MARSH MONITORING PROGRAM: AREAS OF CONCERN SUMMARY REPORTS 1995 - 2002
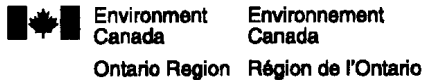

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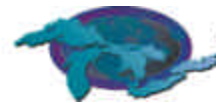Ontario Region
Environment Canada**

by

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PREFACE

This report provides an updated overview of Great Lakes Areas of Concern (AOCs) condition with respect to data collected under the Marsh Monitoring Program (MMP), a joint venture of Bird Studies Canada and Environment Canada. This document is a collection of reports concerning 14 Canadian and binational Great Lakes AOCs surveyed by MMP participants from 1995 through 2002. These reports provide updates on the status of these highly impacted sites distributed throughout the Great Lakes basin. Each AOC-specific report herein is intended for distribution among wetland managers, Remedial Action Plan (RAP) Coordinators, and other parties interested in specific AOCs. Because an understanding of the context and limitations of these MMP-based evaluations is critical to appropriate use of these AOC assessments, a copy of the following introductory comments should be distributed with each individual AOC summary.

INTRODUCTION

The Great Lakes basin is a prominent and important pro-glacial feature of the North American landscape. The Great Lakes comprise a vast network of inland freshwater storage basins. These lakes constitute the largest inland water transportation system in the world, and hold roughly 20% of the world's fresh water (MacKenzie 1997). Its watershed basin contains one-tenth of the population of the United States, one-quarter of the population of Canada, several concentrations of industrial operations, and vast areas of agricultural production (Anonymous 1995). The lakes comprising the Great Lakes network provide water for drinking, angling, transportation, power, industry, recreation, and habitat for a diverse array of wildlife species. Industrialization, urbanization, and intensive agriculture have led to a variety of pollution problems and other impacts in and around these lakes.

The 1987 protocol to the Great Lakes Water Quality Agreement (GLWQA) committed the governments of Canada and the United States to develop and implement RAPs in 43 AOCs identified by the International Joint Commission. These RAPs address pollution and other problems associated with 14 Beneficial Use Impairments in near shore and open lake waters. These impairments relate to the health of wildlife and their human consumers, nutrient and other pollution inputs, and economic and aesthetic impacts (Great Lakes Water Quality Board 1997). Successful restoration of wildlife populations and their habitats is considered part of the recovery and potential delisting of many AOCs. Since the GLWQA amendment, two AOCs (Collingwood Harbour – 1999 and Severn Sound – 2002) have been restored successfully and delisted from the Great Lakes basin list of AOCs.

Coastal areas within AOCs often contain wetland areas, many of which have been degraded by pollution inputs, hydrological disturbance, and other impacts. A high proportion of the Great Lakes basin's wildlife species inhabit wetlands during part of their life cycle, and many of the species and ecosystems at risk in the basin are associated with wetlands. As a group, marsh birds are believed to have experienced major declines

due to historical habitat loss and degradation, but it is unknown whether and to what spatial extent these declines are still occurring (Gibbs et al. 1992, Conway 1995, Melvin and Gibbs 1996). Similarly, there is growing international concern about declines of amphibian populations and an apparent increase in deformities (Bishop and Petit 1992, Green 1997). Results of eight years of MMP data support the belief that several marsh bird species populations and some amphibian species occurrences have been undergoing recent declines (see Timmermans and Craigie 2002). However, the MMP was developed to gain long term data on marsh bird and amphibian population trends, so additional years of data are required for more conclusive evidence of such declines. Much work remains to be completed before ascertaining long-term trends and causes of population decline. Recent investigations have indicated that population status of marsh birds (Timmermans 2002, Craigie et al. 2003) and amphibians (Timmermans 2002) are closely associated with water levels of the Great Lakes.

The MMP was launched in 1995 to provide baseline information about population status of Great Lakes marsh birds and amphibians, to begin an assessment of their habitat requirements, and to contribute to evaluations of AOC recovery. Volunteers throughout the Great Lakes states and Ontario were provided with a survey protocol, a training kit, and necessary equipment to conduct their surveys. Volunteers established stations along marsh edges and surveyed marsh birds during two annual visits and monitored calling frogs and toads during three annual visits. Although a particular effort was made to ensure that AOCs and other coastal marshes were surveyed, establishment of inland routes was also encouraged. The reports herein summarize results of MMP data from 1995 through 2002 with respect to each AOC monitored by MMP participants. Results of these reports are intended to provide a current view of wetland status within these AOCs.

Objectives of the Marsh Monitoring Program

The goal of the MMP is to monitor populations of birds and amphibians throughout the Great Lakes basin, with an emphasis on wetlands within AOCs. Objectives of the MMP are to:

- Compare marshes within AOCs with those outside these areas (i.e., non-AOCs) in terms of marsh bird and amphibian species composition and abundance, and species diversity (Chabot et al.1998).
- Gather data on specific AOCs or marshes within AOCs to help asses their status with respect to wildlife values (Chabot et al. 1998).
- Monitor marsh bird and amphibian populations temporally and on a variety of spatial scales from individual marshes to basin-wide (Weeber et al. 1997, Weeber and Valliantos 2000, Timmermans 2002, Timmermans and Craigie 2002).
- Elucidate marsh bird and amphibian habitat associations and use this information to guide wetland habitat management actions.
- Develop marsh bird- and amphibian-specific indices of wetlands biotic integrity for evaluating anthropogenic impacts to Great Lakes coastal wetlands health.

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METHODS FOR EVALUATING AOCs

Species classifications and community descriptors

Marsh bird species rely on wetlands for supporting various stages of their life cycles. For most species using Great Lakes wetlands, the most critical demands on wetland resources are to support breeding (i.e., nesting, brood rearing) and staging (i.e., preparing for spring and/or fall migration) activities. To help determine resource types that might be most important in each AOC, marsh birds were classified as those species nesting within the marsh, species nesting outside the marsh but foraging within it, and those nesting elsewhere but foraging in the air above wetlands.

Based on input from several experts in marsh bird and amphibian ecology (i.e., Bird Studies Canada staff, Environment Canada staff, and others), a set of amphibian and marsh bird species was selected to serve as indicators (i.e., surrogate measures) of marsh function and habitat provision.

Because many of these relations are poorly understood, use of these species as indicators must be considered preliminary. Along with other research programs, data collected under MMP protocol will help clarify these relationships. Species selected as indicators were identified based on the following criteria:

- the species was sufficiently common to make detection likely
- the species was dependent on marshes for breeding, particularly marshes with a mix of open water, herbaceous vegetation, and a fairly diverse set of plant species
- the species required relatively undisturbed habitat conditions (e.g., habitats with few invasive species and low toxin levels)
- species that were known or suspected to be enduring population declines were selected preferentially
- for amphibians: the set of species contained both early- and late-season callers

The five amphibian and 12 marsh bird species identified as indicator species are listed on the first page of each AOC summary report. Across stations, the presence of each indicator bird species was positively correlated with the number of other indicator bird species, suggesting that indicator bird species were probably reflecting similar quality requirements. For amphibians, with the exception of the Mink Frog, the most rarely encountered amphibian indicator, the presence of each of these species indicators was positively correlated with the number of the other amphibian indicator species.

Because a consideration of entire species communities can be extremely complex, other means are often necessary to describe species assemblages. Species diversity, defined in these reports in terms of number of species present, scaled to sampling effort, was used in these summaries as a descriptor of amphibian and marsh bird communities. Four measures of species diversity were calculated:

- all marsh nesting birds
- marsh bird indicator species only
- all amphibian species
- amphibian indicator species only

Calculations of each diversity measure were based on total number of species detected on each station within each year. Each measure was expressed as the average species richness per station per year.

Context for AOC summary reports

Information gained through the MMP is being used to ascertain habitat associations and population trends of Great Lakes marsh bird and amphibian species. In AOCs, such information can help develop effective strategies, implement restoration projects and measure success of these efforts. Information derived from the program can also contribute to consideration of delisting specific AOCs, specifically in terms of marsh bird and amphibian related Beneficial Use Impairments. However, although the MMP is intended to provide information toward evaluating status of wetlands within AOCs, assessments of these ecosystems' degree of impairment should be based only partly on our results. The MMP should serve as a complementary source of information in concert with other assessment schemes and other perspectives about AOC wetland functions and integrity.

Data Manipulations

Each station was usually surveyed twice for birds or three times for amphibians each year. Prior to analysis, these surveys were combined into a single measure for each year. Because amphibian species differ in the time of year at which their peak calling intensity occurs, the maximum calling code for each species among the three surveys was used as the relative abundance measure for each station. Although these seasonal differences are less pronounced for birds than they are for amphibians, we also selected the maximum number of birds counted during the two surveys at each station. The major disadvantage of this approach was that stations that were surveyed for less than the full number of surveys were likely to average fewer species and lower counts of individuals than other stations. To avoid this bias, such routes were excluded from the analyses described in this report, resulting in the exclusion of a small to moderate percentage of routes.

Accounting for annual variation and marsh size variation prior to scoring

Each AOC was scored according to how its measures of species diversity compared to those measures at non-AOCs MMP routes in the Great Lakes basin. The four measures of species diversity described previously were used in the scoring process of each AOC.

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Variation due to effects of year and marsh size was taken into account prior to use of these measures for scoring AOCs. This was done through use of both linear and quadratic (i.e., second-order polynomial) regression, whereby each of the four diversity measures were used in separate regression models as response variables and year, marsh size class, and their quadratic terms were considered simultaneously as predictor variables. For each AOC, residuals from these models were compared to residuals from these same regressions done using non-AOC MMP data.

Scoring of AOCs

As part of the MMP contribution to assess AOC wetlands, a ranking system was developed that considered amphibian and marsh bird species richness (diversity) measures within each AOC relative to those recorded in other non-AOC routes in the Great Lakes basin. This ranking system required that survey data were statistically corrected for differences in estimated marsh size, therefore MMP routes that did not have available marsh size data collected by volunteers were excluded from this ranking scheme for each AOC. MMP-based evaluations reported herein are based on eight years of data to provide a current view of AOC status. Given the limited number of routes and years surveyed at the localized AOC level, reliable trends cannot be determined. Thus, trend information is not presented for AOCs. In addition, classification of routes as AOC or non-AOC was done based on available boundary information for AOCs. BSC would be pleased to accept better AOC boundary information from RAP teams to improve boundary delineation for future analysis and reporting.

Each AOC was scored relative to the average for non-AOCs in the same lake basin. Scoring was done with respect to each of a series of dependent variables: frequency of occurrence of each indicator species, and the four species richness measures described above. Multiple regressions that corrected for variation in marsh size among routes were run for non-AOCs in each basin. Expected values of the dependent variables based on these regressions (i.e., with non-AOCs) were compared to values of these dependent variables recorded in AOCs. Each AOC was then rated in terms of the difference between the expected values and the values observed in the AOC:

- *impaired* if the residual value was less than one standard error below the mean expected value (score = 0),
- *apparently not impaired* if the residual value was within the range defined by plus or minus one standard error of the mean expected value (score = 1), or
- *not impaired* if the residual value was greater than one standard error above the mean expected value (score = 2).

The scoring procedures outlined above were used to derive an overall score for each AOC. The overall score was based on the four components of species richness: total marsh bird species, marsh bird indicator richness, total amphibian richness, and amphibian indicator richness. The maximum score for each of the four components was two, and the maximum possible overall score for any AOC was eight. In our overall

assessment of AOCs, scores of 0 – 2 suggested that the site was *impaired*; scores of 3 – 5 suggested that there was *no apparent impairment*; and scores of 6 – 8 indicated that site was *not impaired* and deemed healthy.

ACKNOWLEDGEMENTS

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Figure 1. Locations of 43 Great Lakes Areas of Concern.

Table 1. Great Lakes AOCs monitored by MMP participants from 1995 through 2002. Provisional status is based upon amphibian and marsh bird species richness (see text for explanation of rating procedure). AOC reports included in this volume are shaded in grey, and appear in the order in which they occur in this volume.

Areas of Concern	Lake Basin	Provisional Status
Bay of Quinte	Ontario	impaired
Black River	Erie	not impaired
Clinton River	Erie	impaired
Collingwood Harbour	Huron	not impaired - delisted 1999
Cuyahoga River	Erie	impaired
Deer Lake/Carp Creek	Superior	impaired
Detroit River	Erie	impaired
Eighteen Mile Creek	Ontario	impaired
Fox River/ Lower Green Bay	Michigan	not impaired
Hamilton Harbour	Ontario	impaired
Jackfish Bay	Superior	impaired
Kalamazoo River	Michigan	impaired
Manistique River	Michigan	impaired
Maumee River	Erie	not impaired
Muskegon Lake	Michigan	not impaired
Niagara River	Erie	impaired
Nipigon Bay	Superior	impaired
Oswego River	Ontario	Not impaired
Peninsula Harbour	Superior	not impaired
Port Hope	Ontario	impaired
Preque Isle Bay	Erie	impaired
River Raisin	Erie	impaired
Rochester Embayment	Ontario	not impaired
Rouge River	Erie	impaired
Saginaw River	Huron	not impaired
Severn Sound	Huron	not impaired - delisted 2002
Spanish River	Huron	impaired
St. Clair River	Erie	impaired
St. Lawrence River	Ontario	not impaired
St. Louis Bay/River	Superior	impaired
St. Marys River	Huron	not impaired
Thunder Bay	Superior	not impaired
Toronto and Region	Ontario	impaired
Torch Lake	Superior	not impaired
Waukegan Bay	Michigan	not impaired
White Lake	Michigan	impaired
Dunnville Marsh[1]	Erie	not impaired
Oshawa Second Marsh[1]	Ontario	impaired
Presqu'ile Marsh[1]	Ontario	impaired
Rondeau Marsh[1]	Erie	not impaired

[1] Areas of special interest, not within designated Areas of Concern