Student Researcher Support of Adaptive Management of the St Lawrence River using Novel Water Quality Monitoring Methodology

Michael R. Twiss, PhD, Department of Biology Clarkson University, Potsdam, NY, 13676, tel: (315)-268-2359; email: mtwiss@clarkson.edu

Joseph D. Skufca, PhD, Department of Mathematics, Clarkson University, Potsdam, NY, 13676, tel: (315)-268-2399; email: jskufca@clarkson.edu

Senior Personnel: Michael T. Dagrossa, BA, Clarkson University, Potsdam, NY, 13676, tel: (315)-268-6741; email: mdagross@clarkson.edu

Abstract: Restrictive water level regulation in the Saint Lawrence River over the past 50 years has had a profound impact on ecosystem health. Currently, there are no explicit plans to determine how the restoration of more natural water level regimes in the St. Lawrence will impact water quality, although great effort has been made to develop adaptive management as the proper strategic approach. Water quality sensor arrays will be continuously operated in the Moses-Saunders hydropower dam to provide data that can relate change in water quality to changes in water levels. Mercury will be measured in water flowing through sensor arrays as well as in wetlands upstream that have the potential to release Hg with changing water level scenarios. The objective is to collect water quality data and relate this to water levels, to assess the potential for changing water levels to release Hg into the river and to produce three audience-appropriate videos to describe this important endeavor.

Above: Summer intern Evie Brahmstedt of St. Lawrence University sampled St. Lawrence River wetlands for mercury content during the summer of 2016. Ms. Brahmstedt will present her research findings at the July 2017 International Conference on Mercury as a Global Contaminant in Providence, Rhode Island, and begin her doctoral studies in environmental science & engineering at Clarkson University in June, 2017 (Photo: M. Twiss, Clarkson).

Three Summary Points of Interest

• Point 1: High resolution water quality data has been collected with the support of students trained on this project.

• Point 2: A preliminary assessment of legacy Hg contamination of St. Lawrence wetlands has been conducted and used to support receipt of two additional awards to expand this research.

• Point 3: One informative video has been produced and two additional videos geared to a technical and K-12 audience are in development.

Keywords: Great Lakes Water Quality Agreement (GLWQA), Area of Concern (AOC), mercury (Hg), St. Lawrence River, Great Lakes, education, training, Adaptive Management
Policy implication statement; products of interest and/or upcoming events:

Policy implication statement:
Water levels on the St. Lawrence River and Lake Ontario are proposed to be regulated by Plan 2014. Expected erosion of wetlands to a more naturally diverse structure that existed before the river was dammed may release mercury and nutrients trapped in the wetlands that have become entrenched over the past 60 years. The impact of this elemental mobilization on water quality will be observed and used to support adaptive management.

Products to date:
1. Informative (lay audience) video: How Do Saint Lawrence River Levels Affect Wildlife?
   https://www.youtube.com/watch?v=pspA7NZNdLc

Products of interest: Student Presentations Awards at the Summer 2016 SURE Conference, at Clarkson University (July 2016):
1. Best oral Presentation: *Environmental Sciences 2: Ecosystems*
   
   **Brahmstedt, E.,** Holsen, T., Skufca, J., and Twiss, M.R. “Potential for Water Level Regulation in the St. Lawrence River to Affect Sustainable Fish Populations in the Face of Mercury Bioaccumulation”

2. Best oral Presentation: *Applied Mathematics & Data Processing*
   
   **Lumbrazo, C.,** Skufca, J., and Twiss, M.R. “Automated Data Cleaning for Exploratory Data Analysis of Water Quality in the St. Lawrence River”.

Conference Presentations:

Future conference presentations
**Student training**

<table>
<thead>
<tr>
<th>Name</th>
<th>Program (University)</th>
<th>Project</th>
<th>Date</th>
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<tbody>
<tr>
<td>Evie Brahmstedt</td>
<td>Environmental Studies (St. Lawrence Univ.)</td>
<td>Mercury content in St. Lawrence River wetlands</td>
<td>Summer 2016 May-Aug</td>
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<tr>
<td>Colby DeVane</td>
<td>Chemistry and Social Entrepreneurship (Erskine College)</td>
<td>Sensor calibration for river sensor network</td>
<td>Summer 2016 May-Aug</td>
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<tr>
<td>Cassie Lubrazzo</td>
<td>Mathematics &amp; Environmental Engineering (Clarkson)</td>
<td>Methods for cleaning data sets from sensor network</td>
<td>Summer 2016 May-Aug</td>
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<tr>
<td>Ian Vitek</td>
<td>Biology (Clarkson)</td>
<td>Sensor array maintenance</td>
<td>Jan.–April 2017</td>
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**Additional funding received related to this proposal:**

1. *Source-Tracking Mercury (Hg) Mobilization from the St. Lawrence River Wetlands*; Best-in-Science program, Ontario Ministry of the Environment and Climate Change - subcontract from the St. Lawrence River Institute of Environmental Science: $CAD 62,050.

2. *Studies on mercury mobilization from wetlands along the Upper Saint Lawrence River in support of Ecosystem-Based Management*; Great Lakes Research Consortium Small Grants program was selected to be funded in the amount of $20,338.

**Summary of progress to date:**

To date we have trained one graduate student (masters) and four undergraduate students. One additional undergraduate student (Cindy Rodas, Salisbury College) will begin training May 22. Evie Brahmstedt will begin her doctoral research on this topic June 1.

We have collected water quality data continuously at the Moses-Saunders hydropower dam and have expanded our network to the Canadian side of the power dam, with colleagues at the River Institute in Cornwall, Ontario, and to the mid-channel (NY). Data were presented at the IAGLR meeting in Detroit (May 2107).

One informative video (available on YouTube, *see above*) has been prepared and two additional educations videos will be produced in by August 2018.

A manuscript describing the use of the power dam to monitor water quality (365 days per year) is underway.

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