# Calumet Marsh Bird Monitoring Report: Illinois 2023

Prepared by: Jenni Fuller

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Photo: Black-crowned Night-Heron, Rick Derevan/Audubon Photography Awards

# Contents



*Marsh bird surveys were conducted under permits granted by the Chicago Park District, Forest Preserves of Cook County, Northeastern University and the Illinois Nature Preserves Commission.*

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# Executive Summary

**Ten bird monitors conducted 240 surveys at 81 points across 11 wetland sites between 1 May through 15 June 2023. Surveyors detected 13 of seventeen focal marsh bird species. We recorded 658 detections of focal marsh bird species, with Marsh Wren (262 detections) and Swamp Sparrow (153) being the most frequently detected species. Marsh bird occupancy was highest at Orland Grassland in 2023. Average marsh bird occupancy increased at Orland Grassland and Big Marsh in 2023 compared to 2022.**

# Introduction

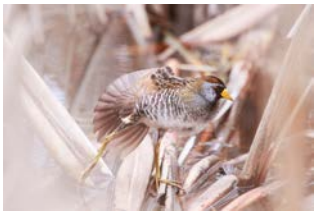
The Calumet region, which makes up the southern shore of Lake Michigan, has historically been dominated by wetland habitats (including marshes, swales, and lakes), which were home to dense populations of breeding marsh birds and waterbirds. A lengthy history of industrialization and urbanization has highly altered the hydrology of Calumet wetlands, resulting in threats to the long-term sustainability of Calumet wetlands, in particular marshes, because of their dependence on natural and dynamic water conditions. Invasive species such as common reed (*Phragmites australus*) and narrowleaf cattail (*Typha angustifolia*) further degrade marsh conditions as reflected by documented declines of marsh-dependent bird species throughout the Great Lakes region (Tozer 2016, Tozer and Mackenzie, 2019). The need for increased scientific information that forms the basis for wetland restoration and long-term management has been widely identified as critical in the conservation community. Marsh birds serve as a primary indicator of wetland quality and their charismatic nature helps to promote public interest that serves to raise the profile of this collaborative research project.

The objectives of the Calumet Marsh Bird Survey are to provide important feedback to landowners on marsh bird populations in response to habitat restoration and to use marsh bird occupancy to inform future management actions. As a result of the collaborative marsh bird monitoring work in the Calumet region, our goal is to increase suitable marsh habitat and therefore positively influence marsh bird population trends, especially for species of concern in the states of Illinois and Indiana. In addition to quantifying marsh bird populations at Calumet wetlands, we aim to collect a variety of habitat data including water level, percent cover of emergent vegetation and open water, and aerial imagery.

# Methods

Sites. During 1 May-15 June 2023, we conducted marsh bird surveys at 11 wetland sites: Big Marsh, Burnham Prairie, Eggers Grove, Gensburg-Markham Prairie, Hegewisch Marsh, Indian Ridge Marsh, Orland Grassland, Square Marsh, Sand Ridge Nature Center, Marian Byrnes Prairie, Wolf Lake Management Unit 5 & 9.

Bird Monitoring. Marsh bird surveys were conducted by volunteer and contracted surveyors using the widely recognized "Standardized North American Marsh Bird Monitoring Protocol" (Conway 2011), developed by the U.S. Fish and Wildlife Service as a continent-wide, standardized protocol for measuring breeding marsh bird densities.



*Sora. Photo: Megan Mahon. Audubon Photography Awards.*

The seven primary focal species for the study are marsh-dependent species that breed in the Calumet area and tend to be "secretive" and thus not well sampled by other survey methods (Conway, 2011; Table 1). Secondary species are not as secretive, but we included them as important indicators of hemimarsh habitat (Table 1). Some secondary species may or may not respond to future hemi-marsh restoration. Three of these species are colonial or semi-colonial nesters not suited for territory mapping, and dependent upon stochastic processes out of our control (e.g. the presence of suitable rookery trees), as much as they are marsh habitat management. Black Tern, Little Blue Heron, Snowy Egret, Yellow-crowned Night-Heron, and Yellow-headed Blackbird are at the periphery of their breeding range though are included in the survey to monitor potential range shifts.

Following the Standardized North American Marsh Bird Monitoring Protocol (Conway 2011), surveyors conducted three point counts at each assigned point three times each season (May 1-14, May 15-31, and June 1-15). The number of points varied from one to thirteen depending on the size of the site and the amount of marsh habitat therein. Points were distributed at a spacing of one point per 200-m grid cell, at an accessible location within the marsh. Each point was visited for 10 minutes in sequence starting 30 minutes prior to sunrise and finishing at the latest three hours post-sunrise. At each point, a pre-recorded playback including vocalizations of each of five of the seven primary focal species were broadcast, with a five-minute period of silent listening before the recording. All visual and audio detections of primary and secondary species were recorded.

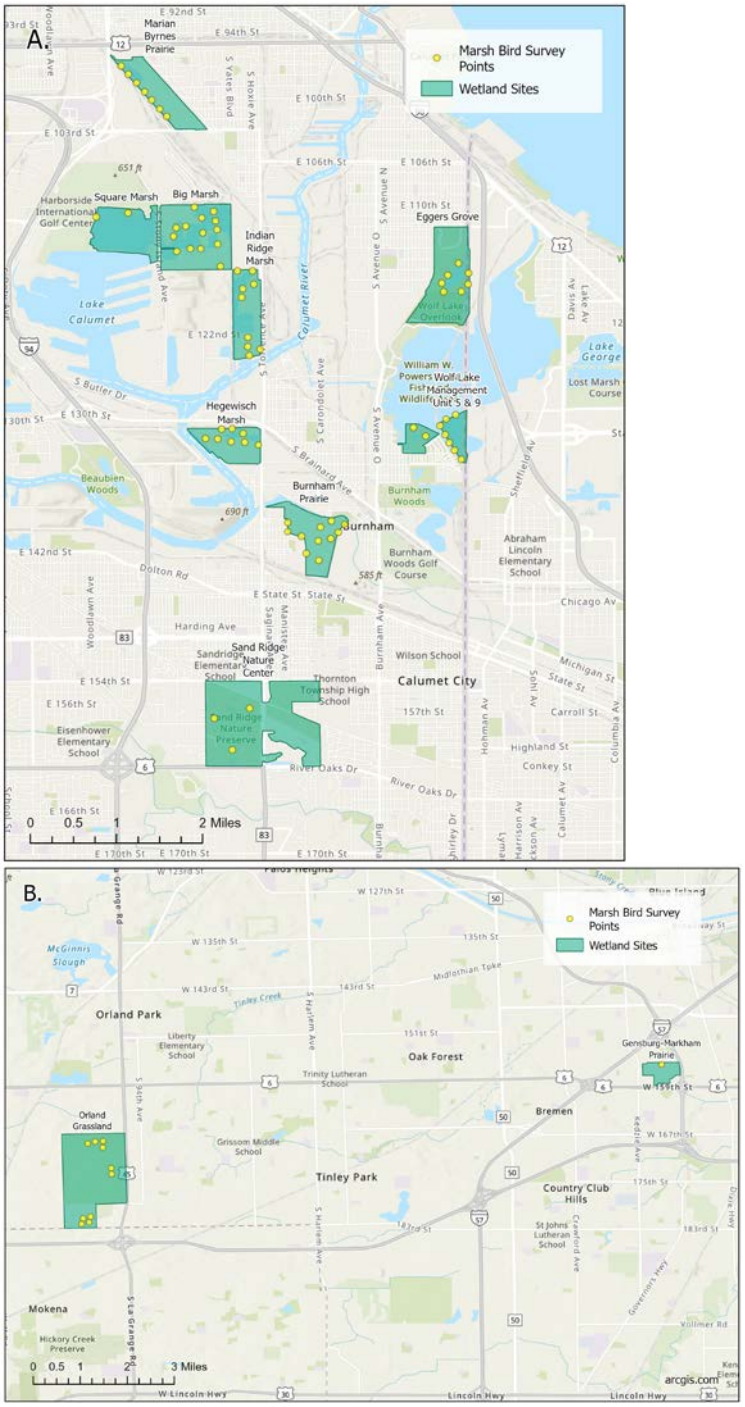



*Figure 1. Marsh bird wetland sites, survey points and water gauges visited in 2022 including A) Lake Calumet sites B) wetlands southwest of the Lake Calumet region: Gensburg-Markham Prairie and Orland Grassland*

*Table 1. Focal marsh bird species.*

| PRIMARY FOCAL SPECIES | SECONDARY FOCAL SPECIES |
|---|---|
| American Bittern (*Botaurus lentiginosus*)* | American Coot (*Fulica americana*) |
| Common Gallinule (*Gallinula chloropus*) | Black Tern (*Chlidonias niger*) |
| Least Bittern (*Ixobrychus exilis*) | Black-crowned Night-Heron (*Nycticorax nycticorax*) |
| King Rail (*Rallus elegans*)* | Blue-winged Teal (*Anas discors)* |
| Pied-billed Grebe (*Podilymbus podiceps*) | Little Blue Heron (*Egretta caerulea*) |
| Sora (*Porzana carolina*) | Marsh Wren (*Cistothorus palustris*) |
| Virginia Rail (*Rallus limicola*) | Snowy Egret (*Egretta thula*) |
| | Swamp Sparrow (*Melospiza georgiana*) |
| | Yellow-crowned Night-Heron (*Nyctanassa vioacea*) |
| | Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) |

**American Bittern and King Rail were primary focal species not included in the audio broadcast.*

Water level monitoring. Staff gauges were installed in 2018 at the following Illinois wetlands: Big Marsh, Eggers Grove, Hegewisch Marsh, Marian Byrnes, Indian Ridge Marsh, and Wolf Lake/William Powers. Volunteer bird monitors recorded water levels at staff gauges during regular bird monitoring visits during 1 May through 15 June. We determined the mean water level value between 1 May-15 June in 2018-2023.

Habitat and management data collection. In 2023, habitat data were collected at all sites where marsh bird monitoring data were collected that year. We used a modified habitat sampling protocol adapted from the Birds Canada Marsh Monitoring Protocol (Birds Canada 2009) and collected data on habitat characteristics at each marsh bird sampling point, such as percent open water, percent emergent vegetation and dominant species present.

Analysis. We estimated occupancy and detection probability parameters for focal species with the unmarked package in R 3.4.3 (Fiske and Chandler 2011). We estimated species-specific occupancy using the likelihood-based method (MacKenzie et al. 2002). We developed separate models for each species based on stacking data from repeated survey visits within years; thus, our "effective sites" were derived from 2 or 3 survey visits at each survey point annually. We treated year as a site-specific covariate in all models.

Under this occupancy model parameterization, the area within 200 m of the survey point (i.e., only detections within 200 m were retained; < 3% of detections omitted) is considered closed to changes in occupancy across all surveys and within years (MacKenzie et al. 2002). Thus, if a given species is detected at a survey point (i.e. site), that point is assumed to be closed to changes in species occupancy for the duration of the breeding season. Therefore, our occupancy response variable can be considered "use" (sensu MacKenzie 2005, MacKenzie et al. 2006) because birds may be temporarily, but not permanently, absent from a given survey point at random times. In this context, our estimate of occupancy describes the proportion of survey points ever occupied, rather than the survey points that are permanently occupied (Kéry and Schaub 2012).

*Least Bittern. Photo: Rick Lewis, Audubon Photography Awards.*

We were interested in accounting for two processes known to influence detection probability of marsh birds during surveys (Conway 2011, Tozer 2016, Wiest et al. 2016): time of day (24 hr) and time of year (ordinal date). Both continuous explanatory variables were standardized to have a mean of zero and standard deviation (SD) of one. We assessed linear and quadratic terms (based on standardized values) for both variables, and used Akaike's Information Criterion (AIC) to compare among models, which included a null (intercept-only) model. The model with the lowest AIC was retained as the top-ranked occupancy model for each focal species.

# Results

Bird monitoring. In 2023, 10 bird monitors conducted 240 surveys at 81 points (Figure 1A-B) during the three two-week sampling periods from 1 May through 15 June 2023. We detected 7 of seven primary focal species (Virginia Rail, Sora, Common Gallinule, American Bittern, Pied-billed Grebe, King Rail, Least Bittern), and 5 of eleven secondary focal species (Swamp Sparrow, Marsh Wren, American Coot, Black-crowned Night-Heron, Blue-winged Teal). We recorded 658 detections of focal marsh bird species during surveys, with Marsh Wren (262 detections) and Swamp Sparrow (153) being the most frequently detected species (Figure 2).

The wetland sites with the highest marsh bird species richness in 2023 were Indian Ridge Marsh (9 species), Orland Grassland (9), Big Marsh (8), Eggers Grove (7), Burnham Prairie (6), and Marian Byrnes Prairie (5). The site with the lowest species richness was Gensburg-Markham Prairie (3). Sora, Marsh Wren, and Virginia Rail were detected at the most wetland sites surveyed. Least Bittern, King Rail, and American Bittern were detected at the fewest sites, but all three species were detected at Orland Grassland.

Marsh bird occupancy. All but 5 marsh bird species were included in the species-specific occupancy analysis. Black Tern, Little Blue Heron, Snowy Egret, Yellow-crowned Night-Heron, Yellow-headed Blackbird were excluded due to low detections. We averaged species-specific occupancy estimates at each site to estimate 'average marsh bird occupancy' annually (Figure 3).

Marsh bird occupancy was highest at Orland Grassland, Big Marsh, and Indian Ridge in 2023. However, all three of these sites decreased compared to 2022. Overall, 1 site(s) increased in occupancy compared to 2022, and 9 site(s) decreased in occupancy. In general, most sites had lower occupancy in 2023 compared to 2022, except for Sand Ridge Nature Center, which had an increase in average occupancy between years.

Water level monitoring. Water gauge data were compiled for the following sites across four to five years: Big Marsh, Eggers Grove, Indian Ridge Marsh, Marian Byrnes, and Wolf Lake. Mean water gauge measurements indicated that water levels decreased on average 5 inches at Big Marsh, Eggers Grove and Marian Byrnes. Marian Byrnes average water level decreased the most (8 in) and Eggers Grove the least (2 in) (Figure 4).

Species-habitat associations. Habitat data were not analyzed in 2023 but may be used in future analyses.

# Conclusions

Marsh bird monitoring results generally showed a decrease in average occupancy of marsh birds in 2023 at Illinois Calumet wetlands compared to 2021. Water levels continued to remain low compared to high levels in 2020. While occupancy likely increased due to higher availability of emergent vegetation at wetlands in 2022, it is possible that the continued drop in water levels reduced ideal interspersion of open water and vegetation in 2023. Additionally, changes in site-specific characteristics (e.g., vegetation type, muskrat presence), which were not analyzed in 2023, may be contributing to this decline.

The future direction of Audubon Great Lakes marsh bird monitoring will be to continue to annual monitoring with the purpose of investigating the impact of management on breeding marsh birds. In addition, a future analysis in 2025 will use marsh bird monitoring data from Calumet in combination with data across the Great Lakes region to investigate the impact of management funded the National Fish and Wildlife Foundation's Sustain Our Great Lakes program on marsh birds and other wetland birds.

*Table 1. Marsh bird species detected during 2023 marsh bird surveys and marsh bird species richness. Includes species detected by monitors both within and outside the survey period. X values indicate that the species was observed. See Appendix I for raw species detection data.*

| | American Bittern | American Coot | Black-crowned Night-Heron | Blue-winged Teal | Common Gallinule | King Rail | Least Bittern | Marsh Wren | Pied-billed Grebe | Sora | Swamp Sparrow | Virginia Rail | Total Species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Big Marsh** | | X | X | X | X | | | X | | X | X | X | 8 |
| **Burnham Prairie** | X | X | | | | | | X | | X | X | X | 6 |
| **Eggers Grove** | | X | | X | | | | X | X | X | X | X | 7 |
| **Gensburg-Markham Prairie** | | | | | | | | X | | X | | X | 3 |
| **Hegewisch Marsh** | | | | | | | | X | X | X | | X | 4 |
| **Indian Ridge Marsh** | | X | X | X | X | | | X | X | X | X | X | 9 |
| **Marian Byrnes Prairie** | | | | X | | | | X | X | X | | X | 5 |
| **Orland Grassland** | X | | | X | | X | X | X | X | X | X | X | 9 |
| **Sand Ridge Nature Center** | | | | | X | | | | X | X | | X | 4 |
| **Square Marsh** | | X | | | | | | X | | X | X | X | 5 |
| **Wolf Lake Management Unit 5 & 9** | | X | X | | | | | X | | X | X | | 5 |
| **Total Species** | 2 | 6 | 3 | 5 | 3 | 1 | 1 | 10 | 6 | 11 | 7 | 10 | 12 |

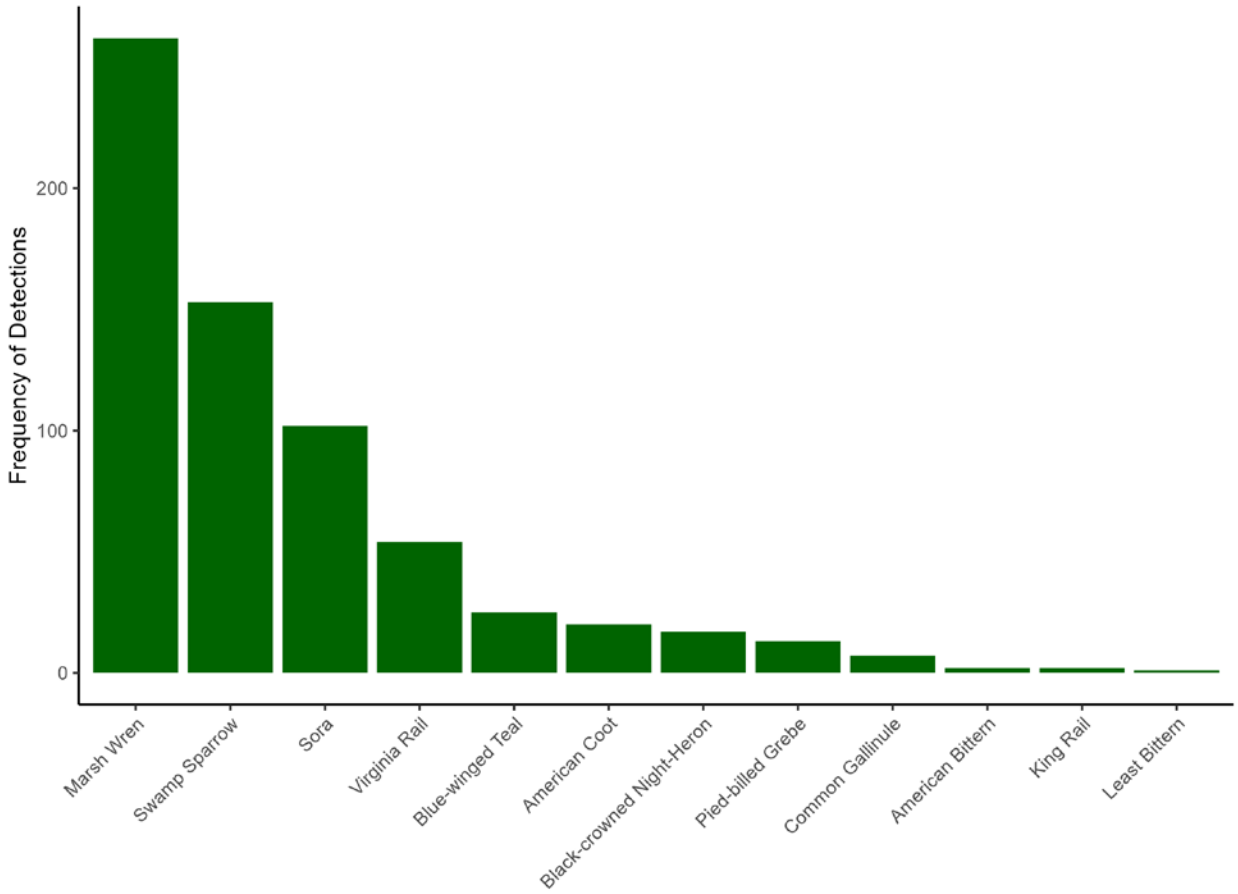



*Figure 2. Combined frequency of detections per species during marsh bird surveys at all Illinois Calumet wetland sites in 2023.*

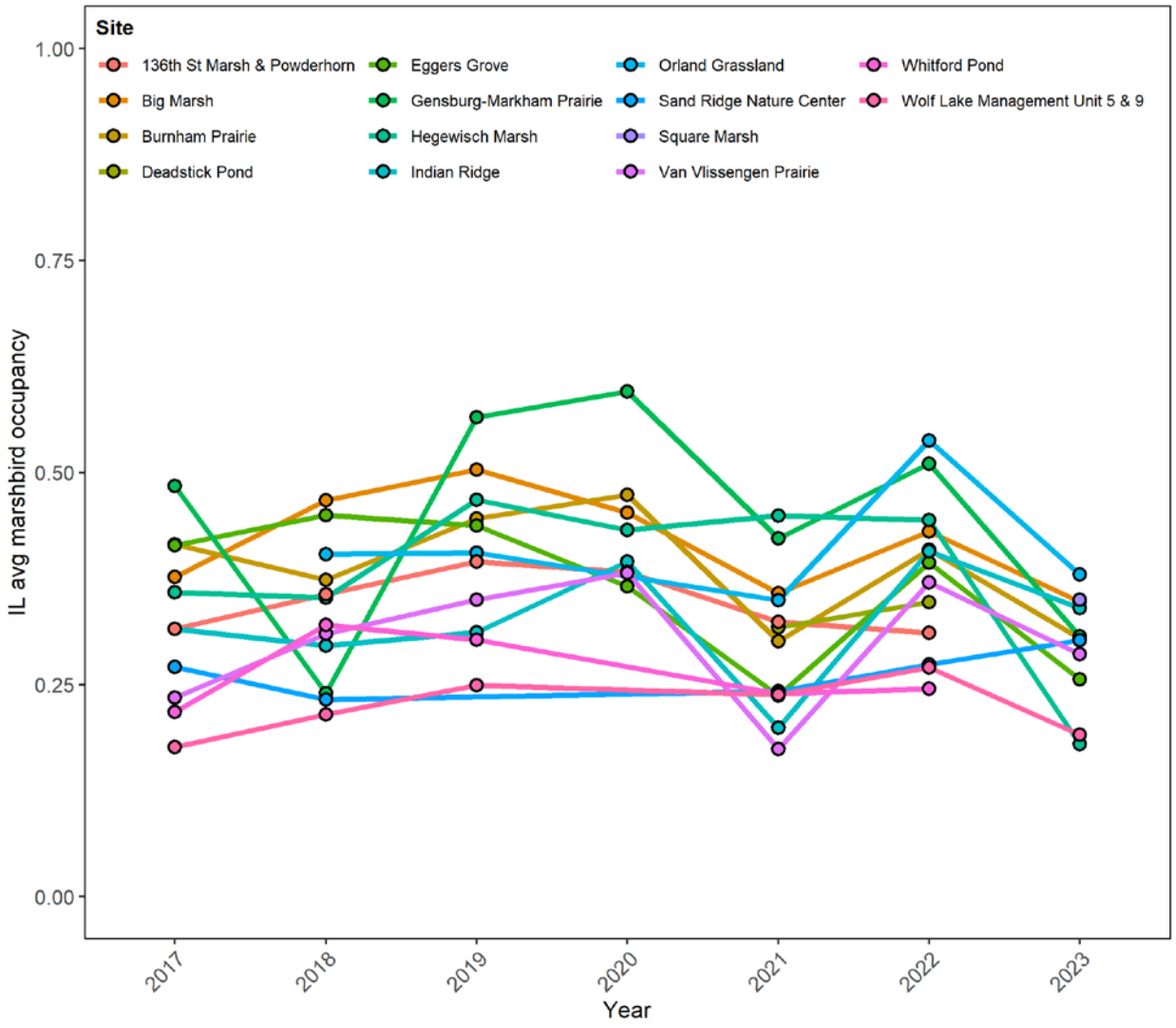



*Figure 3. Average marsh bird occupancy at wetland sites for 2017-2023 Illinois Calumet marsh bird surveys. Not shown: Orland Grassland. Note that Powderhorn Lake and Powderhorn North were combined in this visualization.*

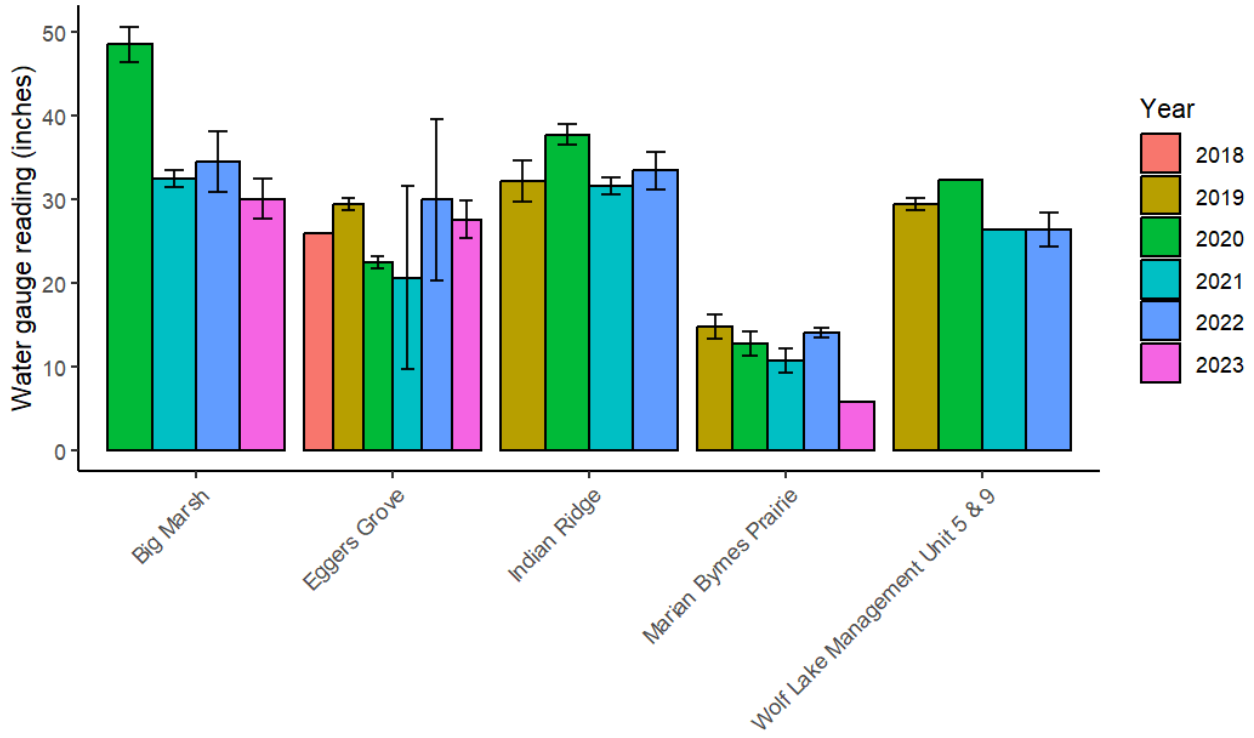



*Figure 4. Mean water level recorded at staff gauges at Illinois Calumet marshes during 1 May-15 June 2018-2023, for gauges with at least four years of data.*

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# Appendix I. Raw marsh bird results for Illinois Calumet Wetlands.

*Raw marsh bird species detections per visit at Illinois Calumet wetlands in 2023.*

| | | Visit 1 | Visit 2 | Visit 3 | Grand Total |
|---|---|---|---|---|---|
| Big Marsh | Total | 65 | 32 | 25 | 122 |
| | American Coot | 1 | | | 1 |
| | Black-crowned Night-Heron | 1 | | 1 | 2 |
| | Blue-winged Teal | 1 | | | 1 |
| | Common Gallinule | 1 | 1 | | 2 |
| | Marsh Wren | 3 | 12 | 18 | 33 |
| | Sora | 33 | 7 | | 40 |
| | Swamp Sparrow | 17 | 8 | 6 | 31 |
| | Virginia Rail | 8 | 4 | | 12 |
| Burnham Prairie | Total | 37 | 36 | 28 | 101 |
| | American Bittern | 1 | | | 1 |
| | American Coot | 1 | | | 1 |
| | Marsh Wren | 9 | 18 | 17 | 44 |
| | Sora | 7 | | | 7 |
| | Swamp Sparrow | 17 | 14 | 11 | 42 |
| | Virginia Rail | 2 | 4 | | 6 |
| Egger's Grove | Total | 13 | 9 | 4 | 26 |
| | American Coot | 2 | 2 | | 4 |
| | Blue-winged Teal | | 1 | | 1 |
| | Marsh Wren | 1 | 2 | 2 | 5 |
| | Pied-billed Grebe | 2 | 2 | 1 | 5 |
| | Sora | 4 | | | 4 |
| | Swamp Sparrow | 1 | 2 | 1 | 4 |
| | Virginia Rail | 3 | | | 3 |
| Gensburg-Markham Prairie | Total | 5 | 2 | 1 | 8 |
| | Marsh Wren | 3 | 2 | 1 | 6 |
| | Sora | 1 | | | 1 |
| | Virginia Rail | 1 | | | 1 |
| Hegewisch Marsh | Total | 10 | 8 | 8 | 26 |
| | Marsh Wren | 6 | 5 | 7 | 18 |
| | Pied-billed Grebe | 2 | | | 2 |
| | Sora | 1 | 1 | 1 | 3 |
| | Virginia Rail | 1 | 2 | | 3 |
| Indian Ridge Marsh | Total | 25 | 14 | 25 | 64 |
| | American Coot | 3 | | | 3 |

| | | | | | |
|---|---|---|---|---|---|
| | **Black-crowned Night-Heron** | 2 | 2 | 2 | 6 |
| | **Blue-winged Teal** | 4 | | | 4 |
| | **Common Gallinule** | | | 4 | 4 |
| | **Marsh Wren** | | 11 | 18 | 29 |
| | **Pied-billed Grebe** | 1 | | | 1 |
| | **Sora** | 13 | 1 | | 14 |
| | **Swamp Sparrow** | 1 | | | 1 |
| | **Virginia Rail** | 1 | | 1 | 2 |
| **Orland Grassland** | **Total** | 17 | 5 | 1 | 23 |
| | **Blue-winged Teal** | 3 | 2 | | 5 |
| | **King Rail** | 2 | | | 2 |
| | **Least Bittern** | | 1 | | 1 |
| | **Marsh Wren** | 3 | | | 3 |
| | **Pied-billed Grebe** | | 1 | | 1 |
| | **Sora** | 2 | | | 2 |
| | **Swamp Sparrow** | 3 | 1 | 1 | 5 |
| | **Virginia Rail** | 4 | | | 4 |
| **Orland Grassland South** | **Total** | 21 | 20 | 25 | 66 |
| | **American Bittern** | | 1 | | 1 |
| | **Blue-winged Teal** | 1 | | 1 | 2 |
| | **Marsh Wren** | 5 | 6 | 10 | 21 |
| | **Sora** | 7 | 3 | 5 | 15 |
| | **Swamp Sparrow** | 6 | 6 | 8 | 20 |
| | **Virginia Rail** | 2 | 4 | 1 | 7 |
| **Square Marsh** | **Total** | 7 | 5 | 4 | 16 |
| | **American Coot** | 1 | | | 1 |
| | **Marsh Wren** | 2 | 2 | 2 | 6 |
| | **Sora** | 1 | 1 | | 2 |
| | **Swamp Sparrow** | 2 | 2 | 2 | 6 |
| | **Virginia Rail** | 1 | | | 1 |
| **Sand Ridge Nature Center** | **Total** | 5 | | 2 | 7 |
| | **Common Gallinule** | | | 1 | 1 |
| | **Pied-billed Grebe** | 1 | | 1 | 2 |
| | **Sora** | 3 | | | 3 |
| | **Virginia Rail** | 1 | | | 1 |
| **Marian Byrnes Prairie** | **Total** | 24 | 8 | 6 | 38 |
| | **Blue-winged Teal** | 1 | 1 | | 2 |
| | **Marsh Wren** | 3 | 4 | 4 | 11 |
| | **Pied-billed Grebe** | 2 | | | 2 |
| | **Sora** | 9 | | | 9 |
| | **Virginia Rail** | 9 | 3 | 2 | 14 |
| | **Total** | 6 | 3 | 5 | 14 |

| | | | | | |
|---|---|---|---|---|---|
| **Wolf Lake Management Unit 5 & 9** | **American Coot** | 1 | | | 1 |
| | **Black-crowned Night-Heron** | | | 2 | 2 |
| | **Marsh Wren** | 2 | 3 | 3 | 8 |
| | **Sora** | 2 | | | 2 |
| | **Swamp Sparrow** | 1 | | | 1 |
| **Grand Total** | | 235 | 142 | 134 | 511 |