DRAFT Recovery Strategy for the Short-eared Owl (*Asio flammeus*) in Ontario

2024

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Declaration

The recovery strategy for the Short-eared Owl (*Asio flammeus*) was developed in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The recommended goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy.

Responsible jurisdictions

Ontario Ministry of Natural Resources
Ministry of the Environment, Conservation and Parks
Environment and Climate Change Canada – Canadian Wildlife Service, Ontario
Parks Canada Agency

Executive summary

Short-eared Owls (*Asio flammeus*) are one of the most widely distributed owls in the world and can be found on every continent except Australia and Antarctica. Within Canada, these owls can be found breeding in all provinces and territories, with the core breeding range located in the tundra, the prairies, northern Quebec and Ontario. In Ontario, the majority of Short-eared Owls breed in the Hudson Bay Lowlands, with smaller numbers of birds breeding in more southern parts of Ontario, primarily in remnant habitat around Kingston, the lower Ottawa River, the Niagara Peninsula, and Sault Ste. Marie. It is believed that most Short-eared Owls that breed in Ontario winter in the United States, however a number of birds do overwinter in Ontario, predominantly in the Carolinian zone and the Kingston region of the province.

Canada's population has declined up to 70 percent between 1970 and 2019, with an overall decline of 30 percent or greater over the past three generations. It is estimated that the Ontario population of approximately 4,200 to 5,200 mature individuals will continue to decline by greater than 20 percent over the next two generations (2.56 - 4.66 % / year over 8 years). The Short-eared Owl is listed as threatened on the Species at Risk in Ontario (SARO) List.

Short-eared Owls are nomadic birds, often moving large distances and settling in areas with high prey densities. The appearance and then disappearance from regions makes it difficult to gather key information on the species' ecology, population trends and threats. The cause of decline in Short-eared Owl populations remains unclear, however loss and degradation of habitat on their breeding and wintering grounds, and potentially along their migration routes, is believed to be the primary factor. Owls in Ontario are faced with numerous threats, such as loss of native habitat, climate change and severe weather, agricultural intensification, habitat fragmentation, increased predation, collisions with anthropogenic structures and human disturbance. The extent of many of these threats to the Ontario population of Short-eared Owls currently remains unknown and needs further investigation.

The recommended long-term recovery goal is to achieve and maintain a stable and self-sustaining Short-eared Owl population within Ontario by 2045 (20 years, and 5 generations). The recommended short-term recovery goal is to reduce or halt the annual rate of decline by 2035 (10 years, 2 - 3 generations).

The recommended protection and recovery objectives for Short-eared Owl are:

1. Address knowledge gaps related to population size, distribution, seasonal and annual movements, habitat requirements, threats and life history strategies that may assist with Short-eared Owl recovery efforts.

2. Reduce and mitigate threats to Short-eared Owl through habitat protection, stewardship, management, education and communication.

3. Monitor Short-eared Owl recovery efforts to track efficacy and adjust actions if needed.

Short-eared Owls rely on a variety of habitats for their survival. The recommended area for consideration in developing a habitat regulation for Short-eared Owl should include important habitat for both breeding and over-wintering owls. It is recommended that regulated habitat be based on a recently occupied nest or winter roost site and should include the nest or roost, a buffer around the site along with any functional foraging habitat within one kilometre. Occupied areas can be defined based on either a documented nest or roost site or a confirmed breeding observation (seen or heard) within the last four years. A 200 m buffer around the nest or roost site is recommended to preserve features such as concealment, protection from the elements and protection from disturbance as well as to ensure safe dispersal of young flightless birds. Foraging habitat should include any open areas such as grasslands, hayfields, pastures, agricultural land, wetlands, or tundra within one kilometre of a nest or roost site. A distance of one kilometre would provide for a home range of 315 ha, depending on availability of open foraging habitat. Home range size has been documented to vary between 15 ha and 1256 ha, with mean home range documented between 64 ha and 218 ha. Including foraging habitat within one kilometre would support observed variation in home range size and account for fluctuations in prey availability. Habitat should be protected for four years after the last record of use. Four years is based on the current estimated generation length (average age of parents in the population) used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

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1.0 Background information

1.1 Species assessment and classification

The following list provides assessment and classification information for the Short-eared Owl (*Asio flammeus*). Note: The glossary provides definitions for abbreviations and technical terms in this document.

- SARO List Classification: Threatened
- SARO List History: Threatened (2023), Special Concern (2004)
- COSEWIC Assessment History: Threatened (2021), Special Concern (2008), Special Concern (1994)
- SARA Schedule 1: Special Concern (2012)
- Conservation Status Rankings: G-rank: G5; N-rank: N4B, N3N, N4M; S-rank: S4?B, S2S3N

1.2 Species description and biology

Species description

Short-eared Owls (*Asio flammeus*) are medium sized owls, measuring approximately 34 to 42 cm in length, with females being slightly larger than males (378 g versus 315 g). Adults have a mottled brown plumage with a buffy chest and brown streaks that provide camouflage. The wings are broad and the tail is short. These owls have rounded heads and ear tufts that are so short that they are often difficult to see. Their yellow eyes are framed by black feathers on a pale facial disk. Juveniles can be distinguished from adults by the lack of facial pattern seen in adults, their more often brown rather than yellow iris, and more dusky plumage on their head and upperparts (Pyle 1997). Short-eared Owls are often seen hunting by day, flying low over open grassland and fields. Their flight pattern is distinctive and can often be described as agile, buoyant and mothlike (Wiggins et al. 2020). The Short-eared Owl is morphologically similar to the Long-eared Owl (*Asio otus*), although it is larger overall. Long-eared Owls have more prominent ear tufts and a cinnamon-coloured facial disc. The birds are often separated by their activity period throughout the daily 24 - hour cycle, with Long-eared Owls being nocturnal and Short-eared Owls being crepuscular (Wiggins et al. 2020).

Figure 1. Short-eared Owl (*Asio flammeus*) perched and in flight. Photos by Rick Leche and Smudge 9000.

Globally, there are 10 recognized subspecies of Short-eared Owl. The only subspecies regularly occurring in Canada is *Asio flammeus*, which also occurs across North America, Europe, North Africa and North Asia (Wiggins et al. 2020).

Species biology

Life Cycle and Reproduction

Little data exists on Short-eared Owl life expectancy, with only 54 banding recoveries over the past century in North America. The oldest recorded Short-eared Owl in North America was at least 4 years and 2 months when it was shot in 1970 (COSEWIC 2021). This is believed to be an underestimate of life expectancy as the oldest recorded Short-eared Owl in Europe was 12 years and 9 months (Wiggins et al. 2020).

Generation length (average age of parents in the population) has been estimated by BirdLife International to be four years. This is based on estimated survival rate, age at first breeding, and maximum lifespan (Bird et al. 2020). While shorter estimates (2 years) for generation length have been used in the past, four years is the current estimate used by COSEWIC (COSEWIC 2021). Birdlife International has estimated generation length of seven other owl species in the genus *Asio,* that range from 4.0 to 6.6 years. Four years for Short-eared Owl is therefore believed to be a conservative estimate.

Short-eared Owls reach maturity at one year of age (Wiggins et al. 2020). Male courtship displays begin during the late winter and continue into the nesting stage. Pairs may begin to form in early February, laying eggs in April and May, although egg laying can commence as early as late March in southern regions, and as late as June or July in the Arctic (Wiggins et al. 2020). In Ontario, known egg dates are not well documented, however, some have been recorded between April 14 and August 1 (James 1991). Nests are constructed by the female and are a simple scrape in the ground lined by grasses and occasionally feathers (Mikkola 1983, Wiggins et al. 2020). Nests are often concealed by adjacent vegetation and built on a small knoll or elevated site (Holt and Leasure 1993).

Clutch size in North America is highly variable, ranging from 3 to 11 eggs, with a mean of 6.9 eggs. On average, larger clutches are found further north. Additionally, clutch size is known to be positively correlated with local prey abundance (Clark 1975, Holt and Leasure 1993). Eggs are incubated for approximately four weeks and hatch asynchronously in the order they were laid (Clark 1975, Wiggins et al. 2020). In North America, Short-eared Owls are known to only lay a single brood, however, if the first nesting attempt fails, they may lay a replacement brood. Nestlings leave the nest before they can fly, at 12 to 18 days, and eventually fledge (learn to fly) at 27 to 36 days. Dispersal distances of young flightless birds have been reported up to and around 200 m from the nest (Clark 1975, Arroyo and Bretagnolle 1999, Wiggins et al. 2020, Price and Wang 2023). It is not well known how long the adults feed and protect the pre-fledged dispersers and fledglings (Wiggins et al. 2020). A recent study in Iceland found 16 of 18 female Short-eared Owls left their chicks before they were independent, leaving the males to feed the owlets until they were self-sufficient (Calladine et al. 2024).

Nesting success can vary significantly depending on prey availability, predation pressure and environmental conditions (COSEWIC 2021). A study in southern Manitoba (Clark 1975) reported 86 percent hatching success and 46 percent fledging success. In Montana, a study reported 74 percent hatching success and 91 percent fledging success. However, other studies have shown hatching success of less than 50 percent

(Holt and Leasure 1993). Fondell and Ball (2004) found reproductive success to vary significantly between grazed (10 %) and ungrazed (60 %) grasslands in Montana. Research needs to be conducted to identify average nesting success rate for Short-eared Owls in various regions and habitats in Ontario.

Diet and Foraging Behaviour

Studies from across North America show that Short-eared Owls primarily feed on small mammals. Their diet varies little by region, season, sex, or age of individuals. Voles (*Microtus spp.)* are known to comprise the bulk of their diet and are considered particularly important to Short-eared Owls, with birds moving in response to vole densities. The most common mammal prey in addition to voles include shrews, lemmings, mice, moles, rats and pocket gophers, along with the occasional rabbit, weasel and muskrat. Along coastal areas, owls are known to prey on adult and nestling seabirds and shorebirds (Wiggins et al. 2020). While being largely crepuscular, Short-eared Owls are known to hunt both by day and night. Erkinaro (1973), found Short-eared Owl activity to coincide with periods of prey activity. The owls hunt primarily on the wing, hovering 2 to 30 m above ground, or less commonly from perches on poles or hills (Clark 1975).

Migration and Dispersal

The migratory behaviour of Short-eared Owls is poorly understood. Limited band recovery data has shown that some birds travel long distances, while other birds remain in one region year-round (Clark 1975, Gahbauer et al. 2021, Calladine et al. 2024). Birds breeding in Canada's north are known to be highly migratory, while those breeding in more southern parts of Ontario are more likely to be resident. A recent telemetry study documented long-distance fall migration in individuals from Alaska travelling between 3,205 and 6,886 km (Johnson et al. 2017). These individuals dispersed over a wide range and showed low site fidelity when returning to the north to breed. Short-eared Owls are believed to select their breeding sites annually in response to asynchronous fluctuations in prey population (Korpimäki and Norrdahl 1991). While Short-eared Owls are considered nomadic, with individuals wandering over large distances to settle in areas with high prey densities, there appears to be a divide in North America between western and eastern populations (Figure 2), with little east-west exchange within Canada (Johnson et al. 2017, Gahbauer et al. 2021). The owls tracked from Alaska ranged widely, but they all remained in the west, whereas owls tracked in a telemetry study in New York were found to remain east of the upper Great Lakes as they migrated between their wintering and breeding grounds (Johnson et al. 2017).

The migratory routes and wintering grounds of Short-eared Owls breeding in Ontario are not known. In southern Ontario, Short-eared Owls are present during summer and winter, but it is not clear whether the birds that breed in this region overwinter or if they move south and are replaced by birds from the north. It is currently unknown where individuals breeding in Ontario's far north tend to overwinter.

Telemetry studies have identified migration stopover locations for Short-eared Owls where individuals cluster together for extended periods of time. This may indicate the importance of select locations for resting and foraging, which are essential considering the energetic demands of migration. In the east, such locations have been observed along the shorelines of Lake Erie and Lake Ontario, along with areas in central Quebec (Gahbauer et al. 2021).

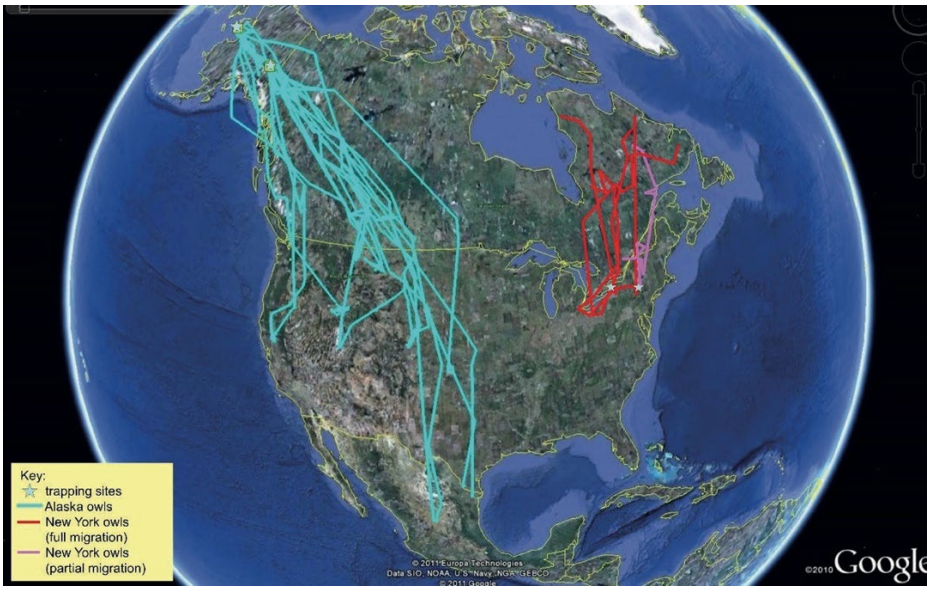

Figure 2. Satellite telemetry tracks of Short-eared Owls (*Asio flammeus*) from wintering grounds in New York, compared with satellite telemetry tracks of Short-eared Owls from breeding grounds in Alaska, from Gahbauer et al. (2021).

Predation

Short-eared Owls nest on the ground in open areas, putting them at high risk of predation from mammals such as fox and skunk, along with larger birds such as crows, gulls, hawks and other owls (Mikkola 1976, Holt 1992). The most significant impact of predation is believed to be on eggs and nestlings, although recently dispersed young which have yet to fledge remain highly vulnerable. (Holt 1992, Wiggins et al. 2020).

1.3 Distribution, abundance and population trends

Distribution

Short-eared Owls are one of the most widely distributed owls in the world, occurring on every continent except Australia and Antarctica. The owl ranges across most of North America and Eurasia, parts of South America, North Africa, and various oceanic islands (COSEWIC 2021). Within Canada, these owls can be found breeding in all provinces and territories, with the core breeding range located in the tundra, the prairies, northern Quebec and Ontario (Figure 3). Short-eared Owls are uncommon in the breeding range where nesting habitat is limited, such as the boreal forest and the Rocky Mountains, as

the owls prefer to breed in tundra and open grasslands (COSEWIC 2021). The North American winter range of Short-eared Owls extends across the lower 48 United States and northern Mexico, with some birds spending the winter in southern British Columbia, the prairie provinces, Ontario, Quebec and Nova Scotia (COSEWIC 2021).

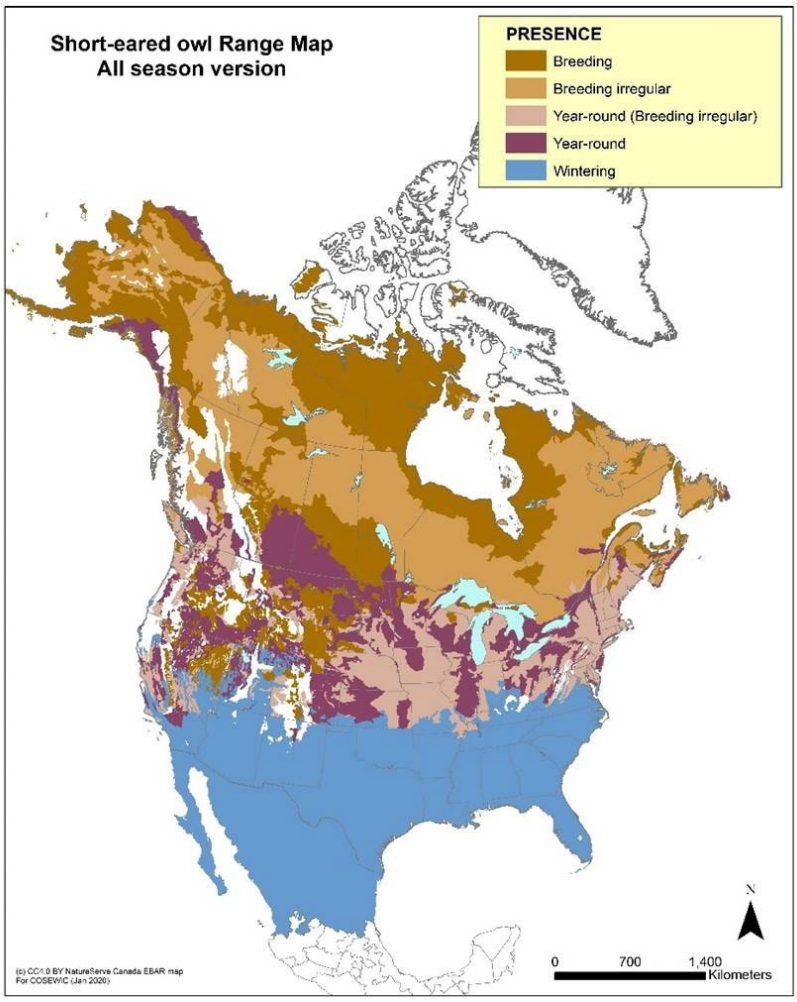

Figure 3. Breeding, wintering, and year-round distribution of Short-eared Owl in North America (COSEWIC 2021).

Ontario Breeding Distribution

In Ontario, Short-eared Owls are broadly distributed across the province during the breeding season, however until recently their occurrences have been rarely documented (Figure 4). The majority of Short-eared Owls breeding in the province appear to be in the Hudson Bay Lowlands, where the probability of observation during Ontario's second Breeding Bird Atlas (2001 - 2005) was seven times greater than the average for the rest of Ontario (Gahbauer 2007). Deployment of autonomous recording units by Canadian Wildlife Services (CWS), across the Hudson Bay and James Bay Lowlands during the third Breeding Bird Atlas (2021, 2022 and 2023) found occurrences of breeding owls to be detected regularly with appropriate survey effort. Surveys were

conducted using recording units in vast areas much further inland from the Hudson Bay Coast than previously conducted, generating Short-eared Owl occurrence records in areas with no previously known occurrence data. These findings suggest that with correct timing, method and location of surveys, the population may be distributed more extensively than previously documented. In the more southern parts of Ontario, the species primarily breeds in remnant habitat around Kingston, the lower Ottawa River, the Niagara Peninsula and Sault Ste. Marie. Observations of breeding within the boreal forest region are rare, other than in grassland habitat near Rainy River (Gahbauer 2007). Short-eared Owls are known to have low breeding site fidelity, moving where the prey is abundant. Clark (1975) however found there to be a select few sites in North America where the owls are known to breed regularly. Amherst Island, Ontario appears to be one of those rare locations, with anywhere between 2 to 10 pairs of owls breeding in the same 6 to 7 breeding areas for the last 50 years (K. Hennige, pers. comm. 2004). The regular breeding population on Amherst Island indicates the importance of select habitat on the island.

Ontario Winter Distribution

It is believed that most Short-eared Owls that breed in Ontario winter in the United States, however a number of birds do overwinter in Ontario. Wintering distribution and abundance varies annually in relation to prey abundance and weather. Owls are often found in small groups, roosting communally in relatively stable roost sites (Holt and Leasure 1993, Johnson et al. 2017). They are often found occupying the same areas and roost sites over consecutive years, although further investigation is needed to determine whether these sites are occupied by the same individuals (Clark 1975). While some birds appear to winter as far north as Thunder Bay, the Ontario winter range is predominantly in the Carolinian zone and the Kingston region of Ontario (Figure 4). Areas such as Amherst Island, Wolfe Island, Long Point and Haldimand County are of particular importance to the owls. The Kingston Field Naturalists have recorded Short-eared Owls wintering consistently on Amherst and Wolfe Island for at least 70 years, with a population of 50 to 100 wintering birds on Amherst Island (K. Hennige, pers. comm. 2024). Most known roosting sites on the island are occupied every winter, suggesting the sites play an important role for winter survival. In years of high numbers of owls successfully over-wintering, an increase in the number of pairs nesting on the island has been observed (K. Hennige, pers. comm. 2024).

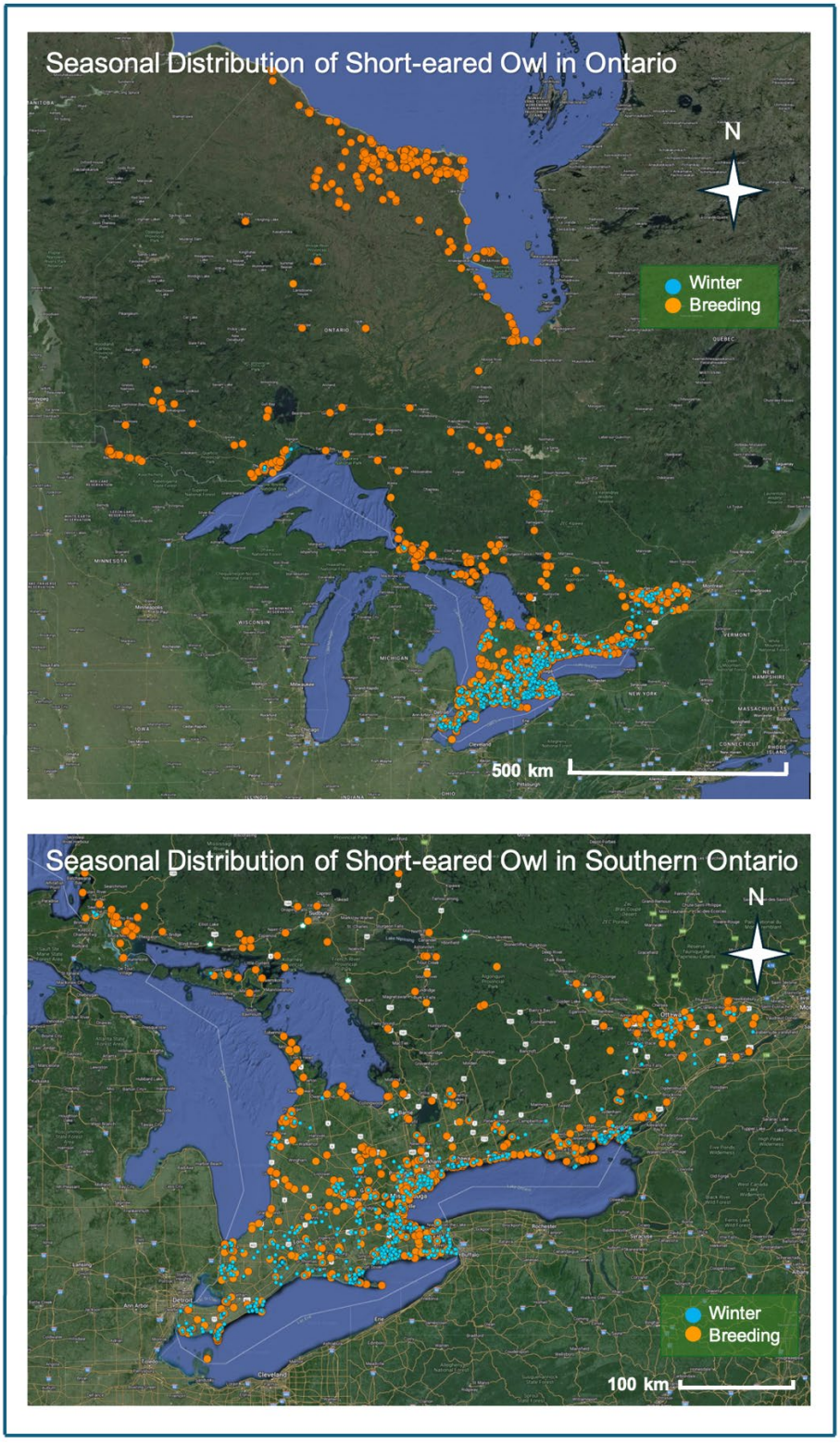

Figure 4. Distribution of Short-eared Owl occurrences in Ontario during winter and breeding seasons (1909 - 2023), based on data compiled from NHIC (2023) and CWS (2023).

Historical Distribution

Historically in Ontario, Short-eared Owl was limited to the Hudson Bay Lowlands in the north, natural prairies in the south and large wetlands and regenerating forest fire sites throughout the province (Austen et al. 1994). It is believed that the clearing of forest for agriculture in the late 19th and early 20th century greatly increased availability of open habitat for Short-eared Owl in southern Ontario. While Nash (1913) suggested the species was the most abundant owl in southern Ontario as a result of land clearing in the early 1900s, by the 1980s, the province's first Breeding Bird Atlas (1981 - 1985) only showed scattered occurrences throughout southern Ontario (Cadman et al. 1987, Austen et al. 1994).

Targeted searches in 2004, using core areas identified from the first bird atlas, found a further decline in numbers of birds (Hunt and Gahbauer 2004). In addition, the second Breeding Bird Atlas (2001 - 2005) found the probability of observation to have declined in all regions of southern Ontario. In the Hudson Bay Lowlands, where survey effort was much higher than in the first atlas, probability of observation increased significantly. This increase however coincided with a peak in small mammal abundance in 2003 (Gahbauer 2007). Whether the increase in observations was due to increased survey effort or an increase in small mammals is unclear. Because the species regularly moves across the landscape in response to prey cycles, monitoring the presence or absence of owls at a local scale, over a short-time period, may provide little information about the population (Korpimäki and Norrdahl 1991). Short-eared Owl distribution should be assessed over time and at a landscape scale, to take into account naturally occurring annual variation in abundance at local scales due to their nomadic nature.

No assessment of the Ontario population has been conducted since 2005, however the third Ontario Breeding Bird Atlas (2021 - 2025) is ongoing and should be of value in understanding the current distribution of Short-eared Owls in the province along with assessing population trends. In recent years, with the growing interest in citizen science, there has been a significant increase in reporting of Short-eared Owls in the province. Forty-eight percent of all owl observations documented by the Natural Heritage Information Centre (NHIC) were from the last 10 years. While the population of Short-eared Owls is known to be declining in Ontario, recent observations (2000 - 2023), gathered predominantly through eBird and the Breeding Bird Atlas, indicate that

381 the breeding and winter range of Short-eared Owls continues to occur where it has
382 been historically recorded (Figure 5).

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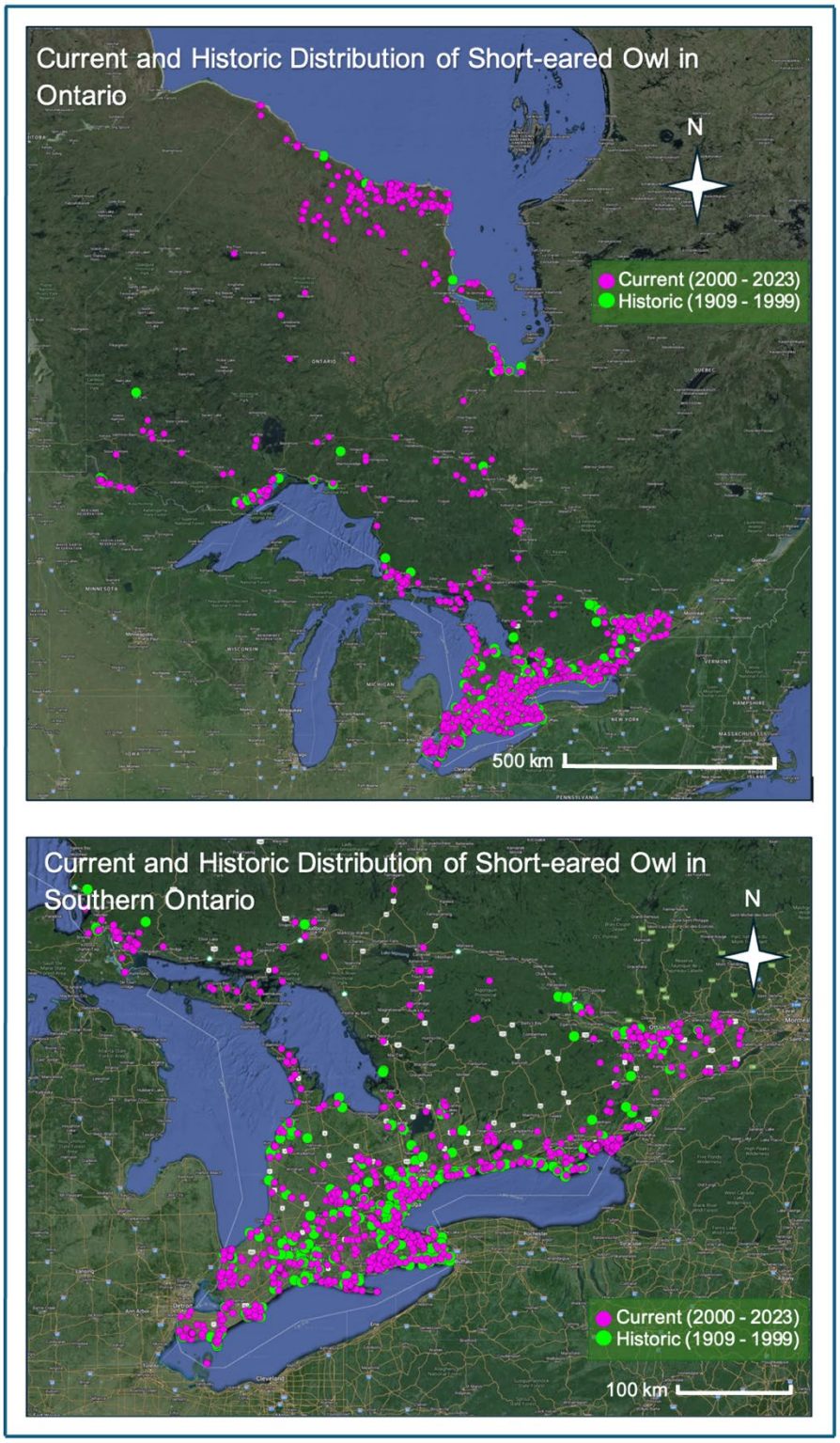

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Figure 5. Distribution of current (2000 - 2023) and historic (1909 - 1999) Short-eared Owl observations (year-round) in Ontario, based on data compiled by NHIC (2023) and CWS (2023).

Abundance

Estimating the abundance of Short-eared Owls is challenging, especially in the remote, difficult to access northern regions, which are considered to be the core breeding range in Ontario. Breeding bird surveys are often conducted in the mornings when owls are rarely vocal, and most breeding owls are thought to be in roadless areas where surveys are not conducted. In addition, the nomadic nature of the species creates a challenge in interpreting data that may show areas with a significant increase in owl abundance one year that is sparse in other years. A long-term, province wide Short-eared Owl monitoring program is needed to get a clear understanding of the number of owls within the province along with a true sense of population trends. Considering results of several monitoring programs, COSEWIC (2021) estimated the number of mature Short-eared Owls in Canada to be approximately 31,000 individuals, with the Ontario population estimated to be approximately 4,200 to 5,200 individuals. Overall, numerous data sources indicate that the Canadian population of Short-eared Owls has declined significantly over the long term. Christmas Bird Count and Breeding Bird Atlas data suggest that Canada's population has declined up to 70 percent between 1970 and 2019, with an overall decline of 30 percent or greater over the past three generations (COSEWIC 2021). It is estimated that the Ontario population will continue to decline by greater than 20 percent over the next two generations (2.56 - 4.66 % / year over 8 years) (COSSARO 2021).

Rescue Effect

It is unclear whether populations from neighbouring provinces or states can be a source for Short-eared Owls in Ontario. With the nomadic nature of the owl, it is likely that individuals move between the United States and other regions of Canada, however, data indicate that populations are also declining throughout neighbouring regions. With a decline of populations globally there may be little potential for rescue from elsewhere.

1.4 Habitat Needs

In North America, Short-eared Owls occur in a variety of natural open habitats, including tundra, shrublands, wetlands, estuaries and grasslands. Additionally, they are found in different types of agricultural habitats. There is currently little information on habitat preferences at the landscape scale, and key features within these habitats are poorly understood. It is, however believed that a reliable source of small mammal prey is a key feature in defining suitable habitat throughout the year (Korpimäki and Norrdahl 1991, Wiggins et al. 2020).

Breeding Habitat

Short-eared Owl nest predominantly in large open areas. In the north, nests are typically found in tundra at the base of a small shrub, such as birch or willow, which can provide cover for nestlings and incubating females (Jehl Jr. 2004, Wiggins et al. 2020). In southern parts of the species' range, nests are often found in grasslands, hayfields and native prairies. Nest scrapes are often located on elevated dry spots, in preferably ungrazed habitat with grass height typically less than 60 cm with a taller clump of grass nearby to help conceal the nest (Herkert et al. 1999, Fondell and Ball 2004, Keyes et al. 2016, Wiggins et al. 2020). Owls tend to avoid habitat with very short or minimal vegetation, requiring grasslands with a deep litter layer which provides nesting habitat for both owls and their small mammal prey (Linner 1980, Swengel and Swengel 2013). Native grasslands where the litter layer has become sparse or removed by grazing livestock has proven to be poor habitat for Short-eared Owl (Wiggins 2004). Owls have been known to nest in hay fields, stubble fields and other agricultural lands, although evidence suggests that breeding success in those habitats may be reduced as a result of human disturbance, mowing or higher predation rates (Fondell and Ball 2004, COSEWIC 2021).

Preferring to nest in large open areas, Short-eared Owls are thought to be sensitive to habitat fragmentation (Wiggins 2004), however total area of habitat within a landscape is considered more important than size of individual patches (Herkert et al. 1999). Owls may use small patches of habitat if they are located close to large habitat patches. Breeding territories are known to vary widely in size, depending on local prey abundance (Clark 1975). A minimum area of 50 to 100 ha is thought to be required by the species for breeding (Austen et al. 1994). When food is abundant, multiple pairs may nest with overlapping territories, as observed in New Brunswick, where 30 active nests were reported in a 164 ha area (Holt and Leasure 1993). Home range size of these owls has not been well documented and warrants further research. Mean home range size of 74 ha has been reported in Manitoba (Clark 1975), 64 ha in Massachusetts (Holt 1992) and 218 ha in New York (Gahbauer et al. 2021). Significant variability in home range size however has been documented, ranging between 15 ha and 1256 ha (Clark 1975, Holt 1992, Wiggins 2006, Gahbauer et al. 2021). Home range size is thought to be related to many factors such as snow cover, competition and prey availability.

Winter Habitat

Winter habitat for Short-eared Owl is similar to breeding habitat, but owls may also use large open areas near or within woodlots that provide roosting and shelter (Clark 1975, Wiggins 2004, COSEWIC 2021). The species is also known to use stubble and weedy fields, shrublands, marshes, dumps, gravel pits and rock quarries for foraging and roosting throughout the winter (Clark 1975). A study by Gahbauer et al. (2021), found wintering owls favoured areas with a high density of vole runways, and preferred to hunt in areas with high forb cover, thatch depth and plant species diversity. Short-eared Owls are known to roost both on the ground, or at low heights in low to mid-height conifer trees when snow (> 5 cm) is on the ground. Ground roosts tend to be in either old overgrown fields or hayfields that were not mowed in late summer or fall providing taller, thicker, more diverse vegetation that provides shelter from wind and predators

(Gahbauer et al. 2021). While it is generally understood that Short-eared Owls avoid areas with human activity, studies in New York and Ontario have observed owls roosting in conifer trees near residences and barns. On Amherst Island, Ontario, 18 Short-eared Owls were found roosting in a red cedar (*Juniper virginianus*) three metres from an occupied house. Gahbauer et al. (2021) believes that in some areas, availability of suitable roosting trees may be limited, and that the importance of shelter may outweigh disturbance from human activity, especially during periods of extreme weather.

Stopover Habitat

A telemetry study (Gahbauer et al. 2021) investigating movement patterns of Short-eared Owls across North America found migrating owls to stopover in clustered locations for extended periods of time. In Ontario, this was found to be along the shorelines of Lake Erie and Lake Ontario. Gahbauer et al. (2021) believe the observed pattern suggests that some regions may be of particular value to the species during stopover, and that habitat use at those locations deserves further investigation. More information is needed to examine habitat preferences and patterns of use throughout the year for Short-eared Owl within the province.

1.5 Limiting factors

Limiting factors are intrinsic attributes that may influence a species' reproduction and survival, which may constrain a species' recovery potential. Prey abundance is the main limiting factor for Short-eared Owl in Ontario. Voles are known to comprise the bulk of their diet and are considered particularly important to Short-eared Owl. Voles naturally undergo cyclic population fluctuations every two to five years (Krebs and Myers 1974), which in turn influence breeding success of Short-eared Owl (Wiggins 2004). The owls are believed to be somewhat resilient to naturally fluctuating population cycles of prey, with their ability to move nomadically to areas with greater prey densities, along with their ability to increase clutch size in times of prey abundance. However, it remains unclear to what extent loss and degradation of habitat may decrease overall prey availability, further influencing reproductive success and overwinter survival of Short-eared Owl. Additional research on prey availability in Ontario and how its cyclical nature influences Short-eared Owl populations would provide a better understanding of how prey is a limiting factor for the species in the province.

1.6 Threats to survival and recovery

While the cause of decline in the Short-eared Owl in Ontario and elsewhere remains unclear, several factors have been suggested as likely threats to the species. The primary factors are believed to be loss and degradation of habitat on their breeding and wintering grounds, and potentially along their migration routes (COSEWIC 2021). Threats are presented in what is believed to be the order of decreasing significance.

Loss of native grassland and wetland habitat

The conversion of native grasslands, wetlands and old fields to agricultural, residential and recreational lands has resulted in significant loss of native habitat for Short-eared Owls across Canada and the United States (Campbell et al. 1990, Holt and Leasure 1993, Wiggins 2004). In southern Ontario, native grasslands once covered a substantial part of the landscape, scattered from Windsor to the Eastern edge of the province. Of the estimated 1000 km^2 tallgrass prairie that existed in Southern Ontario, less than three percent remain (Tallgrass Ontario 2017). Approximately three-quarters of the wetlands that once covered southern Ontario have been drained or filled in. While much of the potential breeding and wintering habitat in southern Ontario has already been lost to urbanization and agriculture, there is a continued threat of loss to what little native habitat remains. Habitat loss and degradation are known to: reduce availability of suitable nesting and foraging habitat, increase fragmentation of foraging and nesting habitat, increase predation rates on nests, and decrease reproductive success as a result of lower prey availability (Holt 1992, Tate 1992, Wiggins 2004).

Many of the Short-eared Owls in Ontario breed in the northern regions of the province, where limited habitat alterations have occurred. It is believed that the majority of these birds migrate south of the border to winter. Habitat loss and degradation on the wintering grounds outside of Ontario can result in population declines, independent of suitable habitat in northern Ontario.

Climate change and severe weather

The Hudson Bay Lowlands, which are Ontario's main breeding ground for Short-eared Owl, have experienced, and are expected to continue to experience dramatic rates of climate change (Kaufman 2009). The longer and warmer growing seasons in the north due to climate change have resulted in the expansion of woody plants/shrubs in arctic environments, known as shrubification. The projected increase in shrub growth, along with a northward colonization of shrubs (Myers-Smith et al. 2011, Miller and Smith 2012) is expected to reduce the area of open ground available to Short-eared Owl. The loss of open habitat is predicted to reduce availability of nesting sites, impair foraging efficiency, and increase predation by providing cover for ground predators along with hunting perches for aerial predators (COSEWIC 2021). Very little is currently known or understood about how shrubification may affect breeding success of Short-eared Owls in Ontario's north.

In southern Ontario, climate change is resulting in milder winters with significantly less snowfall (Brisette and Poulin 2021). This could have a substantial impact on populations of small mammal prey. Small mammals spend their winter in tunnels under the snow, which maintain a consistent temperature regardless of the air temperature above the snow. Melting and freezing of snow reduces its insulating properties, reducing the quality of these spaces as refuges from the cold temperatures. How the milder winters and reduced snowfall is impacting small mammal populations remains unclear.

Climate change is known to generate extreme and erratic weather events, resulting in droughts and flooding. Severe drought has the potential to constrain the growth of grasses and other vegetation that Short-eared Owl may use for shelter, concealment, and nesting. During the breeding season, flooding in low-lying areas can be detrimental to a ground nesting species such as the Short-eared Owl. Flooding can result in nest loss and short-term reductions in prey availability (COSEWIC 2021). To what extent extreme weather events may affect Short-eared Owl populations in Ontario remains unknown.

Agricultural intensification

Agriculture has changed significantly in the last century, with management practices that increase productivity by reducing the number of crop species, increasing the use of chemical pesticides and fertilizer, removing hedgerows and trees, avoiding fallows and increasing the use of machinery. Available nesting and foraging habitat for Short-eared Owl has declined with the loss of pasturelands and with fewer fields being left fallow (Campbell et al. 1990, Hunt and Gahbauer 2004, Wiggins et al. 2020). Pasture and hay acreage has declined in Ontario by 62 percent and 40 percent since 1976 (Smith 2017). Owls and their nests are at increased risk in actively managed agricultural lands, where grazing, mowing and harvesting can overlap with the nesting period, resulting in egg and nestling mortality (Arroyo and Bretagnolle 1999). Trampling by livestock and mechanical trauma may occur before young leave the nest. Grazing, mowing and harvesting have been shown to reduce the level of nest concealment, increasing the likelihood of predation on eggs and nestlings (Campbell et al. 1990, Herkert et al. 1999, Fondell and Ball 2004, Keyes 2011).

Pesticides can cause Short-eared Owl mortality through secondary poisoning, by scavenging on dead or dying prey that have consumed rodenticides or other poisons used to control pests (Mineau et al. 1999). In the western United States, rodenticide poisoning of raptors is a substantial concern (COSEWIC 2021). Research is needed to further understand whether residue levels of pesticides pose a risk to eggshell thickness, embryonic mortality or tissue damage of Short-eared Owls, and what the risks may be to Ontario populations (Shaffer et al. 2021).

Habitat fragmentation and increased predation

Short-eared Owls require large areas of open habitat. The conversion of native grasslands, wetlands and old fields to agricultural, residential and recreational lands results in increasingly fragmented habitat. With an increase in fragmentation comes an increase in predation pressure (Wiggins 2004). Fragmented habitats have more edge habitat, which is preferred by predators (Paton 1994). Ground nesting birds are already vulnerable to predation and the added pressure of increased predation due to fragmentation can have significant effects on reproductive success. While eggs, nestlings and recently dispersed young are highly vulnerable to predation, small mammal prey are also at an increased risk. A reduction in prey populations would reduce suitability of habitat for Short-eared Owls (Holt 1992, Wiggins et al. 2020).

Collisions with anthropogenic structures

Anthropogenic structures are responsible for Short-eared Owl mortality across the breeding and non-breeding range. Owls have been known to collide with vehicles, powerlines, barbed-wire fences, wind turbines and aircraft (Fitzner 1975, Knight et al. 1980, Jacobson 2005, Dolbeer and Wright 2008, Loss et al. 2013). Short-eared Owls perch along roads and fly low to the ground when hunting, making them vulnerable to collisions with vehicles, especially at night (Jacobson 2005). The Owl Foundation in southern Ontario reported 80 percent of the 161 birds admitted for treatment between 1970 and 2018, had trauma likely as a result of a vehicle collision (COSEWIC 2021). The Western *Asio flammeus* Landscape Study (WAfLS) in the northwestern United States suggested that vehicle strikes may be a significant concern for the species, having reported over 130 vehicle strikes on predominantly backroads over just four or five years (Miller et al. 2019).

Open habitat at airports is known to attract Short-eared Owls, resulting in the occasional collision with aircraft. The Owl Foundation in Ontario reported six percent of the 161 birds admitted for treatment between 1970 and 2018, were injured from collision with aircraft (COSEWIC 2021). A study summarizing owl collision data from 1) the Federal Aviation Administration's National Wildlife Strike Database and 2) the US Air Force Strike Database between 1990 and 2014, found 19 percent of 2,456 owl strikes with aircraft were Short-eared Owls. The percentage of Short-eared Owl strikes increased by 700 percent and 300 percent at each location, during that time (Linnell and Washburn 2018, Shaffer et al. 2021). The number of civil and military flights during this time remained comparatively constant or decreased slightly. The observed increase in owl strikes is thought to be a result of increased voluntary reporting of wildlife strikes, along with a potential increase in the number of owls on the landscape (Linnell and Washburn 2018).

Short-eared Owl collision with powerlines, barbed-wire fences and wind turbines has been documented, although the extent of the threat in Ontario is not known (Fitzner 1975). Collision with barbed-wire fences is a known threat for many grassland bird species. Miller et al. (2019) suspects that Short-eared Owl mortality due to barbed-wire fences occurs more often than reported. While Short-eared Owl mortalities have been reported at wind facilities (Loss et al. 2013), the threat is not considered to be very high, as most owls hunt at low levels, below the clearance of most wind turbine blades. However, it is unclear whether Short-eared Owls may be displaced from wind farms, altering their local habitat use and distribution. Wind turbines have recently (2018) been installed on Amherst Island, which is known to have a year-round population of Short-eared Owls. Since the wind turbine installation, there have been no known casualties, however the winter population has shifted its roosting habitat away from the turbines and no nesting has been documented in areas with turbines nearby (K. Hennige, pers. Comm. 2024). Further research needs to be conducted to determine whether wind farms are displacing Short-eared Owls from habitat that may be suitable for nesting, foraging or roosting.

Human disturbance

Short-eared Owls are sensitive to human disturbance. In Ontario, Short-eared Owls are believed to be the most vulnerable to human disturbance while roosting in public parks or other recreational areas where there are multiple walkers and off leash dogs. Owls have been known to roost in large numbers, at times attracting many birders and photographers, which can cause the birds to flush. When a bird is flushed several times a day, the bird expends unnecessary energy (Price 2008). Repeated flushing may also make the bird more vulnerable to harassment by crows or larger predatory owls. It is unclear to what extent the repeated flushing and disturbance of the owls affects their survival. Short-eared Owls are also sensitive to human disturbance while nesting and establishing breeding territories. While their nests are often well concealed, nearby human disturbance may result in females abandoning nests and attempting to re-nest elsewhere. With most breeding in Ontario occurring in the remote region of the Hudson Bay Lowlands, the risk of human disturbance to nesting owls is very low. However, Short-eared Owls nesting in southern Ontario are at greater risk of human disturbance and nest abandonment.

1.7 Knowledge gaps

Short-eared Owls are nomadic birds, often moving to new breeding sites each year. The appearance and then disappearance from regions makes it difficult to gather key information on the species' ecology, population trends and threats. Investigating trends over time, such as long-term changes in the number of breeding pairs in an area, survival rates, and responses to various management techniques are a particular challenge. Significant knowledge gaps exist for this species within Ontario due to its remote breeding area. Most North American research and literature on Short-eared Owl is based on studies conducted within grassland habitats, outside of Ontario, with little information on birds breeding in the tundra. Limited knowledge of this species' distribution and biology may hinder the efficacy of protection strategies for Short-eared Owl in Ontario. Research on the following knowledge gaps would contribute to a more complete understanding of what is necessary for the protection and recovery of Short-eared Owl and its habitat:

Species Biology

- Basic population demographics (age structure, life expectancy, fledging rate and mortality) of Short-eared Owls in Ontario.
- Timing of nest building and egg laying in northern and southern Ontario.
- The size, status and distribution of Short-eared Owl populations in Ontario, at various times of year.
- An understanding of where owls that breed in Ontario spend the winter, along with an understanding of where owls that overwinter in Ontario go to breed.
- Migratory corridors/routes and stopover sites in Ontario, which may act as critical feeding/refueling areas.
- Habitat factors that are critical to breeding, foraging and wintering in Ontario.

- How abundance, survival and reproductive rates vary across different habitat types during the breeding and non-breeding season.
- Foraging distances and home range size of nesting Short-eared Owls in Ontario.
- Availability and composition of Short-eared Owl prey in breeding and wintering territories in Ontario.
- How the cyclical nature of prey populations impacts the Short-eared Owl population.

Threats

- How climate change is altering and shifting breeding habitat in Ontario.
- How climate change is affecting the prey population within Ontario.
- How different management techniques influence abundance, survival and reproductive rates.
- What management techniques can be used to maintain or enhance habitat for Short-eared Owl in Ontario.
- Occurrence and frequency of mortality due to collision with fences, powerlines, automobiles, airplanes and wind turbines in Ontario.
- Whether wind farms displace Short-eared Owls from suitable breeding and roosting habitat.
- Impacts of poisoning from rodenticide and other chemicals used as pesticides and herbicides in Ontario.
- An understanding of tolerance levels to different types of human disturbance.
- Significance of habitat threats on migration and wintering areas outside of Ontario, to the Ontario population.

1.8 Recovery actions completed or underway

Despite the steady decline in Short-eared Owls since the 1970s, very little research, targeted monitoring or conservation initiatives for the owl have occurred in Ontario. Conservation initiatives and management plans that protect other grassland species and their habitats may indirectly benefit Short-eared Owls. The following recovery actions in Ontario have been completed or are underway.

Inventory and monitoring of Short-eared Owls

- Ontario Breeding Bird Atlas (OBBA) conducts 5-year surveys every 20 years across Ontario, gathering avian distribution and abundance data. The third atlas (2021-2025) is currently ongoing.
- The Christmas Bird Count (CBC) has gathered yearly winter (single day between 14 December and 5 January) bird count data since 1900, acting as a source of information regarding long term changes to populations.

- Citizen science websites such as eBird and iNaturalist gather Short-eared Owl observations made by recreational birders and ornithologists, providing abundance and distribution data at a variety of spatial and temporal scales.
- Birds Canada has a volunteer-based nocturnal owl survey program in Ontario, although the surveys are conducted primarily in forested regions of central and northern Ontario (Birds Canada 2024).
- In 2003, the Migration Research Foundation (MRF) launched a Short-eared Owl monitoring and research program in southern Ontario. Surveys were conducted during the summers of 2003 and 2005, assessing the distribution of breeding birds in southern Ontario (The Migration Research Foundation 2009).
- During 2009 and 2010 a graduate student, Kristen Keyes, conducted research on Short-eared Owls in the Kingston region (Amherst and Wolfe Islands), investigating nest site characteristics, habitat use, and movement patterns (K. Keyes 2011).
- In 2010, the MRF and the Kingston Field Naturalists developed a survey protocol for Short-eared Owls and initiated a volunteer-based winter survey program (November through March) on Amherst and Wolfe Islands, Ontario (Keyes et al. 2011).

Management and protection of Short-eared Owls and their habitat

- The Ontario Ministry of Natural Resources provides direction to the forestry industry on how to work in proximity to Short-eared Owl nests through *The Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* (OMNR 2010).
- The Ontario Cover Crop Program provides farmers with funding to plant cover crops (grasses, legume and forbes) on land in between periods of normal crop production.
- The Alternate Land Use Service (ALUS) program provides farmers with funding to conserve and restore natural features such as wetlands, creeks and native grasses, along with ecosystems such as tall grass prairie and oak savannah (Ontario Nature 2023).
- The Ontario Grassland Initiative works with private landowners, conservation groups, non-government and government groups to restore and create large tracts of native grasslands (Tallgrass Ontario 2017).
- Ongoing programs and organizations such as the Nature Conservancy of Canada (NCC) and Ducks Unlimited help protect Ontario's natural areas and the species they sustain, including Short-eared Owls.
- Land protection in the Hudson Bay Lowlands, such as Moose River Migratory Bird Sanctuary, Hannah Bay Migratory Bird Sanctuary and Polar Bear Provincial Park protect important breeding habitat for Short-eared Owls.
- As a threatened species, Short-eared Owl receives species and general habitat protection under the *Endangered Species Act*, 2007.
- The *Conservation Authorities Act* protects several wetlands in southern Ontario that may be used by Short-eared Owls.

2.0 Recovery

2.1 Recommended recovery goal

The recommended long-term recovery goal is to achieve and maintain a stable and self-sustaining Short-eared Owl population within Ontario by 2045 (20 years, and 5 generations). The recommended short-term recovery goal is to reduce or halt the average annual rate of decline by 2035 (10 years, and 2-3 generation).

Narrative to support recovery goal

Achieving and maintaining a stable and self-sustaining population in Ontario is considered a feasible long-term goal. The species is widespread across the province with the main breeding population being in the far north, away from the pressures of urban development and agricultural intensification. It is anticipated that it will take a few generations (10 years) of applying recovery actions before we would see a reduction in the rate of decline. Once the rate of decline has slowed or halted, the aim is to achieve population stability. The long-term goal of 20 years (5 generations) acknowledges that population declines will occur over the next 10 years, as the rate of decline slows, and that additional time will be needed for the population to stabilize and feasibly increase.

Population estimates in Ontario are poorly understood, making it difficult to establish rigorous short- and long-term population targets. Existing data is sparse, and reliability is uncertain for estimating abundance and trends (COSEWIC 2021). Data has predominantly been gathered from standard morning bird surveys which rarely detect owls, and little data exists for the main breeding range, due to its remote and difficult to access location. Additionally, much uncertainty exists around the magnitude of current threats and how the owls will respond to recovery actions. Once more accurate and reliable population estimates have been gathered, along with a further understanding of factors influencing the population decline, it is recommended that short- and long-term population targets be established.

2.2 Recommended protection and recovery objectives

The recommended protection and recovery objectives for Short-eared Owl are:

1. Address knowledge gaps related to population size, distribution, seasonal and annual movements, habitat requirements, threats and life history strategies that may assist with Short-eared Owl recovery efforts.

2. Reduce and mitigate threats to Short-eared Owl through habitat protection, stewardship, management, education and communication.

3. Monitor Short-eared Owl recovery efforts to track efficacy and adjust actions if needed.

2.3 Recommended approaches to recovery

Table 1. Recommended approaches to recovery of the Short-eared Owl in Ontario.

Objective 1: Address knowledge gaps related to population size, distribution, seasonal and annual movements, habitat requirements, threats and life history strategies that may assist with Short-eared Owl recovery efforts.

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Critical	Short-term	Inventory, Monitoring and Assessment	**1.1** Assess current population size and monitor population trends across the province. • Develop survey design and protocol for a long-term, province-wide monitoring program that captures winter and breeding season demographics. • Conduct province-wide surveys to capture current population size and distribution throughout the winter and breeding season. • Prioritize regions that have little to no population data.	Knowledge gaps: • Population size and distribution
Critical	Short-term	Inventory, Monitoring and Assessment Research	**1.2** Monitor seasonal and annual movements across the province. • Identify migratory routes and important stopover areas. • Assess breeding site fidelity and juvenile dispersal distances. • Identify breeding grounds of wintering birds and wintering grounds of breeding birds. • Identify areas within the province frequently used by breeding, roosting, foraging and wintering birds to understand habitat needs and to know where to focus conservation efforts.	Threats: • Habitat loss and degradation Knowledge gaps: • Habitat requirements • Fidelity, dispersal, and home range size • Migratory routes

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Necessary	Short-term	Inventory, Monitoring and Assessment Research	**1.3** Encourage and support research to better understand habitat requirements at various life stages in different regions of the province. • Identify, describe, and quantify habitat characteristics of nest sites, foraging areas and winter roost sites in southern and northern Ontario at multiple scales. • Assess habitat requirements and home range sizes with differing degrees of habitat fragmentation and utilization.	Threats: • Habitat loss and degradation Knowledge gaps: • Habitat requirements • Home range size
Critical	Ongoing	Research	**1.4** Encourage and support research on threats limiting the recovery of Short-eared Owl in Ontario. • Assess and monitor the impact of extreme weather events and altering habitat due to climate change on reproduction and survival. • Assess the risk of predation in areas with differing degrees of habitat fragmentation and utilization. Investigate feasibility of reducing predation rates in areas of high predation. • Investigate the impacts of secondary poisoning on Short-eared Owl populations. • Compile collision mortality data (from vehicles, aircraft, fences, and wind turbines) and explore mitigation activities. • Investigate how windfarms influence habitat use. • Investigate tolerance levels to various levels of perceived human disturbance.	Threats: • Climate change • Increased predation • Pesticides • Collisions • Windfarms • Human disturbance Knowledge gaps: • Best management practices

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Necessary	Short-term	Inventory, Monitoring and Assessment Research	**1.5** Encourage and support research to better understand the relationship between irruptive prey populations and Short-eared Owls. • Develop a small mammal monitoring program concurrent with Short-eared Owl monitoring. • Investigate how prey abundance influences distribution of Short-eared Owls during the breeding and winter seasons. • Investigate the relationship between prey abundance and reproductive success of Short-eared Owls.	Threats: • Habitat loss and degradation Knowledge gaps: • Irruptive nature of prey • Limiting factors
Beneficial	Short-term	Research Inventory, Monitoring and Assessment	**1.6** Encourage and support research on Short-eared Owl biology and life history within Ontario. • Monitor nesting success, post-fledging and adult survival rates across the province. • Identify time of egg-laying in different regions of the province. • Estimate lifespan, generation time and reproductive success of Short-eared Owl in Ontario. • Determine what life history stages are most critical to population growth in Ontario.	Knowledge gaps: • Life history • Survival rates • Reproductive success • Regional differences in productivity • Limiting factors

Objective 2: Reduce and mitigate threats to Short-eared Owl through habitat protection, stewardship, management, education and communication.

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Critical	Ongoing	Protection Management Education and Outreach Communication	**2.1** Implement actions that support protection and securement of land important to Short-eared Owl. • Identify core regions where the owls regularly occur and focus habitat protection efforts on these regions. Prioritize regions with little to no protection. • Develop partnerships with municipalities, Indigenous communities, and other levels of government to assist in identifying and protecting key habitat. • Support the maintenance and continued protection of secure habitat while increasing the supply of native grassland through the promotion of land trusts and conservation easements to various landowners, agencies, and organizations. • Contact landowners of high value Short-eared Owl habitat regarding the establishment of reserves. • Encourage conservation of areas (grasslands, marshlands, hay, and fallow fields) not currently occupied but that could support owls in the future. This is especially important with the nomadic nature of the species. • Develop and support incentives and actions that would help landowners maintain existing pasture, hay and other suitable habitat.	Threats: • Habitat loss and degradation Knowledge gaps: • Best management Practices

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Critical	Ongoing	Management Stewardship Education and Outreach Communication	**2.2** Support management and stewardship programs that benefit Short-eared Owl. • Work with farmers and landowners to develop management techniques (e.g. timing and intensity of mowing) that benefit Short-eared Owl, along with providing advice on actions to improve and restore habitat. • Encourage management activities that improve nesting habitat such as timing, intensity and rotation of grazing, haying and mowing. Promote fallow fields during breeding season. • Encourage management activities that improve foraging habitat by increasing small mammal populations through initiatives such as re-seeding idle grasslands with native plants. • Promote restoration and enhancement of habitat through incentives and stewardship. • Encourage managers and landowners to integrate the needs of Short-eared Owl in their conservation and management plans. • Encourage the incorporation of Short-eared Owls and their habitat in management of other grassland species. • Provide information to landowners on programs such as the Species at Risk Stewardship Program, Species at Risk Farm Incentive Program, and the Conservation Land Tax Incentive Program.	Threats: • Habitat loss/degradation • Pesticides • Human disturbance Knowledge gaps: • Best management Practices

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Beneficial	Short-term	Education and Outreach Communication Stewardship Research	**2.3** Establish and encourage education and communication to inform and collaborate on Short-eared Owl recovery efforts. • Monitor the adoption of mitigation measures and coordinate the sharing of information to relevant groups on effectiveness of measures. • Increase public awareness through the development of appropriate education and outreach materials. • Encourage public participation in programs such as the Christmas Bird Count and the Ontario Breeding Bird Atlas and encourage volunteers to report owl sightings to eBird, iNaturalist, Birds Canada or the Natural Heritage Information Centre (NHIC). • Post educational signage to minimize human disturbance to winter roosts and nest sites. • Develop an information booklet on best management practices for landowners that have owls nesting or roosting on their property. • Participate in and attend local, national and international meetings/conferences to share information on Short-eared Owl population status, research, and conservation efforts. • Collaborate with the United States and other provinces to understand threats to Short-eared Owls that spend part of the year outside Ontario. • Establish communication with organizations working toward the conservation and/or recovery of other grassland species and grasslands. • Collaborate with conservation planning efforts for other species at risk in the Hudson Bay Lowlands.	Threats: • Habitat loss/degradation • Pesticides • Human disturbance • Climate change Knowledge gaps: • Best management practices • Habitat requirements • Population trends

Objective 3: Monitor Short-eared Owl recovery efforts to track efficacy and adjust actions if needed.

Relative priority	Relative timeframe	Recovery theme	Approach to recovery	Threats or knowledge gaps addressed
Necessary	Ongoing	Inventory, Monitoring and Assessment Research Management Communication	**3.1** Track efficacy of recovery efforts on Short-eared Owl populations and habitat. • Conduct province wide monitoring every 2-3 years (see 1.1) to determine whether 1) the population decline has been reduced or halted (short-term), 2) the winter and breeding ranges have not diminished and 3) the population is self-sustaining (long-term). • Monitor adoption and efficacy of management and stewardship activities and make changes if needed. Changes should incorporate any newly acquired research on factors such as habitat requirements, limiting factors and threats to the owls. • Share effectiveness of recovery measures with relevant groups.	Threats: • Habitat loss/degradation Knowledge gaps: • Population status • Best management practices

2.4 Performance measures

To assess whether recovery actions have beneficial effects on the species or its habitats, the following should be considered as performance measures:

- The winter and breeding ranges do not diminish over the next 10 years.
- The occurrence of Short-eared Owls breeding or wintering in areas where threat mitigation has occurred, increases.
- The rate of population decline of Short-eared Owls in Ontario is reduced over the next 5 to 10 years.
- An increasing or stable population is maintained over the long term (by 2045).

2.5 Area for consideration in developing a habitat regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of the Environment, Conservation and Parks on the area that should be considered if a habitat regulation is developed. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below by the author will be one of many sources considered by the Minister, including information that may become newly available following the completion of the recovery strategy should a habitat regulation be developed for this species.

In Ontario, Short-eared Owls rely on a variety of habitats for their survival. The recommended area for consideration in developing a habitat regulation for Short-eared Owl should include important habitat for both breeding and over-wintering. During the breeding season, owls are thought to be most vulnerable to habitat alteration and human disturbance, particularly in southern Ontario where habitat is already limited. Loss and degradation of winter habitat in Canada and the United States is believed to be responsible for recent population declines and the reduced number of migrants moving through Ontario (Schmelzer 2005, Wiggins et al. 2020). Breeding habitat should include the nest, the area around the nest, and the surrounding foraging habitat. Winter habitat should include the roost site, the area around the roost and the surrounding foraging habitat. The relative importance of various habitat types and features within those habitats remains poorly understood in Ontario. Research to further understand habitat requirements of these owls in Ontario would be valuable in the development of a habitat regulation.

When defining breeding habitat in the development of a habitat regulation, it is important to consider the following:

- Short-eared Owls predominantly breed in the far north of the province, in the Hudson Bay Lowlands. However, owls are known to breed in select regions in more southern parts of Ontario as well.
- Short-eared Owls typically have low nest site fidelity, moving to areas with abundant prey. Suitable habitat may therefore not always be occupied, as prey

abundance fluctuates. However, this species is known to have a select few locations in North America where birds consistently breed and winter. Amherst Island, near Kingston is one of these locations; with Short-eared Owls nesting on the island for 50 or more years (K. Henninge, pers. comm 2024). Sites like these are considered to be of high value to the birds. In addition, they are valuable for research, as Short-eared Owls are often difficult to study over time, due to their nomadic nature.

- Owls require grasslands or tundra with a deep litter layer which provides nesting habitat for both owls and their small mammal prey (Linner 1980, Swengel and Swengel 2013).
- Nests are built on the ground: often on elevated dry spots, in preferably ungrazed habitat with grass height typically less than 60 cm with a taller clump of grass nearby to help conceal the nest (Herkert et al. 1999, Fondell and Ball 2004, Keyes et al. 2016, Wiggins et al. 2020).
- Breeding birds require abundant and accessible prey near the nest site. Old fields and hay pastures are often sites recognized as suitable for prey, and therefore good foraging habitat.
- Size of home range is dependent on prey abundance. A minimum area of 50 to 100 ha (Austen et al.1994) is thought to be required for breeding, however significant variability in home range size has been documented in Canada (21 - 121 ha), United States (15 - 1256 ha), and Europe (40 - 900 ha) (Clark 1975, Calladine and Morrison 2012, Gahbauer et al. 2021).
- Territorial behaviour is believed to be more relaxed when prey availability is high, resulting in owls breeding in loose aggregations. In New Brunswick, 33 active nests were reported in a 200 ha area (Holt and Leasure 1993).
- Defining a nest location is extremely difficult as owls often do not flush from their nests, nests are very concealed and most are located in the far north in difficult to access areas.

When defining winter habitat in the development of a habitat regulation, it is important to consider the following:

- In Ontario, Short-eared Owls winter predominantly in the Carolinian zone and the Kingston region.
- Winter habitat for Short-eared Owl is considered to be more stable than breeding habitat, with sites being used consistently over several years.
- Short-eared Owls have wintered consistently on Amherst and Wolfe Island for at least 70 years, with a population of 50 to 100 wintering birds on Amherst Island (Kurt Hennige, pers. comm. 2024). Most known roosting sites on the island are occupied every winter, suggesting the sites play an important role for winter survival.
- Roost sites within winter habitat must be close to foraging areas, with high vole activity. In addition, they must provide protection from weather and concealment from predators. Ideally, they are free from human disturbance.
- Owls often roost on the ground, in taller and diverse ground cover that provides protection and concealment. They are also known to roost in conifer trees when

snow on the ground is greater than five centimetres. The number of suitably sized conifer trees in proximity to foraging habitat may be limited.

- In winter, this species will gather in large numbers where habitat is suitable, and prey is abundant. Winter roosts of up to 110 birds have been documented in British Columbia (Campbell et al. 1990).
- Short-eared Owls need open foraging habitat that supports an abundance of small mammal prey. Large open areas, such as old fields, with variable grass heights and shrub patches are often associated with abundant prey and are important foraging habitat. Short-eared Owls are known to forage in grasslands, hayfields, pastures, agricultural lands, wetlands and tundra.

It is recommended that regulated habitat be based on an occupied or recently occupied nest or winter roost site and should include the nest or roost, a 200 m buffer around the site along with surrounding foraging habitat. Because observations of Short-eared Owl are rare, due to their widely dispersed but predominantly remote and difficult to access breeding range, any nest or roost site used during the previous four years should be considered as an occupied site and should be protected for four years after the last record of use. Short-eared Owls do not always return to the same area to breed or winter; thus is critical to not disregard an area that is unoccupied for a few years. A four-year timeline will ensure that previously occupied sites are protected for birds that return after a few years absence. Four years is based on the current estimated generation length (average age of parents in the population) used by COSEWIC (COSEWIC 2021).

Occupied areas can be defined based on either a documented nest or roost site. Because Short-eared Owl nests are notoriously difficult to find, a confirmed breeding observation (seen or heard) based on standards used for the Ontario Breeding Bird Atlas (Cadman et al. 2007, see Appendix A) can be used to define an occupied nest site.

A 200 m buffer around the nest or roost site is recommended to preserve features such as concealment (i.e. tall grasses around nest), support structures (i.e. tree used as roost), protection from the elements and protection from disturbance. Human disturbance, such as walking and talking near nesting or roosting owls can have adverse effects on birds, resulting in nest abandonment, unnecessary energy expenditure and increased vulnerability to harassment and predation (Price 2008). Habitat altering activities such as mowing and harvesting of crops can directly threaten nests and young unable to fly. Dispersal distances of up to 200 m have been reported for young flightless birds (Clark 1975, Arroyo & Bretagnolle 1999, Wiggins et al. 2020, Price and Wang 2023). A 200 m buffer would ensure safe dispersal for young flightless owls.

Foraging habitat around the nest or roost should include any open areas such as grasslands, hayfields, pastures, agricultural land, wetlands, or tundra within one kilometre of a nest or roost site. While habitat selection remains poorly understood for Short-eared Owls, a reliable source of small mammal prey is known to be a key feature in site selection (Korpimäki and Norrdahl 1991, Wiggins et al. 2020). With clutch size, nesting success and overwinter survival being highly dependent on availability of prey,

the presence of a functional foraging habitat within a home range is important. An area within one kilometre of a nest or roost site would provide for a home range of 315 ha, dependant on availability of open foraging habitat. Roads, urban development, and forest habitat should be excluded. Home range size of these owls has not been well documented and warrants further research. Mean home range size has been reported as 74 ha in Manitoba (Clark 1975), 64 ha in Massachusetts (Holt 1992) and 218 ha in New York (Gahbauer et al. 2021); however, significant variability in home range size has been documented, ranging between 15 ha and 1256 ha (Clark 1975, Holt 1992, Wiggins 2006, Gahbauer et al. 2021). Home range size is thought to be related to many factors such as snow cover, competition and prey availability. Without a clear understanding of the habitat needs of Short-eared Owls, along with an understanding of the importance of prey availability, which fluctuates from year to year, a precautionary approach should be considered. A one-kilometre radius would support observed variation in home range size and account for fluctuations in prey availability, which may require owls to forage over a greater area.

Glossary

Buffy: A pale yellowy-brown colour.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee established under section 14 of the Species at Risk Act that is responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. Ranks are determined by NatureServe and, in the case of Ontario's S-rank, by Ontario's Natural Heritage Information Centre. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

1 = critically imperiled
2 = imperiled
3 = vulnerable
4 = apparently secure
5 = secure
NR = not yet ranked

Crepuscular: occurring or active during twilight.

Endangered Species Act, 2007 (ESA): The provincial legislation that provides protection to species at risk in Ontario.

Fidelity rate: Proportion of surviving birds returning to the previous year's nest site or natal area compared to surviving birds returning elsewhere.

Nest Success: Successful fledging of at least one individual from a nest.

Plumage: The pattern, colour and arrangement of feathers covering a bird.

Scrapes: The simplest nest construction which is a shallow depression in the ground.

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This Act establishes Schedule 1 as the legal list of wildlife species at risk. Schedules 2 and 3 contain lists of species that at the time the Act came into force needed to be reassessed. After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008 (Ontario Regulation 230/08).

List of abbreviations

CBC: Christmas Bird Count
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
CWS: Canadian Wildlife ServiceESA: Ontario's *Endangered Species Act, 2007*
ISBN: International Standard Book Number
MECP: Ministry of the Environment, Conservation and Parks
MNRF: Ministry of Natural Resources and Forestry
MRF: Migration Research Foundation
NHIC: Natural Heritage Information Centre
OBBA: Ontario Breeding Bird Atlas
SARA: Canada's *Species at Risk Act*
SARO List: Species at Risk in Ontario List

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Personal Communication

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Appendix A

These are the suggested standards for evidence of Short-eared Owl nest site use and breeding occupancy in Ontario, based on the standards used by the Ontario Breeding Bird Atlas (Cadman et al. 2007). These measures are recommended as Short-eared Owl nests are known to be well concealed and often difficult to find.

Probable breeding

- Pair observed during the breeding season in suitable nesting habitat.
- Permanent territory presumed through registration of territorial song on at least two days, a week or more apart, at the same place.
- Courtship or display between a male and a female or two males, including chasing, flight displays, feeding or copulation.
- Visiting probable nest site.
- Agitated behaviour or anxiety calls of an adult.
- Nest building.

Confirmed breeding

- Distraction display.
- Used nest or egg shell found (occupied or laid within the period of the study).
- Recently fledged young, including young incapable of sustained flight.
- Adults leaving or entering nest site in circumstances indicating occupied nest.
- Adult carrying fecal sac.

- Adult carrying food for young.
- Nest containing eggs or young (seen or heard).

Photo credit