

## **Development and Assessment of Environmental Indicators Based on Birds and Amphibians in the Great Lakes Basin**

### **Investigators and Institutions:**

#### *Co-Principal Investigators:*

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### **Project Summary:**

**Objectives:** This proposal is part of a multi-disciplinary investigation involving scientists from seven academic institutions, the Minnesota Department of Natural Resources, and US EPA Mid-Continent Ecology Division. Cooperators will address a central question: “What environmental indicators can most efficiently, economically, and effectively measure and monitor the condition, integrity, and long-term sustainability of Great Lakes coastal ecosystems?” Specific objectives of this subproposal are to: 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.

**Experimental Approach:** Birds and amphibians in the Great Lakes basin react to ecological stressors in complementary ways: amphibians are sensitive to local factors such as water quality and microhabitat availability, whereas birds are sensitive to larger scale factors such as landscape degradation and habitat area. We will evaluate Great Lakes ecosystem types (coastal wetlands, shorelines, estuaries) within watersheds and coastal reaches. Standardized methods will be used to sample a large number of sites for birds and amphibians. Data will provide a basis for multivariate analyses of species’ associations and environmental correlates. These analyses will be used to develop *indices of biotic integrity* based on observed species composition relative to species assemblages in undisturbed “reference” sites. Our research will evaluate indices of biotic integrity at a variety of scales and circumstances, addressing biogeographic patterns within the Great Lakes basin and needs of policy-makers at local, regional, and national levels. In collaboration with other investigators, we will test statistical relationships between independently measured environmental stressors (pressure indicators) and proposed indices of biotic integrity (state indicators).

**Expected Results:** The final product will include a suite of bird and amphibian indicators of ecological condition in the Great Lakes basin. We also will recommend a long-term monitoring strategy that minimizes costs while maximizing statistical power for discriminating degraded vs. high quality ecosystems. Results from our analysis will be shared with land managers and policymakers as tools for sustainable management of the Great Lakes’ coastal environment.