

PROPOSAL TO THE GREAT LAKES COMMISSION  
IN RESPONSE TO THE GREAT LAKES COASTAL WETLANDS CONSORTIUM  
REQUEST FOR PROPOSAL

**PROJECT TITLE:**

Testing of Great Lakes Coastal Wetland Indicators and Metrics - an  
Integrated and Collaborative Approach

**PROJECT TEAM:**

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## INTRODUCTION

The overall goal of the Great Lakes Coastal Wetlands Consortium (GLCWC) is to develop a basin wide monitoring program for Great Lakes coastal wetlands that can be implemented and sustained into the future. Intentions are to further build on work that has been completed as part of the State of the Lakes Ecosystem Conferences (SOLEC) and previous development of coastal wetland health indicators. Refinement and adaptation of Great Lakes wetlands indicators requires coordination and cooperation not only across various disciplines, but also across many political boundaries.

Within the Flora and Fauna Indicators identified by the GLCWC, significant research has occurred in an effort to understand interactions and relationships among abiotic, biotic variables and human disturbance within wetlands of the Great Lakes region (Keddy 1999, Keddy and Reznicek 1986, Keough et al. 1999, Loughheed et al. 2001 and Maynard and Wilcox 1996). More recently, research has focused on developing indicators and metrics of specific biota based on identified responses of the biota to environmental change. Invertebrate (Burton et al. 1999, Loughheed and Chow-Fraser 2001), fish (Randall et al. 1996, Minns et al. 1994) and plant community (Mack et al. 2000) indicators and metrics are the most fully developed for wetlands associated with the Great Lakes basin. However, much of this work has been completed on inland wetlands or coastal wetlands within a limited geographic area. Thus, development and implementation of a Great Lakes coastal wetland monitoring program will require testing and adaptation of the indicators and metrics to address the environmental variability and wetland diversity associated with the Great Lakes ecosystem.

## STUDY PLAN

The overall objective of this proposal is to work collaboratively with other researchers in development and testing of metrics and methodologies for invertebrate, bird and plant community health Indicators across Lake Ontario, Lake Erie, Lake Huron and Lake Michigan. Through discussions with other researchers proposing indicator development within the Great Lakes, Environment Canada has agreed to complete the following elements within a collaborative initiative.

### Study Sites

Lake Ontario: Ten coastal wetlands in the Canadian side of Lake Ontario will be studied. The study sites will consist of five exposed embayment and five protected embayment coastal wetlands. These hydrogeomorphic wetland types have been specifically identified as priorities for designing and testing of monitoring methods within the RFP. Eight of the study sites on Lake Ontario are those already under study by Environment Canada (EC) as part of the IJC Water Regulation Review Study (see below, Other Funding).

Lake Huron: Ten coastal wetlands in the Canadian side of Lake Huron will be studied. The study sites will consist of five exposed embayment and five protected embayment coastal wetlands. These study sites have been added based on discussions with the Michigan Research Team (MRT) (see below, Collaborators). Data collection on these sites will be completed in partnership with Bird Studies Canada (BSC) (see below, Collaborators).

Lake Erie: Data collection will also occur at protected and exposed embayment sites within the Long Point wetland complex on Lake Erie in cooperation with BSC (see below, Collaborators).

## **Invertebrate Community Health Indicators**

Burton et al. (1999) and Lougheed and Chow-Fraser (2001) have documented correlations between the presence and relative abundance of various species of invertebrates and levels of human disturbance in coastal wetlands. Based on these relationships, potential multi-metric invertebrate IBIs for Great Lakes coastal wetlands have been developed (Burton et al. 1999 and Lougheed and Chow-Fraser 2001). Both research teams indicate the need to further test and refine the invertebrate IBI across the Great Lakes basin. To facilitate testing and refinement across different regions of the Great Lakes, EC has agreed to collect appropriate invertebrate data on the study sites identified above. The work will be completed in cooperation with MRT and macroinvertebrate data collection will follow the protocol as developed and proposed by MRT. Sampling will consist of replicate sweep net sampling with a standard 0.5 mm mesh, D-frame dip nets. Three replicate samples will be collected within a July and August timeframe in unique plant community zones of each wetland study site. In the field, samples will be placed in grided white enamel pans, and 150 invertebrates will be collected by picking all specimens from one area of the grid before moving on to the next grid area until 150 invertebrates are sampled. Plant detritus will be sorted for a few additional minutes to ensure that sessile species are included in the sample. As a means of semi-quantifying samples, picking of specimens will be timed. Individual replicates will be picked for one-half -person-hour, after which, if 150 specimens have not been obtained, organisms will be tallied and picking will continue to the next multiple of 50. The samples will then be preserved in ethanol and shipped to the MRT for final sorting and data entry. These data will be combined with data that is proposed to be collected by the MRT on Lake Huron and Lake Michigan and existing data sets.

Data analysis will be completed by the MRT and include testing for within wetland variability, within metric variability, basin wide applicability and sensitivity to varying levels of human disturbance. Results of the analysis will be used to identify and calibrate invertebrate metrics that are suitable for development of a multi-metric IBI for use in monitoring Great Lakes coastal wetland health.

## **Plant Community Health Indicators**

Extensive research has occurred on development of plant community metrics and methodologies in different regions of the Great Lakes basin (Mack et al. 2000, Burton pers. comm. and Wilcox pers. comm.). Similarly, several current studies (Mack pers. comm.) including the STAR grant project, "Development of Environmental Indicators of Condition, Integrity, and Sustainability in the Coastal Regions of the US Great Lakes Basin" are underway to further refine metrics and methodologies specifically for Great Lakes coastal wetlands. Although there is significant commonality in the types of plant community metrics being developed, methodologies differ. For these reasons, it is proposed that a literature review and direct contact with various university, state, provincial and federal agencies be undertaken to determine past and ongoing wetland plant community health monitoring programs and related metrics development studies within the Great Lakes basin. Existing relevant metrics and methodologies, including those identified within the RFP will be evaluated using the six GLCWC criteria. Based on the evaluation, a hierarchical or tiered, wetland plant community health metrics and methodology will be developed for Great Lakes coastal wetlands. A hierarchical approach will enable monitoring of plant community health at a range of intensity (e.g. air photo interpretation to quantitative sampling), which enables flexibility and sensitivity to resource availability in implementation of a monitoring program.

A review is critical as existing plant community health metrics and methodologies have not been developed specifically for the purposes of implementing a long term monitoring project at a scale of the Great Lakes basin. Assessing the plant community health monitoring options against the six criteria developed by the Consortium will provide valuable information in determining the appropriate methodologies for GLCWC objectives. This initial step will also clearly identify the

metrics and methodologies that should be further tested and refined, or identify those to which a comparative study should be initiated.

The above activities will be completed in cooperation with the MRT and the recommended protocol will then be tested on all of the study sites identified above in cooperation with BSC. It is expected that the data collection will include air photo interpretation and qualitative and quantitative sampling on site. Data collected on site will include a number of variables to enable compilation of plant species occurrence lists, relative percent cover information and floristic quality indexes. Data collected by EC on the Canadian study sites will be provided to MRT for integration of data sets and analysis. Data analysis will be similar to that proposed for invertebrate multi-metric IBI development. A MRT and EC jointly authored report summarizing the review, data analysis and providing recommended metrics and methodology for use in monitoring plant community health at a Great Lake scale will be submitted to the GLCWC. This report will represent the “state of the science” as it relates to Plant Community Health Indicators for the Great Lakes. Given the ongoing nature of the “Vegetative Indicators of Condition, Integrity, and Sustainability of Great Lakes Coastal Wetlands” project (part of the STAR funded project) with a completion date of 2004, protocols will have to be reassessed as new information becomes available.

### **Bird and Amphibian Indicators**

The Marsh Monitoring Program (MMP) is a binational Great Lakes marsh bird and amphibian monitoring program that has been in place since 1995. The program was established specifically to enable volunteer-based monitoring of marsh bird and amphibian populations within the Great Lakes basin. The program is scientifically based and led by Bird Studies Canada. Data collection is reliant on volunteers and through successful promotion and administration of the program by BSC, significant amounts of data and information has been collected on marsh bird and amphibian populations around the Great Lakes (Weeber and Vallianatos 2000). The program was designed to monitor and report on marsh birds and amphibians within Great Lakes basin. In order to refine the protocol implementation for the purposes of the GLCWC specifically, EC will work in cooperation with BSC to ensure that MMP data is collected by volunteers or field staff using the established protocol on all Lake Ontario study sites. As well, cooperative efforts will be made to ensure all 10 of the Lake Huron sites are surveyed. BSC will ensure MMP data collection at Long Point sites. Survey protocol will follow that which has been established by BSC (Weeber and Vallianatos 2000) and includes two bird and three amphibian survey visits to each site in the over the spring and early summer. All bird and amphibian data collected will be provided to BSC for analysis and reporting.

### **Landscape Measures**

Landscape measures including the extent of human disturbance on each wetland study site will be determined using existing land use/cover data and site specific observations. Disturbance parameters will include such variables as percent urban and agricultural area within the watershed, number of adjacent dwellings, dredging. Other landscape measures will include aerial extent of wetlands and habitat adjacent to wetlands. The specific variables and methods of collection will be coordinated with the MRT in order to ensure compatibility of results between Canadian and US site data and enable analysis of metrics sensitivity and calibration to varying levels of human disturbance.

## **COLLABORATORS**

Since response from the Letters of Intent, EC has initiated several discussions with other investigators planning to submit proposals to the Commission. All investigators to which discussions occurred have indicated their willingness to meet as soon as possible and further coordinate initiatives once funding decisions have been made by the GLCWC. EC has agreed to collaborate and cooperate with the following groups;

- 1) Don Uzarski, Grand Valley State University, lead contact for the Michigan Research Team (MRT). As identified above, EC has agreed to collect plant, macroinvertebrate and landscape measures data using a common protocol and provide the data back to the MRT for analysis and reporting purposes.
- 2) Steve Timmermans, lead contact, Bird Studies Canada. EC has agreed to work with BSC to ensure MMP bird and amphibian data is collected on all Lake Ontario, Lake Huron and Long Point study sites. EC will also collaborate with BSC in the collection of plant, macroinvertebrate and landscape measures at Long Point and the Lake Huron sites (assuming a jointly staffed field crew of 2).
- 3) Mark Bain, Cornell University, lead contact for the Biocomplexity Research Group. No specific collaboration has been identified, however both groups have indicated the need and willingness to ensure compatibility of results and meet for this purpose once funding decisions have been made by the GLCWC.

EC is also willing to discuss collaboration with other groups involved in development of a Great Lakes Coastal Wetland Monitoring Program to ensure the most efficient and effective use of resources.

## **TIMELINES**

**December,2001-March, 2002:** Study site selection, air photo acquisition and air photo interpretation to map vegetation communities. Review of existing plant community health metrics and methodologies

**April, 2002:** Hire contract staff, identify and train volunteers for collection of MMP bird and amphibian data. Development of hierarchical plant community health protocol

**May-July, 2002:** Coordinate volunteers and assist in collection of MMP bird and amphibian data on all study sites

**July-August, 2002:** Collect plant and invertebrate data at all study sites, transfer of invertebrate samples to MRT

**September-October, 2002:** Plant and MMP data entry and transfer to MRT and BSC. Collection of landscape measures data for each study site

**November, 2002:** Completion of joint EC-MRT plant community health report, submission to GLC along with all electronic data sets

## LITERATURE CITED

- Burton, T.M., D.G. Uzarski, J.P. Gathman, J.A. Genet, B.E. Keas and C.A. Stricker. 1999. Development of a preliminary invertebrate index of biotic integrity for Lake Huron coastal wetlands. *Wetlands* 19:869-882.
- Keough, J.R., T.A. Thompson, G.G. Guntenspergen and D.A. Wilcox. 1999. Hydrogeomorphic factors and ecosystem responses in coastal wetlands of the Great Lakes. *Wetlands* 19:821-834.
- Keddy, P.A. 1999. Wetland restoration: The potential for assembly rules in the service of conservation. *Wetlands* 19:716-732
- Keddy, P.A. and A.A. Reznicek. 1986. Great Lakes vegetation dynamics: The role of fluctuating water levels and buried seeds. *J. Great Lakes Res.* 12:25-36.
- Lougheed, V.L. and P. Chow-Fraser. 2001. Development and use of a zooplankton index to monitor wetland quality in the Laurentian Great Lakes basin.
- Lougheed, V.L., B. Crosbie and P. Chow-Fraser. 2001. Primary determinants of macrophyte community structure in 62 marshes across the Great Lakes basin: latitude, land use, and water quality effects. *Can. J. Fish. Aquat. Sci.*
- Mack, J.J., M. Micacchion, L.D. Augusta and G.R. Sablak. 2000. Vegetation Indices of Biotic Integrity (VIBI) for wetlands and calibration of the Ohio Rapid Assessment Method for Wetlands v.5.0. Final report of US EPA Grant No. CD9856276, Interim report to US EPA Grant No. CD985875 Volume 1.
- Maynard, L., and D. Wilcox. 1997. Coastal wetlands of the Great Lakes: background paper for the State of the Lakes Conference (SOLEC). Environment Canada and U.S. Environmental Protection Agency EPA 905-D-96-001c, Chicago and Toronto.
- Minns, C.K., V.W. Cairns, R.G. Randall and J.E. Moore. 1994. An Index of biotic Integrity (IBI) for fish assemblages in the littoral zone of Great Lakes' Areas of Concern. *Can. J. Fish. Aquat. Sci.* 51:1804-1822.
- Randall, R.G., C.K. Minns, V.W. Cairns and J.E. Moore. 1996. The relationship between an index of fish production and submerged macrophytes and other habitat features at three littoral areas on the Great Lakes. *Can. J. Fish. Aquat. Sci.* 53:35-44.
- Weeber, R.C. and M. Vallianatos (editors) 2000. The marsh monitoring program 1995 - 1999: Monitoring Great Lakes Wetlands and Their Amphibian Inhabitants. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. 47pp. <http://www.bsc-eoc.org/mmpreport.html>