

A Summary of Winter Raptor Surveys in the Sax-Zim Bog Important Bird Area, St. Louis County

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The Sax-Zim Bog Important Bird Area (Sax-Zim Bog IBA) is a well-known bird watching destination, visited by thousands of bird watchers and nature enthusiasts from Minnesota and beyond every year (Friends of Sax-Zim Bog 2020). Most visitors come in hopes of seeing Great Gray Owl (*Strix nebulosa*) or Northern Hawk Owl (*Surnia ulula*), winter finches such as Pine Grosbeak (*Pinicola enucleator*) and White-winged Crossbill (*Loxia leucoptera*), and resident species like Boreal Chickadee (*Poecile hudsonicus*) and Black-backed Woodpecker (*Picoides arcticus*). The Sax-Zim Bog IBA is located approximately 45 miles northwest of Duluth in St. Louis County and consists of 147,000 acres of diverse habitat types (National Audubon Society 2018). The habitat diversity in this region lends itself to impressive biodiversity year-round, including a number of overwintering northern boreal and tundra breeding bird species.

A survey of wintering birds of prey was established in the Sax-Zim Bog IBA during the winter of 2015–2016. These surveys are completed as part of the Hawk Migration Association of North America's Winter Raptor Survey (HMANA WRS) program. The HMANA WRS program was established in 2007 as a way to survey wintering populations of birds of prey across North America. Under this program, protocols have been established to allow citizen scientists to collect and submit standardized data for future analysis.

Survey Route Description and History

The HMANA WRS route in the Sax-Zim Bog IBA is 93.4 miles in length and was established in 2015 by Friends of Sax-Zim Bog Executive Director Sparky Stensaas. Since the inception of the survey route, I have been the primary observer for every completed survey. The sur-

vey starts along the south end of the Sax-Zim Bog IBA, zig-zagging north and east through open field habitats and agricultural lands, mixed forest, lowland conifer forest, shrub carr, and a variety of roadside habitats across the Sax-Zim Bog IBA. The route was defined based on past observations of overwintering birds of prey, and appropriate wintering habitats visible from the road. It was selected for its efficient coverage of the Sax-Zim Bog IBA. Since its initial definition, the route has remained unchanged (Figure 1).

Survey Methods

Winter raptor surveys in the Sax-Zim Bog IBA are completed by a primary and a secondary observer four times a season, starting in late November and ending in late February or early March. February surveys are sometimes completed during the first week of March, to maintain around 30 days between surveys. In the first year of participation (2015–2016), surveys were completed only in December and January.

Weather data — such as snow depth, ice condition, temperature, wind speed and direction, precipitation, and cloud cover — are collected at the beginning and end of each survey. Surveys are completed by driving along roadways and maintaining low speeds to ensure all raptors present can be observed. When a bird of prey is observed from the survey route, we stop to record a number of data points: identification of species, age and sex (when appropriate or possible), GPS coordinates, behavior notes (perched, flying, hunting, etc.), distance and direction from observation point, and associated habitat. Following the completion of each survey, data is entered on the HMANA WRS website.

As the name suggests, the HMANA WRS's goal is to identify and document only birds

Winter Raptor Survey Observations by species in Sax-Zim Bog IBA 2015–2022

Species Observed	November (n=6)	December (n=7)	January (n=7)	February/March (n=6)	Total birds observed	Total birds/Survey (n= 26)
Bald Eagle	77	22	6	25	130	5.0
Rough-legged Hawk	50	20	2	26	98	3.8
Northern Shrike	17	28	15	17	77	2.9
Northern Goshawk	5	4	0	0	9	0.34
Northern Hawk Owl	3	0	0	0	3	0.12
Northern Harrier	1	0	0	2	3	0.12
Red-tailed Hawk	3	0	0	0	3	0.12
Great Gray Owl	1	1	0	0	2	.07
Snowy Owl	0	1	0	0	1	.04

Table 1. All birds of prey detected and identified on Winter Raptor Surveys in the Sax-Zim Bog IBA from 2015–2022. The total number of surveys per month is noted, as well as the total number of birds observed and birds observed/survey.

Bald Eagle detections breakdown by age in Sax-Zim Bog IBA 2015–2022s

Age	November (n= 6)	December (n=7)	January (n=7)	February/March (n=6)
Hatch Year	5	0	0	1
2nd	0	0	0	1
3rd	2	0	1	1
4th	3	0	0	0
Adult	65	21	5	21
Unknown age	2	1	0	1

Table 2. The table above notes the specific ages of Bald Eagles observed during Winter Raptor Surveys in the Sax-Zim Bog IBA. Determination of age follows plumage characteristics and unknown age birds were birds too distant to be aged properly, but still correctly identified.

Rough-legged Hawk detections by age, sex, and color morph in Sax-Zim Bog IBA 2015–2022

Sex (n=98)	November (n=6)	December (n=7)	January (n=7)	February/March (n=6)
Male	18	4	1	9
Female	12	3	1	10
Unknown	20	13	0	7

Age and Morph	November (n=6)	December (n=7)	January (n=7)	February/March (n=6)
Adult Dark	9	5	0	1
Adult Light	21	4	2	18
Juvenile Dark	2	2	0	1
Juvenile Light	16	8	0	5
Unknown Dark	0	0	0	0
Unknown Light	2	1	0	1

Table 3. The table above is broken down into two sections: Section 1 considers the sex breakdown of observed Rough-legged Hawks. Section 2 considers the breakdown of observed color morphs and ages of detected Rough-legged Hawks. Rough-legged Hawk detection breakdown by age, sex, and morph in Sax-Zim Bog IBA 2015–2022.



An adult Bald Eagle repositions on its perch overlooking a road-killed white-tailed deer, 27 November 2017, Sax-Zim Bog, St. Louis County. Photo by Clinton Dexter-Nienhaus.

of prey, including falcons, caracaras, vultures, eagles, kites, hawks, and owls. Formerly, shrikes were also surveyed. Survey data summarized below will consist of adopted protocol recommendations from older guiding documents. Current data is collected with the 1 November 2019 protocol revision in mind, but for purposes of further study for the Friends of Sax-Zim Bog, data is still collected on Northern Shrikes (*Lanius borealis*) and a survey is completed during the month of November, though each is no longer required by HMANA WRS protocol. A full list of documented species can be found in Table 1.

Weather During Survey Period

Weather plays a significant role in the behavior of birds and the ability of a surveyor to spot birds. Surveys were completed with wind speeds from 0–15 km/h. Cloud conditions during surveys are variable, from entirely overcast skies to clear skies. Surveys are rescheduled if too much snow is falling at the start of the survey. Visibility measurements were not taken during surveys. During surveys, February/March had the deepest snowpack on average (52.1 cm), while January was the coldest month on

average with the average low temperatures of -12.8°C and average high temperatures of -9.3°C during surveys (Figure 2). The coldest survey started at -32°C (January 2019) and the warmest survey temperature recorded was 3°C (November 2016, March 2018, and November 2018). Snow pack ranged from 0 to 91.4 cm and varied greatly by month and year. November had on average 9.3 cm of snow, December averaged 26.4 cm, January 42.9 cm, and February/March averaged 52.1 cm of snow on the ground during surveys (Figure 3).

Survey Results

To date, twenty-six surveys have been completed in the Sax-Zim Bog IBA, documenting 326 individual birds of prey. Five species of diurnal raptor, three species of owl, and one shrike species have been documented during the surveys. Of the birds counted, 93.5% of observations have consisted of three species: Bald Eagle (*Haliaeetus leucocephalus*), Rough-legged Hawk (*Buteo lagopus*), and Northern Shrike. Of the remaining species, Northern Goshawk (*Accipiter gentilis*) has been observed on six surveys, Snowy Owl (*Bubo scandiacus*) and Red-tailed Hawk (*Buteo jamaicensis*) have

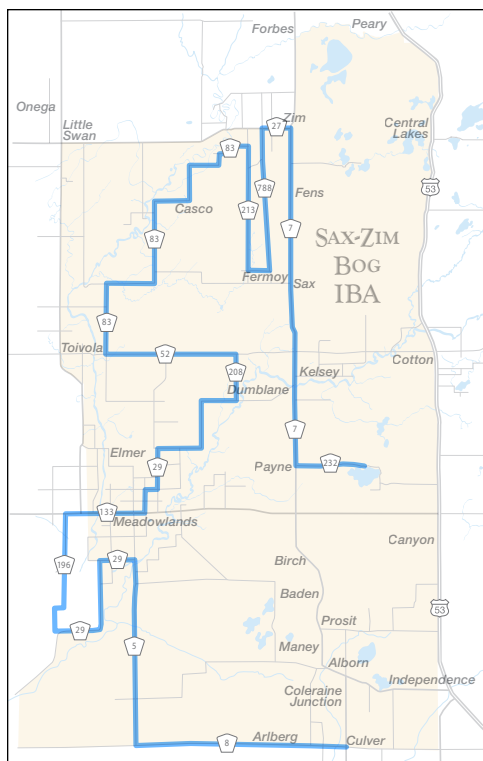


Figure 1. The HMANA WRS route is shown by the blue line within the Sax-Zim Bog IBA. The route starts at Culver and ends at the public boat launch on Lake Nichols east of Payne.

been documented once, while Northern Harrier (*Circus hudsonius*), Great Gray Owl (*Strix nebulosa*), and Northern Hawk Owl (*Surnia uhula*) have each been observed on fewer than five surveys (Table 1).

The following data analysis considers only data collected on Bald Eagles, Rough-legged Hawks, and Northern Shrikes, as these species have been detected with enough frequency to offer adequate data for analysis and interpretation.

Bald Eagles are the most numerous raptor observed during winter raptor surveys in the Sax-Zim Bog IBA, with 130 individuals documented for an average of 5 eagles/survey (Table 1). Unlike shrikes, Bald Eagles can be readily aged in the field. An overwhelming majority (86.2%) of Bald Eagles observed on winter raptor surveys are adult birds. Only 14 sub-adult Bald Eagles have been detected during winter

raptor surveys in the Sax-Zim Bog IBA (Table 2). At least two birds detected during January surveys constituted adult birds at a nest site (Figure 4).

Rough-legged Hawks are the second most numerous raptor observed during winter raptor surveys in the Sax-Zim Bog IBA, with 98 individuals documented for an average of 3.77 hawks/survey. These Holarctic raptors have two color morphs, and adults can be reliably aged and sexed in the field, offering opportunities for increased data analysis. Peak numbers of this species occur in November (Figure 5). Of all the Rough-legged Hawks detected during the surveys, only four were not seen well enough to be aged and sexed (Table 3), though color morph was determined for each. Approximately 20% were dark morph birds. Adults made up 61% of the Rough-legged Hawks observed, with 35% aged as non-adult, and the remaining 4% unaged. Males made up 32.6% of observations, with females making up 26.5% of observations. Unknown sex Rough-legged Hawks account for the remaining 40.8% of observations. This correlates closely to the percent of juvenile birds observed (38.7%). Most hatch-year, second-year, and some dark morph Rough-legged Hawks cannot be reliably sexed in the field, so it makes sense there would be a high number of unsexed birds reported (Liguori 2011).

Northern Shrikes are the most frequently detected bird of prey during December and January surveys, but only the third most numerous bird of prey documented (Figure 6). An average of 2.96 shrikes/survey are detected, but a total of 28 shrikes have been documented on December surveys, with 15 individuals documented on January surveys. These totals outnumber Bald Eagle (Figure 4) and Rough-legged Hawk (Figure 5) detections during the same months. Northern Shrikes are difficult to age and impossible to sex in the field, so most shrikes documented on surveys in the Sax-Zim Bog IBA are reported as unknown age and sex.

Discussion

Before final discussion, it is important to note that the winter raptor survey period in the Sax-Zim Bog IBA is completed during the late fall period and very early spring period of raptor migration in Northern Minnesota. Typically, raptor migration is not complete through St. Louis County until early-mid December and

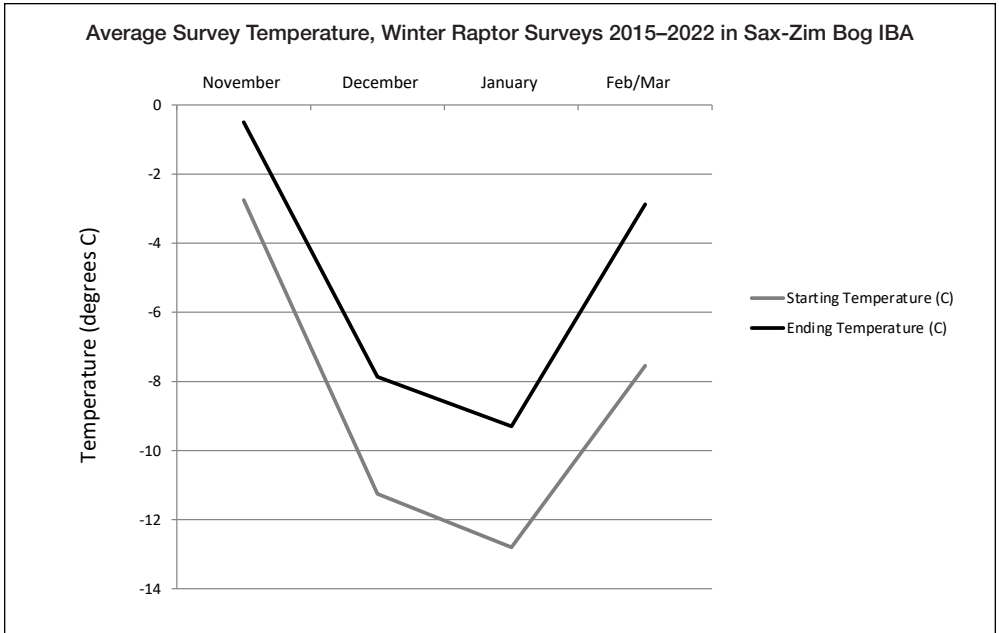


Figure 2. Average temperatures (degrees Celsius) at the start and end of each survey are recorded and noted in the figure above. The pale line notes temperature at the start of surveys and the dark line notes the temperature at the end of surveys.

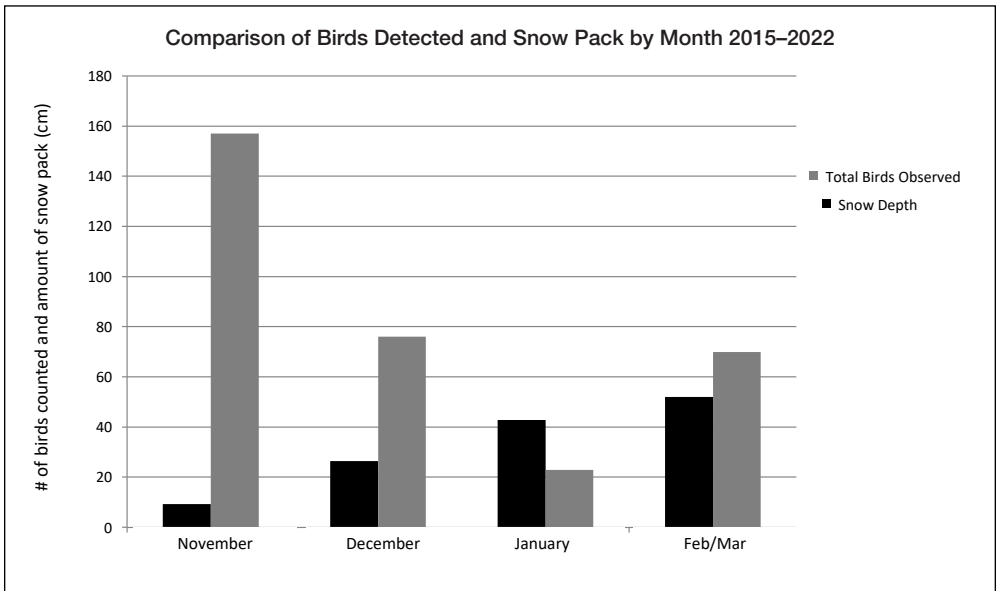


Figure 3. The total number of birds counted is displayed in relationship to the estimated snow pack (cm). Total birds observed is noted by the dark gray bars, while snow depth is noted by the black bars.

starts again in late February and early March. This observation of migration period can be confirmed by looking at Hawk Ridge Bird Observatory's hawk watch data collected from Duluth. The fall hawk count typically ends on 30 November, but has continued to document migration into December (2009, 2011, 2013), as conditions allow (Hawk Ridge Bird Observatory 2022). In the spring, the count usually begins 1 March, but has been completed in late-February documenting early eagle migration (Hawk Ridge Bird Observatory 2021).

Considering the above, birds detected during the late-November survey period may consist of migrants using the Sax-Zim Bog IBA as stop-over habitat and those birds may or may not overwinter in the area. Birds detected during December and late February/early March survey periods may consist of migrants, but likely also include overwintering individuals. January surveys would then be expected to include only overwintering individuals. These hypotheses can be supported by the following observations during HMANA WRS data collection in the Sax-Zim Bog IBA.

Northern Harriers very rarely overwinter in northeastern Minnesota, with only 18 winter records in the MOU database (Minnesota Ornithologists' Union 2022). All but three of the winter records come from early December, likely indicating late migrants as opposed to overwintering individuals. On winter raptor surveys in the Sax-Zim Bog, this species has been observed in both November and late February/March surveys, indicating migrants and not overwintering birds. Similarly, Red-tailed Hawk, another uncommon to rare overwintering species in the Sax-Zim Bog IBA, has been observed only during one November survey. The time period of this observation, with no following observations, would seem to indicate migrating individuals using Sax-Zim Bog IBA as stop-over habitat (Table 1).

The strong periodicity in observations of Bald Eagles and Rough-legged Hawks documented on surveys also supports the above hypotheses. The bulk of Rough-legged Hawk (77.5%) and Bald Eagle (78.1%) observations occur in November or February/March showing that, although high numbers of these raptors are seen during November and late February/early March surveys, many of these birds shouldn't be considered as truly overwintering individuals.

Weather has an impact on which species and how many individuals overwinter in the Sax-Zim Bog IBA (Figure 3). As snow pack increases, the number of birds observed decreases. Deep snow makes hunting difficult for visual hunters or scavenging species (like Rough-legged Hawks and Bald Eagles). However, Northern Shrike numbers maintain fairly consistent levels over the same conditions. To understand this disparity, it is important to consider the life history of each species.

Bald Eagles are adept scavengers, but with scarce patches of open water in the Sax-Zim Bog IBA and snow pack reaching depths of over 1 m during some winters, feeding opportunities are limited. Even so, Bald Eagles are detected regularly during January, indicating enough foraging opportunities to allow a few individual birds to remain in the area. Open water is sometimes present along the St. Louis River during winters in the Sax-Zim Bog IBA, but road-killed (by train or vehicle) or predator-killed mammals are available in the region most winters and Bald Eagles are often seen in small number at those carcasses.

Rough-legged Hawks are well-adapted to winter weather conditions, but foraging success can be limited by snow depth. Voles (especially Meadow Vole) constitute an important food source for Rough-legged Hawks on their wintering grounds (Schnell 2009 and Britt 1967). These small mammals spend much of their time below the snow pack, making them difficult to capture for visual predators like Rough-legged Hawks. Watson (1984) notes that with snow depths of greater than 12 cm, Rough-legged Hawks wintering in Idaho attempted fewer small mammal predations and relied more heavily on carrion when compared to predation attempts with snow depths of 10 cm or less. Schnell (1967) noted that there were significant behavior changes in Rough-legged Hawks with snow depths over five inches, as more birds were found along roadsides than foraging away from roads. Britt (2009) also noted southbound movements from Rough-legged Hawks in response to increased snow depth in the eastern United States. It appears that snow depth may play a role in the number of Rough-legged Hawks wintering in the Sax-Zim Bog IBA during Winter Raptor Surveys.

While Bald Eagles and Rough-legged Hawks might have overwintering capacity lim-

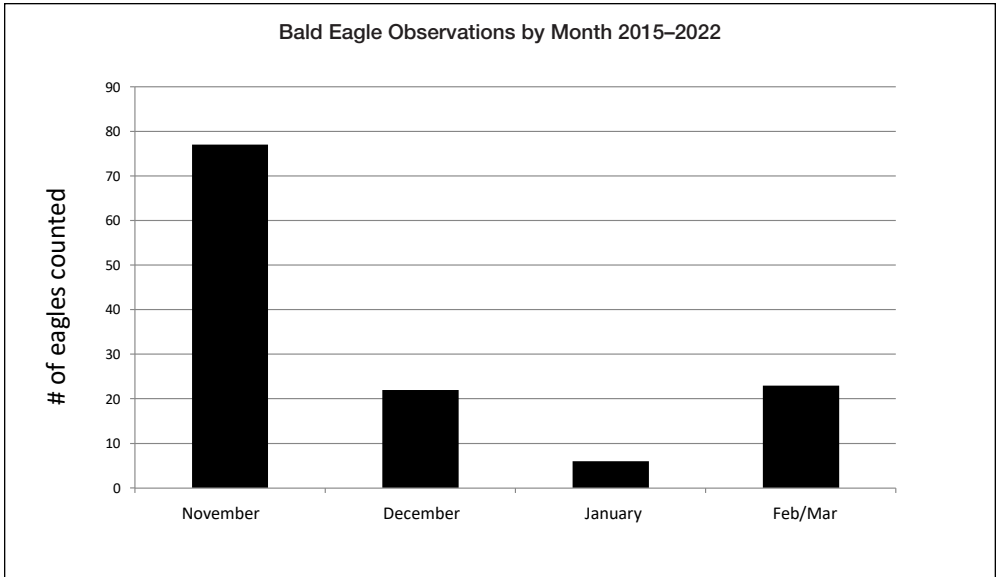


Figure 4. The total number of Bald Eagles documented on Winter Raptor Surveys in the Sax-Zim Bog IBA by month.

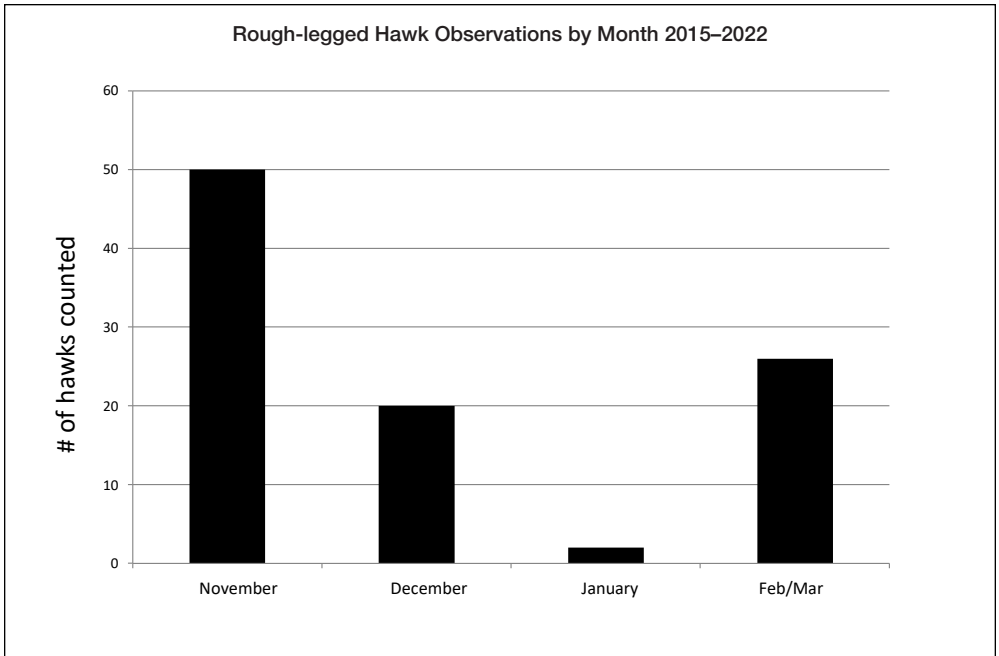


Figure 5. The total number of Rough-legged Hawks documented on Winter Raptor Surveys in the Sax-Zim Bog IBA by month.

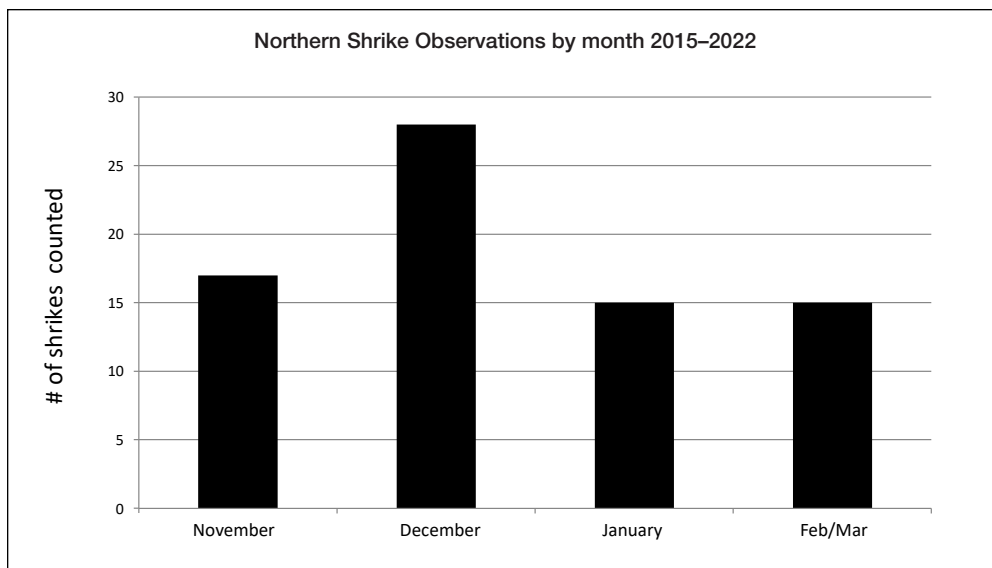


Figure 6. The total number of Northern Shrikes documented on Winter Raptor Surveys in the Sax-Zim Bog IBA by month.

ited by snow depth and foraging opportunities, Northern Shrikes are much better adapted to overwinter in the Sax-Zim Bog IBA. Birds and small mammals make up this visual predator’s winter diet, giving them a greater variety of prey options than Bald Eagles and Rough-legged Hawks. Not only this, but Northern Shrikes will cache prey on wintering territories (Paruk et al. 2020). If snow depth impedes their predation attempts on small mammals, Northern Shrikes can access caches, hunt birds, or even scavenge carcasses.

Though wintering raptors, outside of resident species, may not be overly abundant in the Sax-Zim Bog IBA, Winter Raptor Surveys done so far have shed some light on the stop-over value of this region. While truly overwintering birds of prey may become scarce as winter rolls on, the number of birds of prey using this region during migration is not insignificant. It is my hope that this summary is the first of many on the winter raptor surveys conducted in the Sax-Zim Bog IBA and gives a picture of wintering raptors in greater Northeastern Minnesota.

I would encourage anyone interested in birds of prey or furthering their citizen science pursuits to consider participating in winter raptor surveys. As of this publication, only two other HMANA WRS routes (Nicollet and Blue

Earth counties) are established in Minnesota. In my opinion, the tallgrass aspen parkland and prairie biomes of western Minnesota offer great opportunities for understanding wintering raptors, especially Red-tailed Hawks, in Minnesota and should be considered for future surveys. The prairies and agricultural lands of western Minnesota are under-birded during the winter, compared to more populated areas of Minnesota. However, this area does see a number of interesting Red-tailed Hawk subspecies in migration, including Harlan’s (*B. j. harlani*), Krider’s (*B. j. krideri*), Northern (*B. j. abieticola*), and rarely Western (*B. j. calarus*), all alongside resident and migrant Eastern Red-tailed Hawks (*B. j. borealis*). How many of those migrants stick around during the winter? What other raptors might consider the prairies and agricultural fields of western Minnesota as wintering grounds? A couple of questions that you, dear reader, might be able to help answer!

For further information on the HMANA WRS program, check out HMANA’s website: <https://www.hmana.org/winter-raptor-survey/>. For more information about the Sax-Zim Bog IBA, or the Friends of Sax-Zim Bog check out the following websites: <https://saxzim.org/> and <https://www.audubon.org/important-bird-areas/sax-zim-bog-iba>.



An adult light-morph Rough-legged Hawk overlooking a grassy meadow adjacent to shrub carr habitats along the roadside in the Sax-Zim Bog, 7 November 2019, Sax-Zim Bog, St. Louis County. Photo by Clinton Dexter-Nienhaus.

Acknowledgments

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