Distribution and numbers of Snowy Owls on Amherst Island, Ontario, during an irruption year

Paul R. Martin

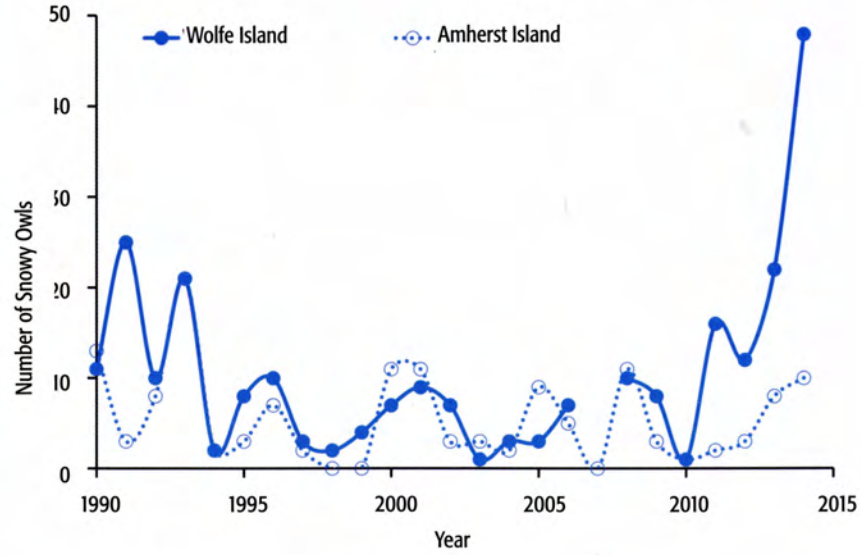
Figure 1. A Snowy Owl (thought to be an adult male based on plumage) perched along Lower 40 Foot Road, Amherst Island, on 10 March 2015. *Photo: Paul R. Martin.*

Introduction

Snowy Owls (*Bubo scandiacus*) (Fig. 1) are regular visitors to Ontario in winter, but their numbers fluctuate from year to year (Godfrey 1986, Parmalee 1992). For example, on Kingston and Amherst Island Christmas Bird Counts, the number of Snowy Owls has fluctuated between zero and 21 (Amherst Island) and between one and 48 (Wolfe Island, Kingston) over the last 24 years (Fig. 2). Historically, winter irruptions of Snowy Owls were thought to be caused by low food abundance in the north — particularly lemmings at a low point in their population cycles (Parmalee 1992). More recently, however, evidence suggests that years of high reproductive success may also cause larger numbers of owls to move south in winter, as was thought to be the case in the irruption winters of 2013-14 and 2014-15 (Leonard 2015). Heavy snowfall and cold winter temperatures on the breeding grounds or the scarcity of other prey (*e.g.*, ptarmigan, ducks) could also contribute to winter irruptions; however, the importance of these other factors remains poorly understood (Parmalee 1992, Potapov and Sale 2012).

Amherst and Wolfe islands in the Kingston region have hosted some of the largest concentrations of wintering Snowy Owls in North America, in addition to a diversity of other wintering raptors (Quillium 1965, Weir 1973, 2008, Bell *et al.* 1979). From 1959 to 2007, Kingston (including Wolfe Island) or

Figure 2. The number of Snowy Owls recorded on Christmas Bird Counts from 1990 to 2014 for the Kingston region (including Wolfe Island) and Amherst Island. Data are from National Audubon Society (2010), supplemented with data from Weir (2008) for years missing from the Audubon data set.



Amherst Island have had the highest Christmas Bird Counts for Snowy Owl in North America in 16 different years (Weir 2008). Densities of Snowy Owls on these islands vary with broader, regional irruptions, and also with the densities of rodents on the islands (particularly Meadow Voles, *Microtus pensylvanicus*) that fluctuate from year to year (Phelan 1976, Phelan and Robertson 1978, Bell *et al.* 1979). The large numbers of wintering Snowy Owls on these islands, particularly during irruption years coincident with large rodent numbers, has lead to studies of their distribution, ecology and behaviour on Wolfe Island (Quillium 1965, Weir 1973), and, in part, to broader studies of raptor-prey interactions on Amherst Island (Phelan 1976, Phelan and Robertson 1978).

Here I describe the distribution and numbers of Snowy Owls on Amherst Island during the irruption winter and spring of 2015 (January to April), with additional information on their spacing, interactions and perch use. The goal of this study was to provide systematic survey data on Snowy Owl distributions on Amherst Island prior to wind power development. While I focused on Snowy Owls for surveys and only discuss this species here, I also recorded the location and number of all other raptors observed during each survey.

Methods

I surveyed all passable roads (Fig. 3; except Kerr Point Road where suitable habitat was lacking) three times during January 2015, and about once a week from 10 March to 14 April 2015. I began surveys on the west or east side of the island, alternating between surveys. I recorded the location of each Snowy Owl on printed satellite maps (Google maps), and then estimated the GPS position of each individual using Google maps online (https://www. google. ca/maps/). I also recorded the time, perch (if not in flight) and height above ground of each individual. I carefully searched the island during surveys, and sporadically surveyed ice during January and early March. After locating an owl on the ice on 17 March, I systematically surveyed ice through to 14 April. I recorded the details of each owl when first located, and discarded any later observations of the same bird on the same day to ensure that observations were independent. I identified individual owls by their plumage colouration and general location on the island. Overall, each survey took, on average, 7.0 hours to complete and covered 80.8 km. All surveys except for one began with the arrival of the first ferry (06:50 or shortly after, at first light, in January), and all surveys were completed by 15:30. Surveys were conducted using 10x50 Leica binoculars and a 20-60x Swarovski HD spotting scope.

Figure 3. The route, in red, for each survey. Surveys began with either the east or west side of the island (alternating between surveys) and covered the entire route.

Ageing and Sexing

I estimated age and sex of each owl following Josephson (1980), supplemented with additional photographs in Parmelee (1992). Briefly, adult males were identified by mostly white plumage with little barring and mottling and a white crissum (*e.g.*, Fig. 1). First-year males were separated from adult males by more extensive barring and mottling throughout. First-year males were separated from females by having thinner ventral bars (*e.g.*, Fig. 4). Adult females also typically have less extensive mottling on the remiges and wing coverts than first-year males or females. Adult females were separated from first-year females by having white covering greater than 50% of the back of the head. First-year females were typically heavily barred with dark brown or black, with some individuals showing extensive black barring. Despite differences in plumage colouration, overlap occurs between age and sex classes that undoubtedly led to errors in my estimations (see Josephson 1980 and a discussion of the complexity of Snowy Owl colouration by Bortolotti and Stoffel 2012).

Results

A total of 156 Snowy Owls was observed over the course of the surveys (Fig. 5), with an estimated 12 owls wintering in January on the island. Larger numbers of owls were recorded in March and April, with maximum daily totals of 23 on 24 March and 44 on 6 April (Fig. 6).

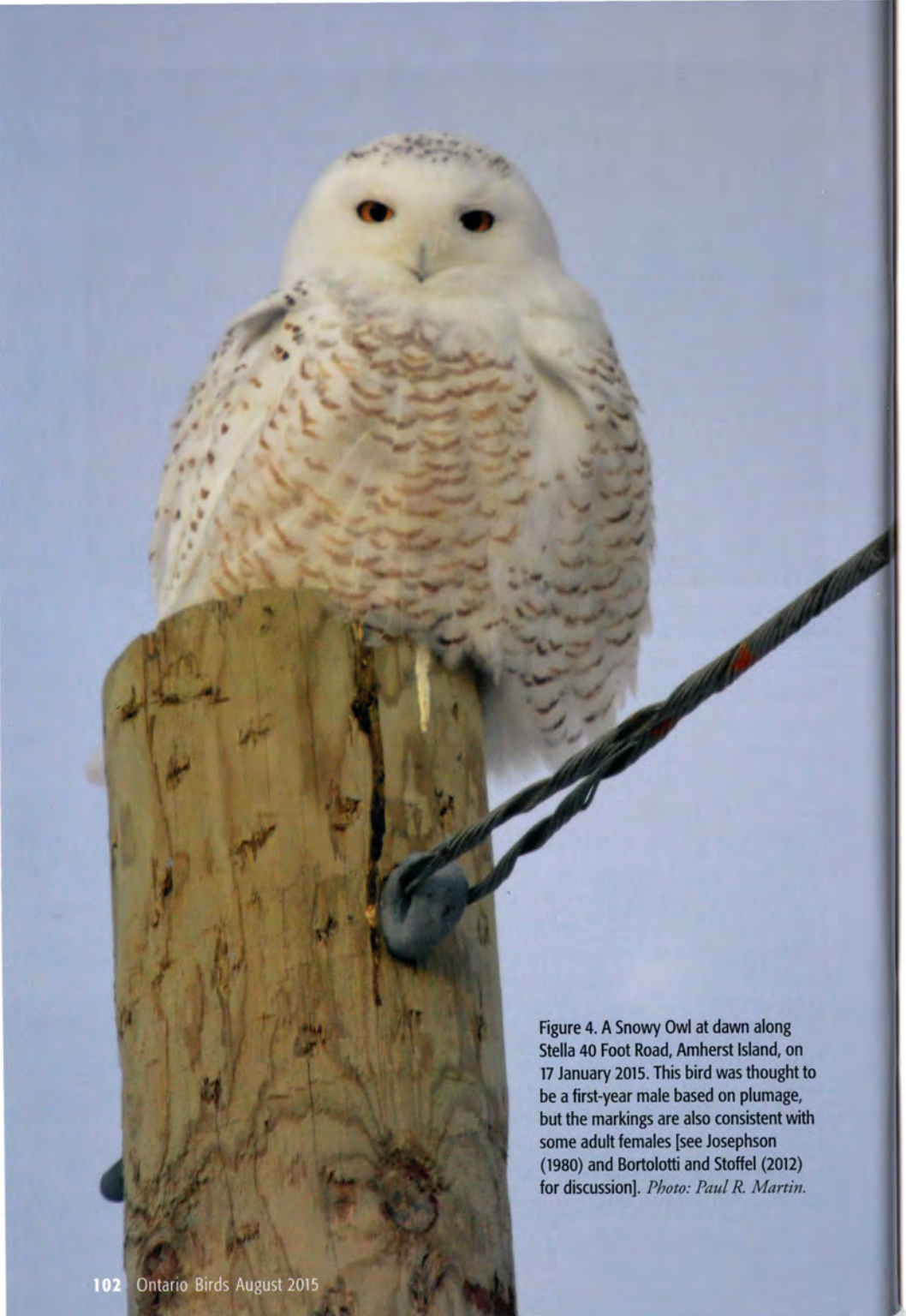


Figure 4. A Snowy Owl at dawn along Stella 40 Foot Road, Amherst Island, on 17 January 2015. This bird was thought to be a first-year male based on plumage, but the markings are also consistent with some adult females [see Josephson (1980) and Bortolotti and Stoffel (2012) for discussion]. *Photo: Paul R. Martin.*

Figure 5. Distribution of the 156 Snowy Owls recorded on Amherst Island during all surveys, 2015. Blue symbols represent females, red symbols represent males; circles represent adults, crosses represent first-year birds. Note the predominance of sightings on the eastern half of the island.

Distribution on the Island

Snowy Owls were not distributed evenly across the island. On the island itself, the majority of individuals was observed near the center of the island (Figs. 5, 7-9). No owls were observed on the west side of the island (west of Amherst Bay; Fig. 5), despite intensive searches of this area (Fig. 3). On the island, owls occupied open fields with few trees; however, many areas of open fields had few or no owls. No owls were observed on the ice in January (Fig. 7); however, large numbers congregated off the southeast shore of the island in late March (Fig. 8) and off the south and southeast shores in early April (Fig. 9). Females were more likely to occur on the ice (Figs. 5, 8, 9), particularly farther out on the ice in March (Fig. 8). In total, 50 of the 63 owls observed on the ice were females, compared with 49 of the 93 owls observed on the island (Chi-squared test, Chi-squared = 10.4, df = 1, P = 0.001).

Interactions and Spacing

Snowy Owls often occurred in clusters of individuals, with 6-13 individuals visible from one location on several occasions. Despite this broader clustering, individual Snowy Owls rarely occurred within 200m of each other, but instead appeared to be spaced out at somewhat regular intervals. Many of the owls observed in winter appeared to remain in the same general location on the island throughout January (Fig. 7), suggesting that some of these birds held winter territories. For example, an extremely dark first-year female was observed on 3rd Concession opposite the Big Marsh on every survey in January, often occupying the same perch.

While owls were typically spaced out, they occasionally came into close proximity. One fight between owls was observed on 17 January, when an adult male displaced a first-year female. On two occasions, owls replaced each other on the same perch within hours, suggesting an interaction: an adult female replaced a first-year female on the same

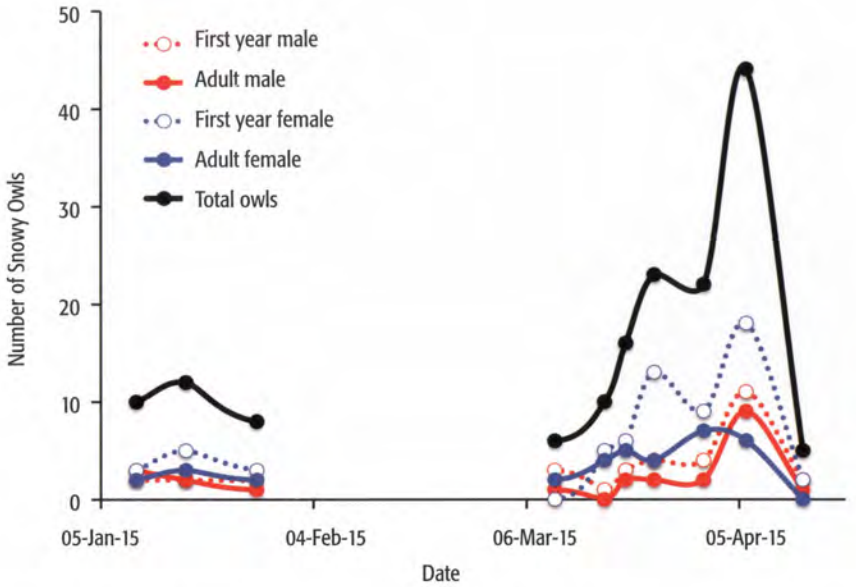


Figure 6. Numbers of Snowy Owls recorded during surveys on Amherst Island. Numbers reflect total number and numbers of each age and sex class.

perch on 17 January, while an adult male replaced a first-year male on the same perch on 6 April. A unique observation was made on 6 April, when a first-year male and first-year female were observed sitting on the ice of Amherst Bay 10-15 cm apart, preening. These two owls showed no aggressive behaviours toward each other during several minutes of observation, despite occurring much closer to each other than any other owls that I observed during my surveys.

I observed few interactions between Snowy Owls and other animals. One first-year male Snowy Owl was dive-bombed by an adult Herring Gull (*Larus argentatus*), on 6 April, while a first-year female was flushed by a domestic dog (*Canis familiaris*) on 24 March. I did not observe any aggressive interactions between Rough-legged Hawks (*Buteo lagopus*) and Snowy Owls, despite previous observations of aggressive interactions on Wolfe Island (Weir 1973) and an abundance of Rough-legged Hawks on Amherst Island in 2015 (high count of 50 on 6 April 2015).

Perch Use and Activity

Snowy Owls were most active in the early morning, with activity declining within an hour of sunrise. Owls appeared to remain active longer into the day on darker, overcast days. During the day, owls frequently sat on the same perch for many hours. For example, one bird was observed sitting on the same branch of the same tree over six hours after the first

Figure 7. Distribution of Snowy Owls on Amherst Island during three surveys in January, 2015. An estimated 12 owls wintered on the island.

Blue symbols represent females
Red symbols represent males
Circles represent adults
Crosses represent first-year birds

Figure 8. Distribution of Snowy Owls on Amherst Island during 5 surveys in March, 2015. A high count of 23 owls was observed on 24 March. Note the distribution of almost exclusively female Snowy Owls on the ice south of the island.

Figure 9. Distribution of Snowy Owls on Amherst Island during 2 surveys on 6 and 14 April, 2015. A high count of 44 owls was observed on 6 April; only 5 birds were observed on 14 April. The latest Snowy Owl on Amherst Island was observed on 30 April, 2015 (Read 2015). On 6 April, ice had melted along most of the southern point (Emeric or Long Point), with a string of birds lining the ice edges in both Amherst Bay (13 birds) and off the south end of Stella 40 Foot Road (8 birds). By 14 April, most ice was gone, with the exception of soft ice remaining in Wemps and Amherst bays.

observation. Across all observations, Snowy Owls were more likely to sit on the ground later in the day (Fig. 10; including birds perched on ice: Binomial Generalized Linear Model, slope = -0.498, SE = 0.09, z = -5.3, P < 0.0001; excluding birds perched on the ice: Binomial Generalized Linear Model, slope = -0.393, SE = 0.12, z = -3.3, P = 0.001). Ground perches were commonly next to a rock or mound, but also occurred in depressions, in the middle of open fields and against hedge rows. I only observed active hunting (*i.e.*, owls moving around, apparently actively searching for prey, and periodically dropping to the ground with extended legs) in the early mornings, and I could not identify any prey caught by the owls.

On the island itself, Snowy Owls were most often seen perched at the tops of trees, on fence posts and on the ground (Fig. 11). Birds were less commonly observed flying, and perched on telephone poles and Osprey nest platforms. Fewer than three individuals were observed perched on fallen trees, fence gates, hay trailers, hay bales, light poles, brush piles and livestock sheds, although some individuals appeared to use these perches regularly. On 14 April, two of the five Snowy Owls were perched beside small amounts of lingering snow, with most of the snow melted away (see similar observations in Quillium 1965, Weir 1973 and Potapov and Sale 2012).

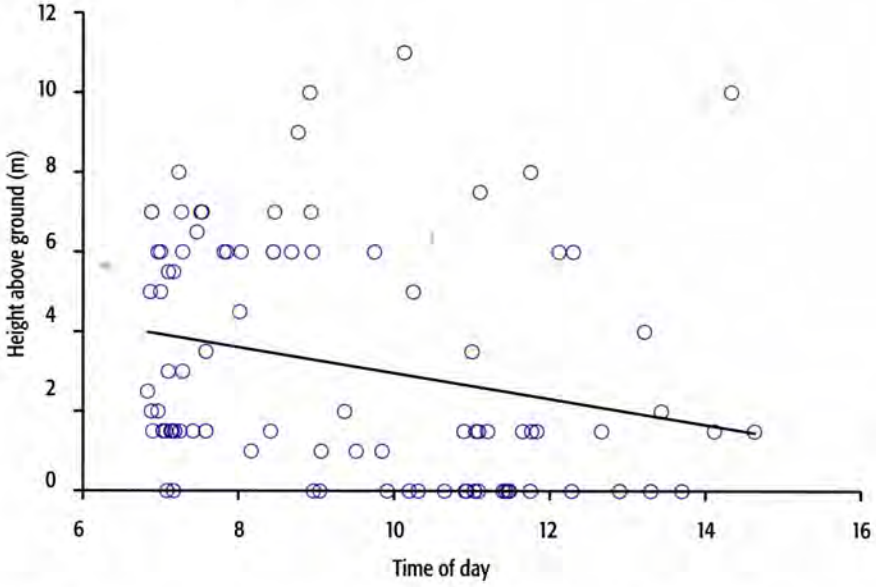


Figure 10. The height above the ground of Snowy Owls as a function of time of day, excluding owls perched on ice. Snowy Owls actively hunted in the early mornings, but were more likely to sit on the ground later in the day (Binomial Generalized Linear Model, P = 0.001).

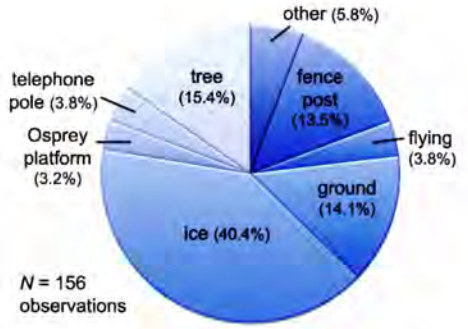


Figure 11. The frequency of use of different perches by Snowy Owls during surveys on Amherst Island. Birds found in flight are also included in the graph. Perches used by three or fewer Snowy Owls are lumped within "other."

From late March to early April, owls began perching on the ice in large numbers, and ice became the most important perch overall (Fig. 11). Many of these birds sat beside or on small mounds of snow or ice that had formed on the ice surface, often at the edge of open water. The occurrence of owls on the ice coincided with a regular observation of coyotes (*Canis latrans*) on the ice, and the presence of ducks in the leads of open water. Several duck carcasses (one scaup, *Aythya* spp., one adult male Common Merganser, *Mergus merganser*, and two unidentified ducks) were evident on the ice, but Snowy Owls were never observed hunting or feeding. The peak number of Snowy Owls on 6 April coincided with the edge of the ice reaching the southeast shore of the island and outer reaches of Amherst Bay (Fig. 9). At this time, large numbers of Snowy Owls lined the edges of the ice, while others were present at the edges of leads in the ice to the east, and on expanses of ice without water to the east (in addition to birds on the island itself; Fig. 9). On the same day, no owls were observed on the ice to the west or north of the island, despite leads in the ice and the presence of ducks (Fig. 9).

Discussion

The numbers of Snowy Owls using Amherst Island, and adjacent offshore ice, varied through the winter and spring, peaking at 44 Snowy Owls on 6 April (Fig. 6). These numbers likely represent underestimates because sections of the island (*e.g.*, Long Point Bay, Emeric Point) were not visible from the survey route (Fig. 3), and owls on the ground were not always visible from roads. Similar spring peaks in Snowy Owl numbers were noted during other irruption years, for example, high counts of 30 owls on 31 March 1961, Wolfe Island, 55 owls on 14 March 1965, Wolfe Island (Quillium 1965), 87 owls on 13 February 1972, Wolfe Island (Weir 1973) and 21 owls on 4 and 17 March 1979, Amherst Island (Bell *et al.* 1979). The large numbers of owls in March and April illustrate the importance of Amherst Island as a migratory stopover site for Snowy Owls in some years.

Snowy Owls observed on Amherst Island represented both sexes and age classes, with more probable first year females than any other group (Fig. 6). The makeup of owls during this irruption year differed from the irruptions of

1964-65 and 1971-72, when most birds were believed to be adults (Quillium 1965, Weir 1973).

Distribution

Most Snowy Owls observed during surveys occurred in the centre and east sides of the island (Fig. 5) despite apparently suitable open habitat elsewhere. The areas on the island preferentially used by the owls in 2015 were similar to areas occupied by owls in previous irruption years (R. Weir, pers. comm.), and also coincided with the best areas to find Snowy Owls historically, including during non-invasion years (B.M. Di Labio, pers. comm., P.R. Martin, pers. obs.). Presumably, the areas preferentially used by the owls host the highest densities of prey in the optimal habitat for wintering and migrant Snowy Owls. Previous work on Snowy Owls on Wolfe and Amherst islands suggested that Snowy Owls on the islands are feeding primarily on Meadow Voles (Quillium 1965, Weir 1973, Phelan 1976, Phelan and Robertson 1978).

On the ice just off the island, most owls were found off the south and southeast shore; I found no birds off the north or west shores, west of Sand Bay (Fig. 5). In previous years, Snowy Owls have been regularly observed using the ice either along the south shore, or sometimes along the north shore, of the island (R. Weir, pers. comm.). The areas of ice occupied by the owls in 2015 were some of the first to develop open leads of water in the spring, but similar leads were present in April off the north and west shores without owls present. The ice off the south and southeast shores may have been preferred by Snowy Owls because these areas had larger densities of prey (*e.g.*, ducks or dispersing voles), were more open and safer for roosting, or were the first near-shore expanses of ice encountered as owls moved north across the lake.

Spacing, Activity, and Perch Use

Snowy Owls were usually separated from other owls by 200m or more, but broadly clustered in their distributions on Amherst Island, with up to 13 owls visible from one location at one time. The high degree of spacing of owls differed from observations from western North America, where Snowy Owls have been documented using diurnal communal roosts in very close proximity (*e.g.*, Holt and Zetterberg 2008).

Apparent site fidelity, one physical fight, and turnovers of the same perch over short periods of time suggested that wintering owls on the island were territorial, and that territory boundaries were sometimes contested. Similar territorial behaviour has been documented in several areas of the Snowy Owl's wintering range (*e.g.*, Evans 1980, Parmalee 1992), including Wolfe Island (see Quillium 1965, Weir 1973). On only one occasion, I witnessed two individuals in very close proximity without fighting. Given the spacing of all of the other owls observed, the close proximity of the two owls (sitting 10-15 cm apart, see above) seems remarkable and suggests that these owls had formed some sort of relationship (*e.g.*, were siblings or were paired for later breeding). Courtship behaviour and close associations between male and female Snowy Owls have been reported from several locations on the wintering grounds (Boxall and Lein 1982a; including observations from Wolfe Island in March 1972, Weir 1973), suggesting that the initial stages of pairing may occasionally begin on the wintering grounds (Boxall and Lein 1982a, Parmalee 1992).

Most of my observations of Snowy Owls involved birds sitting. The only actively hunting birds that I observed were hunting early in the morning, within an hour of dawn. These observations are consistent with previous work from Wolfe Island and Alberta, where most diurnal hunting occurred at dawn and dusk (Weir 1973, Boxall and Lein 1989; I did not survey for owls after 15:30, so I have no data on dusk activity levels). I suspect that birds also hunted at night, as has been suggested from other studies of wintering Snowy Owls (Boxall and Lein 1989); however, I did not survey or observe Snowy Owls at night.

Snowy Owls often shifted to ground perches later in the mornings, particularly in the spring (Fig. 10). Similar shifts and patterns of perch use were noted by Quillium (1965) in her surveys of Snowy Owls on Wolfe Island in winter (see also patterns in Boxall and Lein 1989). Quillium (1965) also found that Snowy Owls were more likely to use ground perches on sunny days or on days with high winds, although Weir (1973) did not find similar trends. My observations of Snowy Owl roost sites were consistent with the observations of Quillium (1965), although I lacked enough data to test these ideas formally.

Use of Ice During Migration

During migration in late March and early April, large numbers of Snowy Owls — particularly females — used the ice off the south and southeast shores of Amherst Island (Figs. 8, 9). Congregations of up to 11 and 14 Snowy Owls were also reported from Lac Deschênes on the Ottawa River in early April, 2014 and 2015, respectively (B.M. Di Labio, pers. comm.), suggesting that Snowy Owls may use ice during spring migration in the Ottawa region as well. Previous observations on Wolfe Island also noted the use of ice by Snowy Owls during spring migration, with 10 observed perched "on pressure ridges on the ice at Reed Bay" on 21 March 1961 (Quillium 1965), and an influx of owls using the ice off the south shore of Wolfe Island in March 1972 (Weir 1973). Similar to this study, Snowy Owls were not noted on the ice in the winter irruption of 1971-1972 prior to March (Weir 1973).

I do not know why Snowy Owls used ice in such numbers in March and April, but several reasons are possible. (1) Ice may help owls to keep cool as temperatures rise in the spring. Some owls on the island in April were panting heavily and ruffling feathers, apparently trying to keep cool during periods of warm temperatures. A study of thermoregulation in Snowy Owls found their thermal conductance to be among the lowest recorded for any animal (Gessaman 1972), presenting a greater challenge for reducing heat loads as temperatures warm. (2) Ice may offer safer roosting sites, providing owls with greater visibility to spot potential predators. Ice roosting may also

reduce the likelihood of mobbing by other birds, such as corvids, that become more aggressive in spring and defend territories on land. The ice also provided a cryptic background when snow was melting on the island, potentially further protecting owls against predation and mobbing (although snow cover was extensive in late March when the owls began to use the ice). (3) The ice may have provided important hunting opportunities during the spring, particularly with ducks occupying narrows leads that formed in the ice in late March. Larger females are more likely to take larger prey (*e.g.*, Boxall and Lein 1982b), and their dominance on the ice is consistent with hunting ducks in the leads. Similarly, the increase in coyotes on the ice during this time suggested a shared response to prey. Previous observations of Snowy Owls during years of high vole densities also found voles dispersing onto the ice off the north shore, with Snowy Owls picking them off as they scurried over the ice (R. Weir, pers. comm.). I did not observe voles dispersing over the ice in 2015; however, I did not survey the ice at dusk or at night when the voles might have been more active. Similar opportunities for hunting ducks or voles were not obvious at Lac Deschênes on the Ottawa River despite the congregation of Snowy Owls on the ice in April 2014 and 2015 (B.M. Di Labio, pers. comm.), suggesting that the use of ice during spring migration is not exclusively tied to prey.

Regardless of the reasons, ice appeared to be an important resource for migrating Snowy Owls off the south shore of Amherst Island in 2015. Owls were present as far as I could see out on the ice, and more Snowy Owls may have roosted further out on the lake beyond my view. As the ice melted, larger numbers of Snowy Owls occurred off the island. These numbers peaked on 6 April, when the edges of the ice on Lake Ontario reached the south shores of the island, including Amherst Bay. Many of the birds visible on the ice on 6 April may have been using the ice further out in the lake earlier in the spring; surveys of offshore ice are necessary to know the full extent of Snowy Owl numbers in eastern Lake Ontario at this time.

Acknowledgements

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Correction from Volume 33(1) (April 2015)

47 column 1, line 9: Change "The record high count for Ontario (148 individuals) occurred on 26 October 2010 at Fifty Point Conservation Area" to "The record high count for Ontario (148 individuals) occurred on 26 October 2012 at Fifty Point Conservation Area"

47-48 column 2, 2nd line from the bottom: Change "Outside of the 'traditional' late fall window are three spring records of single birds (*fide* Wormington)," to "Outside of the 'traditional' late fall window are two spring records of single birds (eBird, 2015),"

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