LONG POINT WATERFOWL AND WETLANDS RESEARCH PROGRAM

Technical Report

1 April 2020 to 31 March 2021

By Douglas C. Tozer, PhD
Port Rowan, ON

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Common Loon Photo: Mark Peck

Long Point Waterfowl and Wetlands Research Program

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Summary

The Long Point Waterfowl and Wetlands Research Program is Birds Canada's umbrella for all of its waterfowl and wetlands research at Long Point and in the lower Great Lakes. It was established in the 1980s with support from The Bluff's Hunting Club, who continues to be concerned about the long-term welfare of waterfowl and wetlands at Long Point. The program's mission is to advance the conservation of waterfowl and other wetland wildlife and their habitats through research and monitoring. The program has a vision of being recognized and respected internationally as a leader in high-quality applied science for conservation planning by federal, provincial, state, and non-profit partners.

Research projects undertaken by the Long Point Waterfowl and Wetlands Research Program are selected according to the program's mission, vision, and strategic plan, and are vetted by a scientific advisory committee comprised of waterfowl and wetland specialists. This ensures high-quality projects that are relevant and useful for waterfowl and wetland conservation. The program's strategic plan currently calls for research that aims to:

- Advance scientific understanding of waterfowl and other wetland wildlife;
- Monitor populations of waterfowl and other wetland wildlife and their habitats;
- Answer timely questions of conservation interest and address emerging science needs of waterfowl and wetlands stakeholders; and
- Provide diverse training and development for young wildlife professionals.

The program is committed to achieving its goal and vision by providing hands-on opportunities for young wildlife technicians, biologists, and scientists in all aspects of wildlife science. From April 2020–March 2021, the program pursued 20 research projects, trained 13 young professionals, and published 10 peer-reviewed manuscripts in scientific journals. Students and staff gave presentations at the North American Ornithological Conference; the Northeast Loon Study Working Group Annual Meeting; and the Long Point World Biosphere Research and Conservation Conference. Plus, 3 students successfully obtained graduate degrees with the program or are now employed in wildlife conservation.

The tremendous success of the Long Point Waterfowl and Wetlands Research Program of Birds Canada is due to its diverse partners and supporters in Canada and the U.S. These include private donors, foundations, governments, corporations, universities, non-government organizations, and various granting agencies. A heartfelt thank you to each and every one of you for your support and partnership!

In the pages that follow we highlight results from projects we worked on over the past year. We hope you like what you see.

With best regards,

Douglas C. Tozer, Ph.D.
Director, Waterbirds and Wetlands
- Long Point Waterfowl and Wetlands Research Program
- Great Lakes Marsh Monitoring Program
- Canadian Lakes Loon Survey

Photo: Jeremy Bensette

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Implanted satellite transmitters affect sea duck movement patterns at short and long timescales

Juliet S. Lamb[1,2], Peter W.C. Paton[1], Jason E.Osenkowski[2], Shannon S. Badzinski[3], Alecia M. Berlin[4], Tim Bowman[5], Chris Dwyer[6], Luke J. Fara[7,8], Scott G. Gilliland[3], Kevin Kenow[7], Christine Lepage[3], Mark L. Mallory[9], Glenn H. Olsen[4], Matthew C. Perry[4], Scott A. Petrie[10], Jean-Pierre L. Savard[3], Lucas Savoy[11], Michael Schummer[12], Caleb S. Spiegel[6], Scott R. McWilliams[1]

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Studies of the effects of transmitters on wildlife often focus on survival. However, sublethal behavioral changes resulting from radio-marking have the potential to affect inferences from telemetry data and may vary based on individual and environmental characteristics. We used a long-term, multi-species tracking study of sea ducks to assess behavioral patterns at multiple temporal scales following implantation of intracoelomic satellite transmitters. We applied state-space models to assess short-term behavioral patterns in 476 individuals with implanted satellite transmitters, as well as comparing breeding site attendance and migratory phenology across multiple years after capture. In the short term, our results suggest an increase in dispersive behavior immediately following capture and transmitter implantation; however, behavior returned to seasonally average patterns within ~5 days after release. Over multiple years, we found that breeding site attendance by both males and females was depressed during the first breeding season after radio-marking relative to subsequent years, with larger relative decreases in breeding site attendance among males than females. We also found that spring and breeding migrations occurred later in the first year after radio-marking than in subsequent years. Across all behavioral effects, the severity of behavioral change often varied by species, sex, age, and capture season. We conclude that, although individuals appear to adjust relatively quickly (i.e. within 1 week) to implanted satellite transmitters, changes in breeding phenology may occur over the longer term and should be considered when analyzing and reporting telemetry data.

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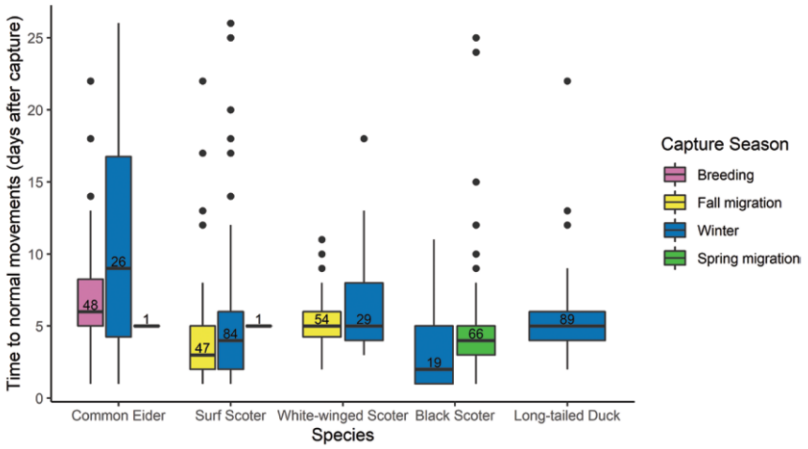

Average number of days after transmitter attachment that daily behavioral (movement pattern) state assignment probability matched the seasonal average by species and capture season for 5 sea duck species tracked between 2002 and 2017 in eastern North America. Box plots show sample size (text), median (center bar), interquartile range (shaded box), minimum/maximum (vertical bars: ± 1.5 times interquartile range), and outlier (dots) values. All movements and proportional occupancy of nodes by season.

Migratory connectivity of waterfowl using the Great Lakes

Jackson Kusack[1,2,*], Douglas C. Tozer[2], Simon J. Bonner[1], Keith A. Hobson[1]

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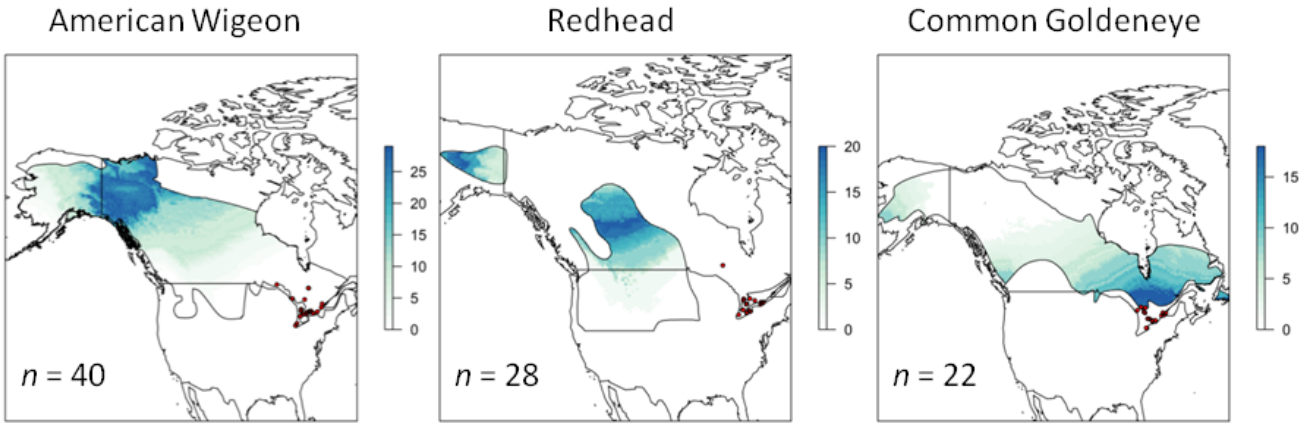
Waterfowl harvest regulations in North America are based on careful scrutiny of demographics of breeding, staging, and overwintering birds within each of four major migratory flyways. A diverse suite of information flows into this decision-making process guided by the North American Waterfowl Management Plan. The information includes extensive abundance and habitat monitoring data, as well as data from various extrinsic sources such as banding, satellite tags, and radio-transmitters, and various intrinsic sources including genetic markers and isotopes. Each of these sources of information has advantages and disadvantages depending on the research question being pursued. Taken together, they generally form for most species a reasonable understanding of which populations are being harvested, and in some cases by how much, although numerous knowledge gaps remain. Analysis of stable hydrogen isotopes in feathers of harvested waterfowl has proven to be useful and efficient for identifying harvested populations at broad scales, and in the Great Lakes region has been examined to a certain extent in Mallards, American Black Ducks, and Lesser Scaup, but to our knowledge not in other species. In this study, we analyze stable hydrogen isotope signatures of flight feathers of males and females of both hatch-years and after-hatch-years of multiple waterfowl species harvested throughout the Great Lakes region. Our main goal is to better define natal and molt origins of waterfowl harvested in the Great Lakes. We also examine origins as a function of sex, age, date, and breeding pair abundance. We include information from band recoveries as informative priors in models, and range extent as a constraint on model output. Results from the study will enhance knowledge of the origins of harvested waterfowl in the Great Lakes, and will improve the ability of waterfowl managers to make informed decisions when setting annual harvest quotas.



Preliminary depictions of probable origins of individuals of three different duck species harvested in southern Ontario. Darker blue shows most probable areas of origin; red dots show harvest locations; sample size of the number of individuals is also shown (*n*).

Origins of harvested American Black Ducks: a stable isotope approach

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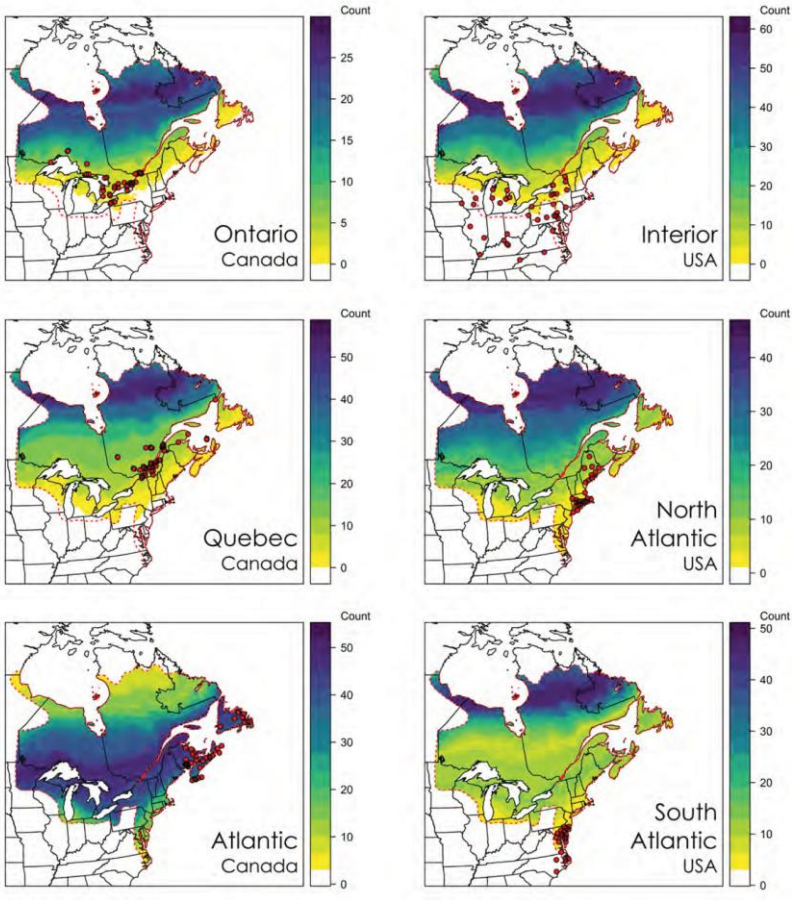
The international adaptive harvest management strategy for the American Black Duck (*Anas rubripes*) uses information from harvested and banded individuals and assumes that they originate from the same regions located throughout the species' range. However, various lines of evidence suggest otherwise. As a result, the 'flyover' hypothesis has been proposed, which states that Canadians are more likely to harvest birds from the southern portion of the breeding range and birds in the northern boreal are more likely to be harvested by Americans. To test the flyover hypothesis, we used stable-hydrogen isotope analysis of flight feathers of harvested individuals to estimate origins. We chose this method because it allows for the tracking of migratory waterfowl without the need for extrinsic markers (such as leg bands). This is because stable hydrogen values within feathers reflect those of the site of feather growth, which are in turn related to patterns of stable hydrogen in precipitation along a broad latitudinal gradient. This aspect of the method was critical for testing the flyover hypothesis because banding operations are almost entirely absent throughout the northern portion of the American Black Duck's breeding range. Using preliminary data from the 2017-2018 hunting season, we found that hatch-years harvested in the US, Ontario, and Quebec likely originated in the northern boreal, whereas individuals harvested in Atlantic Canada had more southerly or local origins. Origins of hatch-years harvested in Atlantic Canada provide preliminary support for the flyover hypothesis. It is unclear why the same pattern is not shown by individuals harvested in Ontario and Quebec. We will continue to investigate patterns in origins by increasing our sample size within and across hunting seasons, including additional covariates in assignment models, and by better refining our estimates of origin with additional data.



Likely origins of immature American Black Ducks harvested in three regions of Canada and three regions of the United States during the 2017–18 and 2018–19 harvest seasons. The colours represent the number of immature ducks likely to have originated in that area, from yellow (few ducks) through deep blue (relatively more ducks). The red circles show harvest locations. The red-dashed lines indicate the breeding range.

Source areas of Northern Pintails harvested in northeastern North America

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Banding suggests that the majority of Northern Pintails harvested in the Atlantic Flyway of northeastern North America are derived from the Prairies or Alaska. However, few pintails are banded on the breeding grounds in remote areas in northern Ontario and Quebec due to logistical challenges, so it is unlikely that banding reflects the true sources of harvested birds. For instance, over-wintering females marked with satellite transmitters along the Atlantic coast revealed that 80% of 55 birds used an eastern migration corridor and all but 2 settled to breed in the southern James Bay lowlands of Ontario or locales farther east. Our objective is to use stable isotope techniques to determine origins of Northern Pintails harvested across the Atlantic Flyway and at specific stop-over sites like Winous Point, Ohio and the Montezuma Wetlands Complex, New York, where large numbers of pintails congregate during migration. We are particularly interested to estimate proportions of harvested individuals that breed or molt in Alaska versus the Prairies versus eastern Canada. The results from the study will enhance knowledge of the origins of harvested pintails in the Great Lakes and elsewhere in eastern North America, and will inform and help improve management and conservation of pintails.

Male Northern Pintail. Photo: Rick Leche.

Assessing year-round habitat use by migratory sea ducks in a multi-species context reveals seasonal variation in habitat selection and partitioning

Juliet S. Lamb[1,2], Peter W.C. Paton[1], Jason E.Osenkowski[2], Shannon S. Badzinski[3], Alecia M. Berlin[4], Tim Bowman[5], Chris Dwyer[6], Luke J. Fara[7,8], Scott G. Gilliland[3], Kevin Kenow[7], Christine Lepage[3], Mark L. Mallory[9], Glenn H. Olsen[4], Matthew C. Perry[4], Scott A. Petrie[10], Jean-Pierre L. Savard[3], Lucas Savoy[11], Michael Schummer[12], Caleb S. Spiegel[6], Scott R. McWilliams[1]

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[3] Canadian Wildlife Service, Environment and Climate Change Canada
[4] U.S. Geological Survey Patuxent Wildlife Research Center
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[6] Migratory Birds Division, U.S. Fish and Wildlife Service
[7] U.S. Geological Survey, Upper Midwest Environmental Sciences Center
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Long-distance migration presents complex conservation challenges, and migratory species often experience shortfalls in conservation due to the difficulty of identifying important locations and resources throughout the annual cycle. In order to prioritize habitats for conservation of migratory wildlife, it is necessary to understand how habitat needs change throughout the annual cycle, as well as to identify key habitat sites and features that concentrate large numbers of individuals and species. Among long-distance migrants, sea ducks have particularly complex migratory patterns, which often include distinct post-breeding molt sites as well as breeding, staging and wintering locations. Using a large set of individual tracking data (n = 476 individuals) from five species of sea ducks in eastern North America, we evaluated multi-species habitat suitability and partitioning across the breeding, post-breeding migration and molt, wintering and pre-breeding migration seasons. During breeding, species generally occupied distinct habitat areas, with the highest levels of multi-species overlap occurring in the Barrenlands west of Hudson Bay. Species generally preferred flatter areas closer to lakes with lower maximum temperatures relative to average conditions, but varied in distance to shore, elevation and precipitation. During non-breeding, species overlapped extensively during winter but diverged during migration. All species preferred shallow-water, nearshore habitats with high productivity, but varied in their relationships to salinity, temperature and bottom slope. Sea ducks selected most strongly for preferred habitats during post-breeding migration, with high partitioning among species; however, both selection and partitioning were weaker during prebreeding migration. The addition of tidal current velocity, aquatic vegetation presence and bottom substrate improved non-breeding habitat models where available. Our results highlight the utility of multi-species, annual-cycle habitat assessments in identifying key habitat features and periods of vulnerability in order to optimize conservation strategies for migratory wildlife.

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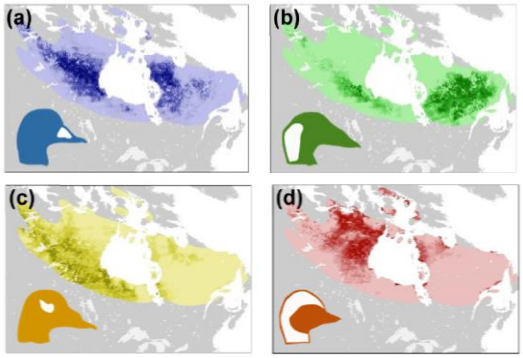

Maps of habitat suitability scores for sea duck breeding areas derived from individual telemetry data, 2002–2017. Suitability is projected across the 95% kernel density of individual locations. Maps (a–d) show single-species habitat suitability for (a) black scoter, (b) surf scoter, (c) white-winged scoter and (d) long-tailed duck, with darker colors indicating higher suitability.

Prioritizing coastal wetlands for marsh bird conservation in the U.S. Great Lakes

Joanna Grand[1], Sarah P. Saunders[1], Nicole L. Michela[1], Lisa Elliott[2,*], Stephanie Beilkec[3], Annie Bracey[4], Thomas M. Gehring[5], Erin E. Gnass Giese[6], Robert W. Howe[6], Bradford Kasberg[3], Nathaniel Miller[3], Gerald J. Niemi[4], Christopher J. Norment[7], Douglas C. Tozer[8], Joanna Wua[1], Chad Wilsey[1]

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Human activity surrounding the Laurentian Great Lakes basin has significantly degraded coastal wetland habitats, resulting in severe marsh bird population declines and reduced coastal resilience to changing environmental conditions. Given the need to conserve remaining coastal wetlands for wildlife and people, we developed a spatial prioritization to identify the most important U.S. Great Lakes coastal wetlands for 14 marsh bird species. We modeled occurrence and relative abundance of each species using boosted regression trees, a machine learning algorithm, to relate standardized monitoring data to ten remotely-sensed environmental covariates. We then used Zonation conservation planning software to rank every wetland cell based on its importance for the suite of marsh bird species. Evaluation of the drivers of marsh bird occurrence and abundance revealed that open water, herbaceous wetland, latitude, longitude, and impervious surface were the most important predictors across focal species. The high-priority wetlands for marsh birds (defined as grid cells ranked in the top 20%) occurred along the shores of eastern Lake Ontario, western Lake Erie/St. Clair, Saginaw Bay, Green Bay, northern lakes Michigan and Huron, and western Lake Superior. Overall, less than half (42%) of highpriority coastal wetlands across the Great Lakes basin are currently under some level of protection, with Lake Ontario priority wetlands being the least protected (25%). Our findings represent an opportunity to improve coastal wetland conservation in a region where wetland loss and degradation continue to threaten marsh bird populations and the integrity of one of the world's largest freshwater ecosystems.

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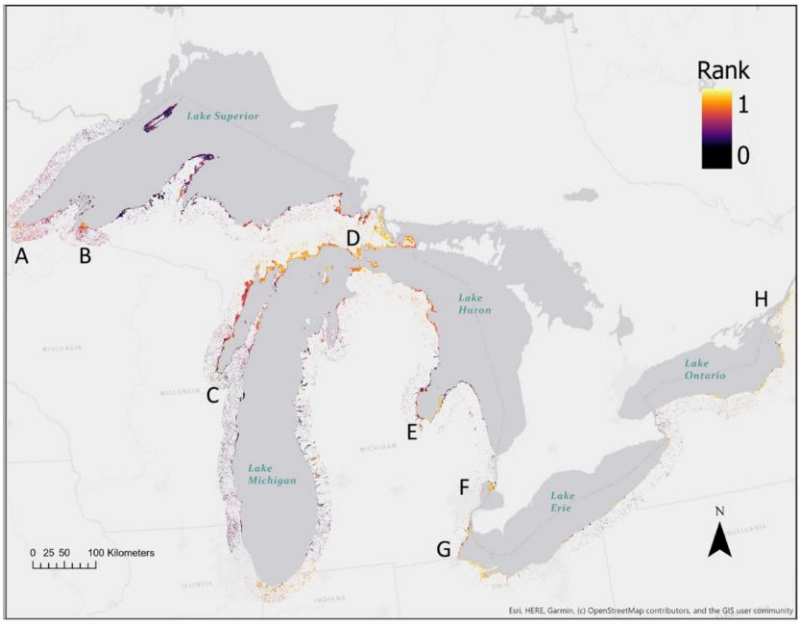

Prioritization ranks of U.S. Great Lakes coastal wetlands from the Zonation optimization scaled from 0 to 1 (the analysis excluded coastal wetlands in Canada).

Bird community response to changes in wetland extent and lake level in Great Lakes coastal wetlands

Tara Hohman[1,2,*], Robert W. Howe[1], Douglas C. Tozer[2], Erin E. Gnass Giese[1], Amy T. Wolf[1], Gerald J. Niemi[3], Thomas M. Gerhing[4], Greg P. Grabas[5], and Christopher J. Norment[6]

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Coastal wetlands in the Laurentian Great Lakes undergo frequent, sometimes dramatic, physical changes at varying spatial and temporal scales. Changes in lake levels and the juxtaposition of vegetation and open water greatly influence biota that use coastal wetlands. Several regional studies have shown that changes in vegetation and lake levels lead to predictable changes in the composition of coastal wetland bird communities. We report new findings of wetland bird community changes at a broader scale, covering the entire Great Lakes basin. Our results indicate that water extent and interspersion increased in coastal wetlands across the Great Lakes between low (2013) and high (2018) lake-level years, although variation in the magnitude of change occurred within and among lakes. Increases in water extent and interspersion resulted in a general increase in marsh-obligate and marsh-facultative bird species richness. Species like American bittern (*Botaurus lentiginosus*), common gallinule (*Gallinula galeata*), American coot (*Fulica americana*), sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and pied-billed grebe (*Podilymbus podiceps*) were significantly more abundant during high water years. Lakes Huron and Michigan showed the greatest increase in water extent and interspersion among the five Great Lakes while Lake Michigan showed the greatest increase in marsh-obligate bird species richness. These results reinforce the idea that effective management, restoration, and assessment of wetlands must account for fluctuations in lake levels. Although high lake levels generally provide the most favorable conditions for wetland bird species, variation in lake levels and bird species assemblages create ecosystems that are both spatially and temporally dynamic..

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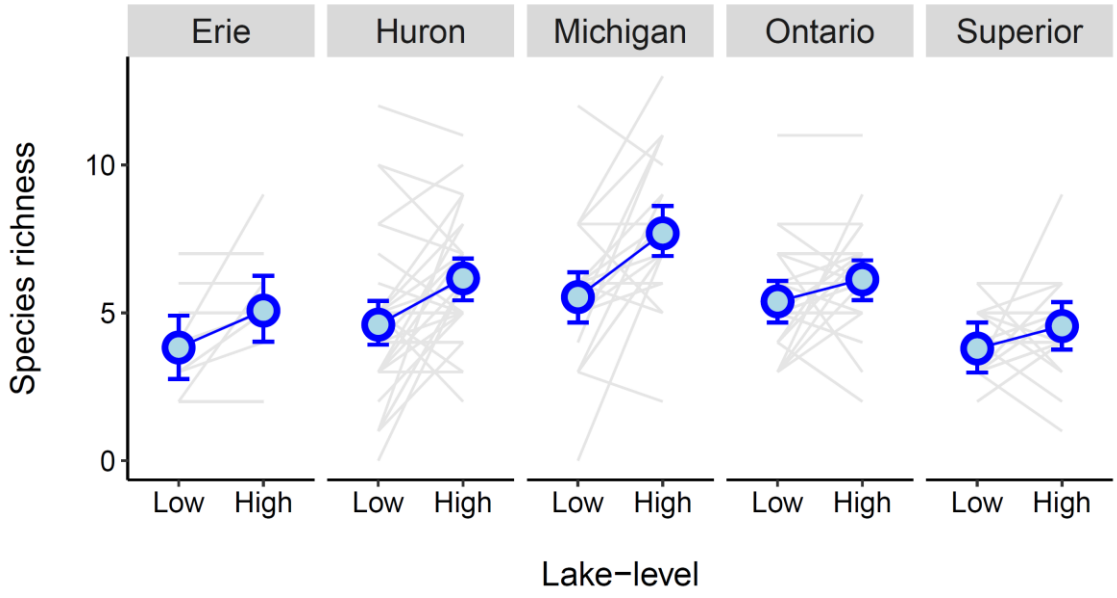

Species richness at bird sample points during low (2011–2013) and high (2016–2018) lake-level years across the Great Lake basin. Shown are model-predicted values (circles) from the final model ± 95% confidence intervals; raw data for each sample point are shown as lines without circles.

Multi-scale species distribution models to inform anuran conservation and management in Great Lakes coastal wetlands

Bridget A. Wheelock[1,*], Thomas M. Gehring[1], Donald G. Uzarski[1], Douglas C. Tozer[2], Gerald J. Niemi[3], Robert W. Howe[4], Christopher J. Norment[5], Michael J. Monfils[6], Brian L. Becker[7], Erin E Gnass Giese[4], Annie Bracey[3], Valerie Brady[3], Jan J.H. Ciborowski[8], Matthew J. Cooper[9], Joseph P Gathman[10], Greg P. Grabas[11], Gary A. Lamberti[12], Ashley Moerke[13], Carl Ruetz[14], Douglas A. Wilcox[5]

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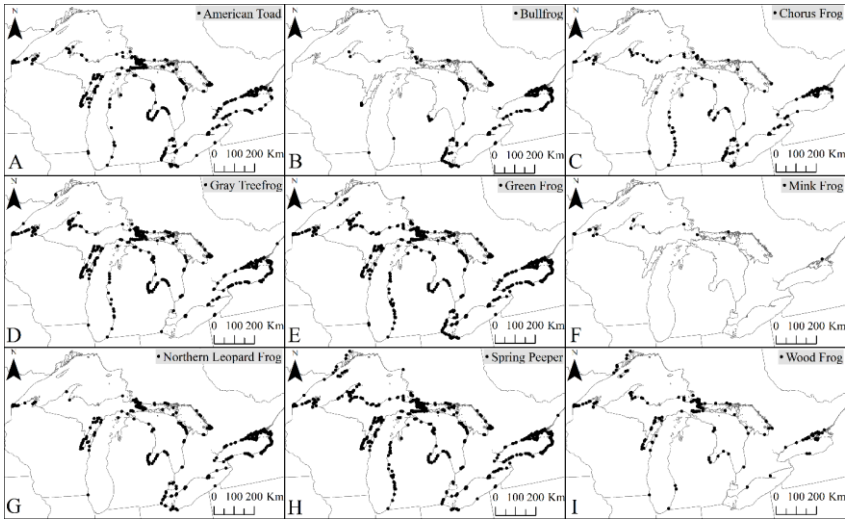
Anurans are an important part of wetland food webs and are indicators of wetland health. However anuran populations are declining worldwide due to widespread anthropogenic disturbance. Our objective was to build species distribution models to identify landscape covariates associated with breeding habitat and the scale(s) most appropriate for conservation and restoration efforts of anurans of the Great Lakes region. We collected species presence data using call surveys in Great Lakes coastal wetlands from 2011-2015 throughout the entire Great Lakes basin as part of the Great Lakes Coastal Wetland Monitoring Program (CWMP). We used Maxent to examine associations between anuran presence and landscape covariates across multiple spatial scales. Proportion of woody wetland was the best predictor covariate for eight species and proportion of human development was the best predictor covariate for mink frogs (*Lithobates septentrionalis*). Three species were best predicted using covariates at small (500m and 750m) spatial scales and six species at multiple spatial scales. Management plans for anurans will need to take species-specific differences related to mobility and other life history traits into account. Our results support implementing conservation and management practices at multiple spatial scales to effectively manage and conserve communities of anurans.



Distribution of nine anuran species detected during 2011-2015, at survey points in Great Lakes coastal wetlands based on data collected by the Great Lakes Coastal Wetland Monitoring Program.

Drivers of declines in common loon (*Gavia immer*) productivity in Ontario, Canada

Kristin Bianchini[1,2,*], Douglas C. Tozer[2], Robert Alvo[3], Satyendra P. Bhavsar[4], Mark L. Mallory[1]

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Common loons (*Gavia immer*) are top predators that depend on lake food webs to successfully fledge chicks. Common loon reproductive success is consequently recognized as an important indicator of aquatic ecosystem health. Existing evidence points to long-term declines in productivity in portions of the common loon range; however, the reason for these declines is not well understood. Our objectives were to define underlying baseline patterns of loon reproductive success in Ontario, Canada, and to identify drivers of temporal changes in loon productivity. We analyzed 38 years of reproductive data from over 1500 lakes using data from the Canadian Lakes Loon Survey, a citizen science loon monitoring program managed by Birds Canada that has run annually in Ontario since 1981. Overall, we estimated a declining trend in common loon reproductive success of −0.10 six week- old young per pair per year in Ontario between 1981 and 2018. We assessed the influence of 14 factors on loon reproductive success. We identified low pH and associated higher mercury as factors linked to loon productivity declines. We also demonstrated that lake area, longitude, and April temperatures can predict the number of six-week-old young per pair per year. We hypothesize that climate change-induced stress, acting through multiple interacting pathways involving mercury acidity, fish abundance, lake size, and geographic location, may account for declining loon productivity. These results will be important for focusing future research and conservation efforts to help understand and mitigate threats to common loon populations.

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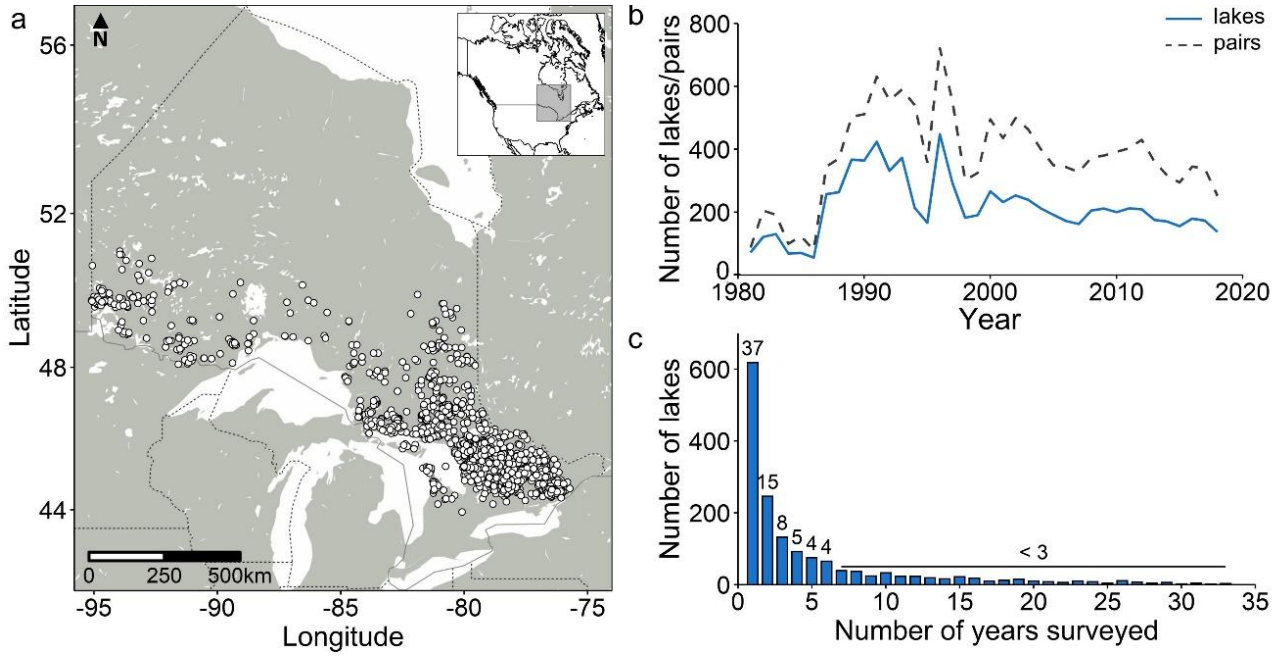

Location of CLLS lakes used to investigate patterns in Common Loon reproductive success in Ontario between 1981 and 2018. Figure inset indicates the study area in North America represented on the map (a). Number of lakes (solid blue line) or Common Loon pairs (dashed gray line) surveyed per year (b) and the number of years that each lake was surveyed (c) by CLLS participants. In panel c, numbers above the bars indicate the value of each bar as a percentage of the total number of lakes surveyed.

The legacy of regional industrial activity: Is loon productivity still negatively affected by acid rain?

Kristin Bianchini[1,2,*], Robert Alvo[3], Douglas C. Tozer[2], Mark L. Mallory[1]

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Metal mining and smelting in Sudbury, Ontario, Canada, began in the 1880s and peaked in the 1950s and 1960s. By the mid-1970s, thousands of lakes had been acidified by sulfur dioxide (SO2) emitted from Sudbury metal smelters. Common loons (*Gavia immer*) are top predators in lakes across Ontario, and lake acidification has resulted in loss of prey for developing chicks and declines in common loon breeding productivity. Acidifying emissions have declined greatly since the 1960s, but many lakes remain acidic. We evaluated chemical recovery and loon breeding success in 69 single-loon-pair (small), variably acidified lakes near Sudbury using 38 years of loon survey and water chemistry data (1982–2019). Lake pH increased, particularly in lakes that were more acidic and closer to Sudbury, but 65% of lakes that were highly acidic in the 1980s remained below pH 6.0 (where biological damage can occur) in 2019. Furthermore, over half of our study lakes showed hydrochemical properties indicative of acid impairment (e.g., high relative sulfate levels, low base cation concentrations, high aluminum and manganese concentrations). More acidic lakes were associated with lower loon productivity, and overall, loon breeding effort and success declined over four decades on these lakes. The legacy of acid rain continues to negatively impact small lakes near Sudbury, and we hypothesize that loons may be more vulnerable to population declines in areas throughout their range that were directly and heavily degraded due to acidifying emissions.

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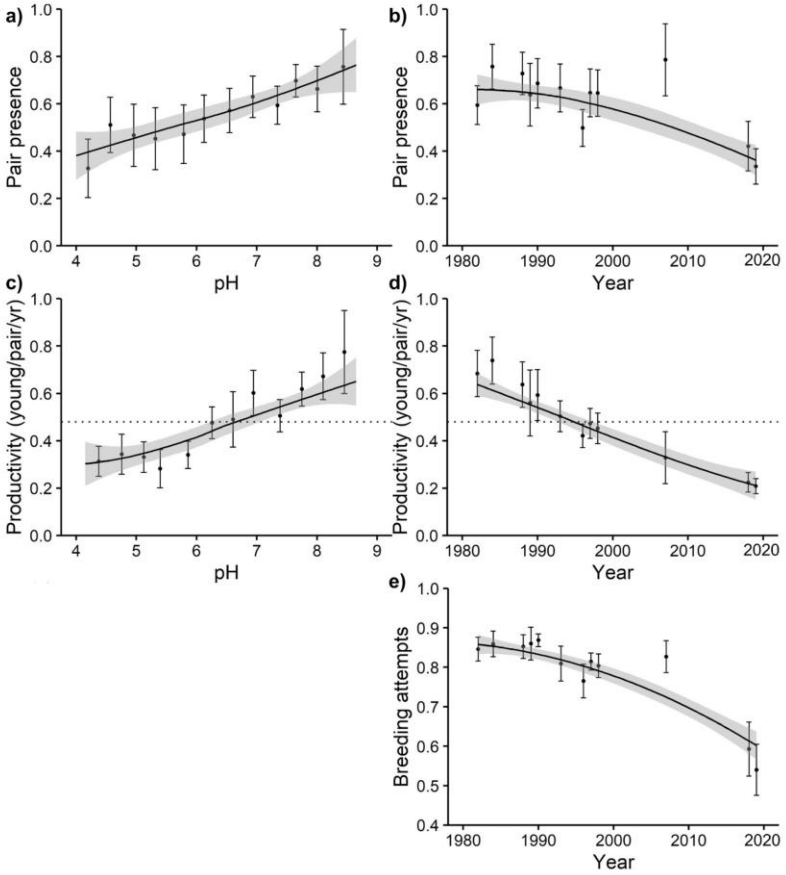

Influence of time and lake pH on loon presence and reproduction on 69 lakes surrounding Sudbury, Ontario. Pair presence (0 = absent, 1 = present) increased with pH (a) and decreased over time (b). On lakes with loon breeding pairs, productivity increased with pH (c) and decreased over time (d), and breeding attempts (0 = no breeding attempt, 1 = breeding attempt) decreased over time (e). Lines indicate model-based predictions ±95% confidence intervals. Circles show model-predicted mean values by arbitrary pH bins (panels a, c) or by year (panels b, d, e). Note that these means were not used to fit the model. In panels c and d, the horizontal dashed line indicates the minimum estimated number of fledged young per pair (0.48) required to support a stable breeding population of common loons.

Late ice-off negatively influences breeding in Common Loons (*Gavia immer*)

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* Long Point Waterfowl and Wetlands Research Program postdoctoral researcher

Productivity of *Gavia immer* (Common Loon) has declined in Ontario and across southern Canada. Variations in the timing of lake ice-off have the potential to negatively influence productivity of Common Loons, but there is conflicting evidence as to how ice-off dates affect this species' reproductive success. Our study investigated the association between annual ice-off timing in southern Ontario and the presence and reproductive success of Common Loons surveyed at 69 small lakes in 16 years over a 38-year span (1982–2019). We found negative relationships between residual ice-off date and the presence of Common Loon pairs, the proportion of Common Loon pairs attempting to breed, and the number of large young per pair per year, suggesting that there were fewer pairs, breeding attempts per pair, and large young per pair in years with later ice-off dates. Our results show that ice-off date is an important factor affecting reproduction in Common Loons, and that ice-off dates can be used to help predict annual variations in productivity of Common Loons.

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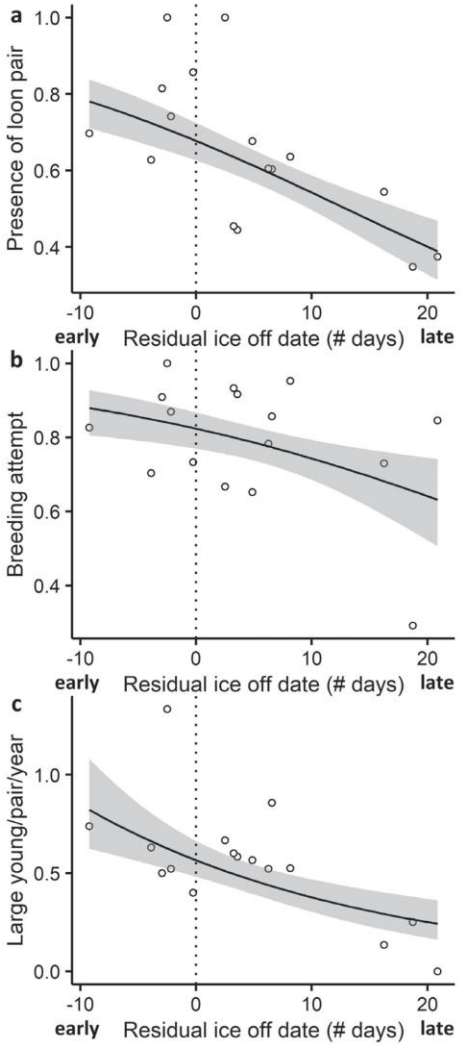
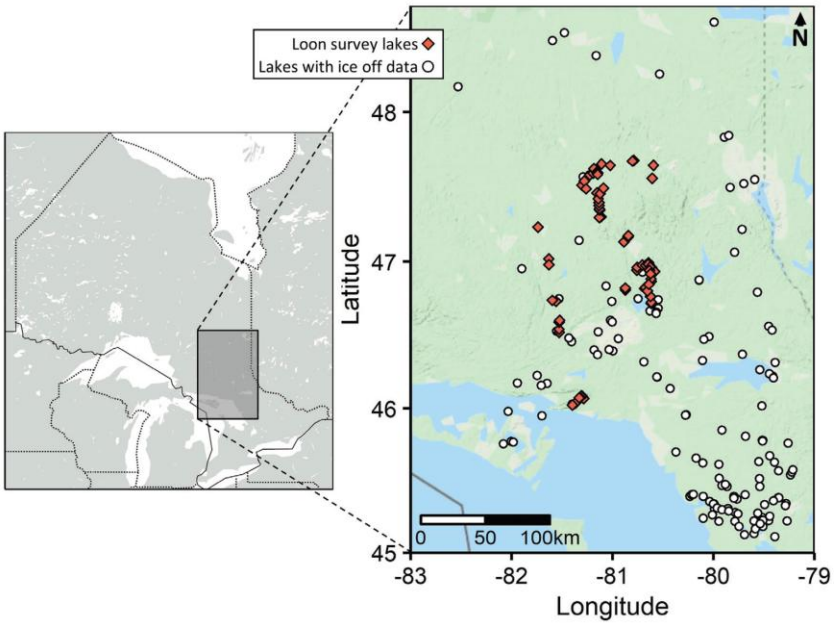


Relationship between iceoff date and Common Loon presence and reproduction. There was a negative relationship between the mean annual residual ice-off dates for lakes within the study area and (a) the proportion of surveyed lakes with a resident Common Loon pair, (b) the proportion of Common Loon pairs that made a breeding attempt, and (c) the mean number of large young per pair per year over 16 years (1982–2019). The vertical dotted line indicates a mean residual ice-off date of zero, where more positive values indicate later iceoff dates, and more negative values indicate earlier ice-off dates. Solid lines indicate model-based predictions ± a 95% confidence interval. Circles indicate means of the response variable for each yearly mean residual ice-off date, and are shown to illustrate model fit, but be aware that these means were not the data used to fit the model.



Location of 69 Common Loon survey lakes (diamonds) and 136 lakes with ice-off data (circles) used to investigate the relationship between ice-off date and Common Loon presence and reproduction between 1982 and 2019.

Integrating wetland bird point count data from humans and acoustic recorders

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[1] Long Point Waterfowl and Wetlands Research Program, Birds Canada
[2] Birds Canada
* Long Point Waterfowl and Wetlands Research Program Paid Research Intern

Wetland loss is cause for concern for populations of many wetland bird species throughout North America. The North American Breeding Bird Survey, the primary resource for broad-scale avian population data, does not provide sufficient data for many marsh bird species. Targeted marsh bird monitoring programs have been implemented across the continent in an attempt to fill this gap. Despite these efforts, a number of wetland species are so elusive that they remain an analytical challenge because of small sample sizes and low detectability. Thus, there is need for tools and approaches that will increase sampling efficiency and boost geographic representation. Autonomous recording units (ARUs) have the potential to address some of these challenges, but require the ability to combine in-person survey data with ARU data for collective analysis. Our primary objective was to estimate statistical offsets, or correction factors, to account for systematic differences between in-person and ARU counts of wetland-associated bird species. We found that ARU recordings were generally equivalent to in-person point counts, with bias in a small number of species (2 of 19 for Song MeterTM SM2 and 1 of 16 for Song MeterTM SM4 Acoustic Recorders; Wildlife Acoustics Inc. ©, Maynard, MA). However, bias was removed in all of the species through use of our correction factors. Therefore, our correction factors were effective for integrating in-person and ARU point count data even for species where differences exist. We also found that commercially available SM4 recorders have larger effective detection radii than SM2 recorders. Researchers should consider the microphone sensitivity and signal-to-noise ratios of any recording unit before purchasing, and more sensitive models with lower noise should be used where possible. Our results, and particularly our correction factors, are useful for biologists combining in-person and ARU point count data to achieve larger sample sizes, higher statistical power, and ultimately better information for more effective wetland conservation.

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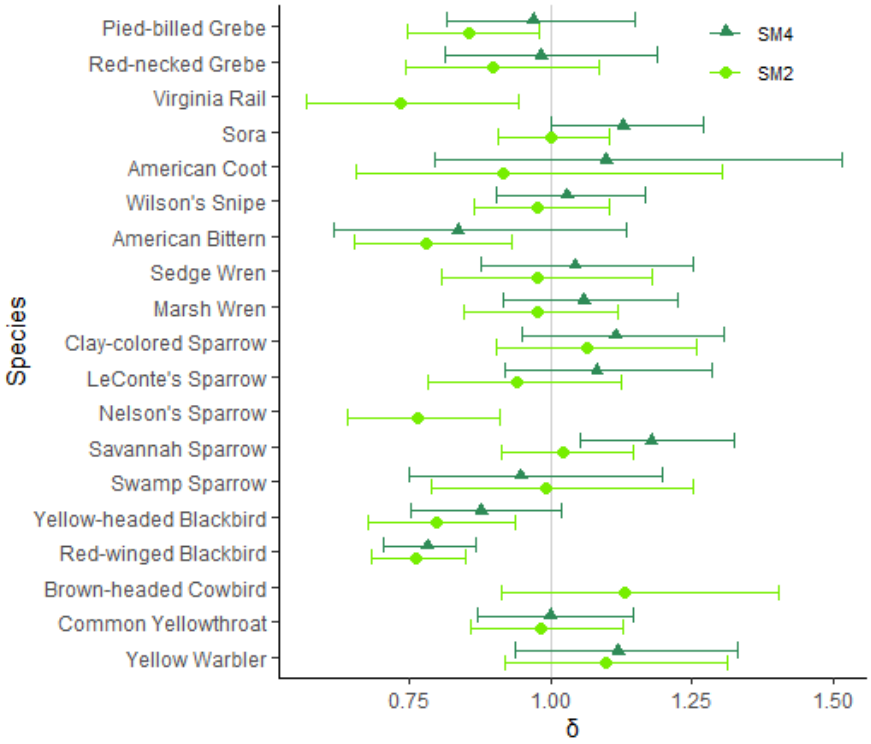

Correction factors (δ) for SM2 and SM4 surveys. Where δ is less than 1, autonomous recording units (ARUs) count fewer individuals on average than in-person surveys. Presented are medians and 95% confidence intervals of Monte Carlo simulations.

Changes in abundance of Least Bitterns in Ontario, 1995-2019

Michael J. Kirchin[1], Giuseppe E. Fiorino[1], Greg P. Grabas[1], Douglas C. Tozer[2]

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Populations of many breeding marsh bird species continue to decline in the southern Great Lakes basin, although this is not the case for the threatened Least Bittern. Recent analysis based on data from the Great Lakes Marsh Monitoring Program of Birds Canada shows that its abundance has increased consistently since the mid-2000s throughout the lower Great Lakes in the U.S. and Canada, with the highest abundance occurring in recent years. In this study, we expanded on these findings by assessing patterns in abundance of Least Bitterns among different geographical locations in Ontario and across years from 1995 to 2019. We found that abundance was relatively consistent in Ontario from 1995 to 2016, but notably higher from 2017 to 2019, largely due to increases in abundance of Least Bitterns at Great Lakes coastal locations (i.e., those directly influenced by fluctuating Great Lakes water levels) compared to inland, particularly in the Lake Erie basin. We also found strong evidence that the increase in abundance was closely tied to increasing water levels during the breeding season on Lake Erie and Lake Ontario. Although this appears to be a good-news story for this species of priority conservation concern, it should be emphasized that Great Lakes water levels naturally fluctuate over time, so it is reasonable to expect a decline in abundance of Least Bitterns when water levels eventually begin to recede. It is also important to realize that the increase in abundance reported here may be due to a change in distribution of Least Bitterns moving into our study area during high water rather than an increase in the total size of the population. Nonetheless, the recent increase that we observed, if it represents a genuine increase in total population size, is encouraging for this species at risk in Ontario and Canada.

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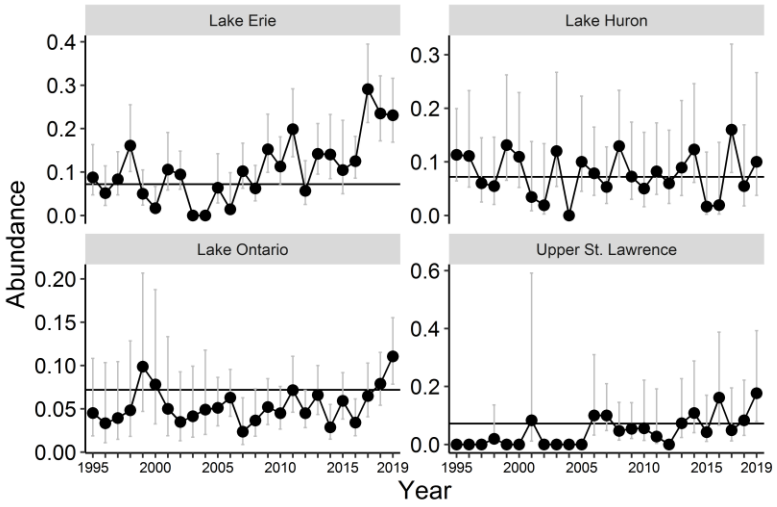
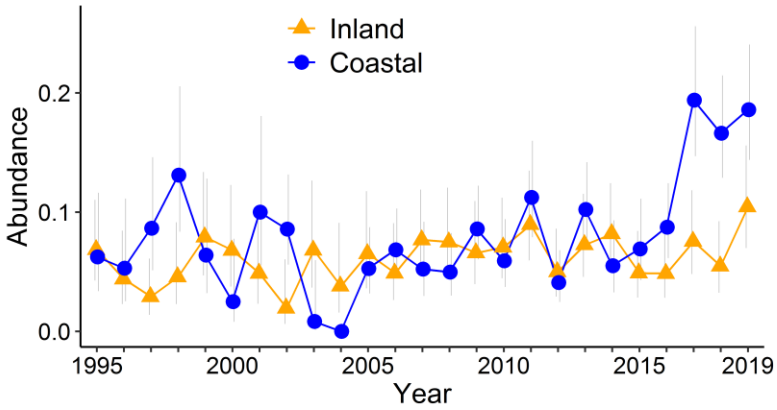


Abundance (maximum number of individuals among surveys per station) of Least Bitterns for the Lake Erie, Lake Ontario, Lake Huron, and upper St. Lawrence River basins in Ontario,1995-2019. Note the difference in the y-axis among lakes; a horizontal line is shown at the mean abundance across all lakes and years for reference. Error bars are 95% confidence intervals.



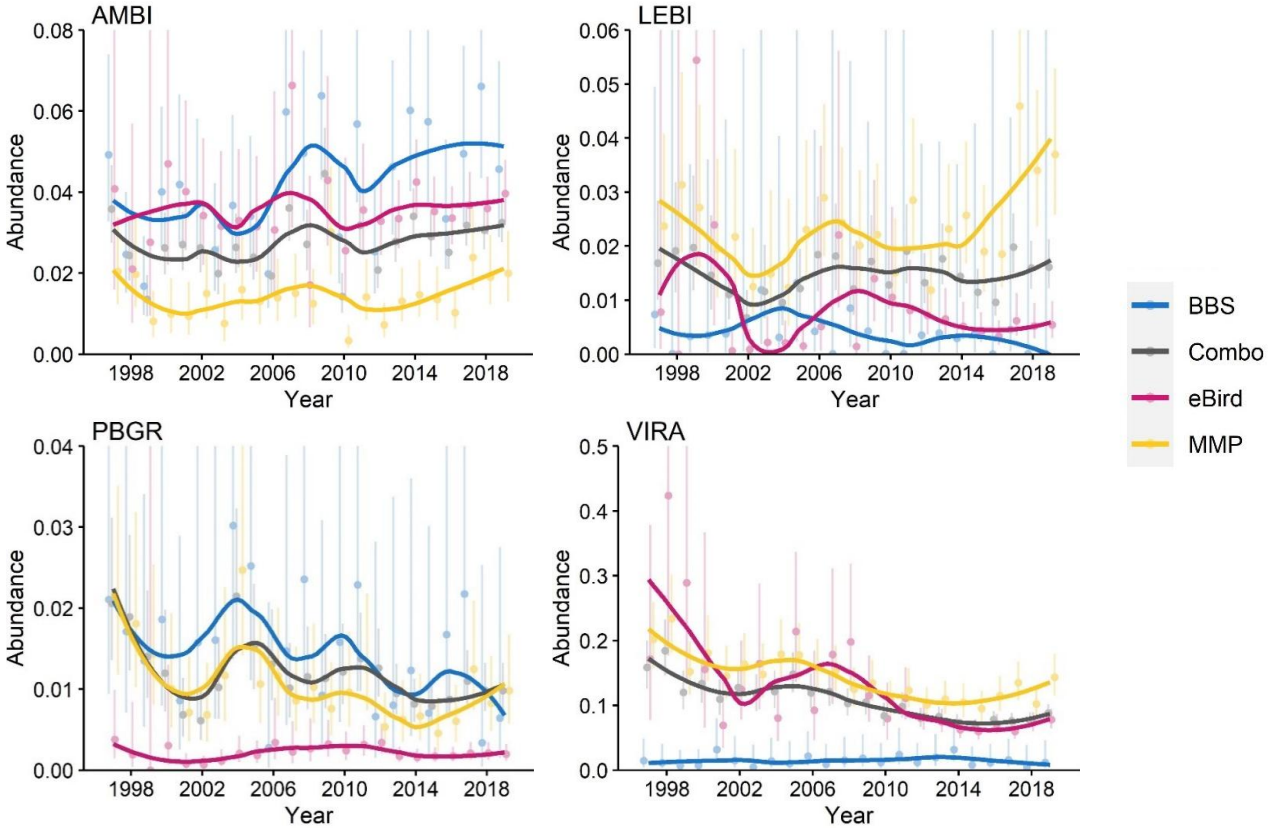
Abundance (maximum number of individuals among surveys per station) of Least Bitterns for coastal and inland survey stations in Ontario, 1995-2019. Error bars are 95% confidence intervals.

Marsh bird population indices and trends based on three independent monitoring programs across southern Ontario

Kristin Bianchini[1], Douglas C. Tozer[1]

[1] Long Point Waterfowl and Wetlands Research Program, Birds Canada

Declining populations of marsh breeding birds of conservation concern are monitored annually across southern Ontario and throughout the lower Great Lakes by the Great Lakes Marsh Monitoring Program (GLMMP) of Birds Canada. This dedicated program follows well-tested, science-based design criteria used and endorsed by the bi-national Great Lakes Coastal Wetland Monitoring Program and the North American Standardized Marsh Bird Monitoring Program. It is assumed that the GLMMP is needed because no other long-term bird monitoring program adequately samples this group of birds. For example, it is throught, though rarely tested, that the number of marsh bird detections made during the randomized, road-based North American Breeding Bird Survey is too low to provide the required statistical power to adequately monitor this group of species. By contrast, observations of marsh birds by increasing numbers of observers participating in eBird may provide an adequate substitute to dedicated marsh bird monitoring in the region, although this has never been investigated. This project aims to test these questions and assumptions by comparing population trends and annual indices of abundance for 18 marsh bird species throughout southern Ontario based on data from 1) GLMMP, 2) Breeding Bird Survey, 3) eBird Canada, and 4) combinations of the 3 programs. We expect that combined models based on some or all of the programs will yield the most precise and accurate trend estimates, but that the GLMMP will prove to be an invaluable backbone amongst the 3 programs. The project stands to yield important and useful recommendations for the most efficient and effective way to monitor marsh breeding birds of conservation concern across the lower Great Lakes.



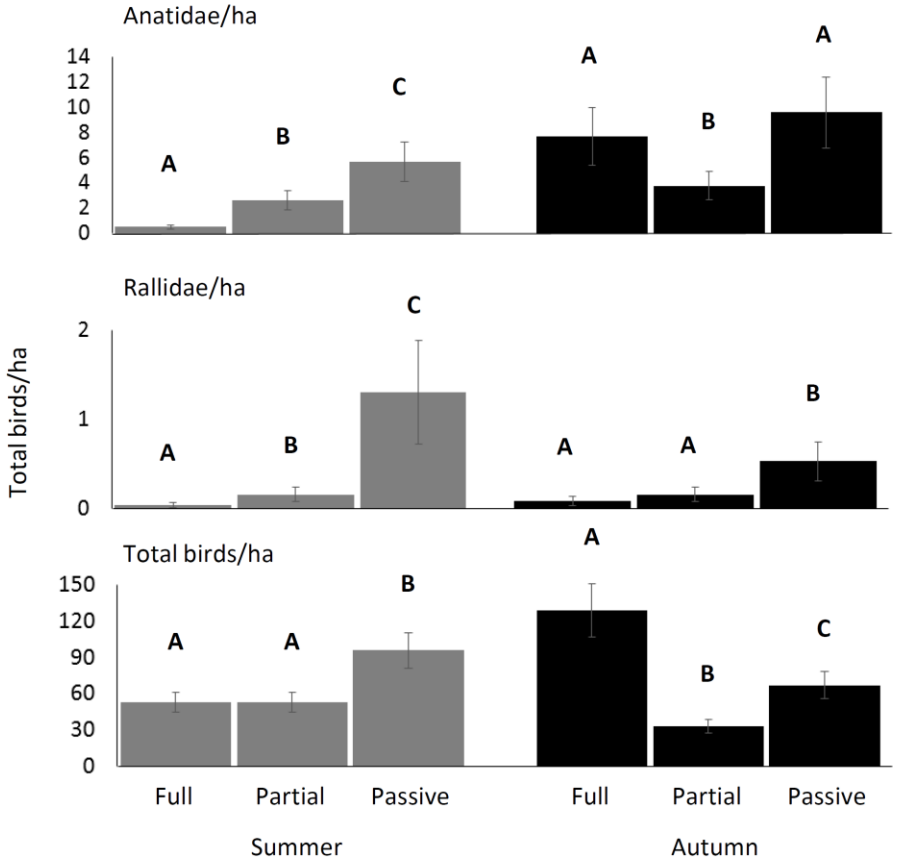
Preliminary results showing annual population indices between 1995 and 2019 for American Bittern (AMBI), Least Bittern (LEBI), Pied-billed Grebe (PBGR), and Virginia Rail (VIRA) throughout southern Ontario based on data from the Breeding Bird Survey (BBS), eBird Canada (eBird), the Great Lakes Marsh Monitoring Program (MMP), and a combination (Combo) of all 3 datasets.

Influence of water level management on vegetation and bird use of restored wetlands in the Montezuma Wetlands Complex

Edward Farley[1,2,*], Michael L. Schummer[1], Don Leopold[1], John M. Coluccy[3], Douglas C. Tozer[2]

[1] College of Environmental Science and Forestry, State University of New York
[2] Long Point Waterfowl and Wetlands Research Program, Birds Canada
[3] Ducks Unlimited
* Long Point Waterfowl and Wetlands Research Program MSc student

Active water management of wetlands promotes seed and tuber production to feed migrating waterfowl, but few assessments exist to determine how management actions influence wetland structure, vegetation, and bird response throughout the year. We identified effects of full water drawdown, partial water drawdown and passive wetlands (no active dewatering during the growing season) on plant communities and bird abundance in wetlands of the Montezuma Wetlands Complex, New York, May–October 2016–2018 and February–April 2017–2019. We detected few differences in the plant community during June, but during September we detected greater vegetative forage quality index, annual plant cover and seed density in full and partial drawdowns and greater vegetation height variation in passive and partial drawdowns. Bird abundance was greater in June–July in passive wetlands and greater in September–October in full drawdowns. During spring migration, duck densities were greater in full and partial drawdowns. Our results indicate that wetland managers should use a mix of full drawdowns and passive wetlands to provide habitat for the greatest diversity and number of birds throughout the year.



Treatment least-squared means ± SE from the mixed model linear regression of birds/hectare for flush counts of 11 different bird groups, conducted in full drawdown, partial drawdown, and passive wetlands during early summer and early autumn in the Montezuma Wetlands Complex, New York, USA 2016–2018. NS denotes no significant difference, and letters that are the same denote no difference between predictor variables at α = 0.10 within season.

Response of aquatic macroinvertebrate density and diversity to wetland management and structure in the Montezuma Wetlands Complex, New York

Michael L. Schummer[1,2], Kayla M. Eason[2], Tyler J. Hodges[1], Edward B. Farley[1,3,5,*], Karen R. Sime[2], John M. Coluccy[4], Douglas C. Tozer[5]

[1] College of Environmental Science and Forestry, State University of New York
[2] Department of Biological Sciences, State University of New York – Oswego
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[5] Long Point Waterfowl and Wetlands Research Program, Birds Canada
* Long Point Waterfowl and Wetlands Research Program MSc student

We investigated how water management and other covariates affected aquatic macroinvertebrate density and diversity of wetlands in the Montezuma Wetlands Complex (MWC) of the Lake Ontario watershed, New York, USA. We conducted aquatic macroinvertebrate sampling during May–July in 2016– 2018 to coincide with when juvenile wetland birds require these protein foods. Models that best explained aquatic macroinvertebrate density and taxon richness included water drawdown treatment, water depth, and water drawdown treatment from the prior year. Predicted mean density of aquatic macroinvertebrates was 117.2% greater in partial drawdown than passive wetlands (i.e., wetlands without active water removal) and increased by 516.2% with 15.5–48 cm increase in water depth. Density of aquatic macroinvertebrates also was 2.6 times greater in wetlands with a full drawdown the year prior. Taxon richness and Shannon Wiener Diversity Index (H0) varied positively with water depth, and there was greater diversity in partial drawdown than passive wetlands. Taxon richness was nearly 2 times greater in areas with full drawdown the year prior than those with partial drawdowns and passive wetlands. Other competing models for H0 also included negative effects of percentage monotypic cattail and invasive plant taxa. These findings are consistent with aquatic macroinvertebrate adaptation to dynamic wetland hydrology, and we recommend that managers actively manipulate hydrology to provide abundant and diverse food resources for birds at managed wetlands in the Great Lakes region.

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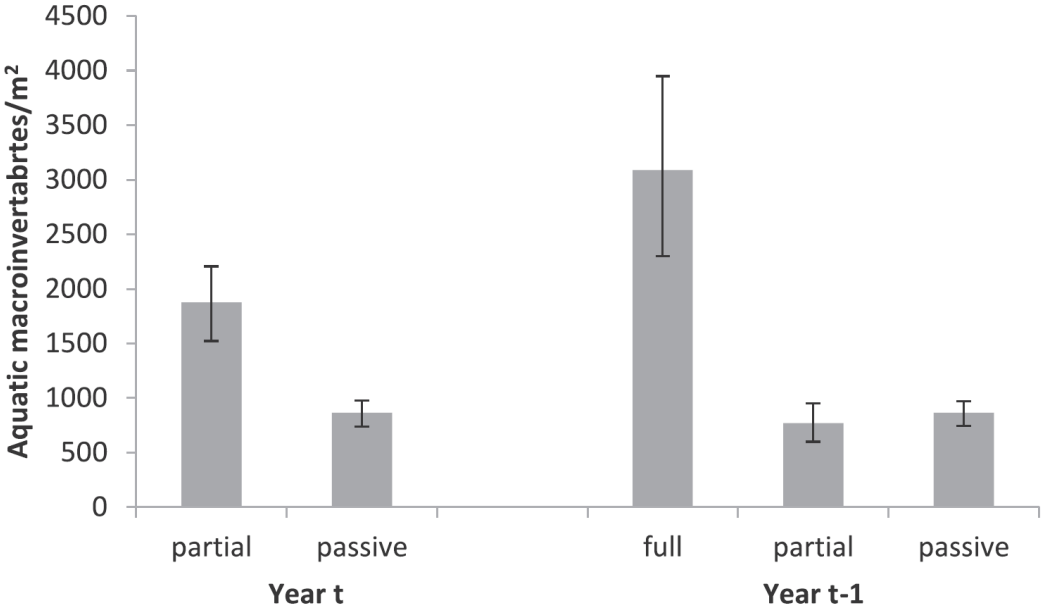

Model predicted mean density of aquatic macroinvertebrates (±SE) at wetlands with full drawdown, partial drawdown, and passive management during the current year (year t) and prior year (year t-1) in the Montezuma Wetlands Complex, New York during June–July in 2016–2018. Values and standard error (SE) bars are back-transformed using log model predicted mean ± SE.

Influence of natural disturbance and control of invasive *Phragmites* on abundance of Fowler's Toads and other anurans at Long Point, Ontario

Victoria Tawa[1,2,*], Douglas C. Tozer[2], David M. Green[1]

[1] McGill University
[2] Long Point Waterfowl and Wetlands Research Program, Birds Canada
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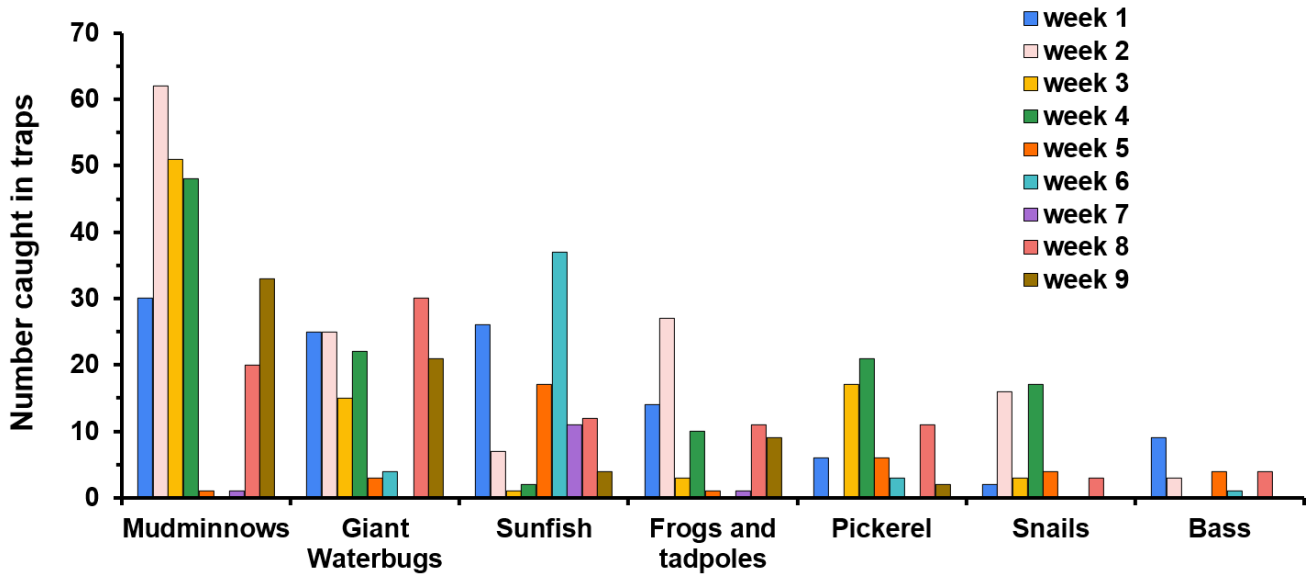
Habitat loss and degradation, including the loss of physical habitat, disruption of connectivity between habitat features, and diminution of habitat quality, are the main threats to amphibians world-wide, including endangered Fowler's Toads and other Canadian anurans. At Long Point, Ontario, loss of breeding sites for Fowler's Toads has been related specifically to the unchecked spread of the non-native, invasive form of the common reed, *Phragmites australis*, and the elimination of shallow, sandy bottom, marshland breeding sites. Control of invasive *Phragmites* may therefore benefit this species, which is dependent upon early successional habitats. Aggressive *Phragmites* control measures, however, may also benefit other, more generally common frog species, such American Toads, American Bullfrogs, Green Frogs, and Northern Leopard Frogs, as well as many fishes and invertebrates. This makes it necessary to evaluate carefully the overall efficacy of *Phragmites* removal with regard to these species. Furthermore, high water levels and wave action on the Lake Erie side of Long Point have severely eroded the dunes along the shore and have cut through the dunes in a number of places, spreading sand into the marshland beyond. Such dune washouts are part of the natural cycle of the lake/dune/marsh ecosystem and the open sandy areas that result may also benefit Fowler's Toad abundance. Accordingly, this research project investigates the influence of both sources of habitat disturbance, *Phragmites* removal in the marshes and dune washouts on the Lake Erie shore, on Fowler's Toads and other anurans at Long Point. Specifically, the project aims to assess the population demographics of Fowler's Toad and the presence and abundance of other resident anurans in relation to habitat change. An intensive capture-mark-recapture survey will be employed to measure changes in Fowler's Toads, and passive trapping with minnow traps will be used to measure changes in other anurans and other wildlife in relation to the sources of disturbance.



Weekly capture totals for the seven most abundant animals recovered in minnow traps from late-July to late-August 2020. Note: "pickerel" refers to Grass Pickerel (*Esox americanus vermiculatus*).

Improving the use of ARUs for monitoring marsh birds in relation to conservation actions

Marissa Zago[1,2,*], Douglas C. Tozer[2], Rebecca C. Rooney[1]

[1] University of Waterloo
[2] Long Point Waterfowl and Wetlands Research Program, Birds Canada
* Long Point Waterfowl and Wetlands Research Program MSc student

Marsh bird populations in the lower Great Lakes are declining. There are several contributing factors, but one of the main culprits is thought to be the expansion of the non-native, invasive form of the Common Reed (*Phragmites australis ssp. australis*) and its homogenization of wetland vegetation relied upon by marsh breeding birds. This project will use a before-after-control-impact investigation of the effects of *Phragmites* control on birds as a case study to improve the use of autonomous recording units (ARUs) for monitoring marsh breeding bird communities in relation to conservation actions. To estimate species diversity from ARUs, they are often interpreted for 5-20 min during the dawn chorus on one or more days spread across the breeding season. However, this short survey positioned at a specific time within the dawn chorus may underestimate species richness by missing species that vocalize earlier or later than the defined time of day, or it may miss species that vocalize infrequently. Therefore, we will investigate how to optimize interpretation of ARU surveys in terms of duration and timing of counts to accurately estimate marsh bird species diversity during the dawn chorus in coastal wetlands. We will also evaluate the accuracy of an automated voice recognizer for the endangered King Rail. We will accomplish this by testing the recognizer's ability to minimize false negatives and false positives of King Rail vocalizations and determine if the recognizer can be used reliably to process large volumes of night time ARU recordings for this extremely elusive and mostly nocturnal species. The results of the study stand to improve the use and utility of ARUs for monitoring elusive marsh bird species in relation to conservation actions, and will provide further evidence of the utility of the control of invasive *Phragmites* for conserving marsh bird species in the lower Great Lakes.

King Rail. Photo: Jeremy Bensette.

Sampling tadpoles and other aquatic animals in relation to control of non-native, invasive *Phragmites* at Long Point, Ontario. Photo: Katharine Yagi

Long Point Waterfowl and Wetlands Research Program

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Inset: Putting transmitter on a Mallard Photo: Mike Moynihan

Dr. Doug Tozer, Program Director
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Blue-winged Teal Photo: Theodore Smith

Impactful results:

- Invasive, non-native mussels are not transferring the element selenium at harmful levels to ducks (scaup); resources redirected to address other factors driving population declines.
- More ducks are overwintering in the Great Lakes due to climate change, with less food for waterfowl in remaining wetlands; on-the-ground actions are being implemented.
- First-ever marsh breeding bird "hotspot" maps for southern Ontario identify new priority areas for wetland securement; helps Canada uphold all-bird conservation obligations.
- Wildlife-based prioritization reveals the best and worst Great Lakes coastal wetlands; wetland protection and restoration being done where it counts.
- Invasive vegetation management on Long Point, Ontario benefits numerous wildlife species; spearheads broad-scale *Phragmites* control program—waterfowl and wetlands are rebounding.

Mallards Photo: Theodore Smith

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Great Lakes RESTORATION

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