

Investigating Lake Sturgeon habitat use, feeding ecology and benthic resource availability in the Lower Niagara river

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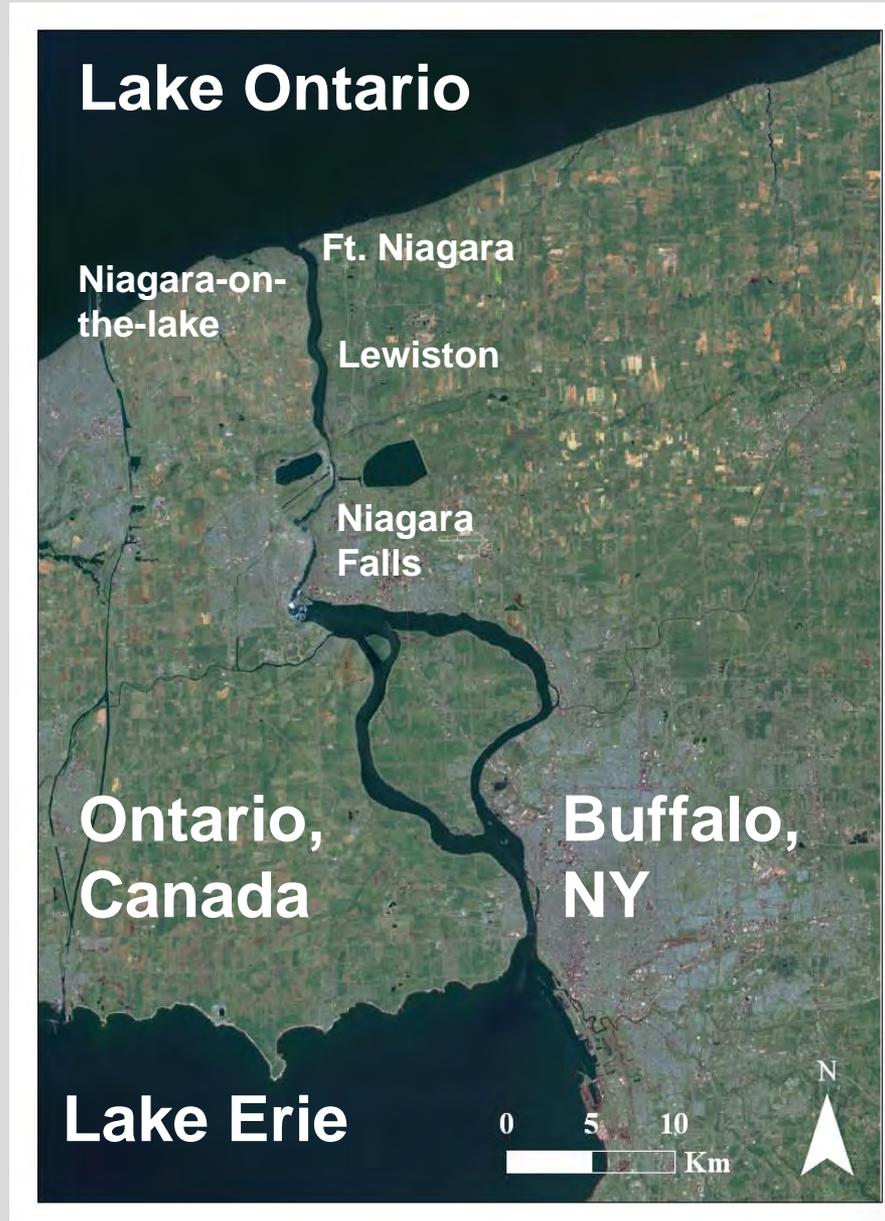
THE GREAT
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The Importance of the Niagara River:

- Drains the combined watersheds of 4 of the 5 Great Lakes
- Supplies 83% of the tributary flow to Lake Ontario
- Ecologically important corridor for fish and wildlife *“where species of plants found and still find protection throughout changes in climate over the past 8,000 years since glaciation” (Eckel, 1986)*
- Habitat for diverse aquatic community
- Due to past commercial and industrial activity was contaminated, leading to the establishment of the Niagara River Area of Concern



Historic and current impacts on the Niagara River:

- Contamination of water and sediment
- Habitat loss and modification
- Invasive species introduction
- Water level fluctuations
- Nutrient loading
- According to the Niagara River Remedial Action Plan (NYS DEC, 1994) the degradation of fish and wildlife and their habitat were “impaired” beneficial uses along the Niagara River corridor



Historic and current impacts on the Niagara River:

- Although identified as “impaired” the structure and functioning of the Niagara River aquatic ecosystem is currently poorly understood
- Referenced survey work is often outdated or not available for many important components of the ecosystem, inhibiting the ability to make effective management decisions.
- Although there are some positive signs of recovery:
 - population of lake sturgeon is larger than previously suggested (*Gorsky et al., unpublished data*)
 - discovery of several refuges of freshwater mussels (*Burlakova, et al., unpublished data*)
 - amphibian communities in several NR AOC wetlands now meet expected reference values (*Archer and Rankin, 2011*).

Further studies are needed to understand if these signs of recovery are very local or represent the recovery of the whole ecosystem

In order to advance our understanding of the Niagara River ecosystem, we need to collect data on the current status of its major communities and their interactions

We propose to study:

- 1. diversity, distribution and density of benthic forage resources*
- 2. biology and ecology of lake sturgeon in the lower Niagara River*

This information will help researchers and managers protect and enhance habitat to advance lake sturgeon recovery in the lower Niagara River

Objectives of proposed work

1. Use bathymetric and substrate data obtained from USFWS's side-scan sonar project to develop benthic habitat maps. Using the habitat maps, assess diversity and community structure of benthic invertebrates in the lower Niagara River (**Benthos**)



2. Document diet, habitat use and behavior (movements and migrations) of lake sturgeon in the lower Niagara River (**Sturgeon**)



Importance of Benthic Macroinvertebrates:

- Serve as a primary food source for fish, including many recreational, commercially important, and endangered species such as lake sturgeon
- Sensitive to environmental disturbances
- Among the most reliable and cost-effective approaches for assessing ecosystem health (*Barbour et al., 1999; Rosenberg and Resh, 1993; Resh and Jackson, 1993; Uzarski et al, 2004*)
- Include endangered species (e.g. unionids)

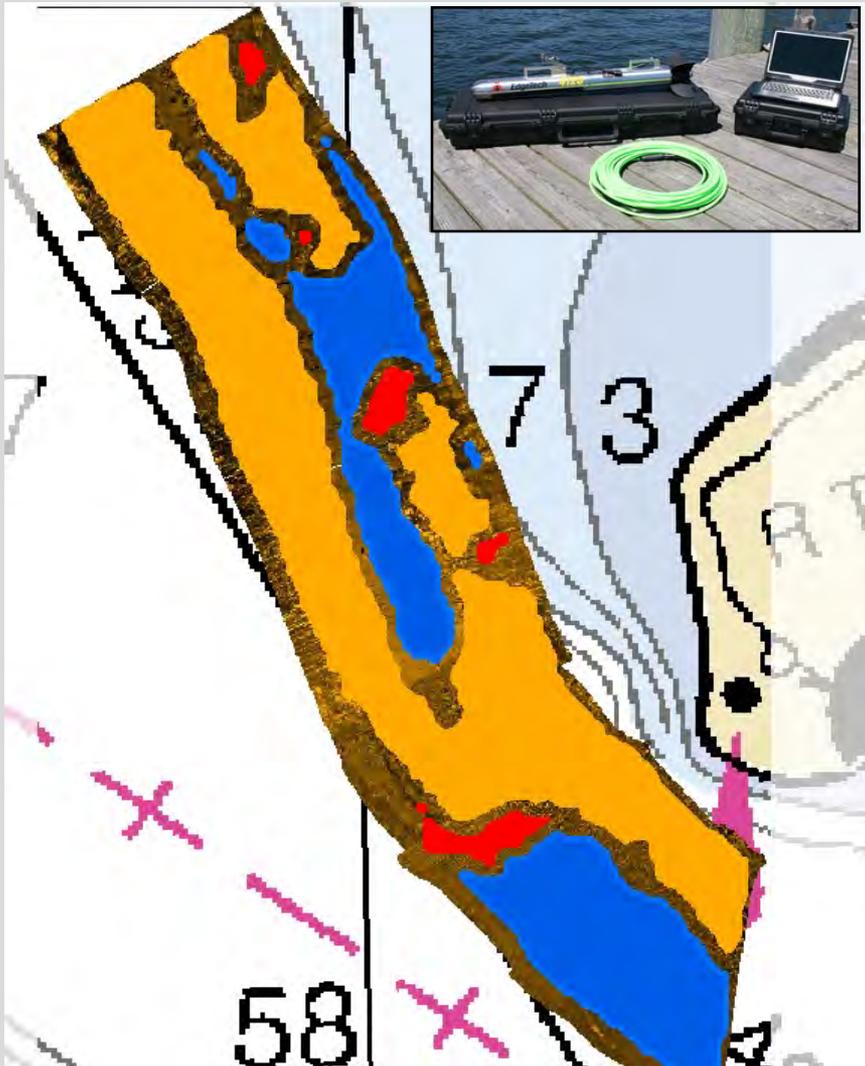


Unionids collected in the Strawberry Island (2011)



Unionids collected in the Spicer Creek (Grand Island, 2011)

Benthos (Habitat mapping)



- Involve surveying, collating information, analyzing and modeling data to derive the habitat distribution and then designing the layout of habitat maps
- Obtain maps of physical habitat from remote sensing (*bathymetry, data from side-scan sonar collected by USFWS in 2011 as well as data collected with a split-beam mobile fisheries sonar*) and historical data (*e.g., Veal, 1968; Mudroch and Williams, 1989*)
- Sample all identified types of habitats to describe species richness, density and biomass in each specified habitats.
- The final maps will predict the distribution of benthic habitats

Benthos (Methods)

- We will use the benthic habitat maps to identify and prioritize habitats of importance as feeding grounds for lake sturgeon and other valuable fishes
- Benthic indices provide assessment for stressors such as pollution, sediment deposition, habitat alteration and storm water runoff that often accompany chemical contamination of the water in urban waterways facing multiple anthropogenic impacts (*Rosenberg, Resh, 1993; Barbour et al., 1999*)
- The Niagara River is affected by all of these stressors and is thus a particularly appropriate candidate for testing benthic bioassessment measures of ecological health
- Currently used indices have to be adjusted for geographical variation and particular anthropogenic impairment (*Resh, Jackson, 1993*)
- We will use existing (*Purcell et al., 2009; Clarke, Warwick, 2001*) and develop new indices to assess the current status of benthic community in different habitats and select valuable habitats for conservation

Sturgeon

- The lower Niagara River provides habitat to one of the few remnant populations of lake sturgeon in the lower Great Lakes
- Although there are some evidence of population recovery, **information about diet and habitat use is lacking**
- We will determine sturgeon movement, habitat use, and diet across multiple years and connect this information with benthic habitat maps
- This information will help to protect and enhance habitat to advance lake sturgeon recovery in the lower Niagara River



Sturgeon

- To determine movement patterns of lake sturgeon we will use acoustic telemetry technology
- We will analyze the gut contents of sturgeon to determine what foods are being consumed both spatially and temporally
- We will document areas of high habitat use and relate it to our benthic habitat analysis to determine substrate and habitat preferences
- We hypothesize that sturgeon select habitats with abundant food items of preferred sources and that preferred food will vary with lake sturgeon size and age
- We will use the abundance of the preferred food source from our benthic analysis to predict a carrying capacity for lake sturgeon in the lower Niagara River that is essential for the restoration of the local population



Proposed budget

