GREAT LAKES MARSH MONITORING PROGRAM

25 years of conserving birds and frogs

Least Bittern Photo: Tim Arthur

BIRDS CANADA
OISEAUX CANADA

WHAT'S INSIDE

Gray Treefrog Photo: Peter Ferguson

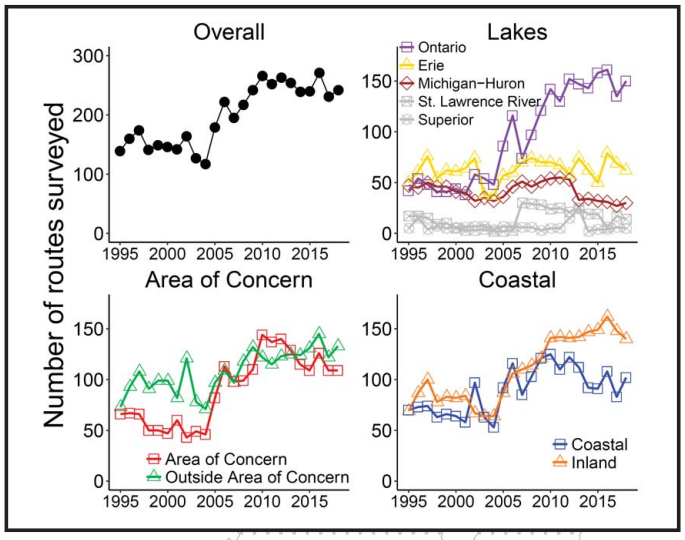
The Great Lakes Marsh Monitoring Program (GLMMP) was launched bi-nationally in 1995 by Birds Canada (then Long Point Bird Observatory) in partnership with Environment and Climate Change Canada and the United States Environmental Protection Agency. In 25 years, more than 1800 Citizen Scientists have volunteered 150,000 hours worth 3 million in-kind dollars to collect information on birds, frogs, and their habitats at 6500 unique survey locations (stations). This impressive effort allows us to achieve many important outcomes, including:

1. Assess populations of marsh birds and frogs at scales ranging from individual marshes to the entire Great Lakes basin;
2. Investigate associations between marsh birds and frogs and their habitat;
3. Contribute to conservation management and planning; and
4. Increase public awareness of the importance of wetland conservation.

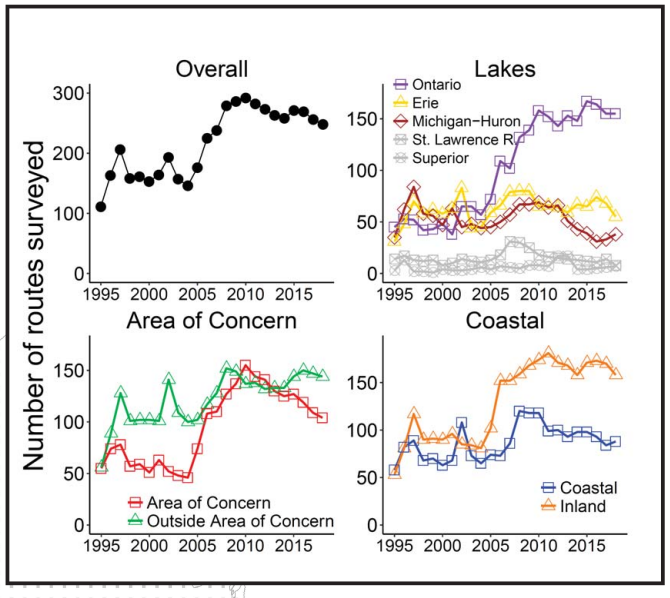
In this report, explore long-term trends and patterns for 18 bird species (p. 4-7) and 8 frog species (p. 8-11), plus evidence that GLMMP Citizen Scientists produce reliable results (p. 12-13). See how GLMMP data are used to conserve marshes and positively impact birds and frogs through management (p. 14-17) and planning (p. 18-19). Read concluding remarks (p. 20-21) and learn what you can do to help (p. 22).

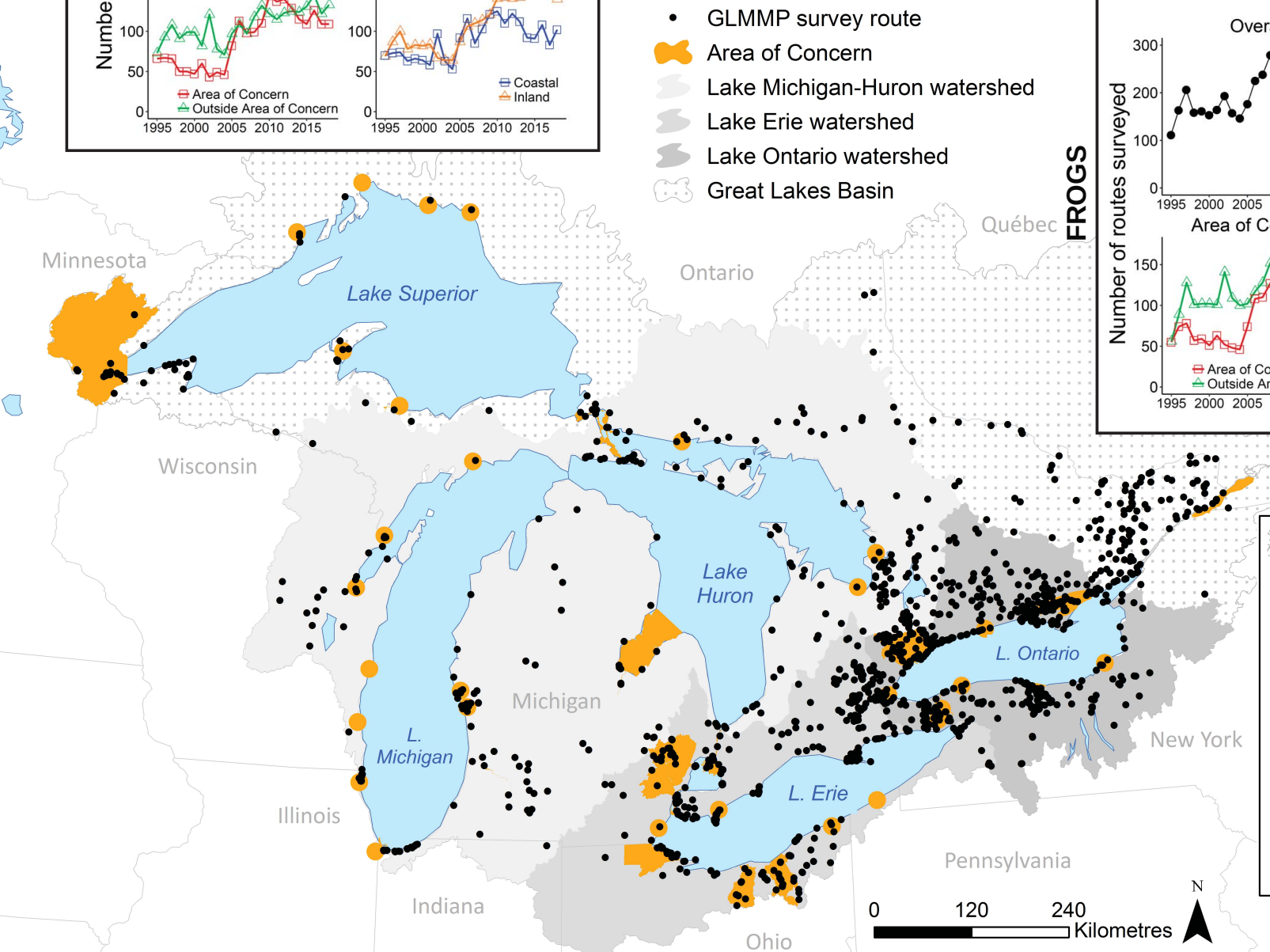
Marsh bird and frog trends and patterns in this report are based on data from survey routes in the southern portion of the Great Lakes basin—within the watersheds of Lake Michigan-Huron, Lake Erie, and Lake Ontario—shown on the map in solid grey. The number of routes surveyed was insufficient to calculate trends and patterns in the Lake Superior and St. Lawrence River watersheds, shown in grey stippling.

BIRDS



FROGS





BIRD TRENDS

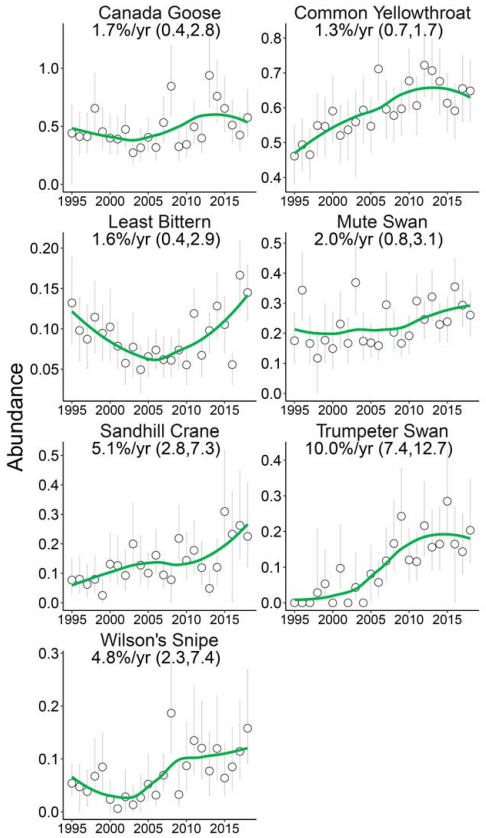
Virginia Rail Photo: Tim Arthur

Overview

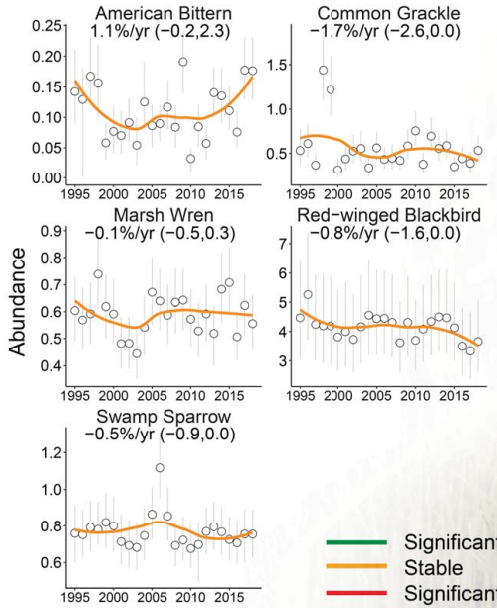
Abundance* of 39% of 18 marsh bird species increased during the past 25 years, whereas 33% decreased in abundance, and 28% remained stable. Notably, there were declines in 71% of elusive species that depend on marshes the most —American Coot, Common Gallinule, Pied-billed Grebe, Sora, and Virginia Rail. By contrast, American Bittern remained stable and Least Bittern increased.

* Mean number of individuals observed per survey station.

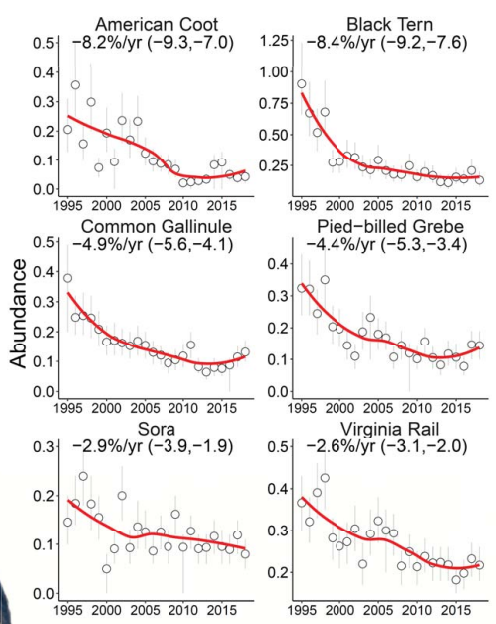
"Working with the GLMMP allows me to contribute to something that is hugely important to me: the health of the Great Lakes. The monitoring process is exciting and identifying indicator species in my stations is a rewarding experience that I look forward to year after year."
—Giovanna Reising, Amherst, Ohio



It's encouraging to see Canada Goose, Sandhill Crane, and Trumpeter Swan increasing. These species declined to near-extinction in the early 1900s due to overhunting and other factors, but are now recovering. Mute Swan is non-native (from Europe) and continues to spread. Least Bittern is at-risk and declined throughout the 1990s and early 2000s, but is now increasing dramatically—a much-needed boost for the struggling population. It's unclear what is driving increases in Common Yellowthroat and Wilson's Snipe.



While the 5 species shown to the left varied from year to year, they showed no overall change through time.



Seeing declines in the 6 species shown to the left is concerning. These species' diets and habitat requirements vary extensively. For example, some eat mostly plants (American Coot, Common Gallinule); the rest consume a mix of seeds, aquatic insects, fish, frogs, and other items. Some require very large marshes with extensive open water for nesting (e.g., Black Tern); others use dense stands of vegetation in marshes of almost any size (e.g., Virginia Rail). Recovering populations of these species will require restoring and protecting a range of different types and sizes of marshes throughout the southern Great Lakes region.

Significantly increasing
Stable
Significantly decreasing

Sandhill Crane Photo: Tim Arthur

Technical details.—Trends are given as annual change in mean number of individuals per station (%/yr), followed in parentheses by 95% confidence limits (lower, upper). Vertical lines represent 95% confidence intervals. Note the difference in scale of the vertical axis among species. Trends and annual abundance were modelled at the survey route level (by including the number of stations as an offset) according to a Poisson distribution with route as a random intercept; lines of best fit are LOESS smoothers.

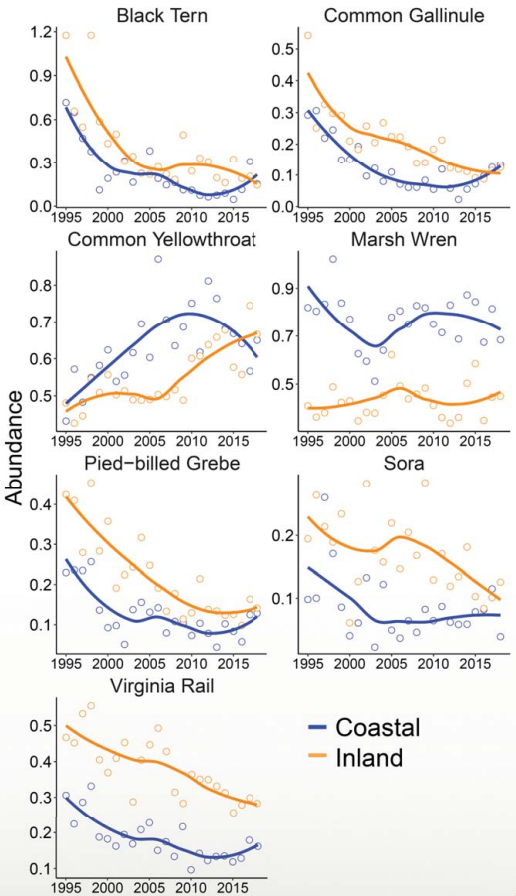
BIRD PATTERNS

Overview

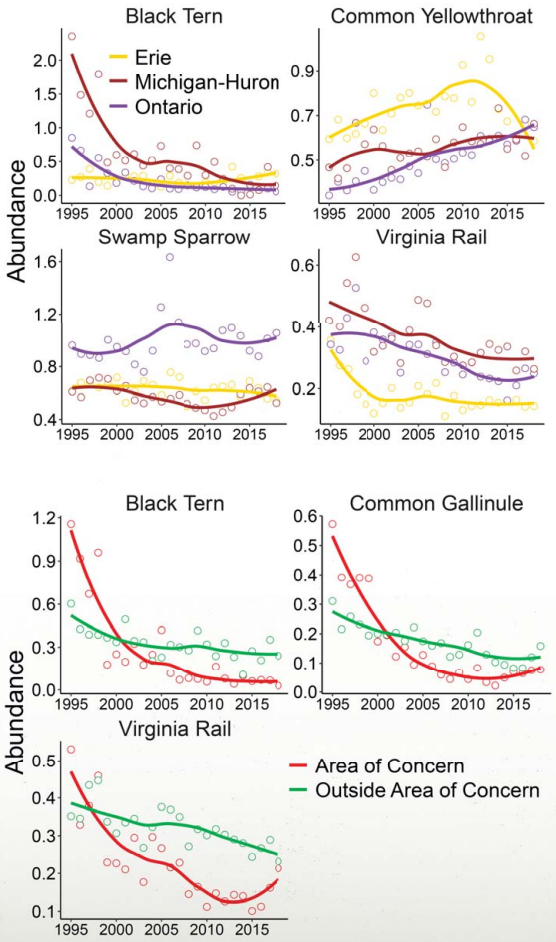
Abundance of the marsh bird species discussed in this section depended, in most years, on these factors: 1) whether they were in Great Lakes coastal marshes or inland marshes, 2) which lake basin they were in (e.g., Lake Erie, Lake Ontario), and 3) whether they were located in marshes inside or outside Areas of Concern (areas with especially degraded environmental conditions compared to outside these areas).

"Everyone needs to experience the sights and sounds of a marsh. The marsh seems to awaken as the sun sets with rustling of waterfowl settling in for the night and the chorus of frogs cranking up the volume. These wetlands are treasures of biodiversity."
—Ray Stewart, Amherst, Ohio

Photo: Birds Canada



Most of the 7 species shown to the left were more abundant at inland marshes compared to Great Lakes coastal marshes, although the opposite occurred for Common Yellowthroat and Marsh Wren. Great Lakes coastal marshes are important for conserving marsh birds, but inland marshes are critical strongholds for declining species.



Black Tern was most abundant in Lake Michigan-Huron; Common Yellowthroat was most abundant in Lake Erie; Swamp Sparrow was most abundant in Lake Ontario; and Virginia Rail was least abundant in Lake Erie. Reasons for these patterns are unclear, although widespread dense cattails in Lake Ontario may boost Swamp Sparrows, and extensive non-native invasive *Phragmites* in Lake Erie may reduce Virginia Rails.

Initially the 3 species shown to the left were found in higher abundance at marshes within Areas of Concern compared to outside. Recently, their abundance decreased within Areas of Concern, suggesting a troubling decline of wetland health in these important areas.

Technical details.—Note the difference in scale of the vertical axis among species. Annual abundance was modelled at the survey route level (by including the number of stations as an offset) according to a Poisson distribution and with route as a random intercept; lines of best fit are LOESS smoothers.

Black Tern Photo: Gregg Thompson

FROG TRENDS

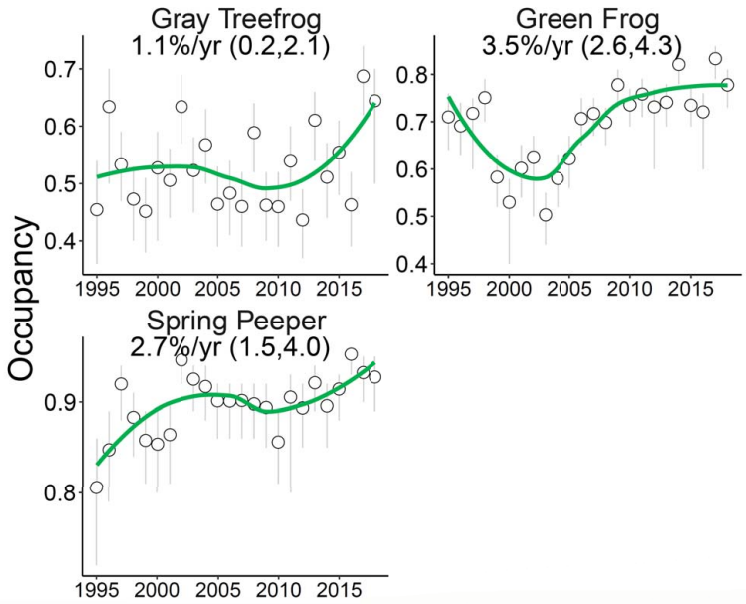
"The GLMMP provides an opportunity to get outside and enjoy nature, wildlife, and biodiversity in all its glory, and to contribute to long-term assessments of Great Lakes wetlands in particular, along with hundreds of like-minded people."—Tony Zammit, Cambridge, Ontario

Overview

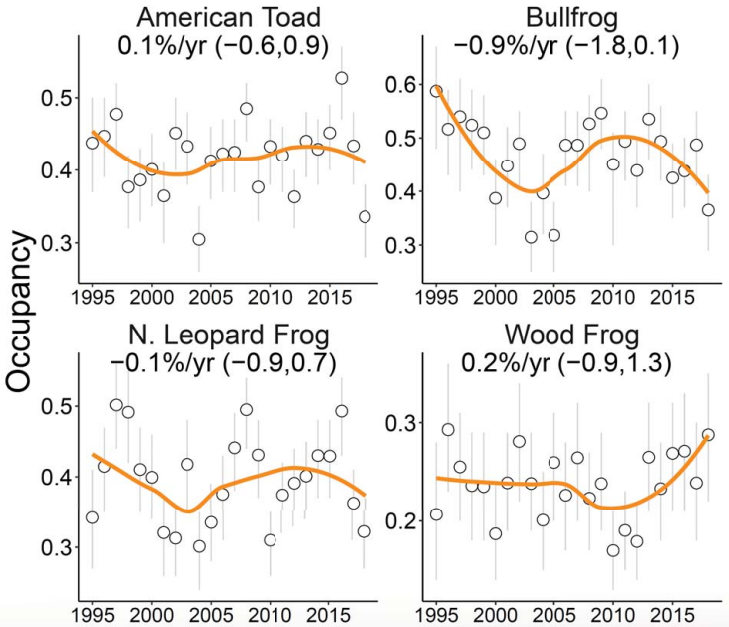
Occupancy* of half of 8 marsh-breeding frog species remained stable during the past 25 years, whereas 3 species increased in occupancy, and 1 species decreased.

* Probability of a survey station being occupied.

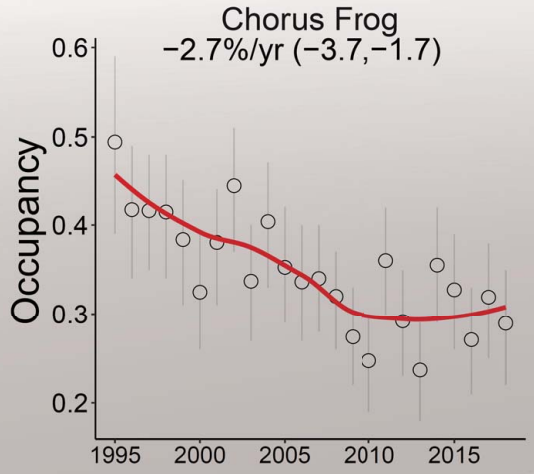
Bullfrog Photo: Scott Gillingwater



Increases in the 3 species shown to the left are encouraging, given that many frogs are declining around the world due to a number of threats such as disease, pollution, and habitat loss. Occupancy of Spring Peeper is known to be negatively influenced by human disturbance, such as urban sprawl, so seeing the recent high occupancy levels for this species is a positive sign.



While the 4 species shown above varied from year to year, they showed no overall change through time.



The Chorus Frog is at-risk in parts of southern Ontario and southwestern Québec where it is declining in all wetland types. This decline is likely due to degradation and destruction of its habitat by urban development and intensive industrial agriculture.

Significantly increasing
Stable
Significantly decreasing

Green Frog Photo: Scott Gillingwater

Technical details.—Trends are given as annual change in probability of a station being occupied (%/yr), followed in parentheses by 95% confidence limits (lower, upper). Vertical lines represent 95% confidence intervals. Note the difference in scale of the vertical axis among species. Trends and annual occupancy were modelled at the survey route level (by including the number of stations as an offset) according to a binomial distribution with route as a random intercept; lines of best fit are LOESS smoothers.

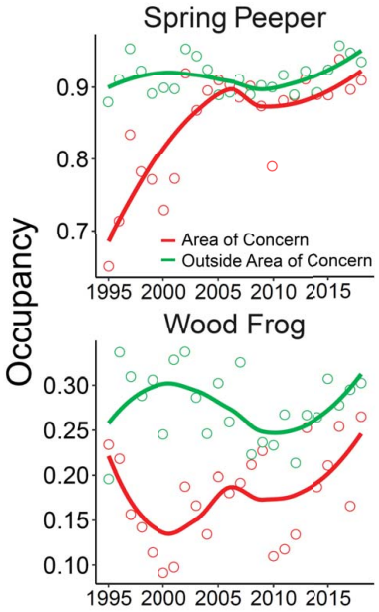
FROG PATTERNS

Photo: Birds Canada

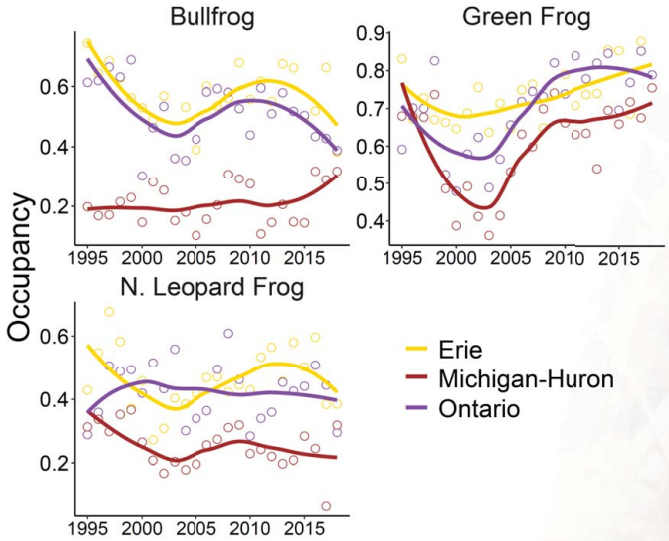
Overview

Occupancy of the frog species discussed in this section depended, in most years, on these factors: 1) whether they were located in marshes inside or outside Areas of Concern, 2) which lake basin they were in (e.g., Lake Erie, Lake Ontario), and 3) whether they were in Great Lakes coastal marshes or inland marshes.

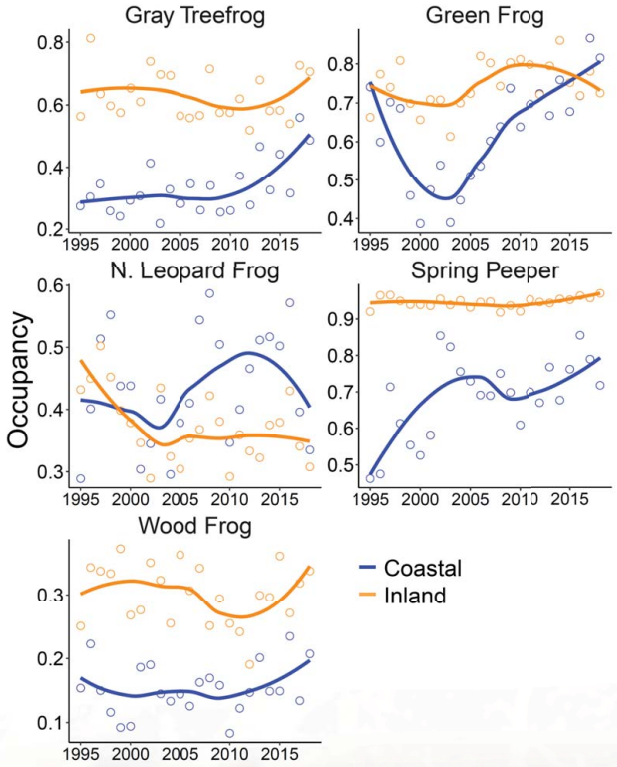
"Wetlands within the Great Lakes basin provide so many natural, cultural, and spiritual benefits. The work that Birds Canada does through the GLMMP is critical to their preservation. Not only does the program collect important data about the quality of wetlands, but it gets people outside, exploring and navigating these important areas and provides a platform for a meaningful connection to the landscape and those that inhabit it."
—Gina Pannunzio, Windsor, Ontario



Initially Spring Peeper and Wood Frog were found at much lower occupancy at marshes within Areas of Concern compared to outside. Recently, their occupancy increased within Areas of Concern, suggesting an increasing trend in wetland health in these important areas. These patterns are opposite to that described for three marsh bird species on p. 5. Birds and frogs respond to different wetland health factors—for example, the permeable skin of frogs easily takes in contaminants from the water, whereas this does not happen in birds. Therefore, the opposite patterns may reflect the health of different marsh characteristics.



The 3 species shown above were found at lower occupancy in Lake Michigan-Huron for reasons that are unclear.



Most of the 5 species shown to the left were found at higher occupancy at inland marshes compared to Great Lakes coastal marshes, although the opposite occurred for Northern Leopard Frog. Gray Treefrog, Spring Peeper, and Wood Frog hibernate in winter in protected locations on land, such as within leaf litter in nearby forests. There, physiological mechanisms prevent them from freezing solid until they thaw out and hop away the following spring. These species may have higher occupancy at inland marshes due to greater availability of nearby terrestrial locations for overwintering.

Wood Frog Photo: Jim Richards

Technical details.—Note the difference in scale of the vertical axis among species. Annual occupancy was modeled at the survey route level (by including the number of stations as an offset) according to a binomial distribution with route as a random intercept; lines of best fit are LOESS smoothers.

CITIZEN SCIENTISTS PRODUCE RELIABLE RESULTS

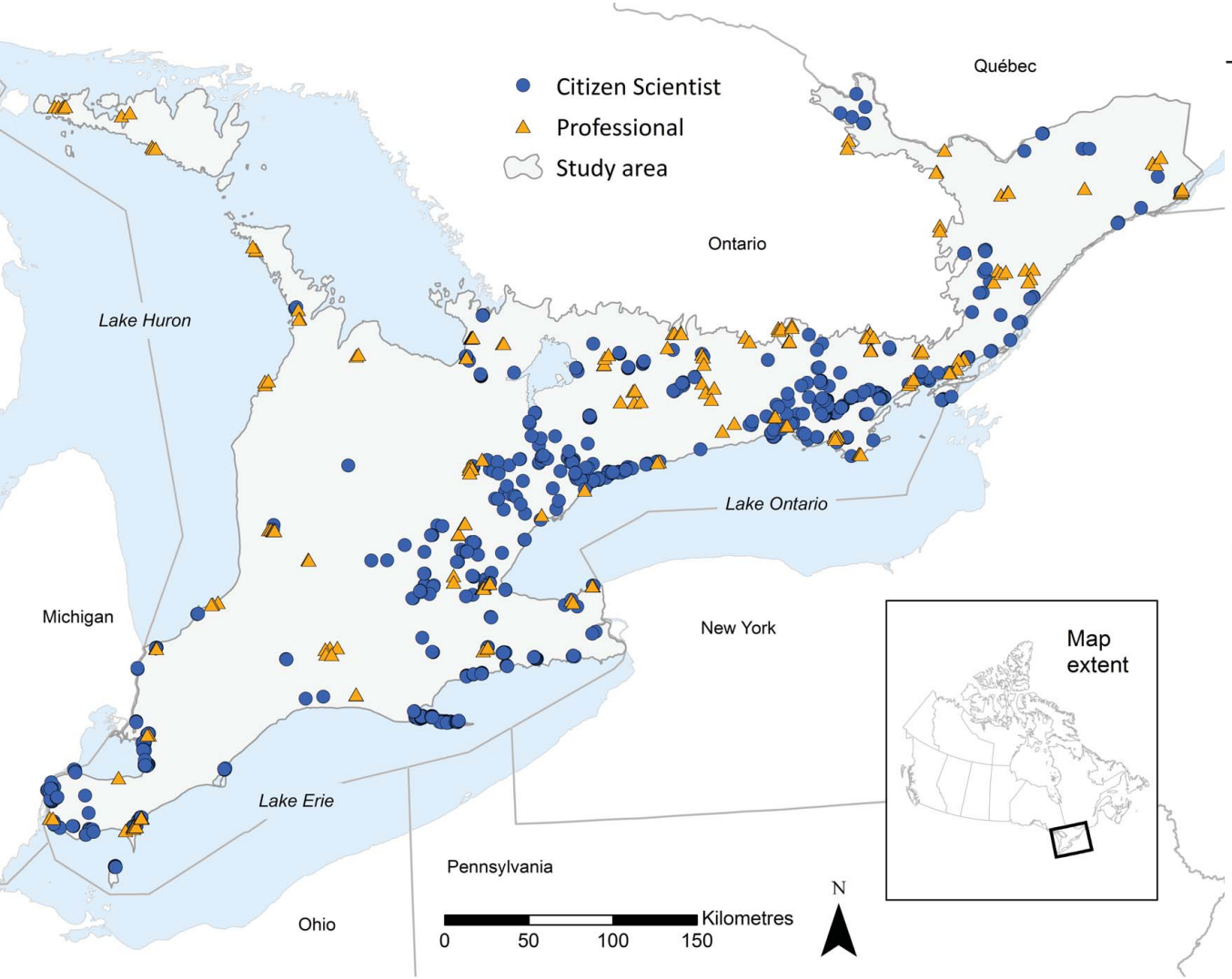
We are often asked: How good are GLMMP volunteer Citizen Scientists at detecting and identifying marsh-breeding birds? And are volunteer-chosen survey stations representative of marsh bird populations at all of the stations that could possibly be chosen? To answer these questions, we compared results in two groups of data, each collected over three years: one group of data was collected by GLMMP Citizen Scientists at stations they chose throughout southern Ontario (blue circles), and the other was collected by professionals at pre-assigned, randomly-chosen stations (orange triangles).

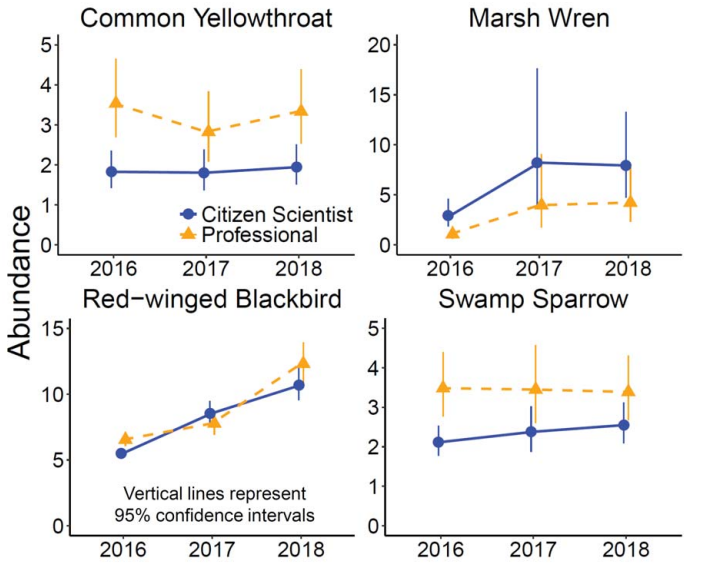
Citizen Scientists observed similar abundance or occupancy compared to professionals in most years for all but 1 of 10 marsh bird species, as shown by overlapping 95% confidence intervals (vertical lines).The difference for Virginia Rail is probably due to Citizen Scientists surveying relatively more Great Lakes coastal stations compared to a random sample, given the species is less abundant in coastal marshes compared to inland marshes (p. 7). This is a discrepancy we can work to account for.

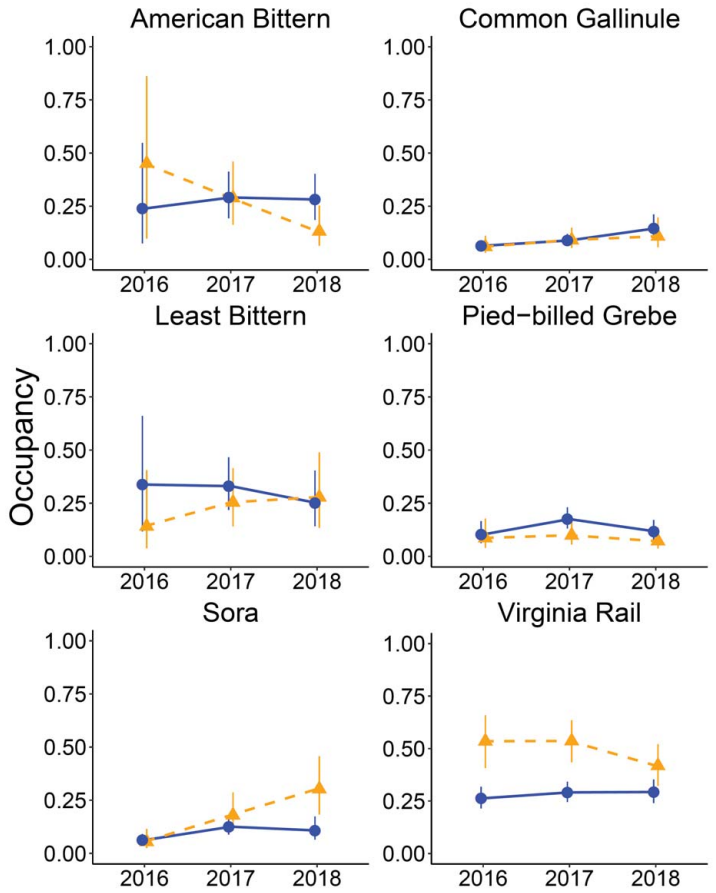
Photo: Emma Buck

"My PhD research uses GLMMP data. It guides conservation of wetland birds in the Great Lakes by understanding what makes wetlands attractive to these rare and often secretive species. Collecting data for my study has made me much more aware of the beauty of Great Lakes coastal wetlands—places I'd never had the chance to explore before."
—Lisa Elliott, Duluth, Minnesota

These results show that volunteer Citizen Scientists yield results comparable to professionals for all but 1 of 10 marsh bird species. This is important because it validates the GLMMP Citizen Science approach. The effectiveness of this approach allows us to produce more and better science to conserve marsh bird populations.







WETLAND CONSERVATION BENEFITS BIRDS AND FROGS

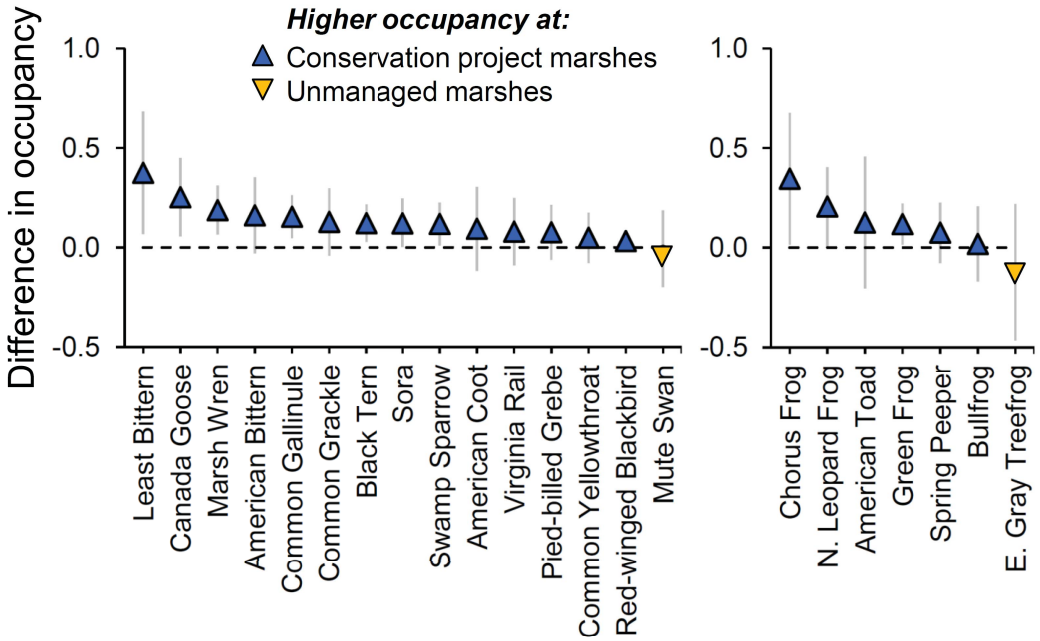
American Bittern Photo: Jeremy Bensette

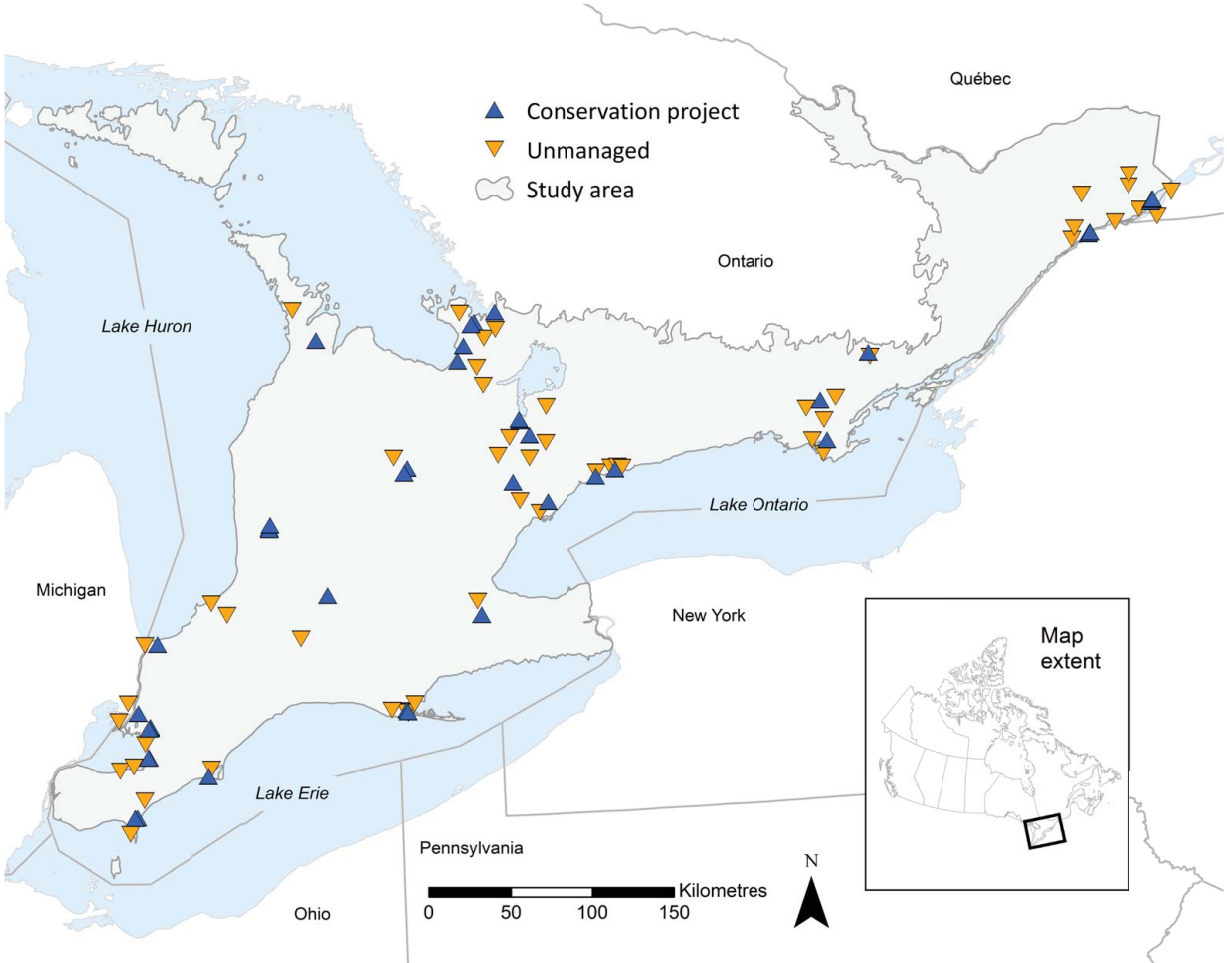
Wetland conservation projects completed by Migratory Bird Joint Ventures under the North American Waterfowl Management Plan (NAWMP) are designed to benefit ducks, geese, and swans. Projects accomplished by these cooperative joint venture partnerships among governments, organizations, and landowners include conservation actions such as controlling water levels to mimic natural water level fluctuations, and planting trees in surrounding uplands to buffer pollution and runoff. Research has shown that marsh wildlife other than waterfowl, like marsh-breeding bitterns, rails, and frogs, also benefit from these conservation actions. However, that research was conducted within limited geographic areas and within a small number of wetlands. To better identify the positive impact of NAWMP conservation projects on other wetland species, we used GLMMP data from hundreds of survey stations throughout dozens of wetlands across southern Ontario to compare occupancy of marsh-breeding birds and frogs in NAWMP conservation project marshes (blue triangles) to occupancy in nearby unmanaged marshes (orange triangles).

"With so little natural space remaining to sustain native species, monitoring sensitive bird and frog populations through the GLMMP can be a big step towards preserving a healthy ecosystem. Birds Canada provides the tools, training, and opportunity for nature lovers to learn about, explore, and help protect critical wetland habitat for the animals that rely on them for their very survival."
—Jennifer Nantais, Windsor, Ontario

Nearly all of 22 species of marsh-breeding birds and frogs occurred more frequently in NAWMP conservation project marshes compared to unmanaged marshes, as shown by differences in occupancy above zero (dashed line). Some declining, at-risk species, such as Least Bittern and Chorus Frog, were much more common in NAWMP conservation project marshes. Illustrating that NAWMP conservation project marshes benefit these species, especially species of conservation concern, is important because it justifies more resources to conserve marsh bird and frog populations.

For more information, see the following scientific journal article:
Tozer, D. C., O. Steele, and M. Gloutney. 2018. Multispecies benefits of wetland conservation for marsh birds, frogs, and species at risk. Journal of Environmental Management 212:160–168 (https://doi.org/10.1016/j.jenvman.2018.01.055).





Wetland conservation includes managing and protecting existing marshes, as well as restoring former marshes that have been lost. Restoring wetlands is a very effective way to increase marsh bird and frog populations.

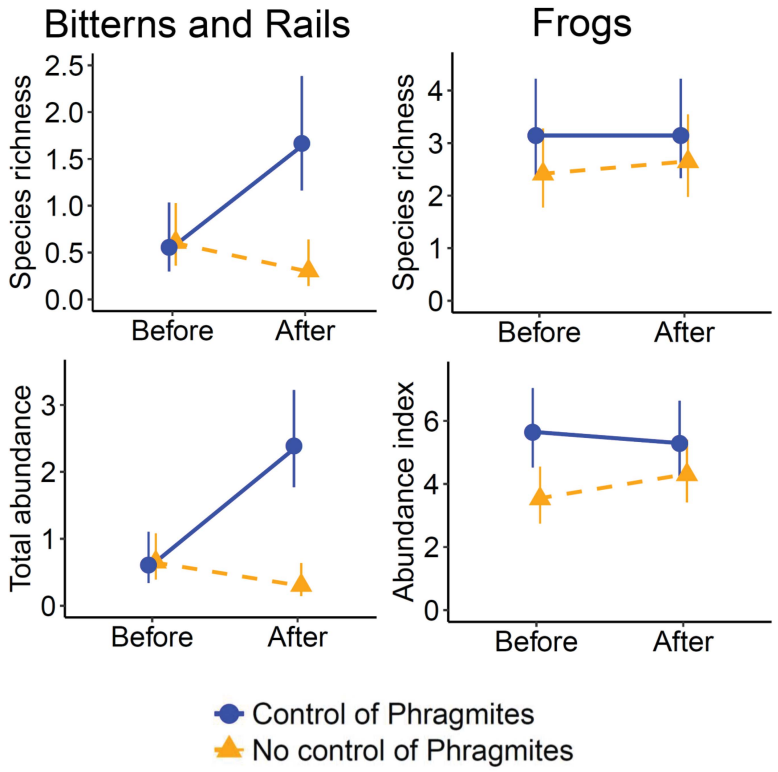
CONTROL OF INVASIVE PHRAGMITES IS WORTH THE INVESTMENT

Photo: Janice Gilbert

"I do the GLMMP because I love field work and spend far too much time indoors as part of my job, and most importantly, because our data are important in detecting long term trends in populations of birds and frogs. Plus we love birds and frogs."
—Richard Stevens and Tim Tatakis, Rochester, New York

Invasive *Phragmites* decreases the abundance and biodiversity of a number of native wetland plants and animals. As a result, conservation agencies including Migratory Bird Joint Ventures are controlling the plant to restore and maintain populations of diverse species. An important unanswered question is, "How much does native wildlife increase after control of invasive *Phragmites*?" To clarify the issue, we used GLMMP data from three wetland complexes in southern Ontario to document occurrence of marsh-breeding birds and frogs before and after control of invasive *Phragmites* at stations where *Phragmites* was controlled and stations where it was not controlled. Surveying stations where *Phragmites* was not controlled allowed us to document simultaneous changes in birds and frogs that had nothing to do with the control of invasive *Phragmites,* such as concurrent changes in water levels or other factors.

Species richness of marsh-breeding bitterns and rails of conservation concern increased by one species and total abundance increased by two individuals in response to control of invasive *Phragmites,* as shown by the steep rise in the blue lines compared to the relatively flat orange lines (p. 17). By contrast, we found no influence of control of invasive *Phragmites* on occurrence or a crude abundance index of frogs; although more-detailed information on abundance of frogs would be useful before a firm conclusion is made. Documenting that control of invasive *Phragmites* increases marsh-breeding bitterns and rails of conservation concern is important because it justifies more resources to control invasive *Phragmites* that will in turn conserve marsh bird populations.



For more information, see the following scientific journal articles:

Tozer, D., and G. Beck. 2018. How do recent changes in Lake Erie affect birds? Part one: invasive *Phragmites*. Ontario Birds 36:161-169 (www.birdscanada.org/download/LakeEriePart1Phragmites.pdf).

Tozer, D. C., and S. A. Mackenzie. 2019. Control of invasive *Phragmites* increases marsh birds but not frogs. Canadian Wildlife Biology and Management 8:66–82 (www.cwbm.name/control-of-invasive-phragmites-increases-marsh-birds-but-not-frogs).

The non-native invasive form of the Common Reed, often referred to simply as *Phragmites*, was introduced to North America from Asia during the 1800s. It is now locally abundant throughout much of the Great Lakes.

Photo: Steve Timmermans

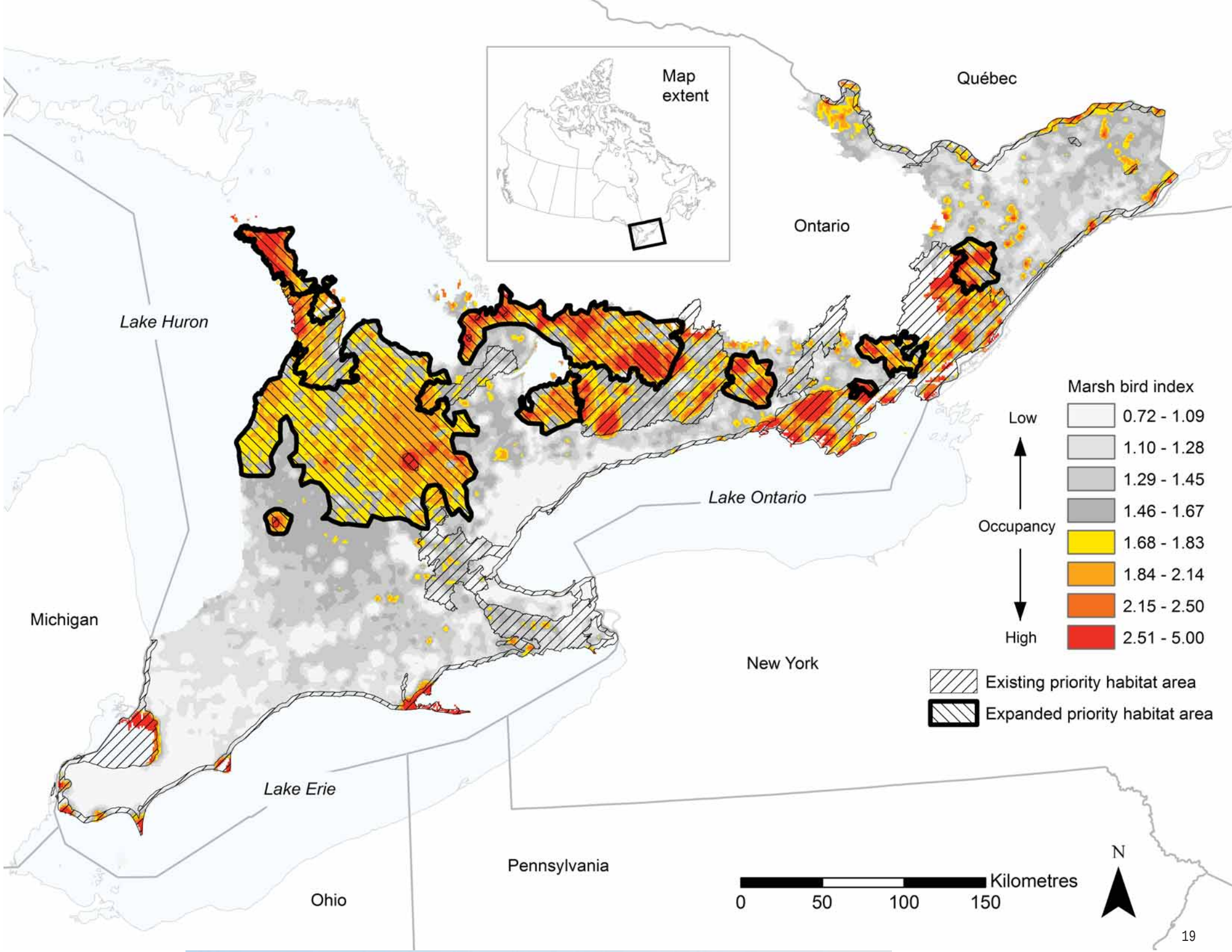
PRIORITY AREAS FOR MARSH BIRDS

The Ontario Eastern Habitat Joint Venture (OEHJV) conserves wetlands for wildlife and people. To date, much of the OEHJV's work has targeted wetlands in priority habitat areas known to benefit waterfowl (ducks, geese, swans). Recently, the OEHJV—along with all other Migratory Bird Joint Ventures—expanded its mandate to include all bird species. As we have seen, conservation work by the OEHJV benefits a large number of species other than waterfowl (p. 14-15). However, it is not known whether existing priority areas based on waterfowl include all of the areas important for marsh-breeding birds. To answer this question, we used GLMMP data to identify marsh-breeding bird priority habitat areas throughout southern Ontario.

Areas with the highest combined predicted occupancy for American Bittern, Common Gallinule, Least Bittern, Marsh Wren, and Pied-billed Grebe were located along the northern edge of the region. About two-thirds of these high-occupancy areas were outside existing priority areas for waterfowl. We recommend that the OEHJV expand wetland conservation work from existing priority areas based on waterfowl to also include these new additional priority areas based on marsh-breeding birds. This is important because it will ensure that future wetland conservation work will target the best wetlands for both waterfowl and marsh-breeding birds.

Common Gallinule Photo: Jim Richards

For more information, see the following scientific journal article: Tozer, D. C., R. L. M. Stewart, O. Steele, and M. Gloutney. 2020. Species-habitat relationships and priority areas for marsh-breeding birds in Ontario. Journal of Wildlife Management (https://doi.org/10.1002/jwmg.21840).


Map extent
Québec
Ontario
Lake Huron
Lake Ontario
Lake Erie
Michigan
New York
Pennsylvania
Ohio
Marsh bird index
Low
Occupancy
High
0.72 - 1.09
1.10 - 1.28
1.29 - 1.45
1.46 - 1.67
1.68 - 1.83
1.84 - 2.14
2.15 - 2.50
2.51 - 5.00
Existing priority habitat area
Expanded priority habitat area
N
Kilometres
0
50
100
150

CONCLUSION

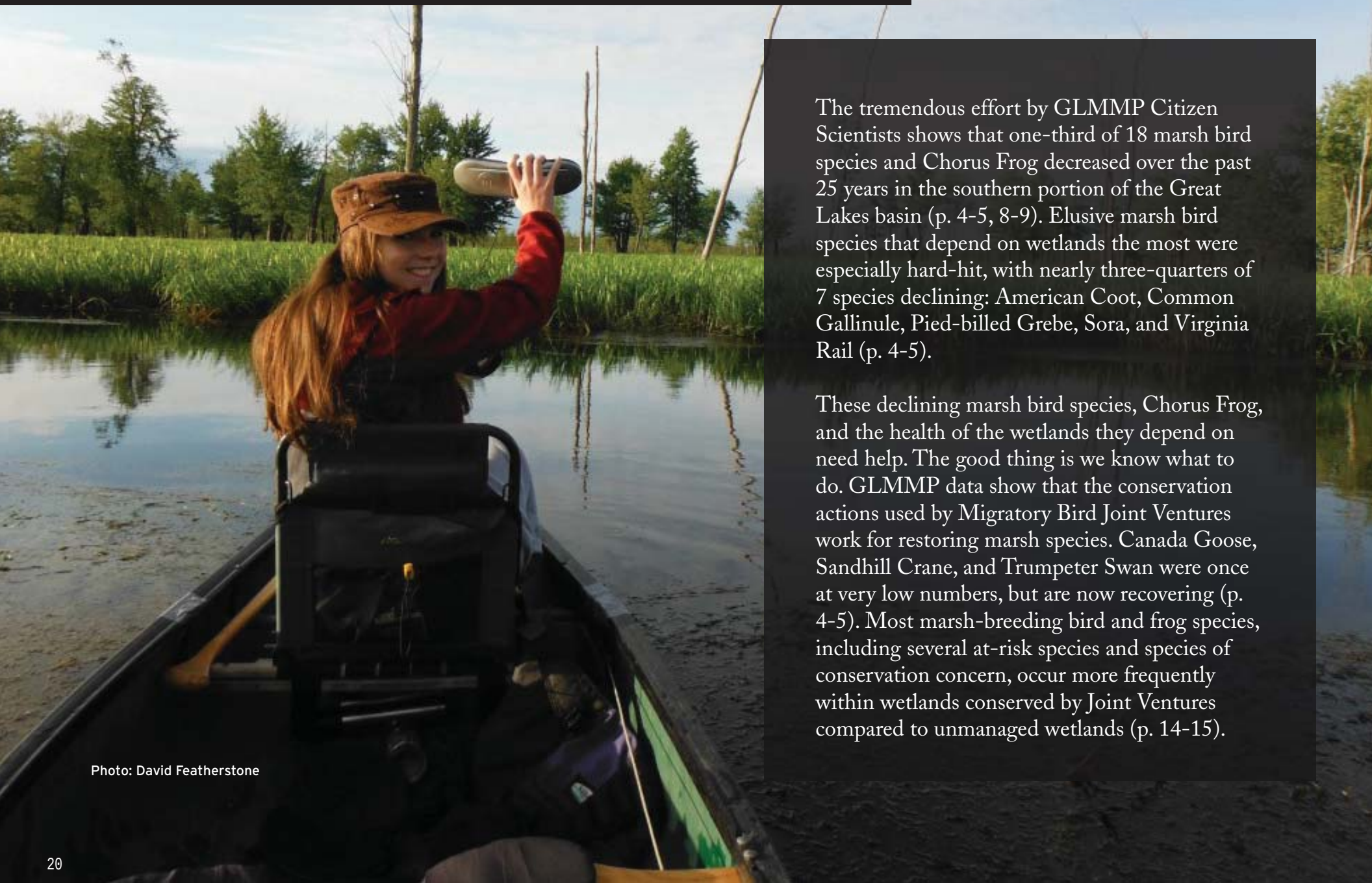


Photo: David Featherstone

The tremendous effort by GLMMP Citizen Scientists shows that one-third of 18 marsh bird species and Chorus Frog decreased over the past 25 years in the southern portion of the Great Lakes basin (p. 4-5, 8-9). Elusive marsh bird species that depend on wetlands the most were especially hard-hit, with nearly three-quarters of 7 species declining: American Coot, Common Gallinule, Pied-billed Grebe, Sora, and Virginia Rail (p. 4-5).

These declining marsh bird species, Chorus Frog, and the health of the wetlands they depend on need help. The good thing is we know what to do. GLMMP data show that the conservation actions used by Migratory Bird Joint Ventures work for restoring marsh species. Canada Goose, Sandhill Crane, and Trumpeter Swan were once at very low numbers, but are now recovering (p. 4-5). Most marsh-breeding bird and frog species, including several at-risk species and species of conservation concern, occur more frequently within wetlands conserved by Joint Ventures compared to unmanaged wetlands (p. 14-15).

As well, targeted conservation efforts by Joint Ventures—such as control of invasive *Phragmites*—further increase populations of marsh bird species (p. 16-17).

We also know where to help. GLMMP data are identifying where the best areas are in southern Ontario for the OEHJV to expand its wetland conservation work to benefit declining marsh bird species (p. 18-19). GLMMP data are also guiding wetland conservation work by Joint Ventures in the U.S.

The information provided in this report is critical for wetland conservation, and would not be possible without the GLMMP and its many dedicated Citizen Scientists. We sincerely thank all of the GLMMP's participants and supporters for helping Birds Canada and our partners conserve marsh bird and frog populations. Please see p. 22 for suggestions on how you can help.

Photo: David Featherstone

"I have always loved giving back to help our environment when I could and I am pleased the GLMMP work we do through the Muskegon Lake Watershed Partnership not only helps with our restoration efforts, but also helps with the overall Great Lakes marsh bird and frog population trends that are so important to keep track of at this time. Doing my GLMMP work is always a time I look forward to each year… get to be in nature and help the environment."
—Catherine Swiatek, Muskegon, Michigan

HOW CAN YOU HELP

Marsh birds and frogs need help in the Great Lakes, and one of the best ways to do that is to protect, restore, and manage wetlands for their benefit. Here we suggest some meaningful ways you can help achieve this.

- **Support Birds Canada (www.birdscanada.org)**
  By giving to Birds Canada you are supporting conservation action through critical research and Citizen Science. You are also nurturing current and future generations in the wonders of birds and nature.

- **Take part in the Great Lakes Marsh Monitoring Program (www.birdscanada.org/birdmon/mmp)**
  By investing time in monitoring marsh birds and frogs you are collecting critical information for conservation of marsh birds and frogs. Many thanks if you already do this!

- **Purchase a Wildlife Habitat Conservation Stamp (www.whc.org/the-stamp, www.fws.gov/birds/get-involved/duck-stamp.php)**
  By purchasing "The Stamp" in Canada or the U.S. you are supporting work to improve and enhance the state of migratory birds and their habitats.

- **Participate in Joint Venture partner programs (www.ehjv.ca/where-we-work/Ontario, www.mbjv.org)**
  By taking part in OEHJV and other Joint Venture programs as a landowner or volunteer you are supporting one of the strongest drivers of wetland conservation in the Great Lakes.

- **Advocate for wetlands (www.wetlandnetwork.ca, www.epa.gov/wetlands)**
  By standing up for wetlands you are benefitting people and biodiversity—especially marsh birds and frogs.

Photo: Birds Canada

"The GLMMP is a great Citizen Science opportunity for the Bay of Quinte Area of Concern Remedial Action Plan. It provides a platform for local volunteers to be involved with the rehabilitation of the bay, by monitoring our local wetlands. Engaging the local community has always been a vital component of the plan."
—Sarah Midlane-Jones, Belleville, Ontario

"I am involved with the GLMMP because Citizen Science is very important for monitoring bird populations. I'm always out birding anyways, so it's great that the birds I see can be turned into valuable data."
—Carter Dorscht, Echo Bay, Ontario

Photo: Birds Canada

"The GLMMP expanded my knowledge of ecosystems and the impact of environmental changes in the area. By monitoring in the evening and night it opened a new world of sights, sounds, and smells that I didn't appreciate during the day. It also gives me an opportunity to interact with the public, share my monitoring experiences, and educate about wetlands and their inhabitants. Most of all, though, the GLMMP is something I enjoy."
—Don Wilson, Waukegan, Illinois

Photo: Steve Timmermans

The Great Lakes Marsh Monitoring Program (GLMMP) is a program of Birds Canada, the country's leading science-based bird conservation organization. Our mission is to conserve wild birds of Canada through sound science, on-the-ground actions, innovative partnerships, public engagement, and science-based advocacy.

If you would like to participate in the GLMMP, or you would like more information, please contact:

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519-586-3531 Ext. 124
Toll-free 1-888-448-BIRD (2473) Ext. 124
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Acknowledgments
A special thank-you goes to the numerous Citizen Scientists who volunteered their time to collect data. Kathy Jones, Tracy Barber, Ted Maddeford, and a dedicated network of regional coordinators provided key support. Annie Bracey, Lisa Elliott, Danielle Ethier, Joe Fiorino, Mark Gloutney, Ellen Jakubowski, Kathy Jones, Jerry Niemi, Melissa Rose, and Ron Tozer made valuable comments that improved the report. The organizations listed at the bottom of the page are gratefully acknowledged for their support.

Citation:
Tozer, D. C. 2020. Great Lakes Marsh Monitoring Program: 25 years of conserving birds and frogs. Birds Canada, Port Rowan, Ontario, Canada. 24 pp.

Ducks Unlimited Canada
Canada
EHJV Eastern Habitat Joint Venture
PCHE Le plan conjoint des habitats de l'est
Environmental Protection Agency
Ontario
JPM Charitable Foundation
TD Friends of the Environment Foundation
U.S. Fish & Wildlife Service
Wildlife Habitat Canada Habitat faunique
Nature Conservancy Canada | Conservation de la nature Canada