

March 15, 2010

Project Title:

Experimental Simulation Facility: The Mesocosm – A large water enclosure system

Submitting Organization and Contact:

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Lake George Watershed Conference Priority:

This project addresses the Lake George Watershed Coalition Priority Objective 1: Reduction of non-point source pollution through the reduction of stormwater runoff/discharge. Also LGWC future priority A2, pg 32. DOS stated watershed management plan implementation activity: Identification of principal pollutants and their sources.

Based on long-term and ongoing monitoring studies, DFWI researchers have formulated predictive hypotheses concerning the future of the lake biota. These hypotheses include higher phytoplankton abundance, increased blooms of noxious species, and introduction of invasive exotic plant and animal species. However, it is difficult to actually test such hypotheses because of the inherent complexity of natural ecosystems. One mechanism to test hypotheses and extend them to future predictions is the simulation of scenarios under very controlled conditions. The conditions must be far more realistic than what we can create in small-scale laboratory studies, yet they must retain appropriate experimental controls. This is one of the great challenges of any ecological research - fresh water, terrestrial or atmospheric.

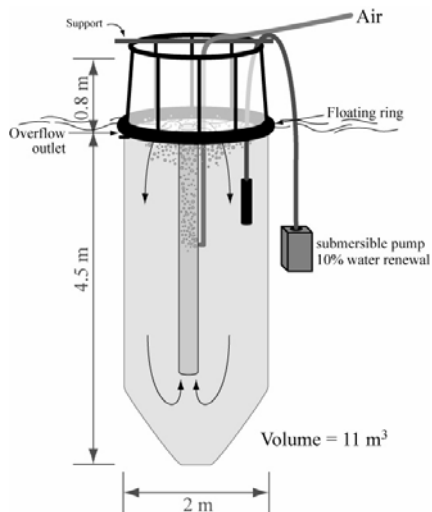
Relatively large water enclosure systems, called mesocosms, have been used successfully in various aquatic environments to simulate ecosystem responses to a range of environmental perturbations, including nutrient loading, toxic substances, acid deposition, or deicing agents. Compared to laboratory scale systems, mesocosms simulate relatively realistic and complex community dynamics. They allow manipulation of specific factors, and create the opportunity to sample the same water mass over a period of time. *Mesocosms provide an ideal tool for better understanding the impact of human activities on Lake George water quality. This information could then be used to help make scientifically sound policy decisions.*

Project Summary (Benefits) Statement:

The principle goals of this project are to develop and use state-of-the-art “in-water” enclosures (a mesocosm system) in Lake George. We have already initiated these studies by hosting a workshop at the DFWI with Dr. Jens Nejstgaard (University of Bergen, Norway) and Dr. Marc Frischer (Skidaway Institute of Oceanography) and Dr. Stella Berger (University of Muenchen, Germany). The outcome of the workshop was determination of construction design, location for mesocosm and experimental planning. Dr. Nejstgaard has 20 years of experience operating state-of-the-art mesocosm facilities and conducting scientific research related to their use. He and Dr. Frischer have collaborated in mesocosm-based studies since 2002. Dr. Berger has over 10 years of

experience designing and operating fresh water mesocosm facilities in Germany. *Thus, we have the ability to draw on this wealth of expertise to benefit Lake George.*

Project Description:



Based on our initial design in 2009 we began construction of a Lake George-specific prototype facility. The basic design of a single mesocosm is shown schematically (on the left). With limited resources we were able to build 3 mesocosm units. We considered and investigated various locations for placement of the mesocosm facility. After examining several potential sites on Lake George for water depth, amount of boat traffic, and distance from DFWI research facilities, we determined the optimal location for placement of the mesocosm facility is approximately 150 feet from one of the docks off the shore of the institute (shown below).



We deployed the prototype mesocosm for initial tests in the summer of 2009. During this study period, we were able to troubleshoot the design, deployment and operation. We gained valuable information from this “test run” and are therefore now well prepared to construct the 4-6 individual mesocosm units that are needed to establish the mesocosm facility. Once constructed the facility will be deployed for experimentation in the late

Spring 2011. Over a 3-4-week period, the mesocosms will be monitored to test the hypothesis that a typical phytoplankton bloom can be stimulated by increasing certain nutrients. The nutrients we have selected to initially study are those readily introduced into the lake through storm water runoff of septic leachate. Specifically, any changes in the numbers and types of phytoplankton in the “contained” mesocosms due to increasing amounts of organic nutrients (representing septic input) will be determined and compared to natural conditions. This research will allow us to determine what concentration of septic input will result in noxious algae blooms in Lake George. This study is timely given the increased observation of Lake George algal blooms.

Photos (from August 2009) of our prototype mesocosm with 3 frames in Lake George (left) and a close up of the mesocosm frames with bags (right) are shown below.



An initial financial investment is critical for the construction of the mesocosm facility. Once constructed, in future years we would be able to utilize these mesocosms to gather valuable information regarding the potential impact and responses to a range of environmental perturbations in Lake George, including nutrient loading, deicing agents and toxic substances. *Therefore, research with the mesocosm facility has the ability to yield results with watershed-wide impact to pressing environmental issues over time.*

Timeline:

Nov.-Feb. 2010-11 - Mesocosm prototype construction, secure necessary permits (this should not present any problems as we have already successfully gone through this process in 2009).

Late Spring 2011- Deployment of mesocosms and sample collection. Experimentation using the mesocosms to obtain information on the impact of nutrient loading on phytoplankton.

Summer 2011- Carry out sample analyses and data interpretation.

Sept.-Dec. 2011- Complete data analyses. Prepare and submit final report.

Deliverables & Evaluation Measures Include:

- Successful construction and deployment of the mesocosms in Lake George
- Meaningful analyses of samples and interpretation of results
- Use of scientific results by others to help guide policy decisions

- Use of mesocosms for public outreach and education via local news articles, and “showcasing” the mesocosms with groups that come to the DFWI in the summer for the lecture series, environmental discovery days, and K-12 outreach groups
- Preparation and submission of final report for the LGWC

Project Funding Estimated Costs:

Personnel	\$14,000
Materials and Supplies	\$ 9,000
Boat time	\$ 1,500
Travel	\$ 5,600
Frischer from Georgia to Lake George (2 round-trips)	
Nejstgaard from Norway to Lake George (1 round-trip)	
Berger from Germany to Lake George (1 round-trip)	
Direct Cost Total:	\$30,100
Indirect Costs (26%):	\$ 7,826

Total LGWC Project Cost: \$37,926

Local Match: *There will be a 1:1 match on the funding requested for this project (Thus \$38,000 from the LGWC and \$38,000 match).* This match funding is set and comes from Froehlich Foundation monies as well as in-kind resources of the DFWI through providing housing, laboratory space and access to research vessels and Lake George, and graduate student help.

Financial Viability & “Bang for the Buck”: A critical goal of the proposed project is to get a mesocosm facility constructed and used to acquire important scientific information. The reason this is so critical is that we can then write grant proposals to federal agencies such as the National Science Foundation (NSF) and/or EPA to secure longer term funding for research on Lake George. We would have a significant advantage for getting such future funding if we already had in place the mesocosm facility, and were able to publish a peer reviewed publication with results from its use in Lake George. *Thus, a relatively small investment of LGWC funds could result in future additional investments for research to help protect Lake George.*