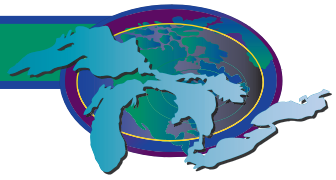

Coastal Wetland Amphibian Diversity and Abundance

Indicator #4504

Overall Assessment

Status:	**Mixed**
Trend:	**Deteriorating**
Rationale:	**Species across the Great Lakes basin exhibited both positive and negative population trend tendencies. Five species exhibited significantly negative species population trends while only one species exhibited a significantly positive species population trend.**

Lake-by-Lake Assessment

Lake Superior

Status: Not Assessed
Trend: Undetermined

Lake Michigan

Status: Poor
Trend: Unchanging
Rationale: Most species in this lake basin exhibited negative population trend tendencies. However, of the only two significant species population trends, one was positive and one was negative.

Lake Huron

Status: Mixed
Trend: Deteriorating
Rationale: Species in this lake basin exhibited both positive and negative population trend tendencies. However, four out of eight species exhibited significantly negative population trends. There were no significantly positive species population trends.

Lake Erie

Status: Mixed
Trend: Deteriorating
Rationale: Species in this lake basin exhibited both positive and negative population trend tendencies. Two focal species (bullfrog and northern leopard frog) exhibited significant population trend declines. Only one species exhibited a significantly positive population trend.

Lake Ontario

Status: Mixed
Trend: Unchanging
Rationale: Species in this lake basin exhibited both positive and negative population trend tendencies. Two species exhibited significantly increasing population trends, while only one species showed a significant declining species population trend.

Purpose

- To directly measure species composition and relative occurrence of frogs and toads
- To indirectly measure the condition of coastal wetland habitat as it relates to factors that influence the health of this ecologically important component of wetland biotic communities

Ecosystem Objective

The overall objective is to restore and maintain diverse and self-sustaining populations of Great Lakes coastal wetland amphibian communities. Breeding populations of amphibian species across their historical range should be sufficient to maintain populations of each species and overall species diversity. This indicator supports the Great Lakes Water Quality Agreement, specifically regarding maintenance of fish and wildlife populations, elimination of bird or animal deformities or reproductive problems, and preservation of fish and wildlife habitat (United States and Canada 1987).

State of the Ecosystem

Background

Numerous amphibian species occur in the Great Lakes basin and many of these are associated with wetlands during part of their life cycle. Because frogs and toads are relatively sedentary and have semi-permeable skin, they are likely to be more sensitive to, and indicative of, local sources of wetland contamination and degradation than are most other vertebrates. Assessing species composition and relative abundance of calling frogs and toads in Great Lakes wetlands can therefore help to infer wetland habitat quality.

Geographically extensive and long-term monitoring of calling amphibians is possible through the enthusiasm, skill and coordination of volunteer participants trained in the application of standardized monitoring protocols. Information about abundance, distribution and diversity of amphibians provides data for calculating trends in population indices as well as investigating habitat associations, which can contribute to effective long-term conservation strategies.

Status of Amphibians

Since 1995, Marsh Monitoring Program (MMP) volunteers have collected amphibian data at 548 discrete routes across the Great Lakes basin. An annual summary of amphibian routes monitored is provided in Table 1.

Year	Number of Routes
1995	115
1996	177
1997	208
1998	168
1999	163
2000	158
2001	166
2002	156
2003	156
2004	146
2005	177

Table 1. Number of routes surveyed for amphibians within the Great Lakes basin, from 1995 to 2005.
Source: Marsh Monitoring Program

Thirteen amphibian species were recorded during the 1995 to 2005 period (Table 2). Spring peeper was the most frequently detected species and was commonly recorded in full chorus (Call Level Code 3) when it was encountered. Green frog was detected in more than half of the survey stations and was most often recorded at Call Level Code 1 (calling individuals could be discretely counted). Grey treefrog, American toad and northern leopard frog were also common, being recorded in approximately one-third or more of all survey stations. Grey treefrog was recorded with the second highest average calling code (1.8), indicating that MMP observers usually heard several individuals calling simultaneously at each survey station. Chorus frog, bullfrog and wood frog were detected in approximately one-quarter of survey stations, while the remaining five species were detected in less than 3% of survey stations.

Species	Percent Station-Years Present [1]	Average Calling Code
Spring Peeper	69.3	2.5
Green Frog	54.3	1.3
Grey Treefrog	39.2	1.8
American Toad	36.9	1.5
Northern Leopard Frog	31.1	1.3
Chorus Frog	26.5	1.7
Bullfrog	25.8	1.3
Wood Frog	18.0	1.6
Fowler's Toad	2.4	1.4
Pickerel Frog	2.4	1.1
Cope's Grey Treefrog	1.6	1.4
Mink Frog	1.2	1.2
Blanchard's Cricket Frog	0.6	1.5

[1] MMP survey stations monitored for multiple years considered as individual samples

Table 2. Frequency of occurrence (Percent Station-Years Present) and average Call Level Code for amphibian species detected at MMP survey stations within the Great Lakes basin, from 1995 through 2005.

Average calling codes are based on the three level call code standard for all MMP amphibian surveys; Code 1 = little overlap among calls, numbers of individuals can be determined, Code 2 = some overlap, numbers can be estimated, Code 3 = much overlap of calls, too numerous to be estimated.

Source: Marsh Monitoring Program

Trends in amphibian occurrence were assessed for eight species commonly detected on MMP routes (Figure 1). For each species, the annual proportion of stations where that species was present within a route was calculated to derive annual indices of occurrence. The overall temporal trend in occurrence for each species was assessed by combining route-level trends in station occurrence. Statistically significant declining trends were detected for American toad, bullfrog, chorus frog, green frog and northern leopard frog. Only spring peeper exhibited a statistically significant increasing population trend.

These data will serve as baseline data with which to compare future survey results. Anecdotal and research evidence suggests that wide variations in occurrence of many amphibian species at a given site is a natural and ongoing phenomenon. Additional years of data will help distinguish whether the patterns observed (i.e., decline in American toad, bullfrog, chorus frog, green frog and northern leopard frog population indices) indicate significant long-term trends or simply natural variation in population sizes inhabiting marsh habitats. Bullfrog, for

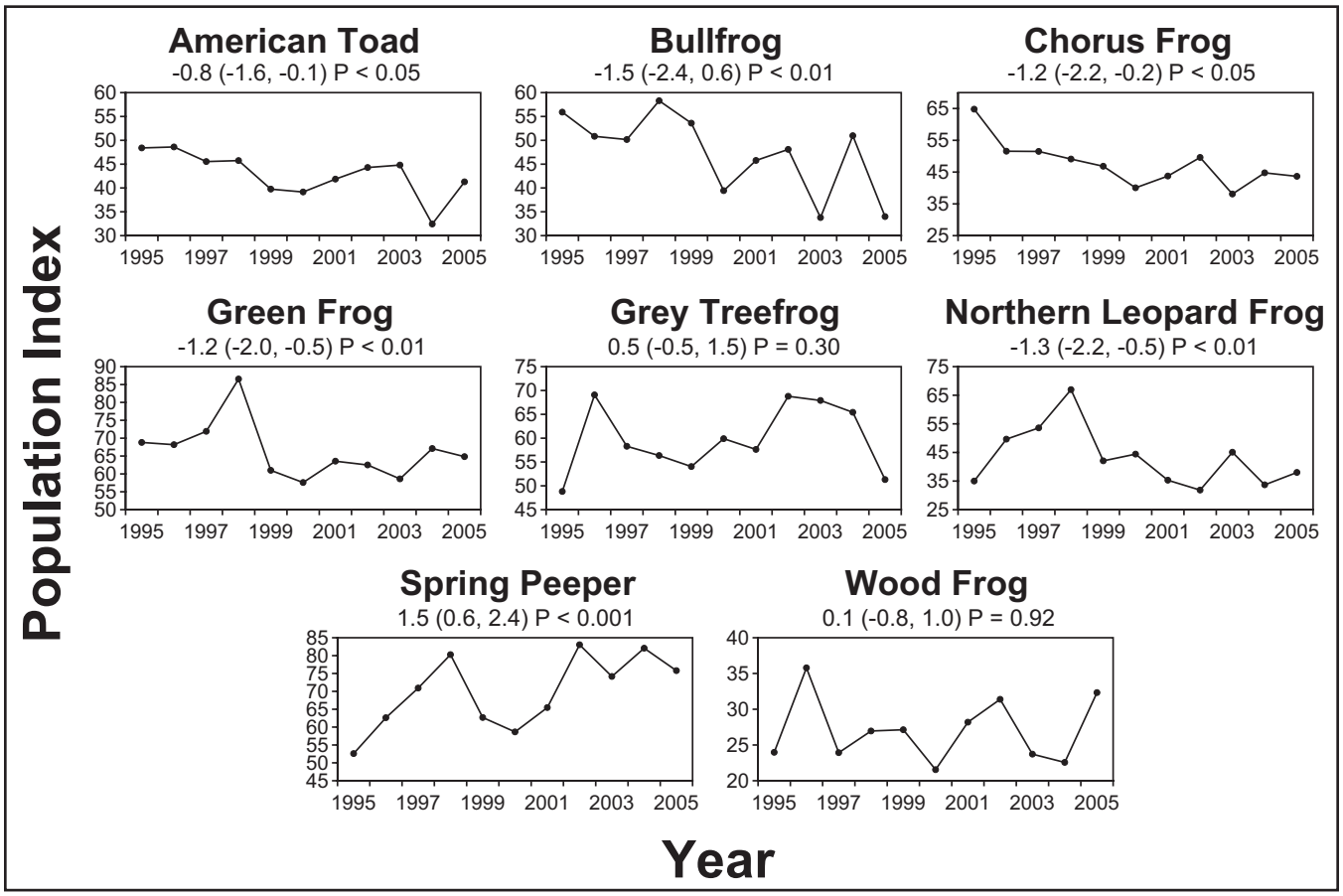

Figure 1. Trends (percent annual change) in station occurrence (population index) of eight amphibian species commonly detected at Marsh Monitoring Program routes, from 1995 to 2005.

Values in parentheses are upper and lower 95% confidence limits, respectively, for trend values given.

Source: Marsh Monitoring Program

example, did not experience a significant population index trend from 1995 to 2004 (Crewe *et al*. 2006; Archer *et al*. 2006) but with the addition of 2005 data, its population index declined significantly. Further data are thus required to conclude whether Great Lakes wetlands are successfully sustaining these amphibian populations. MMP amphibian data are being evaluated to determine how information from their community composition can be used to gain a better understanding of Great Lakes coastal wetland condition in response to various human induced stressors.

Pressures

Habitat loss and deterioration remain the predominant threat to Great Lakes amphibian populations. Many coastal and inland Great Lakes wetlands are located along watersheds that experience very intensive industrial, agricultural and residential development. Therefore, these wetlands are under continued stress as increased pollution from anthropogenic runoff is washed down watersheds into these sensitive habitats. Combined with other impacts such as water level stabilization, sedimentation, contaminant and nutrient inputs, climate change and invasion of exotic species, Great Lakes wetlands will likely continue to be degraded and as such, should continue to be monitored.

Management Implications

Because of the sensitivity of amphibians to their surrounding environment and the growing international concern about amphibian population status, amphibians in the Great Lakes basin and elsewhere will continue to be monitored. Wherever possible, efforts should be made to maintain high quality wetland habitat as well as associated upland areas adjacent to coastal wetlands. There is also a need to address other impacts that are detrimental to wetland health such as inputs of toxic chemicals, nutrients and sediments. Restoration programs are underway for many degraded wetland areas through the work of local citizens, organizations and governments. Although significant progress has been made in this area, more work remains for many wetland areas that have

yet to receive restoration efforts.

Comments from the author(s)
Effective monitoring of Great Lakes amphibians requires accumulation of many years of data, using a standardized protocol, over a large geographic expanse. A reporting frequency for SOLEC of five years would be appropriate because amphibian populations naturally fluctuate through time, and a five-year timeframe would be sufficient to indicate noteworthy changes in population indices. More rigorous studies will relate trends in species occurrence or relative abundance to environmental factors. Reporting will be improved with establishment of a network of survey routes that accurately represent the full spectrum of marsh habitat in the Great Lakes basin.

Most MMP amphibian survey routes have been georeferenced to the survey station level. Volunteer recruitment has also improved significantly since the last status reporting period. Four additional important tasks are in progress: 1) develop the SOLEC wetland amphibian indicator as an index for evaluating coastal wetland health; 2) improve the program's capacity to monitor and report on status of wetland-specific Beneficial Use Impairments among Great Lakes Areas of Concern; 3) develop and improve the program's capacity to train volunteer participants to identify and survey amphibians following standard MMP protocols, and; 4) develop the capacity to incorporate a regional MMP coordinator network component into the MMP to improve regional and local delivery of the program throughout the Great Lakes basin. Also, further work is required to determine the relationship between calling codes used to record amphibian occurrence and survey count estimates.

Acknowledgments
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