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Estuarine Invaders: Environmental Monitoring Tracks Lake Superior NERR Non-Native Species, Surveils Water Quality

By Lori Balster on February 8, 2018

Hannah Ramage and the St. Louis River go back several years. "I went to University of Minnesota at Duluth for my master's degree, where I did research on the St. Louis River estuary," says Ramage, now the Monitoring Coordinator for Lake Superior National Estuarine Research Reserve (NERR). "Working here was a great opportunity to keep doing the research that I loved doing," she says. "I've always been drawn to this NERR system."

Lake Superior NERR research consists of many pieces. Abiotic monitoring is performed, which includes continuous water monitoring and meteorological monitoring. Water quality monitoring is done at several stations chosen to reflect a continuum of lake to river water influence. The Lake Superior NERR is situated on a freshwater estuary where the St. Louis River meets Lake Superior. Monitoring is done using YSI EXO2 sondes now, but prior to that YSI 6600 series sondes were used. "Sondes are deployed for up to one month," says Ramage. "They are also calibrated monthly."

In addition to the System Wide Monitoring Program (SWMP) that all 29 NERRs use, Lake Superior NERR is also experimenting with sending their EXO2 sondes under St. Louis River ice this year. "We want to see how well the probes do for us," says Ramage. "We've seen high chlorophyll a concentrations under the ice and want to keep an eye on it. We want to see if there's algal blooms." The sondes collect temperature, conductivity, dissolved oxygen, turbidity and pH data. One station, at Barkers Island, closest to the exit of the River, right at the end of the dock, also has a sonde with a chlorophyll a and a total algae sensor. Barkers Island has a live setup in coordination with NOAA that transfers all Barkers Island data telemetrically. Barkers Island is also the site of the education center, Lake Superior Estuarium. The sonde furthest upstream is on Oliver Bridge, by the town of Oliver, WI. This particular sonde is stored in a housing attached to the bridge. Another site housing a sonde is at the Blatnik highway bridge. Both bridges have the same kind of sonde housing.

There is also a special site on the Pokegama Bay, where the Pokegama River meets the St. Louis River estuary. "That is our sentinel site for SWMP," says Ramage. "It's a unique part of the river: it's very turbid." A meteorological station is also part of the Pokegama Bay site.

Like all NERRs, Lake Superior NERR does vegetation monitoring. However, the Lake Superior site has a different emphasis than some other NERRs: invasive species. "We are concerned with invasive species here," says Ramage. "The St. Louis River estuary contains the largest port in the Great Lakes (by tonnage), and therefore we get a lot of non-native species introductions. There's an invasion of purple loosestrife, which chokes out native plant species when it gets a chance. We



Hannah Ramage using a paddle board to sample our long term vegetation plots that became inundated with high water in 2017.
(Credit: Dr. Shon Schooler)



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specifically monitor for purple loosestrife at our sentinel site, as it's very adaptable and prolific across areas. It competes with sedges and grasses. There's also rusty crayfish, they're an issue too. Round gobies, Eurasian ruff, tubenose goby, spiny water flea...all of them have come here, and they influence the ecosystem."



Water quality station on Barker's Island which has the EXO2 sonde, Storm 3 data logger (WaterLog and GOES (Geostationary Operational Environmental Satellite) transmission of data once every hour (Credit: Hannah Ramage)

Interestingly, some invasive species are currently being controlled naturally. "Zebra mussels are a devastating invasive species in many other places, but here they don't have enough nutrients in most of areas of Lake Superior, so they're confined to the harbor, along with quagga mussels," Ramage explains.

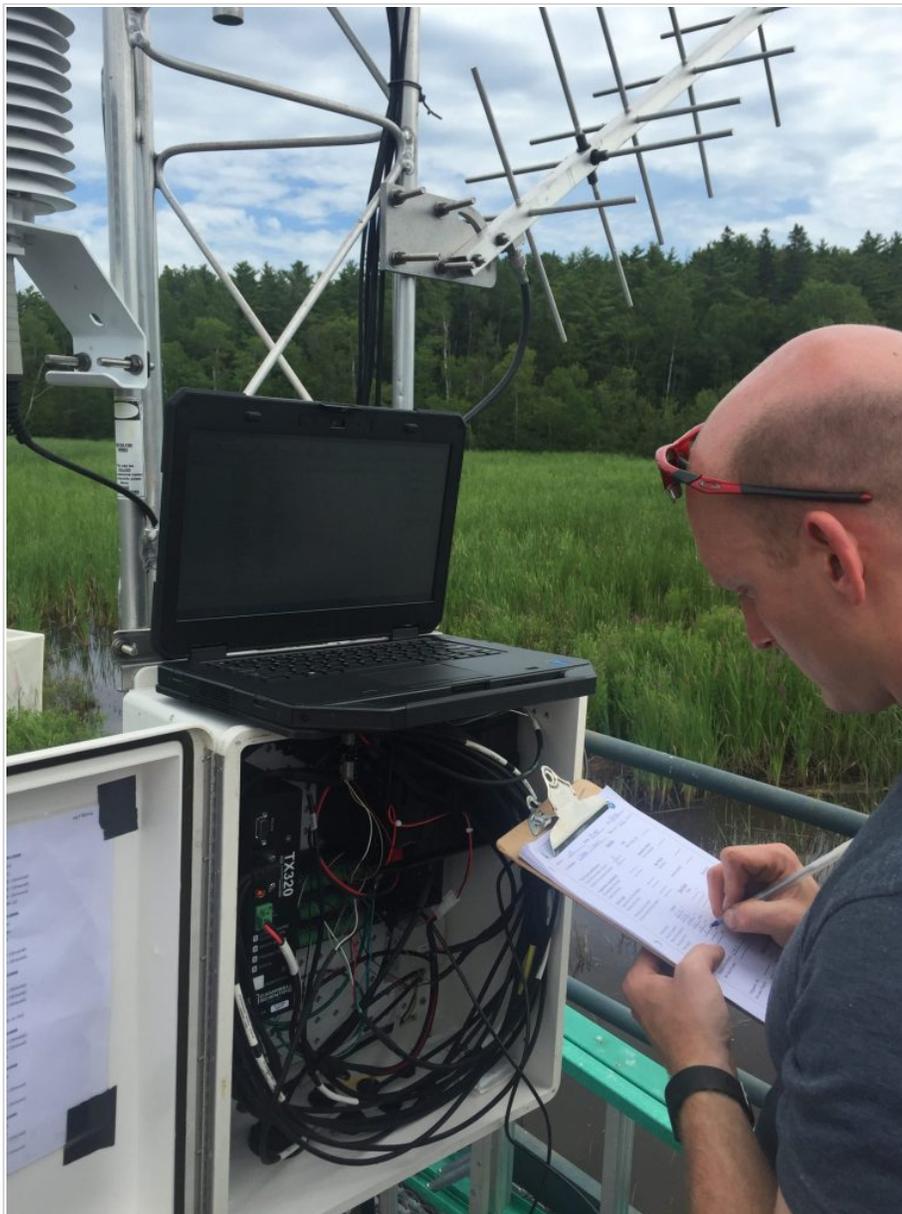
Purple loosestrife can sometimes be controlled in Pokegama Bay by very high water. "Of course in that case, none of the typical native vegetation was growing either," Ramage says. "We don't have the final data for 2017 yet."

Ramage's colleague, Shon Schooler, Lake Superior NERR Research Coordinator, does the most work on the purple loosestrife issue, as well as the rusty crayfish. Besides Ramage and Schooler, there are two undergraduates from the University of Minnesota and the University of Wisconsin-Superior who also perform research tasks at Lake Superior NERR. Students calibrate sondes, collect monthly water nutrient sampling and conduct their own research. "We also have an Education Coordinator, Deanna Erickson, who likes to get students engaged in research with us," says Ramage. In addition to the tasks those students perform, there are many students who act as

citizen scientists (volunteers) from both Wisconsin and Minnesota. "We'd like to get more participation from more college students, too," says Ramage. Around 60-100 students participate throughout the year, and many K-12 and college students use the education facilities at Lake Superior NERR. "Students get grab samples (water samples), sonde water quality data, which gets utilized in the lab," says Ramage. "Shon teaches an Environmental Research Methods class at the University of Wisconsin-Superior. We have programs all year." The Reserve is a state-federal partnership with the University of Wisconsin-Extension being the primary Wisconsin partner and NOAA is the federal partner.

In the past few years, the estuary has gone through some changes. "There was a big flood in the St. Louis River in 2012, which had effects we are still understanding. We also discovered that there were high levels of chlorophyll a under the river ice, despite the cold weather. We didn't really expect winter algal blooms," she says. "We don't have baseline data to compare how unusual the under ice algae phenomenon is." In Lake Superior NERR, floods have become more common in recent years. "We've also seen that whatever happens to the St. Louis River affects the Lake," says Ramage.

The St. Louis River estuary is "a Great Lakes Area of Concern," Ramage mentions. "Historically, the river has seen some significant contaminants." Researchers have been looking at how much sediment the river is moving in the water column, and what materials the river is moving. "It would be great if we could get a team of people to better monitor flood events," says Ramage.



Recent former student technician (University of Wisconsin-Superior) Leo Dressen downloading data from our meteorological station (Campbell Scientific) in Pokegama Bay. (Credit: Tracy Ledder)

During her career studying the St. Louis River estuary, and during her time at Lake Superior NERR, Ramage has developed a great appreciation for the uniqueness of doing research in the Lake area. "We have a very dynamic system here," she says. "Recently, because of high water levels in Lake Superior, our long term vegetation monitoring has revealed areas where, conditions have rapidly changed. Also, Lake Superior water levels affect conditions way upstream, more than you might think. In Pokegama Bay, for example, habitat can change completely because of Lake levels. Plant communities can change drastically here over the course of a single year."

As time goes by, Ramage continues to enjoy research at Lake Superior NERR. "The Great Lakes have great appeal," she says. "I grew up near Lake Michigan, and when you grow up near a huge lake like that, you never want to leave."

She especially likes the freshwater estuary, something Lake Superior NERR has. "They're different from coastal estuaries," she says. "We have a really dynamic river here and a huge commercial port. It's a really rich place to do abiotic and biological research."

Ramage also likes the local community. "There's a really palpable sense of making connections with people who have devoted their lives to upholding this place. We have challenges here, such as remediating contaminants, restoring fish and wildlife populations, and restoring wetlands and shorelines. But the community here definitely gives you a sense of optimism. There's a feeling here that we can fix it!"

featured Lake Superior monitoring NERR news ticker Wetlands & Estuaries

YSI EXO2



About Lori Balster

Growing up near a woods, Lori has always enjoyed the outdoors. Lori is a writer and consultant based in Dayton, Ohio. Lori has also worked at Wright-Patterson AFB as a research chemist.

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2 COMMENTS



Matthew Mabey

February 13, 2018 at 2:46 pm

What definition of estuary is being used to describe the meeting of the St. Louis River and Lake Superior as an estuary? The two definitions I am acquainted with deal with the mixing of fresh and salt water or the meeting of stream flow with a tidal body. NOAA considers the Great Lakes to be officially "non-tidal" and thus I pose my question about the use of estuary in this article.

Reply



Tiffany Bick

February 23, 2018 at 1:49 pm

(via author Lori Balster)

Hi Matt,

I contacted Hannah Ramage about your question. This was her reply:

There isn't a really short answer to this question so I will abbreviate then send a link to more information which you can pass along.

An estuary is generally defined by a place where two chemically distinct water bodies exchange flow or

circulate. Estuaries are classified both by how they are geological formed and by the mechanism of water circulation. A freshwater estuary is a special classification. Indeed, Lake Superior has minimal tidal influence, so the mechanisms chiefly responsible for circulation in the St. Louis River estuary are storm surges and seiches (sloshing).

Here is a link about estuary circulation classifications

https://oceanservice.noaa.gov/education/kits/estuaries/estuaries05_circulation.html

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