Early detection, vectors, and impact of invasive spiny water flea in Wisconsin Lakes

Spiny water flea

Spiny water flea (*Bythotrephes longimanus*) are tiny non-native aquatic animals (zooplankton) which were first reported in the Great Lakes in the 1980s, and identified in a small number of Wisconsin inland lakes in the early to mid-2000s. They can negatively affect native species of zooplankton, which in turn may lead to impacts to fish, algae, water clarity, and other key components of lake ecosystems. Since the completion of this study, spiny water flea has been found in several more locations in Wisconsin. Spiny water flea is listed as prohibited in Wisconsin under ch. NR 40.

Research Methods

- Researchers evaluated the ecological and economic impacts of spiny water flea on lakes they have invaded; including Yahara Chain of Lakes (Mendota, Monona, Waubesa, & Kegonsa; Dane Co.), Stormy Lake (Vilas Co.), Gile Flowage (Iron Co.), and Lake Gogebic (Gogebic/ Ontonagon Co., MI).
- Numerous samples from the study lakes were collected and compared with historical data which was available from these lakes prior to the invasion of spiny water flea.
- The project also assessed several monitoring techniques to learn how to most accurately detect the presence of these very small animals.
- Boats leaving Lake Mendota were also analyzed to identify possible ways this species may spread between waterbodies.

Summary of Results

- Spiny water fleas were found at the highest densities in Lake Mendota and occurred at lower levels in all the other study lakes. Peak densities of spiny water flea were consistently observed during late summer and fall.
- Native zooplankton communities were observed to shift dramatically in response to SWF invasion. Declines were observed in populations of *Daphnia pulicaria*, an ecologically important zooplankton species eaten by spiny water flea.
- Yellow perch were found to feed heavily on spiny water fleawhen they were abundant. Yellow perch diets examined prior to SWF invasion consisted of 60% *Daphnia*, while current diets were estimated at <1% *Daphnia* and 47% SWF.
- Changes in these native zooplankton populations resulted in a decline in water clarity. The researchers estimated the potential cost to offset the negative water quality impacts of SWF at over $100 million in Lake Mendota.
- Spiny water flea detection probabilities were highly seasonal for both net tows and eDNA sampling. Analysis of sediments collected via an Ekman grab found spiny water flea spine subfossils in all invaded lakes, and this method was not sensitive to seasonal variation in spiny water flea population densities.
- Spiny water flea resting eggs were found at high levels within the lake sediment, suggesting that these eggs can potentially be transported between waterbodies in mud attached to anchors and anchor lines.

Potential applications:

This study quantified some of the highly significant ecological and economic impacts spiny water flea can have on Wisconsin lakes. By incorporating northern and southern lakes, this project broadened our scientific knowledge of spiny water flea on a statewide scale. This type of research can inform how the DNR and other partners work to prevent and manage this non-native species throughout the region, including helping to identify waterbodies that may be at the most risk from future invasions.

Related Publications and Resources

Walsh, J.R. et al. 2016. Outbreak of an undetected invasive species triggered by a climate anomaly. Ecosphere 7(12):e01628.

Walsh, J.R. et al. 2016. Invasive species triggers a massive loss of ecosystem services through a trophic cascade. Proceedings of the National Academy of Sciences of the United States of America 113(15): 4081 – 4085.

Walsh, J.R. et al. 2017. Invasive invertebrate predator, *Bythotrephes longimanus*, reverses trophic cascade in a north-temperate lake. Limnology and Oceanography 62: 2498-2509.

Walsh, J.R. et al. 2018. Uncoupling indicators of water quality due to the invasive zooplankter, *Bythotrephes longimanus*. Limnology and Oceanography 63:131-1327.

Walsh, J.R. et al. 2019. Using eDNA, sediment subfossils, and zooplankton nets to detect invasive spiny water flea (*Bythotrephes longimanus*). Biological Invasions 21: 377-389.

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