Greenway Ecological Standing Committee
Grantee Status Report

Status Report Date: *September 15, 2014*	
Project Title: *Investigating Lake Sturgeon habitat use, feeding ecology and benthic resource availability in the lower Niagara River*	
Organization: *Great Lakes Center, SUNY Buffalo State*	
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Project Start Date: *Jan 1, 2014*	Project Anticipated Completion Date: *Dec 31, 2016*

1. Describe what progress you have made toward each of your grant objectives since your last status report. Did you meet your goals for this period? Please be specific.

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

Progress has been made throughout 2014 and the goals for the period have been met. Please find below a detailed description of the activities performed up to date.

To create and classify benthic habitats, side scan sonar (SSS) survey was undertaken by the USFWS in 2011 to obtain images of the bottom of the lower Niagara River and the Niagara Bar. Based on these images we created a benthic map of the entire lower Niagara River and the Niagara Bar using ArcGIS 10 software. Six major substrate classes (i.e. sand, gravel, silty sand, silt, bedrock base and boulder, and rocky substrate) were assigned (see pictures attached at the end of this report) and their area was calculated. Sampling sites in each substrate class were then chosen randomly proportionally to substrate class' area (but with a minimum of 10 sites in each class).

To assess the diversity and community structure of benthos, 147 sites were sampled for benthic invertebrates using a petite PONAR grab (15 x 15 cm). At each site the water depth and temperature were recorded. Additionally, 80 videos were taken and analyzed to describe the substrate in areas which could not be sampled due to strong currents and large rocky substrates. To determine the grain size distribution and the organic matter content of the substrate, we collected 60 additional sediment samples. Both videos and grain size analyses were used to assess the accuracy of the benthic habitat map.

To estimate spatiotemporal changes in the food availability for lake sturgeon over an entire year, additional benthic samples were taken bi-monthly from three sites where the sturgeon were observed feeding (two in the Niagara River and one near the river mouth in Lake Ontario). So far, 42 samples have been taken from beginning of April until September.

In the laboratory, all benthic samples were picked alive within 24 hours of sampling, preserved in 10% formalin, and are currently being processed for identification and biomass

estimation. All 60 sediment samples were dried at 60°C and are currently processed for grain size analysis and organic matter content.

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

To document diet of lake sturgeon, 66 lake sturgeon were captured between May 19th and June 20th using baited setlines. Each setline consists of 25 baited hooks strung between two anchors and fished for 24 hrs. A total of 8 setlines were deployed each day in areas that had high capture rates in previous years. Of the 66 lake sturgeon captured, 25 stomach content analysis (SCA) samples were taken by gastric lavage, a process by which water is pumped into the stomach to induce regurgitation. Expelled stomach contents were collected on a 0.25 mm mesh screen and preserved in a 10% formalin solution. The samples were taken back to the laboratory for identification and weighing to determine the composition of the sturgeon diet as well as the importance of certain taxonomic groups. Fifteen stomach samples have been processed so far.

Stomach content analysis provides a snapshot of very recent diet history with high taxonomic precision; whereas stable isotope analysis (SIA) gives an indication of long-term diet history. For this reason, the two techniques are often used in conjunction in ecological diet studies. Stable carbon isotope ratios can identify the relative contributions of different prey items such as fish and benthic macroinvertebrates to the diet, and help us identify whether those food items (carbon sources) would be found along river banks, near the shoreline or in open water. Stable nitrogen isotope ratios can estimate the trophic status of lake sturgeon when compared against the baseline food resources available. To establish this baseline, bi-monthly benthic macroinvertebrate samples were taken by petite PONAR, picked live within 24 hours, and frozen for further analysis. Blood samples for SIA were collected from 40 sturgeon and sent, along with the food resource samples, to the University of Windsor Chemical Tracers Lab for analysis.

To document habitat use and behavior, a VEMCO acoustic receiver array was deployed throughout the lower Niagara River and into Lake Ontario. To firmly anchor these receivers in place, moorings were constructed from concrete to house each receiver, which are then attached to a 50 lb. pyramid anchor and a concrete cinderblock satellite anchor. In all, 39 acoustic receivers were deployed, 13 outside the mouth of the river in a curtain arrangement, and 12 in groups of 4 spaced out along the river to serve as detection gates, and the remaining receivers placed in tight groups in productive sturgeon capture locations. The curtain outside the river mouth will indicate if fish stay in the river or leave to the lake, the three gates indicate movement direction, and the tightly grouped receivers with overlapping detection ranges give more accurate location data. 27 acoustic tags were surgically implanted into lake sturgeon. These tags emit an ultrasonic pulse that is detected and logged by the receivers at a range of about 500 m. By periodically retrieving the receivers by grappling hook, downloading, then analyzing the detection data, we will document the movements of the

tagged fish throughout the season. So far, 35 receivers have been downloaded and their data added to a growing database.

2. How did you measure your progress since your last status report? What kind of data have been collected to determine whether progress is being made or not being made? What results have been obtained since your last status report?

This is our first status report. Therefore, we left this question blank.

3. What challenges have you encountered since your last status report? How are you addressing these challenges?

A problem that was encountered is the difficulty to obtain sediment samples with a PONAR grab in areas of bedrock and gravely substrate and thus we were only able to obtain a sample at 150 out of 200 (75%) sampling sites. The southernmost part of the lower Niagara River lacks data due to the strong currents near the gorge that prevented safe and successful sampling. Therefore, those areas are currently indicated as 'no data' on the substrate map (Fig. 2). We are currently working on developing efficient and safe methods to collect quantitative benthic samples from these substrates.

The time frame for sturgeon sampling was short this year. The cold spring and late removal of the ice boom delayed sturgeon sampling until mid-May. Sampling was then conducted intensively for one month until water temperatures reached 22º C, whereby, sampling ceased in accordance with our permit. Sampling was resumed in September and will continue into the fall.

There have also been problems retrieving the acoustic receivers. The flow of the river has been unusually high this year making proper deployment and retrieval difficult. Additionally, there are reports of divers interfering with the receivers and in one case pulling it up and moving it. This fall, USFWS divers may be used to locate the missing 3 receivers.

4. Are you on schedule to complete your project in the proposed timeline? If not, please explain why you are ahead or behind schedule.

Based on the progress we have made up to this point we are certain that the project will be completed within the proposed timeline.

5. Please use the table below to report your expenditures since your last status report. Include in-kind support from other resources have you used since your last report below the table. Please explain any differences between anticipated and actual expenditures. Attach copies of any relevant receipts or invoices to this report.

Budget Categories	GESC-approved budget	Funds or in-kind support from other resources	Total expenses to date	Remaining balance
Salaries and Benefits				
Travel				
Equipment				
Supplies				
Meetings				
Printed Material				
Consultants				
Other				
Total Funds				

Because of the illness of one of Research Foundation' Senior Managers, the budget will be approved and the report will be re-submitted tomorrow, September 16, 2014.

6. What progress toward your objectives do you expect to make before your next status report? Please be specific.

Before the next status report we plan to:

1. Continue taxonomic identification and estimation of biomass and density of benthic macroinvertebrates from the samples collected in the summer of 2014.

2. Link invertebrate communities with habitat information (e.g. substrate size, organic matter content, water depth, water temperature, vegetation cover) to provide data on the spatial distribution, quality and quantity of benthic resources. This will be done by using canonical correspondence analysis (CCA) and indicator species analysis (ISA). While CCA is a multivariate analysis that provides insight into environmental factors that most affect the structure of benthic macroinvertebrate communities, ISA is an assessment that groups or clusters communities according to similarities in their structure, and identifies species with greatest fidelity to each group.

3. Determine the community tolerance to pollution and assess the quality of benthic environments using biotic indices, e.g. Hilsenhoff Biotic Index, Shannon Index, and Pielou evenness index. This information along with biomass and density data of each species will help to identify habitats important for lake sturgeon feeding and prioritize valuable habitats for conservation.

4. Conduct stacked sieve analyses of the 60 sediment samples to determine the accurate substrate class, as video images and visual inspection of the sediment alone do not provide accurate information about the grain size distribution.

5. Finish organic matter content analysis by combusting the 60 sediments samples. Organic matter content is an important food source for benthic macroinvertebrates.

6. Continue diet history analysis, sampling stomach contents of sturgeon and using stable isotope analyses of diets.

7. Finish processing stomach samples and prepare and send stable isotope samples for analysis.

8. Implant the remaining acoustic tags.

9. Continue to retrieve and download the data from the deployed receivers and analyze the detections to document the movements and habitat use of lake sturgeon.

10. The first results of this study will be presented at international conferences, such as International Association of Great Lakes Research, New York Chapter of the American Fisheries Society and Society for Freshwater Science in spring 2015.

7. Please include 1 to 2 photographs with dates and short descriptions taken since your last project report.

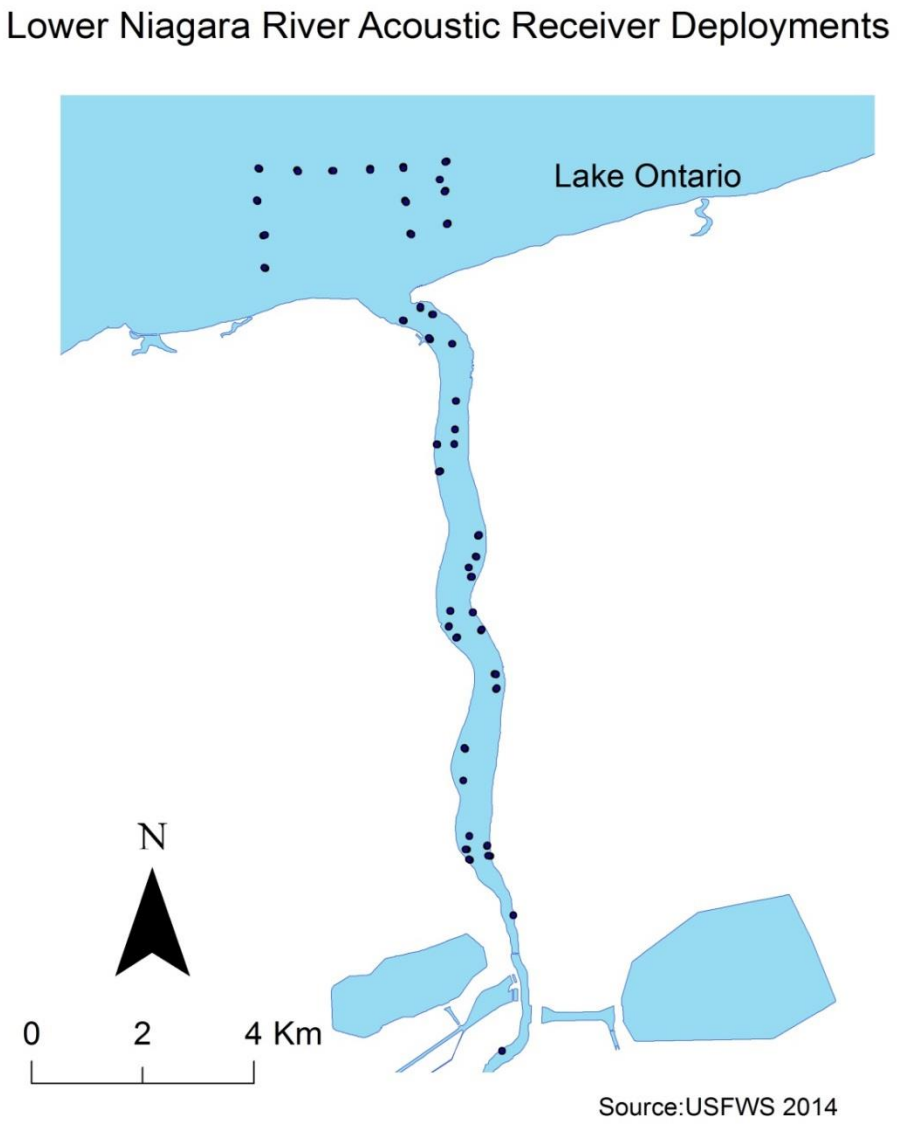

Fig. 1. Locations of acoustic receiver deployments.

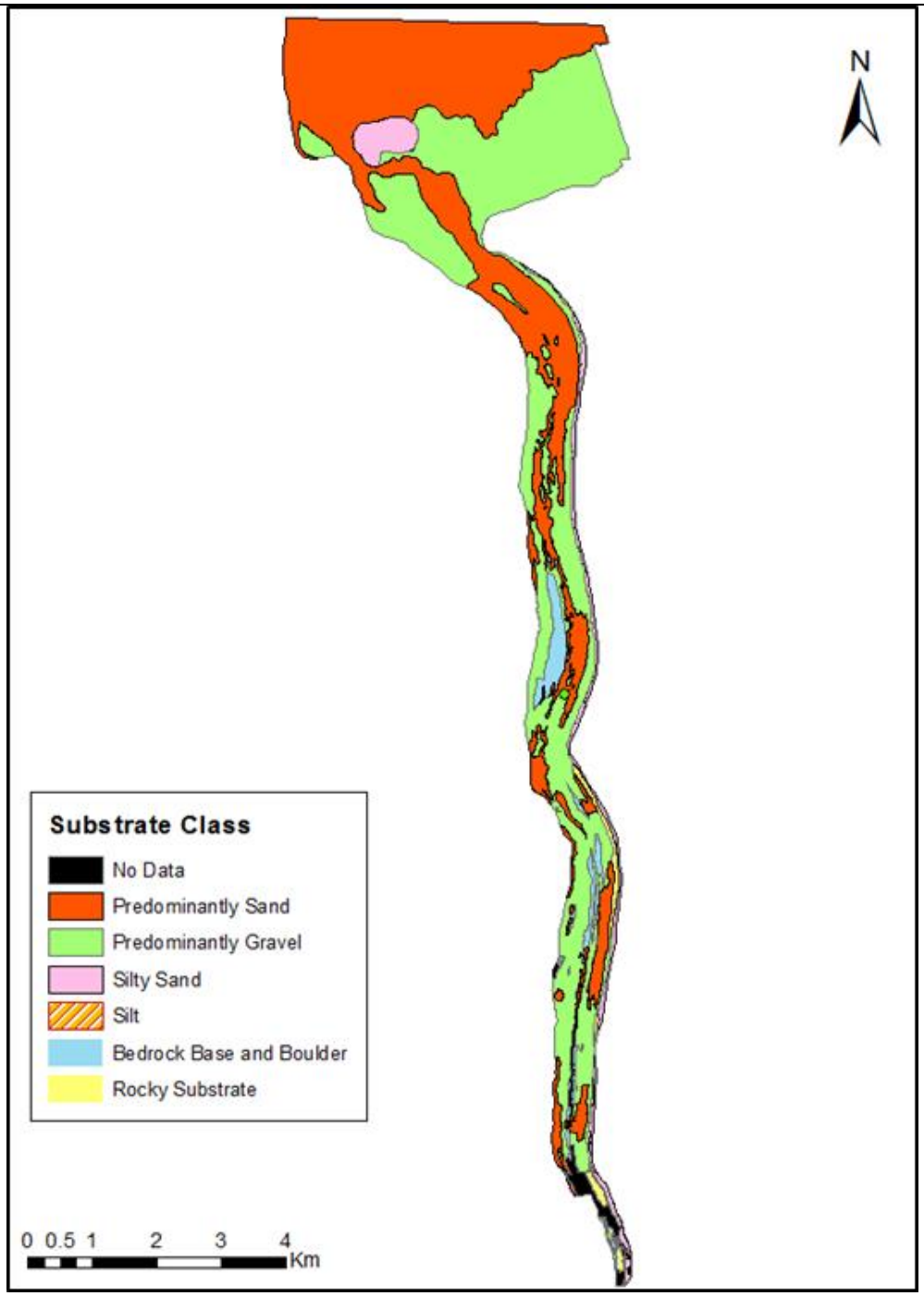

Fig. 2. Map of the Lower Niagara and Niagara Bar showing the six substrate classes.

Fig.3. Three of the 80 substrate images taken with a GoPro camera in July 2014 and the typical benthic fauna associated with these types of substrates.

Fig. 4. Transferring lake sturgeon from the boat to holding pen before tagging

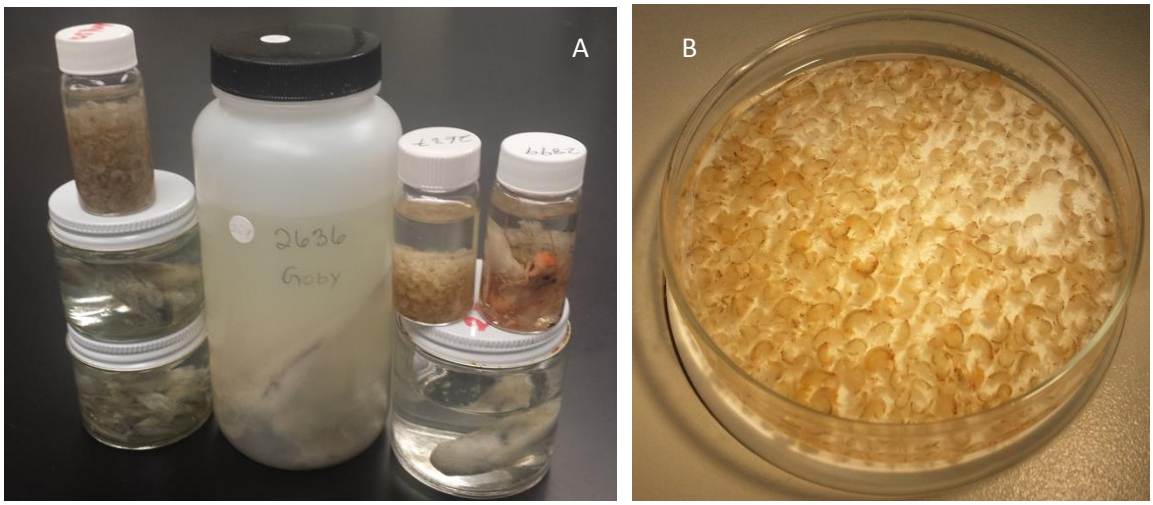

Fig. 5. Processed sturgeon stomach content samples (A) and close up of invasive amphipods found therein (B).