

2003 Progress Report: Development and Assessment of Environmental Indicators Based on Birds and Amphibians in the Great Lakes Basin

EPA Grant Number: R828675-04

Subproject: *This is subproject number 04, established and managed by the Center Director under grant R828675*

Center: [Great Lakes Environmental Indicators Project](#)

Center Director: [Gerald J. Niemi](#)

Title: Development and Assessment of Environmental Indicators Based on Birds and Amphibians in the Great Lakes Basin

Investigators: Robert Howe¹, JoAnn Hanowski², Charles Smith³

Institutions: ¹University of Wisconsin, Green Bay, ²Center for Water and the Environment, Natural Resources Research Institute, University of Minnesota Duluth; ³Cornell University

EPA Project Officer: Barbara Levinson

Project Period: January 10, 2001 to January 9, 2005

Project Amount: \$6,000,000

RFA: [Environmental Indicators in the Estuarine Environment Research Program \(2002\)](#)

Research Category: [Ecological Indicators/Assessment/Restoration](#)

Description:

Objective: Specific objectives are the following:

1. develop a suite of scientifically robust, cost-effective indices of bird and amphibian assemblages that reflect ecological condition of the Great Lakes;
2. quantify the extent to which these indices are related to environmental pressure indicators such as land use characteristics, water quality, presence of exotic species, and hydrological modifications;
3. derive predictive models based on statistical relationship between pressure indicators and indices of bird/amphibian diversity and abundance;
4. use these models to infer ecological conditions at local and regional scales and to establish or improve the baseline for environmental monitoring programs;
5. develop a quality assurance/quality control infrastructure for future assessments of bird and amphibian communities; and, ultimately,
6. provide scientific recommendations for improving and monitoring the ecological health of the Great Lakes basin.

Progress Summary:

Bird amphibian sub-group annual report 2003

Progress Summary: Our efforts in the past year have centered on three major tasks. First, we completed field sampling of wetlands for breeding birds (224 wetlands) and calling anurans (220 wetlands) and for breeding birds on upland (171 study areas within 1km of shoreline) sites. We also quantified annual variation in bird abundance by resampling about 16% of sites in 2003 that were sampled initially in 2002. We have completed preliminary analyses to identify possible biological indicators by examining relationship of anuran and bird metrics to the stress gradients defined in the site selection process (seven principal components). Finally, much effort was

directed toward project outreach, including presentations at scientific meetings, graduate theses, and peer-reviewed articles.

Field Sampling

Wetland breeding bird communities were surveyed on 130 wetlands (186 points) in the Laurentian Mixed Province (LMP) and 94 wetlands (152 points) in the Eastern Broadleaf Province (EBP) (Figure 1). In order to quantify annual variability in our samples, we resampled (surveys completed in 2002 and 2003) 16% of the wetlands in the LMP and 17% of the wetlands in the EBP for wetland birds. A total of 144 bird species were observed over all wetland bird surveys in the LMP and 117 species were documented in the EBP. A total of 154 bird species were observed across all surveys.

Three surveys were completed for calling anurans on 125 wetlands (178 points) in the LMP and 95 wetlands (151 points) in the EBP (Figure 1). To quantify annual variability, we resampled 16% of the wetlands in the LMP and 5% in the EBP (Figure 1). A total of 13 species were heard across the Great Lakes basin, eleven species in each of the EBP and LMP.

We recorded 174 bird species on 1413 surveys (within 95 segments of upland) in the LMP and 154 species on 1137 surveys (within 76 segments) in the EBP (Figure 1). Repeat surveys (2002 and 2003) were completed on 14% of the segments in the LMP and 16% of the segments in the EBP.

Indicators and stressors

Our analysis of indicators and their relationships to stressors has thus far concentrated on stressor gradients defined in the original site selection. For example, we have completed simple correlations of bird and anuran indicators with the principal component axes from the seven principal components for the LMP (with 2002 data). Results thus far are preliminary, but will help us focus on the most promising indicator metrics and potential stressors that birds and amphibians will likely respond to. Thus far, we have found that although birds are more mobile than frogs, the responses of these animals to habitat conditions are different. Birds found in wetlands were highly associated with local habitat conditions, while frogs were more often associated with larger-scale landscape variables. Both groups are therefore useful as indicators of ecological stress because they provide information from different geographic scales.

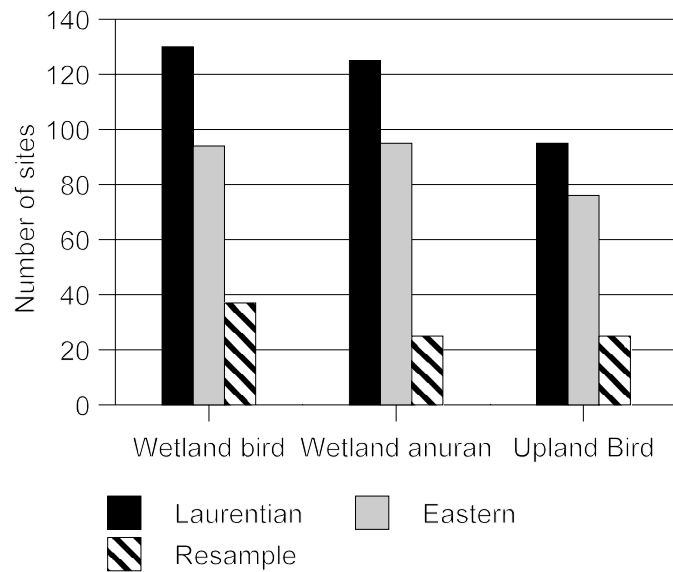


Figure 1. Number of sites sampled (and resampled) for wetland birds and anurans, and upland birds in the Laurentian Mixed and Eastern Broadleaf Provinces in 2002 and 2003.

Future Activities: We will begin statistical analyses of all data when we have the entire site “quality” information (relevant stressor data) from the GIS team. Results of our work will be presented at national meetings this coming summer and four theses will be completed based on this investigation. Work has also begun on peer-reviewed publications from this project as well as from the overall GLEI project.

Completed or Ongoing Theses

Effects of anthropogenic development on breeding bird abundance and communities. Christina Marie Miller. University of Minnesota Duluth. Finished February 2003.

Landscape factors affecting productivity of breeding birds in Great Lakes coastal wetlands. David Grandmaison. University of Minnesota Duluth

Anuran-habitat associations in coastal wetlands of the western Great Lakes. Steven Price. University of Wisconsin-Green Bay. 2003. 85 pp.

Habitat and landscape associations of breeding birds in Great Lakes coastal wetlands. David Marks. University of Wisconsin-Green Bay. 2003 123 pp.

Evaluation of the Ohio rapid assessment methods on wetlands of the Great Lakes basin: a comparative analysis of bird assemblages and wetland quality. Anna Peterson. University of Minnesota Duluth. In preparation.

Publications and Presentations:

<u>Type</u>	<u>Citation</u>
Journal	Hanowski et al. Sampling effectiveness of calling anuran surveys. In prep.
Journal	Hanowski et al. Quantifying sources of variability in wetland breeding bird surveys; effects on sampling design. In prep.
Journal	Price, S. J., D.R. Marks, R.W. Howe, J. Hanowski, and G.J. Niemi. The importance of spatial scale for conservation and assessment of anuran populations in coastal wetlands of the western Great Lakes. In Review. Landscape Ecology.
Presentation	Hanowski J. R. Howe, C. Smith, D. Marks, S. Price. What can birds and amphibians indicate about the ecological condition of coastal ecosystems? Eighty-eighth Annual meeting of the Ecological Society of America. Savannah, GA. 1-8 August.

- Presentation Miller, C., K. Stroom, C. Richards, G. Niemi, J. Hanowski, Negative Response of Bird and Aquatic Macroinvertebrates to Urban Development in Western Lake Superior. IAGLR 2003.
- Presentation Grandmaison, D., G. Niemi and J. Hanowski. Landscape factors affecting productivity of breeding birds in Great Lakes coastal wetlands. IAGLR 2003.
- Presentation Howe, R.W. and G. J. Niemi. 2003. Defining and applying environmental indicators in coastal ecosystems. A symposium presented at the 88th annual meeting of the Ecological Society of America, Savannah, Georgia.
- Presentation Howe, R.W., J. R. Karr, and A. T. Wolf. 2003. Historical and recent approaches to the assessment of ecological condition. A paper presented at the 88th annual meeting of the Ecological Society of America Annual Meeting, Savannah, Georgia.
- Presentation Price, S.J., D.R. Marks, R.W. Howe, J.M. Hanowski, and G.J. Niemi. 2003. The effects of spatial scale on indicator development for amphibians and birds in Great Lakes coastal wetlands. Poster Presentation. Third annual conference of the Estuarine and Great Lakes Initiative, U.S. Environmental Protection Agency Science to Achieve Results (STAR) Program. Bodega Marine Laboratory, Bodega, CA.. 4-7 December.
- Presentation Price, S.J., D.R. Marks, R.W. Howe, J.M. Hanowski, and G.J. Niemi. 2003. The effects of spatial scale on indicator development for amphibians and birds in Great Lakes coastal wetlands. Poster Presentation. Third annual conference of the Estuarine and Great Lakes Initiative, U.S. Environmental Protection Agency Science to Achieve Results (STAR) Program. Bodega Marine Laboratory, Bodega, CA.. 4-7 December.
- Presentation Price, S. J. 2003. Anuran-habitat associations in coastal wetlands of the western Great Lakes: The role of habitat and scale in biological indicator development. Poster Presentation. Seventeenth annual meeting of the Society for Conservation Biology. Duluth, Minnesota. 29 June - 2 July.

Supplemental Keywords: *environmental indicators, birds, amphibians, Great Lakes coastal zone, Great Lakes, coastal wetlands*

Relevant Websites: <http://glei.nrri.umn.edu>