Good afternoon. I have been given the pleasure of describing a major SOLEC accomplishment, the development of coastal wetland indicators for the Great Lakes basin. Over the next 15 minutes I'm going to present to you a brief history of the progress we have made since SOLEC '96 regarding development of a coastal wetland monitoring framework and some information about the indicators that are measured.

Coastal wetlands perform several functions that are of vital importance to the health of the Great Lakes. These include the cycling and storing of nutrients and organic materials, regulation of surface and groundwater flow, and sediment capture. Coastal wetlands are also important to biological diversity as they provide breeding, foraging and staging habitat for many different species of fish and wildlife.

An alarming number of these wetlands have disappeared or been severely degraded over the past decades, reduced by as much as 60-90% from historic levels. This is largely due to urban, industrial and agricultural expansion.

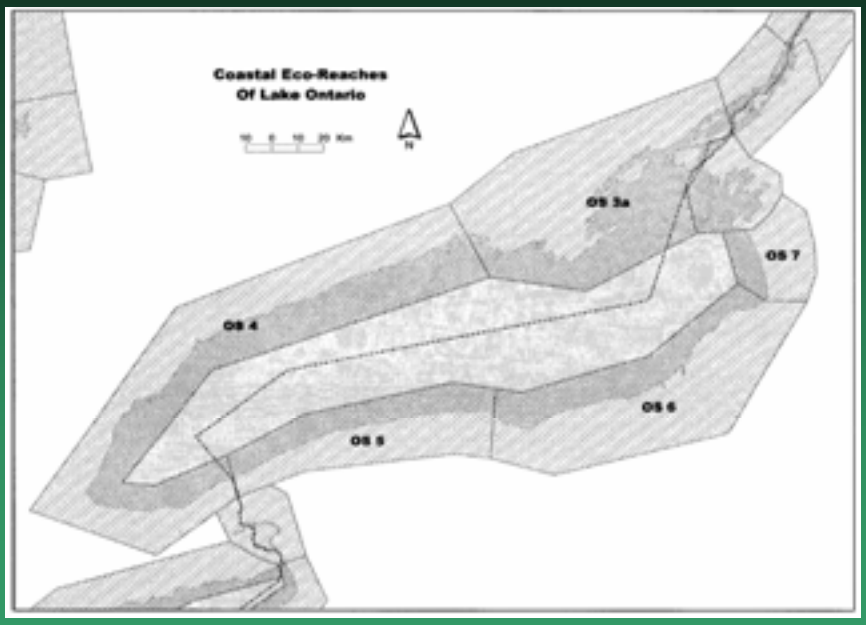
Invasion of exotic species, water level control, eutrophication, sedimentation, shoreline alteration and habitat fragmentation have also degraded many of the remaining coastal wetlands, particularly within the lower Great Lakes.

SOLEC 1996

- Water level monitoring
- Sediment supply characteristics
- Concentration of nutrients and toxic substances
- Tissue concentrations of toxic chemicals or malformations in fish and wildlife
- Population characteristics of economically or socially valuable wetland species
- Presence of characteristic species with narrow environmental tolerances
- Presence and abundance of invasive species
- Changes in area of habitats or vegetation types over time
- *Biodiversity measurements*
- Changes in plant community characteristics
- Changes in faunal community characteristics
- Biotic community indices
- size, position and number of Great Lakes coastal wetlands
- Land-use characteristics in the vicinity of coastal wetlands
- Land use changes upstream in the watersheds of coastal wetlands with inflowing tributaries
- Fish consumption advisories for wetland-dependent species
- Certain health problems
- Commercial fish catches of wetland-dependent species
- Recreational opportunities
- *Number of employed persons in activities directly or indirectly related to coastal wetlands*

At SOLEC 1996, numerous potential coastal wetland indicators, were identified. It was recognized that a select number of informative yet cost-effective indicators of coastal wetland health would be needed for effective coastal wetland conservation and restoration.

SOLEC 1998



At SOLEC 1998, the Lakes were divided into eco-reaches to help classify and monitor specific coastal wetlands. It was recommended that a centralized coastal wetland inventory, plus a standardized sampling protocols and frameworks be established. It was also recommended that a bi-national coordinating body be created to oversee coastal wetland monitoring and data management.

Great Lakes Coastal Wetlands Consortium

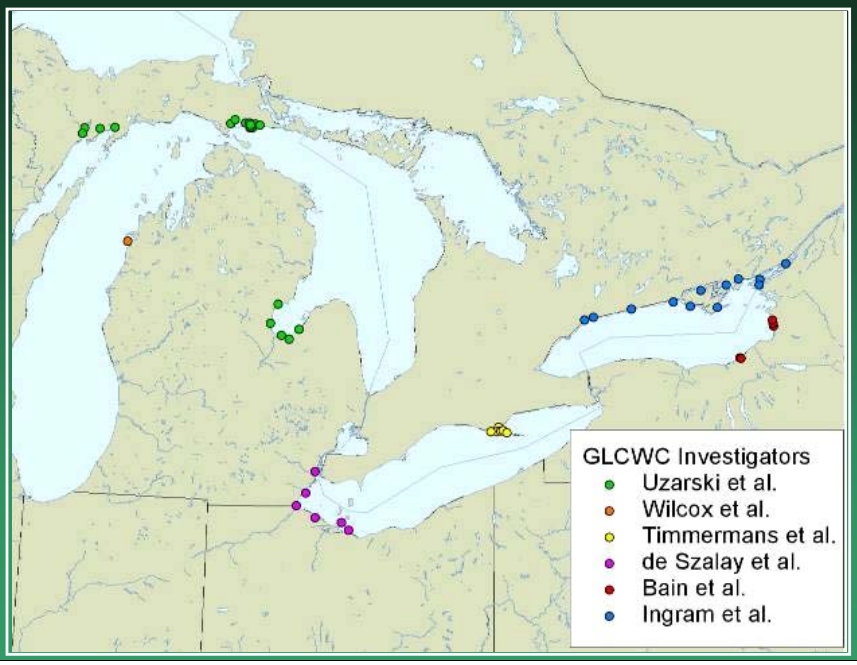
- Consists of several Great Lakes coastal wetlands researchers and policy makers
- Goals
  - Develop a long-term binational Great Lakes coastal wetland monitoring program
  - Expand monitoring and reporting capabilities under the Great Lakes Water Quality Agreement

In response to these recommendations, in 2000, the USEPA funded the creation of the Great Lakes Coastal Wetlands Consortium, which would be coordinated by the Great Lakes Commission.

The two dozen members of the Consortium consisted of several Great Lakes coastal wetlands researchers and policy-makers from American and Canadian federal, provincial, and state government agencies, First Nations and Tribal groups, conservation authorities, non-profit organizations and academic institutions.

The Consortium's goal was to develop a Great Lakes coastal wetland monitoring program to expand the monitoring and reporting capabilities of the US and Canada under the Great Lakes Water Quality Agreement.

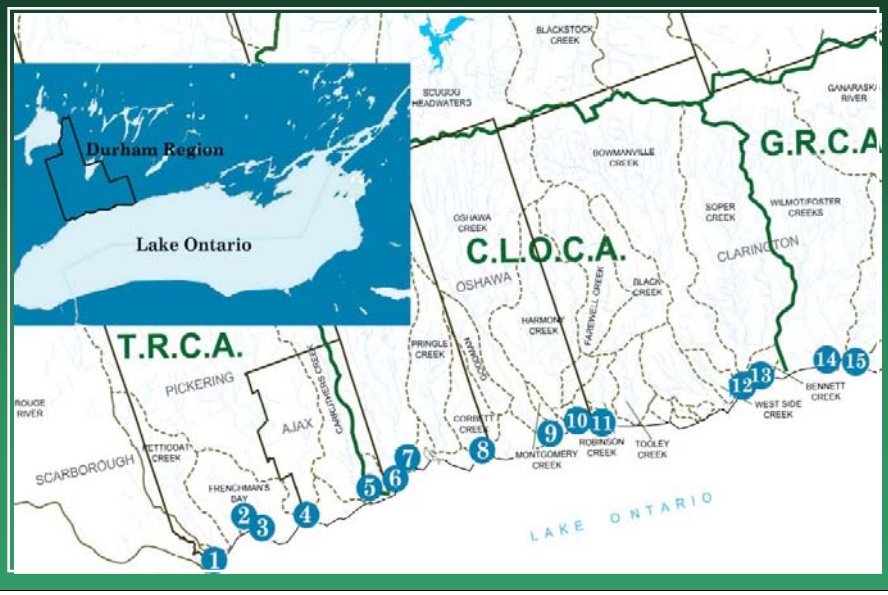
Indicator Evaluations



In 2002, Consortium researchers evaluated proposed coastal wetland indicators and sampling designs in various regions of the Great Lakes basin.

Field-testing activities took place in areas such as Saginaw Bay and in Long Point Bay on Lake Erie, where standardized sampling protocols for aquatic macroinvertebrates, fish, plants, amphibians and birds were tested, and landscape-level data collected.

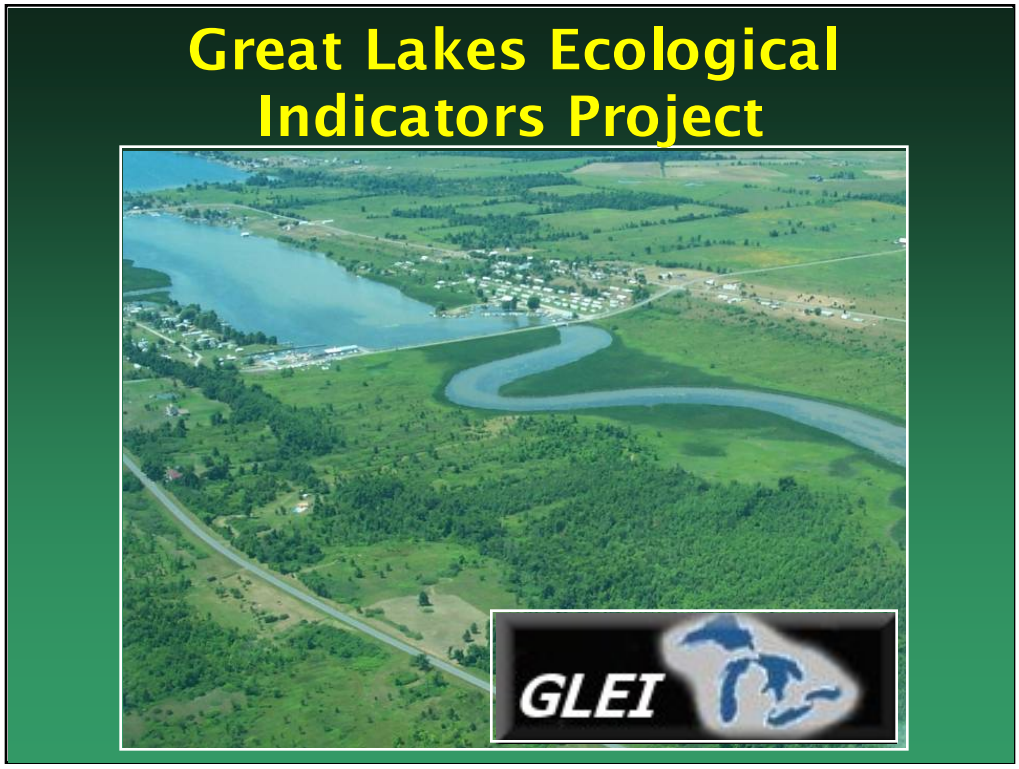
Durham Region Coastal Wetland Monitoring Project



To further test and refine Great Lakes coastal wetland indicators, Environment Canada initiated the Durham Region Coastal Wetland Monitoring Project in 2002. Focusing on a group of 15 coastal wetlands along the north-central shore of Lake Ontario, the Durham Project was designed as a pilot-scale evaluation of a long-term, coastal wetland monitoring program.

Indicators and sampling protocols adopted by the Consortium were further evaluated and tested, including indices of biotic integrity.

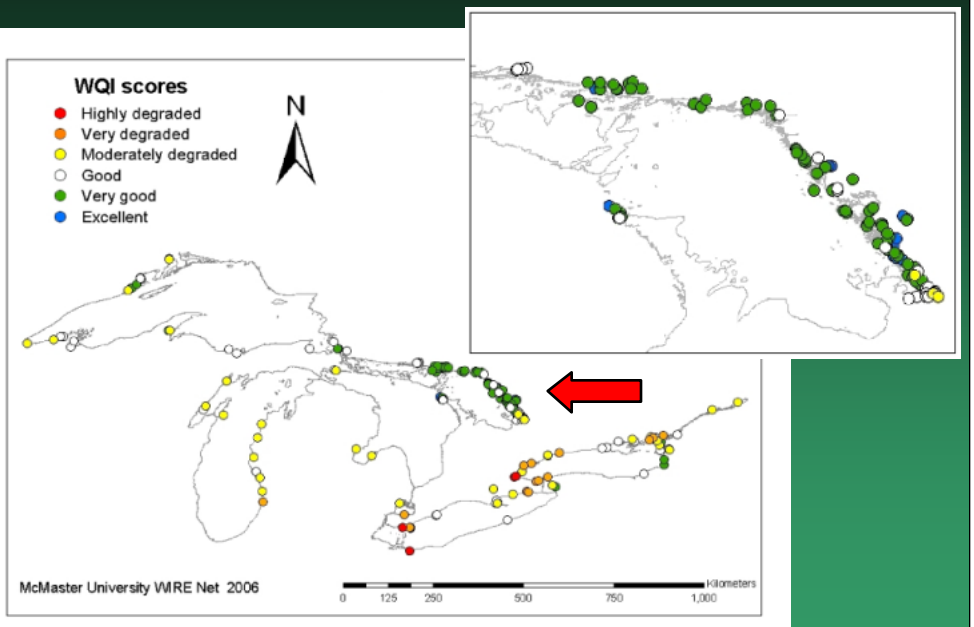
This project successfully provided a blueprint for implementing a basin-wide coastal wetland monitoring program.



At the same time, the U.S. Great Lakes Environmental Indicators project, developed an integrated set of environmental indicators to assess the condition of the entire shoreline, including coastal wetlands.

This project combined field and existing data to link stressors with environmental indicators and recommended a suite of hierarchically-structured indicators.

McMaster University Studies



"Another coastal wetland research program was carried out in northern Lake Huron and Georgian Bay by a team of McMaster University researchers.

Researchers sampled over 100 wetlands throughout Lake Huron using a Water Quality Index to rank wetlands according to degree of disturbance. Habitat quality was calculated using scores for Wetland Fish, Zooplankton, and Macrophyte; **[click here]**

Compared with approximately 100 other Great Lakes coastal wetlands, Georgian Bay and the North Channel are in the "very good" to 'excellent" condition. Wetlands showing signs of moderate degradation occur in the southeastern extent of Georgian Bay as shown by this map. Land-use alterations and shoreline development are primarily responsible for the lower scores."

Environmental Monitoring and Assessment Program (EMAP)

In 2000-2003, USEPA funded a Regional Environmental Monitoring and Assessment Program, study to investigate coastal wetlands. The study included over 300 wetlands which were randomly distributed in each of the Great Lakes plus all of the connecting channels on the American shoreline.

A Standard Operating Procedures document and numerous peer reviewed journal publications and reports (were published), plus a book with 26 chapters which included calibration of lake specific indices of biotic integrity, habitat and water quality.

Indicator Suite Finalized

- Fish communities
- Invertebrate communities
- Plant communities
- Bird communities
- Amphibian communities
- Coastal wetland extent and composition

The Consortium, meanwhile, tested 13 Great Lakes coastal wetland indicators that were proposed at SOLEC 2004, and then narrowed the indicators to six:

fish,

invertebrate,

plant,

bird,

amphibian, and

fish community status, and

coastal wetland extent and composition.

Physical and chemical water quality measurements and land use/land cover assessments would also be collected as covariates.

I will now take a few minutes to describe each of these indicators in a bit more detail, starting with the fish community indicator.

Fish and invertebrates have long been considered indicators of aquatic system health in streams and lakes, but only recently have been considered as indicators of coastal wetland health.

Given that up to 90% of Great Lakes fish species use coastal wetlands during some stage of their life cycle, the health of wetlands can be inferred by assessing their ability to provide habitat for a diverse set of fish species.

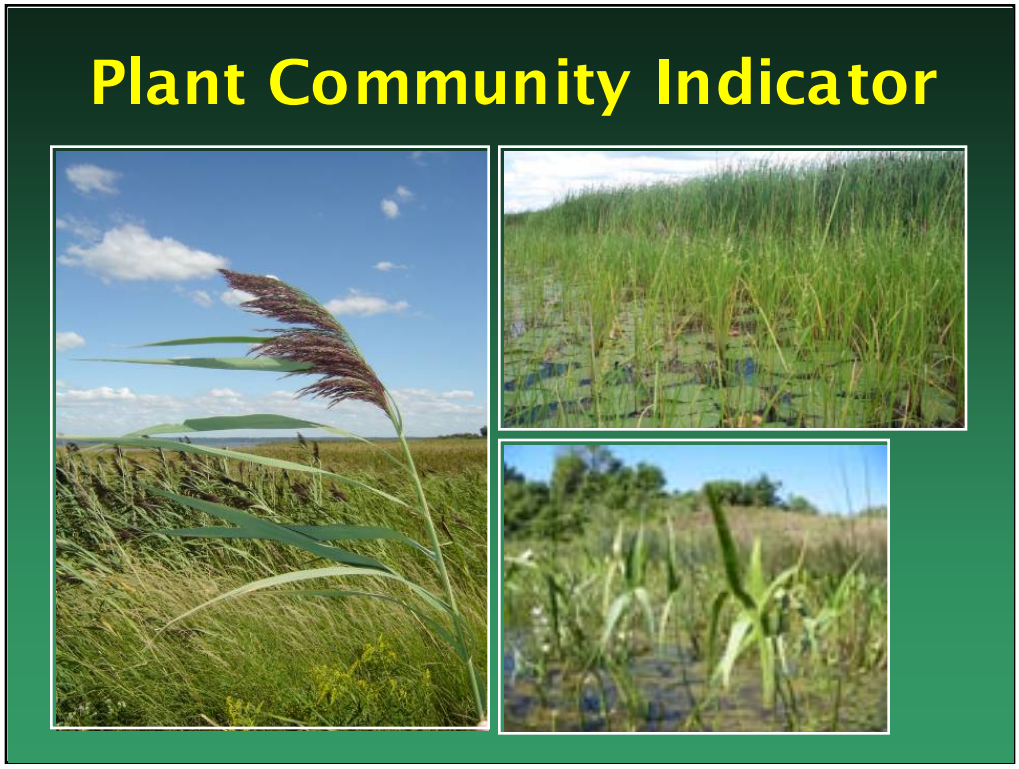
The Great Lakes coastal wetland fish community indicator is still undergoing development, although many reports have been compiled and several options have been investigated.

Over the past few years, indicators of biological integrity, or

As integral parts of the food web for fish and other wildlife, a healthy invertebrate community in coastal wetlands infers the ability of those wetlands to support a healthy diversity of fish and wildlife species. The presence and relative proportions of various pollution-sensitive and pollution-tolerant invertebrate species also provides a biological indicator of wetland water quality.

In recent years, efforts have been made to develop invertebrate-based IBIs in individual Great Lakes, but never on a whole basin scale. A macroinvertebrate-based procedure for Lake Huron coastal wetlands, differed from others because it included metrics from up to four emergent plant zones, using a scoring system based on how many inundated zones are present. This allowed it to be used across a wide range of lake levels.

This IBI-based system was later adapted and tested. While certain factors limit use of this IBI on a Great Lakes basin scale, work is ongoing to refine this IBI to better characterize various Great Lakes regions.



Attempts have been made, with limited success, to develop Great Lakes basin plant IBIs due to vast differences in disturbance factors and water level fluctuations.

As a result, a more limited approach was favoured by plant ecologists which considered:

the coverage and distribution of invasive plants;

the coverage and diversity of submergent and floating plants;

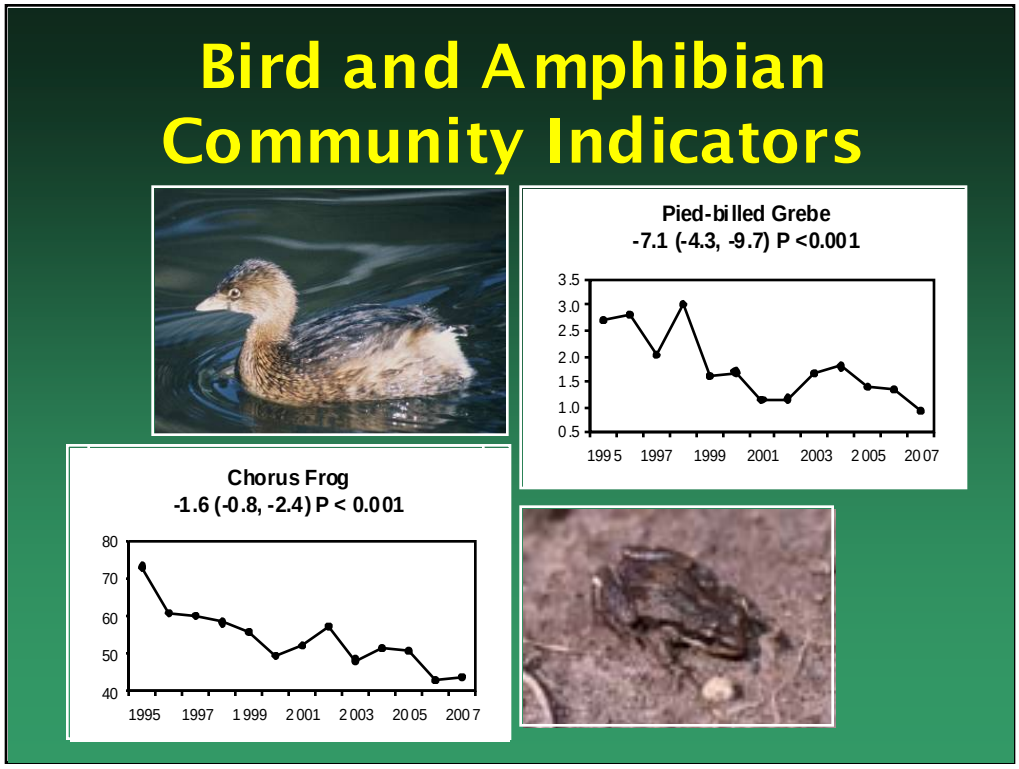
and the results of Floristic Quality Index scores relative to regional controls.

This approach required that different plant zones be surveyed separately in order to develop restoration solutions for each zone facing differing stresses.

The method scores and ranks wetlands in terms of plant species composition. Collective values for marshes can then be calculated, inferring the state of coastal wetland plant health within the basins.

The bird and amphibian community indicators were developed using established protocols of Bird Studies Canada's Marsh Monitoring Program. The Marsh Monitoring Program is a long-term, bi-national marsh bird and amphibian program which relies on a network of several hundred volunteer Citizen Scientists from across the Great Lakes basin who annually collect data on distribution and abundance of two dozen bird and calling amphibian species.

Since 1995, MMP volunteers have submitted their data to BSC, allowing us to develop long-term population trend data and habitat association models to better inform conservation strategies for these vulnerable species and the wetland habitats on which they depend.

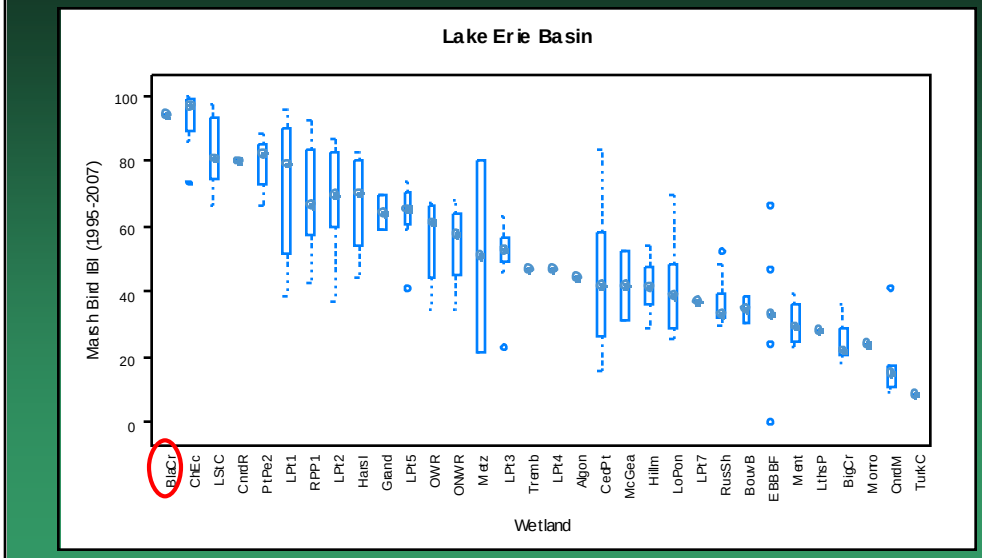


Birds and amphibians serve as bio-indicators of wetland health because they heavily rely on the quality of coastal wetland habitat for breeding, foraging or staging purposes,

Long-term results have shown that wetland-obligate bird species, such as the Pied-billed Grebe, are undergoing dramatic population declines across the Great Lakes basin, while generalist bird species, such as Common Yellowthroat, are seeing persistent population increases. These results are indicative of well-documented incidences of habitat fragmentation and degradation.

In addition, several years of data have shown that the majority of Great Lakes amphibian species, such as the Chorus Frog, are undergoing population declines, further highlighting the importance of and need for coastal wetland conservation and restoration.

Bird Community Indicator



"Bird and amphibian IBIs use several metrics sensitive to coastal wetland disturbance in order to generate wetland-specific scores in terms of the composition and diversity of bird or amphibian species .

Wetland IBI scores can be ranked relative to other evaluated wetlands within the Great Lakes basin in order to identify those sites in most need of conservation or restoration activities. For example, based on Marsh Monitoring Program data collected between 1995 and 2007, **[click here]** Michigan's Black Creek Wetlands and Ontario's Chenal Ecarte wetlands rank highest among monitored Lake Erie basin marshes in terms of bird community status. Conversely, Ontario's Canard River Mouth marsh and Turkey Creek marsh, both of which occur at tributary mouths to the Detroit River, are ranked last in terms of bird community status, highlighting the need and importance of restoration and conservation actions at these sites.

These IBIs have more recently been used as part of efforts to evaluate progress to restore degraded marsh habitats in Great Lakes Areas of Concern."

Extent and Composition

Various remote sensing technologies and methods are being assessed to improve our ability to monitor coastal wetland extent and composition, The Consortium coordinated the development of the first seamless, bi-national Great Lakes coastal wetland inventory database. Existing U.S. and Canadian databases were built upon with the addition of new data derived from Consortium members and partners.

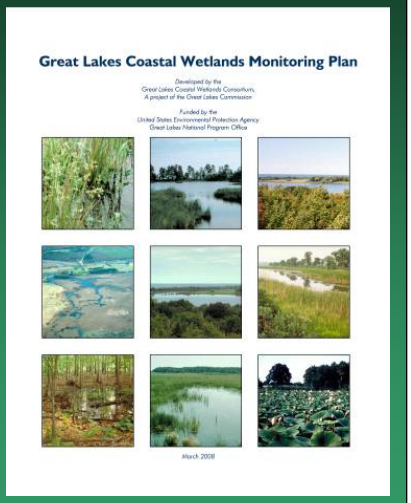
All coastal wetlands inventoried were classified as one of three major coastal wetland types: lacustrine; riverine or; barrier beach.

Due to a lack of data, estimates of coastal wetland extent are only approximate in certain regions, such as the upper Great Lakes.

A comprehensive, coastal wetland inventory, will facilitate establishment of baseline monitoring and reporting on Great Lakes wetlands, improve our knowledge about wetland habitat loss and degradation, and simplify data sharing efforts.

Monitoring Plan

- Map of the 217,000 hectares of known coastal wetlands
- A new coastal wetland classification system
- Field-tested sampling protocols for accepted indicators
- A proposed sampling design
- A database to house future data
- Implementation strategies and potential partners



Earlier this year, the Great Lakes Commission released its final report of Consortium work.

Called the Great Lakes Coastal Wetland Monitoring Plan, this report summarizes seven years' worth of work.

•A map of the 217,000 hectares of coastal wetlands,

•A new coastal wetland classification system,

•Field-tested sampling protocols for indicators,

•A proposed sampling design,

•A database to house data; and,

•Implementation strategies and partners.

Next steps

- Partnerships and implementation
- Open and accessible central database
- Concise methodology manual
- Sampling design refinement
- Funding sources

Several important next steps remain to make this important plan a reality.

These include:

•Partnership development and consolidation of standardized monitoring practices and data reporting.

•Further development of a central database which is open and accessible to all partners;

•The development of a clear and concise methodology manual;

•The development and implementation of a statistically-based 5-year monitoring rotation across the Basin; and,

•Identification of funding sources to allow for initiation and continuation of this monitoring program.

Acknowledgments

Many partners have helped develop a Coastal Wetland monitoring system but there is still some way to go.

Thank you.