

Testing Indicators of Coastal Ecosystem Integrity Using Fish and Macroinvertebrates

Investigators and Institutions:

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Project Summary:

Objectives: The specific goals of our proposal are to:

- a) Evaluate the applicability of SOLEC-derived and complementary indicators in the context of the ecosystem types making up the Great Lakes coastal region;
- b) rigorously test the efficacy of a suite of indicators across the range of habitats that make up the Great Lakes coastal system;
- c) recommend indicators of specific ecological conditions keyed to assessment endpoints and stressors in the Great Lakes coastal region.

Experimental Approach: Our study will complement past and ongoing work of other coastal ecosystem scientists and programs by 1) collecting and compiling existing data sets, 2) measuring components missing in ongoing programs, and 3) developing unique data sets at independent locations. We will select 100 - 120 sites stratified among three Ecological Provinces (Keys & Carpenter 1995) and distributed among five coastal ecosystem types including high energy coastlines, embayments, river-influenced wetlands, coastal marshes, and protected wetlands.

We will conduct synoptic sampling of fish and macroinvertebrates within coastal ecosystems in the Great Lakes. We will use sweep nets, cores, and ponar sampling methods to maximize macroinvertebrate taxonomic richness and diversity encountered, and facilitate integration of previously collected databases with our protocols. Fish communities will be sampled using fyke net arrays in shallow waters and a semi-balloon bottom trawl in the nearshore zone of the lakes.

Landscape (e.g. land use, surficial geology, etc.) and local-scale (e.g. sedimentation, water quality) pressure indicators will be measured at each sample site. Output from hydrologic models will be used to estimate nutrient and sediment loading from adjoining watersheds to river-influenced wetlands. These data will be validated using field measurements.

Using biological community and environmental data we will generate ecologically relevant suites of indicators that have the greatest possible discriminatory power to distinguish degraded systems from least-impaired systems. We will also provide a rigorous analysis of the uncertainty associated with indices at all spatial scales including natural stochasticity, measurement error, parameter error, and model error.

Expected Results or Benefits: The proposed research will identify the relationships between ecosystem stressors operating at multiple spatial scales and coastal ecosystem responses. From these relationships we will develop and evaluate suites of pressure and state indicators that are mechanistically based, integrate ecosystem function and natural and anthropogenic processes at multiple spatial scales.