water flea spines under magnification. No AIS were found.

Meander surveys found no additional invasive species.

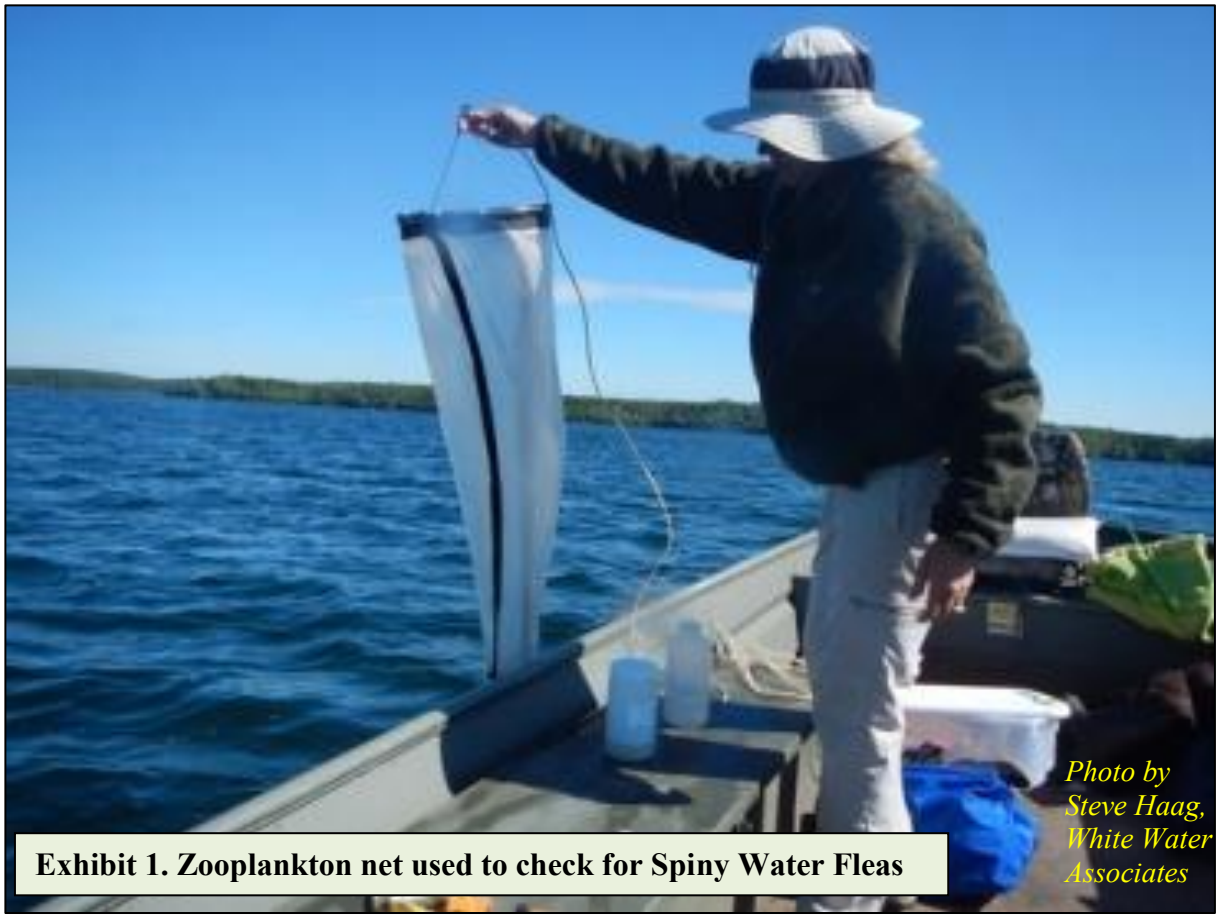
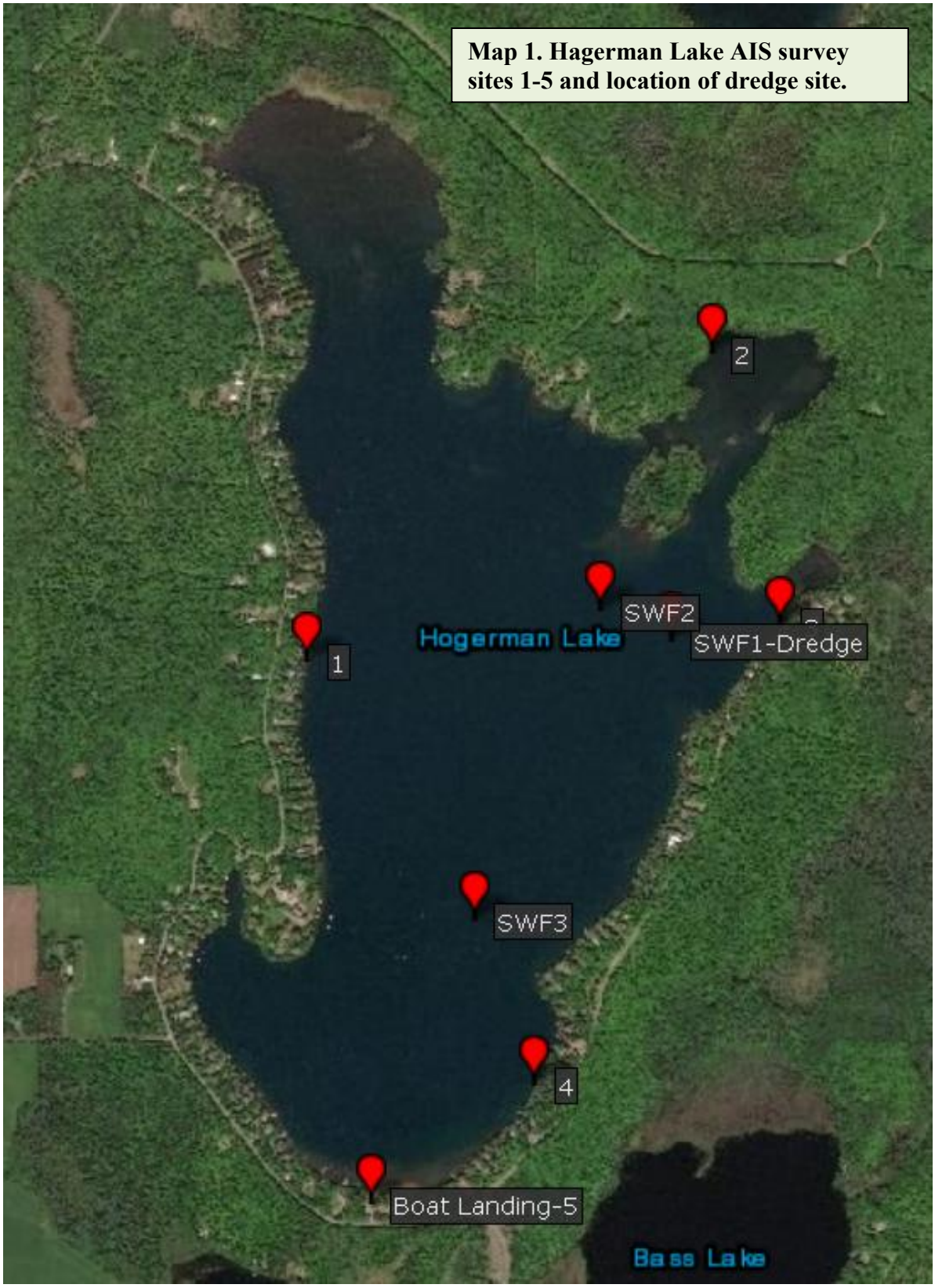


Exhibit 1. Zooplankton net used to check for Spiny Water Fleas

Table 1. AIS Survey on Hagerman Lake 8/30/2018.			
Site	**Latitude**	**Longitude**	**Species Found**
1	46.06018	-88.78429	No AIS
2	46.06738	-88.77064	Possible yellow iris (not confirmed)
3	46.06101	-88.76832	No AIS, reed canary grass (terrestrial invasive species)
4	46.05026	-88.77662	No AIS
5 BL	46.04745	-88.78214	No AIS



Map 1. Hagerman Lake AIS survey sites 1-5 and location of dredge site.

Table 2. Spiny Water Flea Sample from Hagerman Lake 8/30/2018			
Date: 7/22/2018	**GPS Coordinates**		**Depth of sample (feet)**
Site 1- Dredge	46.06065	-88.77200	30
Site 2	46.06136	-88.77437	30
Site 3	46.05411	-88.77864	37

The yellow iris (Exhibit 2) (*Iris pseudacorus)* is a perennial aquatic plant native to Europe, western Asia and North Africa. It was first introduced to North America in the 1800s as an ornamental plant. Over time, the plant has spread too many wetlands and proliferated to the detriment of native plants and animals. Yellow iris is present in numerous Michigan and Wisconsin lake margins. The yellow iris can reduce habitat needed by fish and waterfowl (Thomas 1980). Yellow iris is suspected on Hagerman Lake, but as yet has not been verified by a survey during the flowering season. A future survey, when the yellow iris is in bloom, would be beneficial to determine what strategies could be used to help control this plant.

Exhibit 2. Blue Flag Iris (Native, on left) and Yellow Flag Iris (Non-native, on right)

Photo by Angie Stine, White Water Associates (photo not from Hagerman Lake)

Yellow iris is a poisonous species. Insects and other animals tend not to feed on this plant in its native range (Forest Health Staff 2006). Contact with the plant can cause

dermatitis in humans. It can be difficult to distinguish yellow iris from native irises when not in bloom (Lui et al. 2010, Sarver et al. 2008). Native blue flag irises are typically smaller and more delicate. Yellow iris typically grows much taller and displays large, beautiful, bright yellow flowers. After the flowering period, the shape of the seed capsule can distinguish northern blue flag iris (three-angled seed capsule) from yellow iris (six-angled seed capsule) (Campbell et al. 2010). When in bloom, it is easy to distinguish yellow iris because it is the only iris that grows completely yellow in natural environments (Goodridge et al. 2011).

Exhibit 3. Summary of Yellow Iris Best Management Practices

Adapted from King County Noxious Weed Control Program Yellow-flag iris BMP; 206-296-0290 Website: www.kingcounty.gov/weeds)

Small Infestations in Native and/or Desirable Plants

- Hand digging is recommended for very young plants not yet established.
- Larger plants from isolated small populations can be dug out from moist areas. Requires persistence for several seasons.
- Replace divots created when removing the plants to lessen the amount of disturbed soil.
- Plants in standing water can be cut below the waterline.
- If manual control is not possible, consult DNR, USFS, or consultant for possible chemical approaches and necessary permit(s).

Control in Riparian Areas or Lake Shores

- Survey area and document extent of infestation.
- Focus on manual removal for small infestations.
- When large areas are removed, the cleared area needs to be replanted with native or non-invasive vegetation and stabilized against erosion.
- For areas where herbicide use may be warranted, consult appropriate agency(s) for method(s) that will cause the least amount of damage to desirable vegetation and for advice on permit(s).
- Control efforts may require several years of attention to remove plants germinating from the seed bank and rhizome fragments.

Reed canary grass (*Phalaris arundinacea*), generally considered a terrestrial invasive species, was observed at Site 3. Reed canary grass has been found in nearly every county in Wisconsin and Michigan. It forms dense stands in wetland and riparian areas (Czarapata, 2005). It reproduces by spreading rhizomes, and seeds (Czarapata, 2005).

Finally, we recorded pink water lilly near the shoreline of Hagerman Lake during the point-intercept aquatic plant survey (part of our "boat survey" records). This is an ornamental cultivar of the white water lilly (they are the same species, *Nymphaea odorata*). It is considered to be invasive and future monitoring should determine the extent of this pink water lilly in Hagerman Lake.

CITIZEN LAKE MONITORING PROGRAM EXOTIC PLANT WATCH

The CLMN AIS Monitoring was conducted by a volunteer on August 11, 2017. The survey involved sampling at multiple locations around the lake to detect new aquatic invasive species and document them. The species of concern were Eurasian water milfoil (*Myriophyllum spicatum*), starry stonewort (*Nitellopsis obtuse*), curly-leaf pondweed (*Potamogeton crispus*), and Hydrilla (*Hydrilla verticillata*). No invasive spices were found on that outing. The full report can be found in the *CLMP 2017 Data Report for Hagerman Lake, Iron County* in Appendix 4.

EDUCATION

Clean Boats Clean Waters is a program to educate stakeholders on the importance of transporting aquatic invasive species. Hagerman Lake is fortunate enough to have a permanent boat wash with high pressure water to clean boats (Exhibit 4). The use of this boat wash is imperative to protecting Hagerman Lake from introduction of aquatic invasive species. In order to educate users of Hagerman Lake about lake stewardship and use of the boat wash station, Angie Stine (White Water Associates aquatic biologist) gave a presentation at the boat wash station and boat landing in 2016. Stine also presented on aquatic invasive species to the HLPOA annual meeting in August of 2016. There is a link on the HLPOA website to this PowerPoint document (www.hagermanlake.org). There is also a brochure on the website describing what HLPOA is and about aquatic invasive species.

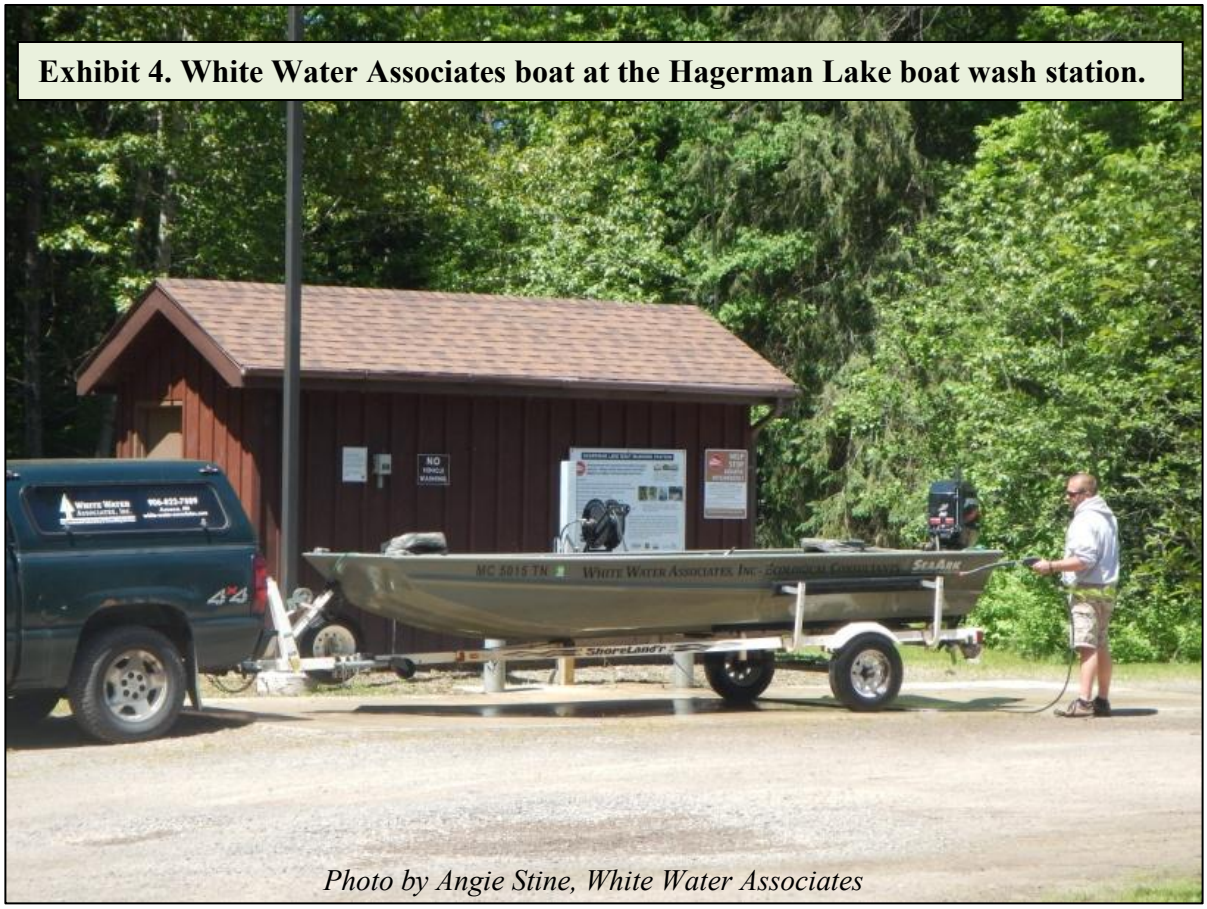


Exhibit 4. White Water Associates boat at the Hagerman Lake boat wash station.

Photo by Angie Stine, White Water Associates

ZEBRA MUSSEL SUSCEPTABLITLY

Zebra mussels are spreading in Iron County and surrounding areas. In 2009, there was an observation record of zebra mussels in Hagerman Lake, but since that time there have been no additional reports. The fact that zebra mussels did not establish in Hagerman Lake could be due to the pH and calcium levels of the water. Hagerman Lake is considered "borderline suitable" for zebra mussels (Exhibit 5). At the beginning of the summer season, May 2012, four zebra mussel substrate samplers (Exhibit 6) were deployed in Hagerman Lake. In 2019, two more additional samplers will be used. Continue to check your docks throughout the water use season and also when they are removed in the fall for attached zebra mussels. The use of the boat wash is helpful, but it should be noted that zebra mussel veligers (the immature life stage) are very small and can be in live wells, bait buckets, or attached to anything that was in the water and transferred to Hagerman Lake. In Iron County, Chicagon Lake and the Fortune Chain of Lakes currently have established zebra mussel populations and

Fortune Pond has the closely related quagga mussel. These are all nearby sources of these AIS. If you visit any of these water bodies (and others), clean, drain, and dry your watercraft and trailer for at least five days before entering another lake. Always assume an aquatic invasive could be in other lakes and take the necessary precautions to stop the spread. If you live on Hagerman Lake and can dedicate a watercraft for use only on Hagerman Lake, this is the best protection against inadvertent transfer of AIS to the lake.

Many water quality factors can augment or inhibit the growth and reproduction of zebra mussels. Calcium and pH levels are the most significant water quality constituents that help predict if zebra mussels can survive in a given lake. Calcium is crucial to zebra mussel survival because it is used at every stage of the life cycle (ANS Task Force). This is why calcium is considered a limiting factor for establishment of zebra mussel populations in inland lakes. According to *The Practical Manual for Zebra Mussel Monitoring and Control*, lakes with calcium ranges from 5-6 mg/L allow for no shell growth, 10-11 mg/L allows for poor growth, 25-26 mg/L allows for moderate growth, and greater than 35 mg/L allows for good growth (Claudi and Mackie, 1994). Important calcium thresholds for zebra mussels are as follows: survival (3 mg/L), shell growth (7 mg/L), reproduction (12 mg/L), and massive infestations (25 mg/L) (Claudi and Mackie, 1994). Hagerman Lake was tested for calcium in 1974 (13 mg/L), 1988 (13.7 mg/L), 2007 (15 mg/L), 2010 (15.9 mg/L), and 2017 (15 mg/L). This level is between poor growth ability and moderate growth. It is, however, sufficient for zebra mussel population establishment.

Zebra mussels also have a distinct pH tolerance level. According to Claudi and Mackie (1994), lakes with pH ranges from 0-6.8 allow for no shell growth, 6.9-7.4 allows for poor growth, 7.5-7.8 allows for moderate growth, and greater than 7.9 allows for good growth. Other important pH thresholds for zebra mussels include (1) survival of adults begins near 6.5, (2) survival of veligers begins near 6.9, (3) the incipient lethal level (level at which 50 percent of a population cannot survive—also known as LD50) for veligers is near 7.4, and levels of infestation begin near pH 8.0 (Claudi and Mackie, 1994). The pH at Hagerman Lake surface was 8.7 (1954), 8.5 (1988), 8.9 (2007), 7.1 (2010), 8.0 (2015), and 8.1 (2017). These data suggest that the pH of Hagerman Lake water is suitable for zebra mussels. This parameter should be monitored in the future.

A zebra mussel population could establish in Hagerman Lake based on both calcium and pH. According to the University of Wisconsin-Madison's Aquatic Invasive Species Smart Prevention, Hagerman Lake is "Borderline Suitable" for zebra mussels (UW-Madison).

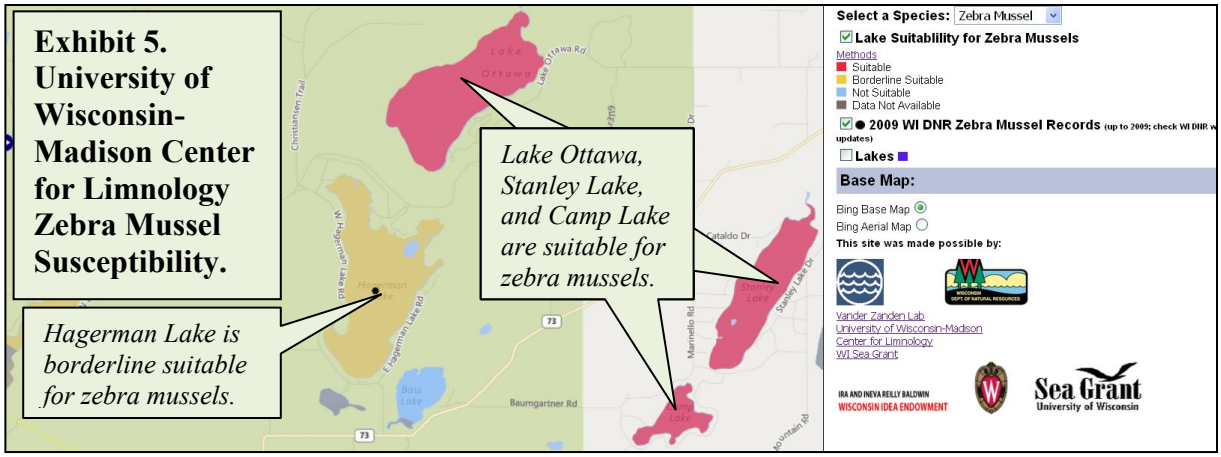


Exhibit 5. University of Wisconsin-Madison Center for Limnology Zebra Mussel Susceptibility.
Lake Ottawa, Stanley Lake, and Camp Lake are suitable for zebra mussels.
Hagerman Lake is borderline suitable for zebra mussels.
Select a Species: Zebra Mussel
Lake Suitability for Zebra Mussels
Methods
Suitable
Borderline Suitable
Not Suitable
Data Not Available
2009 WI DNR Zebra Mussel Records
Lakes
Base Map:
Bing Base Map
Bing Aerial Map
This site was made possible by:
Vander Zanden Lab
University of Wisconsin-Madison
Center for Limnology
WI Sea Grant
IRA AND INEVA REILLY BALDWIN
WISCONSIN IDEA ENDOWMENT
Sea Grant
University of Wisconsin

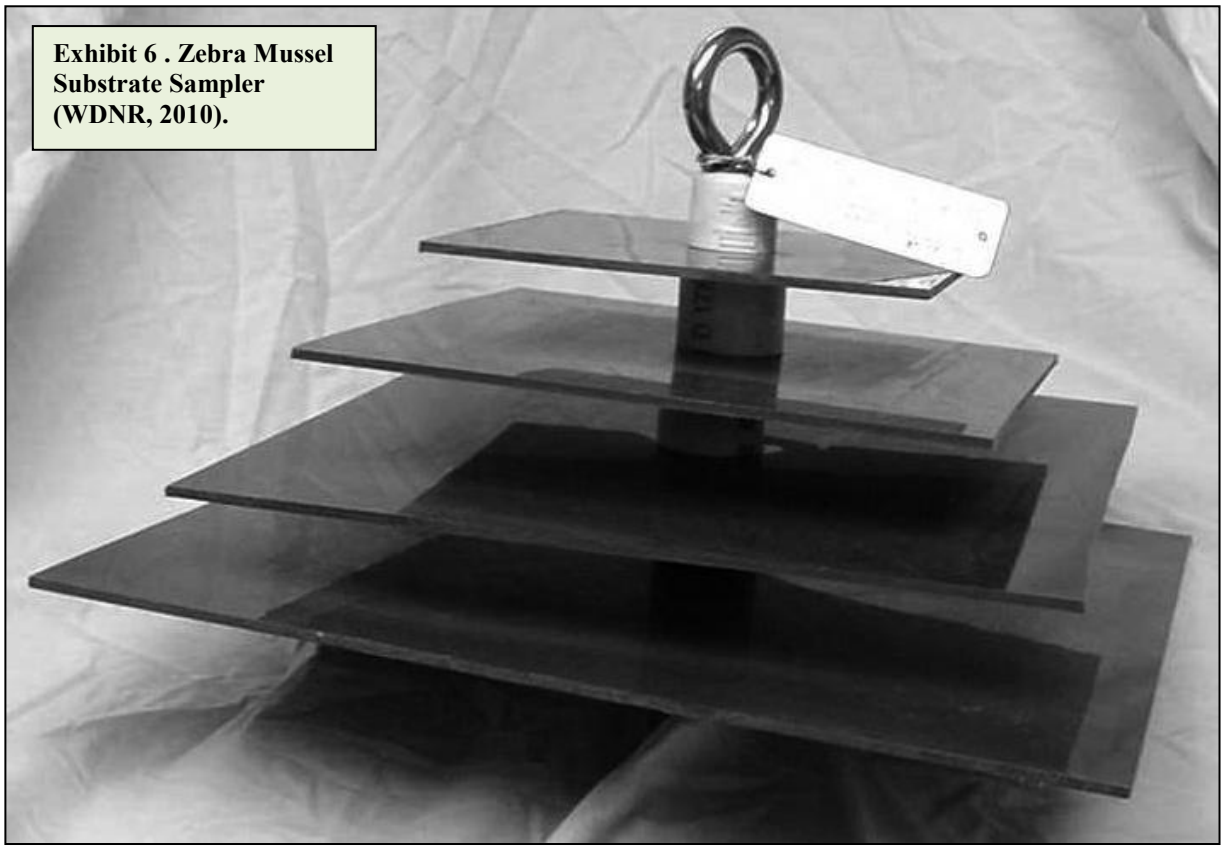


Exhibit 6 . Zebra Mussel Substrate Sampler (WDNR, 2010).

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