

# Iowa Monitoring of Owls and Nightjars (MOON) Annual Report

## 2024

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### Introduction

In 2016, the Iowa Department of Natural Resources (DNR) implemented its first Monitoring of Owls and Nightjars (MOON) survey following protocols developed by the Illinois Natural History Survey. MOON was established because of a need for data on nocturnal bird species, namely owls and nightjars, which are not detected by other IA DNR surveys. Iowa hosts eight breeding owl species and three breeding nightjar species (Table 1). Three owls are on the state threatened and endangered species list, and two others are listed as species of greatest conservation need (SGCN) in the Iowa Wildlife Action Plan. The three breeding nightjars in Iowa are all SGCN (Table 1). Many owl and nightjar populations declined between the first (1985-1990) and second (2008-2012) Iowa Breeding Bird Atlases, with only Barred Owls increasing (Jackson et al. 1996, Dinsmore and Ehresman 2020). The MOON survey provides an opportunity to gather current baseline population data, document changes in species populations over time, and link species occurrence to habitat management.



**Table 1: Breeding Owl and Nightjar Species of Iowa.**

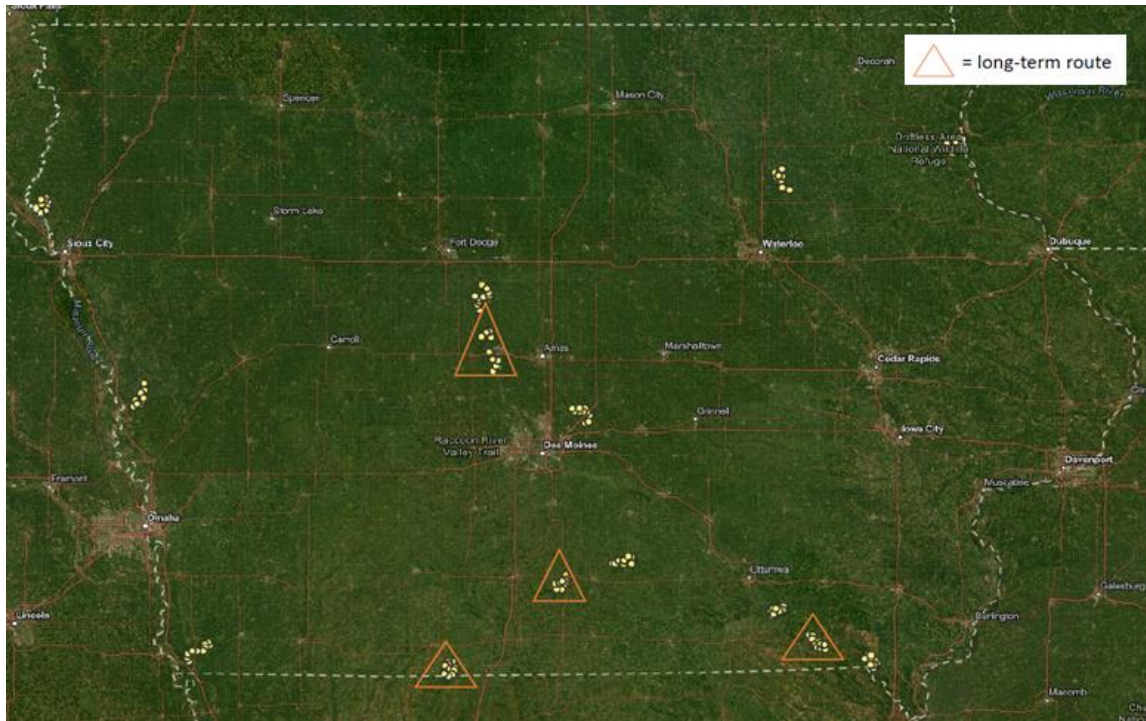
Species Common Name	Family	Conservation Status
Barn Owl	Owl	State Endangered
Short-eared Owl	Owl	State Endangered
Long-eared Owl	Owl	State Threatened
Eastern Screech-owl	Owl	SGCN
Burrowing Owl*	Owl	SGCN
Barred Owl	Owl	
Great Horned Owl	Owl	
Northern Saw-whet Owl**	Owl	
Common Nighthawk	Nightjar	SGCN
Eastern Whip-poor-will	Nightjar	SGCN
Chuck-will's-widow	Nightjar	SGCN

\*Burrowing Owls are historic breeders in Iowa, with the last confirmed nest in 2003.

\*\*Northern Saw-whet Owls were first documented breeding in Iowa in 2024.

Three MOON survey routes were established in 2016, with another added in 2018. These routes were placed in areas with favorable habitat for owls and nightjars, near forests, and have been surveyed most years since establishment. In 2024, 10 new survey routes (Figure 1) were added within Iowa Bird Conservation Areas (BCA) with the ultimate goal of adding at least one route to each of Iowa's 23 BCAs.

Iowa MOON surveys have documented seven owl and nightjar species; Barn Owl, Eastern Screech-owl, Barred Owl, Great Horned Owl, Common Nighthawk, Eastern Whip-poor-will, and Chuck-will's-widow. Although Common Nighthawks are detected by MOON and reported on below, this survey is not ideal for detecting this crepuscular species (active at dawn/dusk) which is not typically active in the middle of the night, and MOON likely underestimates presence of this species.



**Figure 1: 2024 MOON Survey routes are displayed as clusters of yellow survey stops. Long-term routes, surveyed since 2016 or 2018, are surrounded by an orange triangle.**

## Methods

### Survey Methods

MOON surveys are 10-stop driving routes surveyed twice each breeding season. Each survey stop is located at least one mile apart to reduce double-counting of individual birds. At each stop, the surveyor exits and turns off the vehicle and listens passively for owls and nightjars for six minutes. This listening period is followed by a 20-second broadcast of Eastern Screech-owl calls followed by two minutes of listening then a 20-second broadcast of Barn Owl calls followed by two minutes of listening. This results in a total listening time of 10 minutes at each stop. Barn Owl and Eastern Screech-owl broadcasts are played to increase detection probability for these species. During each survey minute, the observer records each individual owl or nightjar detected. After the initial detection of an individual, the observer records whether that individual was detected in each subsequent minute of the survey, creating a detection history of 1s (detected) and 0s (not detected) for each individual at each survey stop.

Surveys are conducted during two specific date windows each year, corresponding to when the moon is 50% or greater illuminated during the breeding season (between April and June). This is to increase detection probability for nightjars, which are most active when the moon is bright. Routes are surveyed once during each window. In 2024, these survey windows were May 15-29 and June 14-28. Surveys are conducted at least 30 minutes after sunset, when the moon is above the horizon, and end no later than 15 minutes prior to sunrise. Surveyors attempt to avoid nights with constant rain, wind speeds over 12 mph, or when cloud cover obstructs the moon.

For each route, surveyors record the start and end time of the route, the observer, the date, and whether the moon was above the horizon during the survey. At each stop, surveyors record the start time, wind speed (mph), cloud cover (%), noise level, and temperature (degrees F). Surveyors use a Bluetooth speaker at full volume to broadcast owl sounds, and use the audio files in the Audubon Field Guide app for Eastern Screech-owl and Barn Owl broadcast.

**Other Species:** Surveyors are asked to record any American Woodcock detections during the survey. American Woodcock are most likely to display near dawn and dusk, but occasionally will display into the night when the moon is bright. MOON is not the ideal survey method for this species, but incidental reports are still useful and given that we lack other targeted surveys for woodcock, we include them here.

## Analysis Methods

The raw counts of individuals detected survey-wide are reported for each species and year. Bayesian occupancy models in the R statistical software 'ubms' package are used to estimate annual survey-wide occupancy probabilities by species. These models account for factors influencing detection probability. Not all species have enough data for these analyses, but reliable survey-wide occupancy estimates are available for Barred Owl, Great Horned Owl, Eastern Screech-owl, and Eastern Whip-poor-will in 2024. For long-term routes (those with five or more years of data), the maximum count of individuals each year is reported for each species and linear trends are estimated. Maximum count is the highest number of individuals of a species detected during a single survey for a given route each year.

## Results

Annual survey-wide raw counts of species are listed in Table 2. Of the 14 MOON routes surveyed in 2024, Barred Owls were detected on 14 routes, Eastern Whip-poor-wills were detected on 10 routes, Great Horned Owls were detected on 9 routes, Eastern Screech-owls were detected on 7 routes, Barn Owls were detected on 4 routes, Common Nighthawks were detected on 2 routes, and Chuck-will's-widows were detected on 1 route (Figure 2). Survey-wide occupancy estimates were highest for Barred Owls (0.72; 95% CrI: 0.59, 0.87) followed by Eastern Screech-owls (0.62; 95% CrI: 0.23, 0.97), though Great Horned Owls (0.51; 95% CrI: 0.22, 0.95) and Eastern Whip-poor-wills (0.53; 95% CrI: 0.43, 0.64) both had estimated survey-wide occupancy probability greater than 50%.

On long-term routes, maximum counts each year indicate that Barred Owls are stable to decreasing (Figure 3), Eastern Whip-poor-wills and Chuck-will's-widows are decreasing (Figure 4), and all other species have unclear trends.

**Table 2: Annual raw count of individuals detected during Iowa MOON surveys by species. The number of routes and surveys (i.e., total visits to routes) are listed for each year, with changes in the number of routes included in the survey indicated by shading of rows. AMWO = American Woodcock, BDOW = Barred Owl, BNOW = Barn Owl, CONI = Common Nighthawk, CWWI = Chuck-will's-widow, EASO = Eastern Screech-owl, EWPW = Eastern Whip-poor-will, GHOW = Great Horned Owl.**

Year	# of Routes	# of Surveys	AMWO	BDOW	BNOW	CONI	CWWI	EASO	EWPW	GHOW
2016	3	6	3	44	1	0	15	3	78	6
2017	3	6	1	60	2	0	5	2	80	3
2018	4	4	0	30	1	1	4	2	83	3
2019	4	7	1	49	1	1	12	3	101	4
2020	4	8	2	69	1	0	21	3	146	6
2021	4	8	4	48	0	0	3	4	53	4
2022	4	7	0	52	1	0	3	3	81	1
2023	4	8	0	48	2	0	2	6	99	0
2024	14	27	2	168	5	2	2	17	181	25

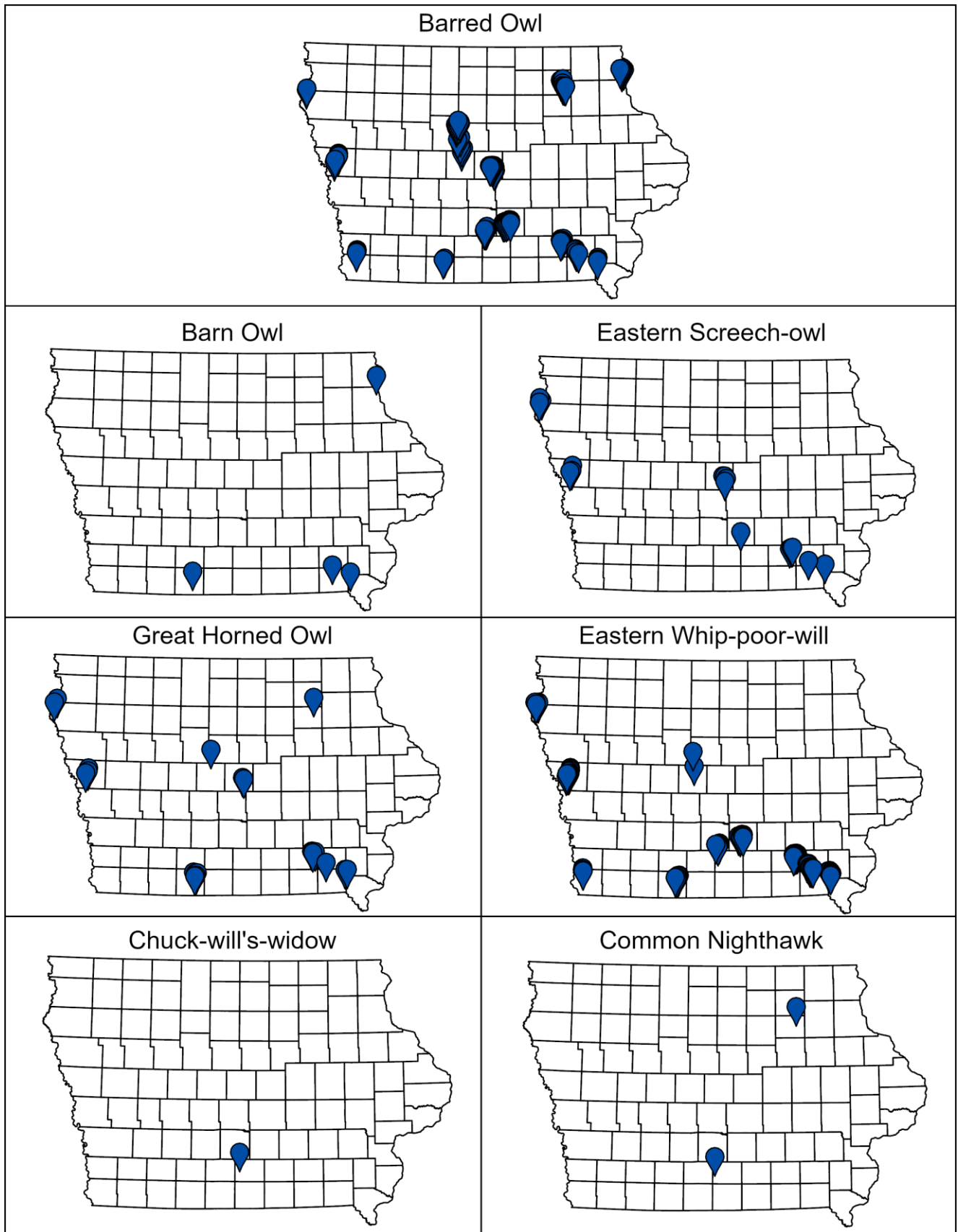
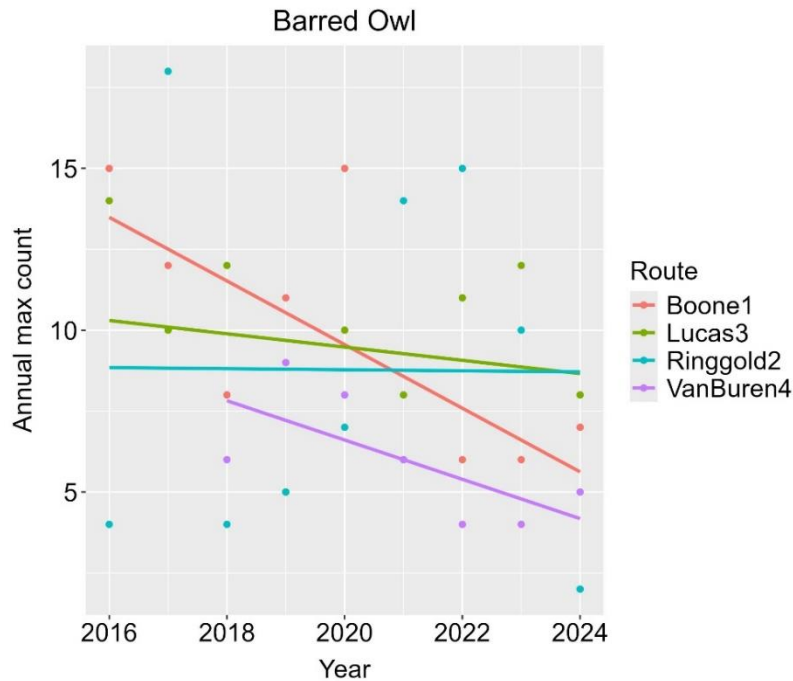
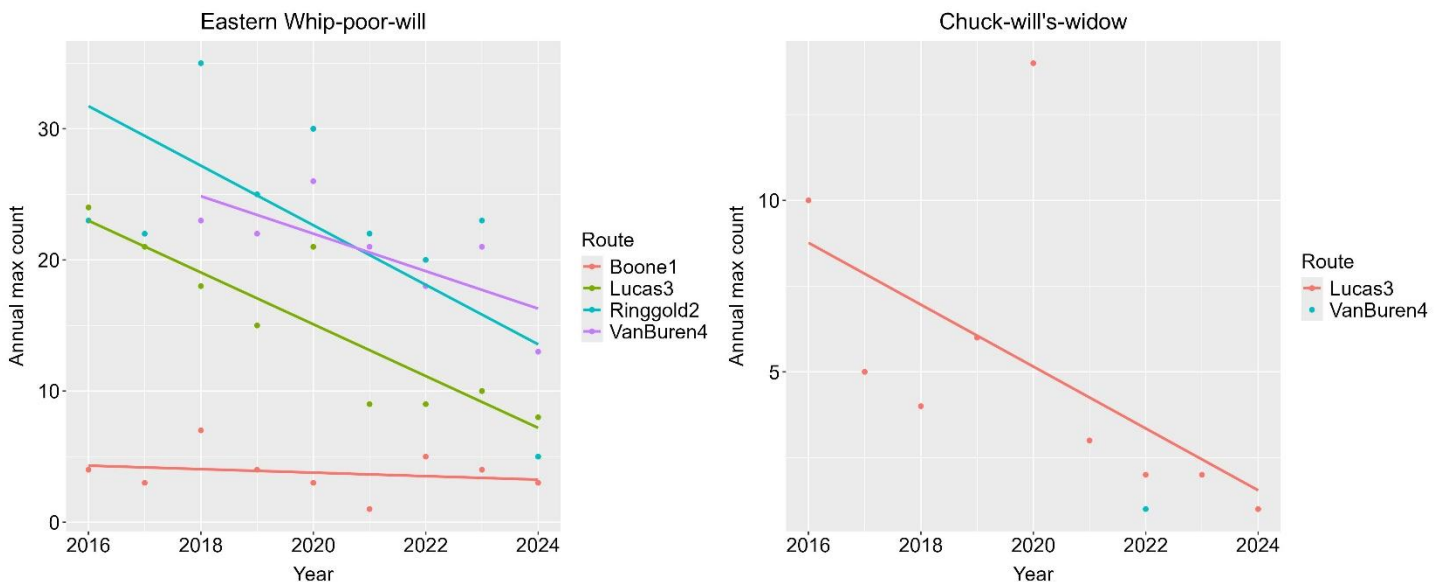


Figure 2: The distribution of survey routes and stops where each species was detected in 2024.



**Figure 3: The maximum count of individual Barred Owls on long-term survey routes each year including trends per route.**



**Figure 4: The maximum count of individual Eastern Whip-poor-wills and Chuck-will's-widows on long-term survey routes each year including trends per route.**

## Discussion

The 10 new routes added in 2024 were the first effort to expand the MOON survey since 2018. By increasing the spatial coverage of MOON in Iowa, we will be able to expand our understanding of owls and nightjars in the state by documenting baseline population indices. Repeated annual surveys will allow us to detect species trends over time for all routes. Our goal is to continue to expand the MOON survey in the coming years so that there is at least one survey route in each of Iowa's 23 BCAs. Although we can only make inferences at the scale of the survey, there are some concerning negative population trends emerging from our long-term routes, particularly with nightjars (Figure 4).

## Management Implications

More years of MOON data and additional data on habitat management are needed to draw specific links between owl and nightjar species occupancy and habitat management in Iowa. However, we have identified four routes where Eastern Whip-poor-wills and Chuck-will's-widows are declining, indicating that these areas may need additional habitat

management to maintain the species at those sites. Managers should consider using forest management strategies such as invasive shrub removal, understory thinning, timber stand improvement, and crop tree release to increase open forest conditions. Open canopy forests are known to support higher levels of Eastern Whip-poor-will foraging than more closed and shrubby forests (Spiller et al. 2022), though some thicker forest nearby is also necessary for nesting and roosting. Managers should favor tree species, like oaks, that support high numbers and abundances of lepidoptera (Narango et al. 2020), the nightjars' primary prey. These nightjar species are declining across their range, and additional research is needed to determine exactly what is causing these population declines, though quality habitat is key to stabilizing populations.

### **Acknowledgements**

We thank all the IA DNR staff and volunteers who helped run survey routes in 2024. Additional thanks go to Tara Beveroth with the Illinois Natural History Survey and Bruce Ehresman, retired Iowa DNR, for their assistance in establishing and expanding the MOON program in Iowa.

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