



Monitoring Great Lakes Coastal Wetlands: Summary Recommendations

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Introduction

In previous chapters, Consortium scientists – with input from Great Lakes Environmental Indicator (GLEI) project scientists – have recommended multiple biological metrics for monitoring the condition of Great Lakes coastal wetlands for plants, invertebrates, fish, amphibians and birds. Also recommended is a design for sampling Great Lakes coastal wetlands that allows users to monitor condition of these wetlands on an annual basis. With a combination of repeated site visits and random sampling of other marshes on an annual basis, users can establish status and trends (positive, negative, no change) of wetland condition for a given site, region or for all Great Lakes coastal wetlands.

The objective of this chapter is to provide an overview of how these protocols can be integrated into a standardized sampling regime that can be used by local, state, provincial, tribal/First Nation, federal, and international agencies and nongovernmental organizations from the United States and Canada. The goal is to standardize the procedures so that status and trends data from several local, provincial, state and tribal agencies can be shared with and used by federal and international organizations and reporting entities (e.g., GLC, GLFC, Environment Canada, U.S. EPA, U.S.ACE, SOLEC) to track status and trends for the entire Great Lakes basin and/or for each of the Great Lakes (e.g., Lakewide Management Plans).

A program to obtain a database on changes in landscape, chemical and physical parameters from year to year is also recommended. Such a database will enable users to independently monitor changes temporally while providing data that will enable scientists and managers to quantitatively measure changes in biotic indicators and relate them to changes in landscape (e.g., land use/land cover/roads, wetland area) and physical/chemical indicators (e.g., lake level, wetland chemistry).

An Overview of the Monitoring Program

The ideal monitoring program should allow governmental agencies and NGOs to assemble one or more teams of investigators to monitor and analyze status and trends data from Great Lakes marshes in their jurisdiction and make these data available for use by organizations that need to monitor status and trends at regional, individual lake and Great Lakes basin levels. Such a program would need to employ staff or contract with consulting firms and/or universities, or use trained volunteers to monitor status and trends at local to international scales.

Composition of the team assigned to wetland sampling

Ideally, each team would have specialists who would have the expertise and training to carry out the proposed sampling design in a timely manner and collect, enter and analyze data on landscape, physical, chemical and biotic indicators. The team members should also have the appropriate background in statistics and use of databases to enter collected data and the ability to quantitatively analyze and integrate the data into graphs, tables and reports on status and trends. The team should include individuals with expertise in collecting and using GIS/landscape, plant, invertebrate, fish, amphibian, bird and physio-chemical data. The team should also include persons with enough background in experimental design and quantitative analyses to analyze those data. It might be possible to reduce the staff members needed on such a team to three individuals who could be trained to accomplish and/or supervise all of the needed tasks with help from seasonal workers or volunteers. A team would likely need to include a plant ecologist, an invertebrate/fish ecologist, and an amphibian/bird ecologist with one or more of these staff members having sufficient training in use of GIS/GPS systems, chemical and physical data collection and analyses and experimental design/statistical treatment of data to perform the needed tasks. Each team member would have the ultimate responsibility in their area of expertise but would have to be willing to work together as an integrated team to obtain needed samples and data for metrics.

Many agencies already have the expertise on staff or may be able to obtain it from other sources. Since these staff members already have responsibilities, recruitment and training of team members may be necessary. Thus, a series of training sessions are likely to be necessary initially and, perhaps annually, to share experiences in implementing Consortium monitoring protocols and agree on any changes that might be needed from year to year. One team member could be designated as the overall team coordinator/manager. For states or provinces such as Michigan or Ontario with wetlands located on most or all of the Great Lakes, more than one team may have

to be assembled to cover the large number of coastal wetlands in their jurisdiction. There would be a need to coordinate activities for multiple teams if that is required.

Schedule of Team Activities

Prior to the field season, team members would obtain or check to be sure that all supplies and equipment would be available and functional when needed. They would also have to plan for and schedule time to obtain data on all indicators and activities for each of the following:

- 1) Randomly select the marshes to be sampled in the upcoming field season using a list of Great Lakes coastal wetlands within state, regional, tribal or provincial jurisdiction and responsibility. An initial inventory of Great Lakes coastal wetlands is available on the Consortium web site.
- 2) Obtain permission to sample selected marshes from the private, nongovernmental or public agency that owns/manages the marsh. If access to the site cannot be obtained, or if the site cannot be accessed from shore or by boat, randomly select another site as a replacement.
- 3) Amphibian sampling: The schedule for amphibian sampling is likely to begin in April and extend into June, but timing is dependent on temperature and other weather conditions during frog and toad breeding season (see chapter on amphibian indicators and guidelines established for frog and toad calling surveys). Frog and toad calling surveys require working at night so compensatory time off during the day is likely to be needed for staff involved in these surveys. Many states and provinces already collect such data, and it may be possible to obtain data on Great Lakes coastal wetlands from the coordinators of these surveys and/or from the Bird Studies Canada coordinator. It is likely, however, that many of the marshes selected in Steps 1 and 2 will have to be sampled by members of the monitoring team and supplemented by volunteer survey data where such data are available. NOTE: It should be possible to recruit a team member with a vertebrate biology background to be in charge of amphibian and bird surveys.
- 4) Bird sampling: Surveys should be done during active breeding season which tends to be from May through early July. (See Chapter 7 on bird indicators for details.) The lead staff person for this task could be the same person responsible for amphibian surveys or two separate team members would need to be assigned responsibility for amphibian and bird sampling.
- 5) Invertebrate sampling should be scheduled in July and August since this is the time when most invertebrates are present as mid- to late-instars. (See Chapter 4 on invertebrate indicators for details.) NOTE: A second team member with experience in invertebrate and fish biology should be recruited for invertebrate/fish sampling, sample processing, and data analyses or two individuals could be assigned as leaders of these tasks.
- 6) Fish Sampling should be scheduled from mid-June through mid-September. Ideally, sampling should be conducted in late July or early August, after emergent vegetation nears peak biomass, but metrics do perform well slightly outside of this time period. Since fish are to be identified in the field and released, an expert taxonomist should be present. Some species are more difficult to identify. Therefore, specimens may occasionally have to be obtained and returned to the lab for identification under a dissecting microscope.
- 7) Plant sampling should occur after dominant marsh plants are near peak biomass and in bloom or putting on seed. For most Great Lakes wetlands, this occurs from early- to mid-July through senescence in mid-September. A plant ecologist who has the ability, or can be trained, to identify dominant plants on sight and use field guides and taxonomic keys to identify >90 % of plants in marshes within agency jurisdiction should be the third member of the team if the agency plans to have only a three-member team assigned to bioassessment of Great Lakes wetlands.
- 8) At least one of the team members should have some background in interpretation of aerial/satellite imagery and enough knowledge with manipulation of GIS databases to determine land use/land cover data for all marshes sampled. Many students in environmental biology, ecology, and fisheries and wildlife now have GIS/GPS training included as part of their curriculum.

9) Between field seasons, team members supplemented with student or temporary helpers should be able to process samples taken during the field season (e.g., sort, identify and enumerate invertebrates and analyze chemical samples), enter all data using approved quality control procedures, obtain all imagery for the marshes and/or their watersheds, and – using the imagery, field notes and data on water quality, water levels, etc. from various sources – independently calculate the position of each of the sampled marshes along physical/chemical disturbance gradients. The database compiled by the GLEI project at the segment-shed level would be a useful source for such data initially once each site is placed in the appropriate segment-shed.

10) Prepare the annual summary report including data on biotic indicators in comparison to physical/chemical indicators and interpretation of data collected during the field season.

Recommended Indicators and Procedures

Experimental Design/Wetland Selection

The statistical design recommended for the project is from N. S. Urquhart, S.G. Paulsen and D.P. Larsen (1998). It calls for a combination of randomly selecting and sampling 14 wetlands within a region or a percentage of these within a state's or other agency's jurisdiction each year. Additional wetlands will be randomly selected each year to establish status; this is coupled with resampling a subset of these wetlands each year to establish trends. (See Chapter 1 on statistical design for details.)

Plant Indicators

Nine plant indicators were recommended using the following procedures: (1) Using aerial photos, map wet meadow and emergent plant zones and, with photos or GPS units in field, map patches of invasives; (2) Overlay a random grid in each zone or select three transects that will cross typical areas of each dominant plant zone; and (3) Sample 15 randomly selected 1.0 m⁻² quadrats in each zone or along the transects; sample dry and flooded parts of each plant zone. Based on data obtained from these quadrats, calculate the following eight metrics. (See Chapter 3 on plant indicators for further details.)

- 1) Invasive Plant Cover for Entire Site;
- 2) Invasive Plant Cover for Wet Meadow and Dry Emergent Zones;
- 3) Invasive Plant Cover for Submergent and Emergent Flooded Zones. Invasive Frequency for Entire Site;
- 4) Invasive Frequency for Wet Meadow and Dry Emergent Zones;
- 5) Invasive Frequency for Submergent and Emergent Flooded Zones;
- 6) Mean Conservatism (Native Species)* for Entire Site;
- 7) Mean Conservatism (Native Species)* for Wet Meadow and Dry Emergent Zones; and
- 8) Mean Conservatism (Native Species)* for Submergent and Emergent Flooded Zones.

* Calculate mean conservatism using values and procedures from the Floristic Quality Index for Michigan.

Invertebrate Indicators

Invertebrate indicators have only been developed for lacustrine (fringing or lake edge) wetlands. Data should be collected from riverine and drowned river mouth wetlands as well (submerged, water lily, emergent zones, etc.), since indicators are being developed and may be available for them soon. Invertebrates should be sampled from each dominant plant zone present in lacustrine wetlands including the wet meadow zone if flooded, the inner emergent zone (*Schoenoplectus* and/or *Typha*) zone, and outer emergent zone. Collection of three replicates per zone is required. (See Chapter 4 on invertebrate indicators for details.)

Metrics used in each plant zone include:

- 1) Odonata (Dragon and Damselflies) richness (number of taxa collected that are dragon flies and damsel flies);

- 2) Percent of total numbers of invertebrates caught that are Odonates;
- 3) Crustacea plus *Mollusca* richness (total number of taxa of amphipods, isopods, crayfish, shrimp, total snails, limpets and clams caught);
- 4) Total genera richness (number of genera present) in entire sample;
- 5) Percent of total numbers of invertebrates caught that were Gastropods (snails);
- 6) Percent of total numbers of invertebrates caught that were Sphaeriidae (finger nail clams);
- 7) Total number of taxa in the entire sample (= richness);
- 8) Evenness index; and
- 9) Shannon index.

Additional metrics are available for inner and outer emergent zones. (See Chapter 4 on invertebrate indicators for details.)

Fish Indicators

Fish indicators have been developed based on fyke net sampling of each wetland for one net night per plant zone using a minimum of three fyke nets per plant zone. Alternative methods of sampling such as electrofishing are also likely to work but additional work to cross validate those sample devices with fyke nets used to sample Great Lakes coastal wetlands will be needed before they can be used routinely. Fourteen fish indicator metrics for bulrush (*Schoenoplectus*) dominated wetlands are recommended; 11 metrics for cattail (*Typha*) dominated wetlands are also available and have been published. (See Chapter 5 on fish indicators for details of what these metrics are and how to calculate them.)

Amphibian Indicators

Amphibian community metrics were developed by Bird Studies Canada and Environment Canada from nine years of data collected through Bird Studies Canada by trained volunteers. Frog and toad call survey data spanned 60 Great Lakes wetlands in the United States and Canada. (See Chapter 6 on amphibian indicators for recommended protocols). The possibility of this being done using existing frog and toad surveys within individual states or provinces exists but would need to be cross-validated with some preliminary studies.

The amphibian community index of biotic integrity (IBI) includes three metrics:

- 1) Total species richness;
- 2) Species richness of woodland species; and
- 3) Probability of detecting a woodland species within a wetland.

Bird Indicators

The marsh bird community IBI was developed by Bird Studies Canada and Environment Canada using data on wetlands collected by trained volunteers. These surveys were conducted in the evening from 6-10 p.m. from routes consisting of 1-8 points per route. Monitoring at each point along the route consisted of five minutes of passive recording of birds present within 100 meters of the point using visual and auditory observations, followed by five minutes of playback recordings of the calls of secretive birds such as rails, followed by an additional five minutes of recording birds observed visually or from calls. Surveys are conducted three times during breeding season. (See Chapter 7 on bird indicators for details.) A major difference between Consortium and GLEI scientists was use of early morning surveys by GLEI researchers versus evening surveys conducted by Consortium scientists. The evening surveys can be more easily combined with amphibian surveys using the Consortium protocols recommended here, but many ornithologists tend to use morning surveys. Data suggest that either morning or evening surveys can be used. The IBI incorporated bird guilds that represented disturbance-sensitive marsh-nesting birds and general marsh-users.

The bird community IBI includes three metrics:

- 1) Abundance of non-aerial foragers;
- 2) Abundance of marsh nesting obligates; and
- 3) Species richness of area-sensitive marsh nesting obligates.