WINTER 2023 VOLUME 81.4

BLUE JAY

As a naturalist and photographer, Monica Dahl documents the relationship between Turkey Vultures and Great Blue Herons at Island Lake, Alberta.

In December 2022, Mark and Anne Brigham observed and photographed a Snowy Owl, near Regina, which was consuming what they identified as a Fox Squirrel. To the best of their knowledge, this species has not been previously recorded as a prey item for Snowy Owls.

Chimney Swift reproduction was studied in St. Adolphe, MB (2007-2009 and 2010-2013). Here, Barbara and Robert Stewart present additional data (2014-2022) and use long-term data (2007-2022) to analyze reproductive trends and examine site-specific breeding success.

Doug Adams details a search for a rattlesnake hibernaculum on and around Checkerboard Hill in Saskatchewan on 26 September 2022.

Ski or hike alongside Robert Wrigley as he discovers the beauty of nature's winter wonderland. Although winter's grasp suspends many ecological relationships and wildlife-viewing opportunities, there remains much to enjoy!

In seven books spanning more than two decades, Trevor Herriot has intimately detailed the Prairies and grasslands in memoir, science and fact. In his eighth book, *The Economy of Sparrows*, he adopts a new tack — fiction.

WHAT'S INSIDE

ON THE FRONT COVER
A Coyote observed along Seven Bridges Road near Lumsden, SK.

Photo credit: Annie McLeod.

ON THE BACK COVER
Gray Partridges photographed in Regina, SK.

Photo credit: Annie McLeod.

FROM THE PRESIDENT

Lorne Scott
President, Nature Saskatchewan

I was born at Indian Head, SK, and raised on a mixed farm (animals and crops). My dad returned from World War II and took over his father's farm. My mother was raised on a farm near Indian Head. I am the oldest (76) of six. Like others my age, I remember no electric power, no running water, driving horses to a one room county school, milking cows, etc. One or maybe two trips were made to Regina each year. The 1898 one room school closed in 1964. School buses transported rural students to town, where I finished high school.

Growing up on the farm is when I found my interest in nature. Birds, animals and plants were all around. Farmers did not clear and drain every acre of land. Nature was a part of the landscape and appreciated. The sloughs provided pasture and hay for livestock. The aspen groves provided firewood for the house. These were good times when life was more in harmony with nature. I did not excel in school and chose to spend time hanging out at the farm. Like most naturalists, I use to hunt with a slingshot. I trapped some fur bearing mammals. In 1962, I started recording bird migration data and made my first bird house at 15. After finding a couple of Mountain Bluebird pairs nesting in natural tree cavities, I began setting out nest boxes for bluebirds. Over the decades, I have made some 2,500 bluebird nest boxes and banded more than 10,000 nestlings.

I was introduced to the Saskatchewan Natural History Society (Nature Saskatchewan) in 1965 through Doug Gilroy's weekly column titled Prairie Wildlife in the Western Producer. Doug had a note from Alfred Serfas at Snowden, Sask. saying that he had bluebirds nesting in boxes. As I also had bluebirds nesting, I wrote to Alfred and we have kept in touch ever since. Alfred was the one that told me about the *Blue Jay*. I have been a member ever since. I attended my first spring meet in 1966 at Rocanville. Since then, I have attended most spring and fall meets. I became a Nature Saskatchewan board member in the late 1960s and have served on the Board off and on over the past 50 years. This will be the third time I have served as President. Fortunately, through the decades there have been dozens of younger people with various backgrounds serve on the Board.

In 1967, I began working at the Saskatchewan Museum of Natural History (Royal Saskatchewan Museum). I provided information labels for exhibits, led school tours, and helped set up nature trails and interpretive centres in Provincial Parks. Until this time, Fred Bard and Fred Larhman — both at the museum — managed the Canada Goose flock in Wascana Centre. In 1975, Wascana Centre advertised for a Park Naturalist. I served in this position until 1991.

On weekends, I would return to the farm to help out. In 1975, I acquired my uncle's farm and have farmed and lived there ever since, two miles from where I grew up. I have retained about 50 acres of aspen and wetlands on each quarter. Sadly, many of the natural areas I knew on surrounding lands have been converted to crop land.

Over the years, I have been fortunate to work with many people in protecting natural areas. The *Wildlife Habitat Protection Act* in the 1980s was a great victory in preventing the sale and destruction of millions of acres of Crown land. The late 1980s saw the controversial battle over the Rafferty and Alameda Dams. I served as President of Saskatchewan Wildlife federation at this time.

I was kind of at a plateau in the early 1990s. Several people suggested and urged me to run for politics. Remember, I am the quiet and shy farm boy who would sooner be out looking for birds. After considerable thought and seeking advice from many, I ran for the New Democratic Party at Indian Head. Thanks to a lot of help from friends, I got elected as a Member of the Legislative Assembly in 1991. I was re-elected in 1995 and

Lorne Scott

served as Minister of Environment and Resource Management for four years. We added more land to the *Wildlife Habitat Protection Act* and brought in a new *Forest Resources Management Act*, which saw forests as more than trees to be harvested. The *Conservation Easement Act*, keeping provincial parks open, compiling all the lands in the province with some form of protection in the Representative Areas Network were some of our accomplishments.

Since my life in politics, we have been working to ensure the public ownership of former Federal and Provincial Community Pastures. Our efforts to save the 100-year-old federal Tree Nursery at Indian Head failed. Other issues such as the coyote bounty, species at risk and habitat securement have received Nature Saskatchewan's attention. The continual loss of native grasslands and the lack of a wetland policy are two main issues requiring our attention.

As Nature Saskatchewan enters into our 75th anniversary year, we can be proud of our past and we will confront challenges ahead of us with facts, credibility and energy. We have a diverse Board with expertise in many areas. I look forward to serving as your President in the coming year.

Together we will continue to be a Voice for Nature in Saskatchewan. Thank you for your support.

BLUE JAY

Blue Jay, founded in 1942 by Isabel M. Priestly, is a journal of natural history and conservation for Saskatchewan and adjacent regions. It is published quarterly by Nature Saskatchewan.

Editor: Annie McLeod
3017 Hill Avenue
Regina, SK S4S 0W2
E-mail: bluejay@naturesask.ca

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Nature SASKATCHEWAN

RELATIONSHIP BETWEEN TURKEY VULTURES AND GREAT BLUE HERONS AT ISLAND LAKE, ALBERTA

Monica L. Dahl
134 Lakeshore Drive S.
Island Lake, AB T9S 1S2
mdahl2368@icloud.com

During the summer of 2018, on an island known locally as Boy Scout Island, I first witnessed interactions between the Great Blue Heron (*Ardea herodias*) and the Turkey Vulture (*Cathartes aura*). The island is home to a heron rookery that has been active since at least 2016 (Justin Gilligan, pers. comm.), and has more than 30 active nests (personal observation). As a naturalist and wildlife photographer, I was very curious to learn more about the relationship between these two large bird species.

Boy Scout Island (~40 ha in size) is situated on Island Lake, Alberta (Figure 1), and is located approximately 150 km north of Edmonton. Great Blue Herons are known to tolerate the presence of other birds and have been observed nesting near eagles, vultures, and various other predatory birds.[1] To corroborate this point, the herons share Boy Scout Island with Ospreys (*Pandion haliaetus*), Barred Owls (*Strix varia*), Turkey Vultures and Common Ravens (*Corvus corax*).

Herons begin arriving on the island in early spring, before the lake becomes ice-free (personal observations). In early May, the herons build and repair their nests and begin nesting (Figure 2). Based on my observations, heron chicks in this rookery begin hatching the last week of May (Figure 3). Research shows herons incubate their eggs 26-29 days.[2]

In 2021, I began conducting field observations in earnest and noted the first Turkey Vultures arrived in the rookery in mid-May. The number of vultures increased, to a maximum count of 14, once the heron chicks had hatched. The vultures can be seen perched in the rookery (Figure 4), and often circling the nests (Figure 5).

The Turkey Vultures were never observed directly contacting the heron

FIGURE 1. Boy Scout Island, Island Lake, AB. Google Maps image. 2023.

FIGURE 2. Great Blue Heron nesting on Boy Scout Island, 11 May 2023. Photo credit: Monica Dahl.

FIGURE 3. Egg shells found at base of tree where Great Blue Herons are nesting, 29 May 2023. Photo credit: Monica Dahl.

FIGURE 4. Turkey Vulture perched near Great Blue Heron nest, 11 July and 2 June, 2023. Photo credit: Monica Dahl.

chicks, but the circling behaviour seemed to induce stress regurgitation. Young herons may vomit over the side of the nest when alarmed; this discourages predators. Juvenile herons could be seen regurgitating (Figure 6) over the edge of the nest when vultures circled above. Afterward, remains of fish could be seen at the base of the nesting tree (Figure 7), which vultures later consumed.While researching the relationship between these two species, I found one similar observation. In 1967[2] a naturalist observed *"After landing on a herons' nest which contained two, three-week-old young, the vulture beat the young herons with its wings and jabbed at them with its beak. This caused the young herons to regurgitate their last meal. The vulture then stopped beating them, ate the mass of semi-digested food, and returned to its own nest to feed its young..."*[4]

FIGURE 5. Turkey Vulture circling Great Blue Heron nests on Boy Scout Island, 7 July 2021. Photo credit: Monica Dahl.

FIGURE 6. Juvenile Great Blue Heron preparing to vomit over the side of the nest, 7 July 2021. Photo credit: Monica Dahl.

FIGURE 7. Remains of White Sucker (***Catostomus commersonii***) found after heron chick regurgitated over the nest, 7 July 2021. Photo credit: Monica Dahl.

FIGURE 8. Remains of juvenile Great Blue Heron found in downed nest after storm. Boy Scout Island, 23 June 2023. Photo credit: Monica Dahl.

FIGURE 9. Downed heron nest with heron remains and a Turkey Vulture feather. Boy Scout Island, 28 June 2023. Photo credit: Monica Dahl.

Although my observations are similar to Temple's, I did not witness the vultures physically harassing the herons or feeding their own young with regurgitated fish. The rookery seems to provide a good source of food for the vultures, through scavenged regurgitated fish from the young herons, and scavenged dead herons.

Throughout my years of observing this rookery, I have noticed regular mortality of young herons (Figure 8). Although I cannot say for certain, some explanations of this mortality may be extreme weather events, accidental falls and sibling aggression.[3] For example, after a particularly stormy week in 2023, I visited the rookery and noted two downed nests with dead young. Feathers left behind suggest that Turkey Vultures scavenged the heron remains (Figure 9). This steady supply of food likely explains the relationship between the vultures and herons on Boy Scout Island.

1. All About Birds. Cornell Lab of Ornithology, Ithaca NY. Accessed July 13, 2023. https://birdfact.com/articles/great-blue-heron-nesting

2. All About Birds. Cornell Lab of Ornithology, Ithaca NY. Accessed July 13, 2023. https://birdfact.com/articles/great-blue-heron-nesting

3. All About Birds. Cornell Lab of Ornithology, Ithaca NY. Accessed July 13, 2023. https://birdfact.com/articles/great-blue-heron-nesting

4. Temple SA (1967) A case of Turkey Vulture piracy on Great Blue Herons. Laboratory of Ornithology, Cornell University, Ithaca, New York 14850:94.

5. All About Birds. Cornell Lab of Ornithology, Ithaca NY. Accessed July 13, 2023. https://birdfact.com/articles/great-blue-heron-nesting

FOX SQUIRRELS: A POTENTIALLY NOVEL PREY ITEM FOR SNOWY OWLS IN SASKATCHEWAN

R. Mark Brigham
Department of Biology
University of Regina
Regina, SK S3S 0A2

Anne C. Brigham
6723 Gillmore Dr.
Regina, SK S4X 3Z1

There have been considerable studies published about the prey items consumed by Snowy Owls (*Bubo scandiacus*) especially during the time of the year when they over-winter on the Great Plains of North America.[1] The take home message of the summary study by Detienne et al. (2008) is that this owl appears to be highly flexible and will eat most anything that it can catch, although mammalian prey do seem to be preferred.

On 30 December 2022, we found a heavily barred individual Snowy Owl on the ground in a stubble field, which we identified as a female. The bird was approximately 10 km south of Regina and approximately 3 km east of Highway #6, about 400 m south of the grid road we were driving along. The individual was clearly eating something (Figures 1-4). We observed it for about 15 minutes. Within 100 m of the owl was a human dwelling surrounded by an extensive shelterbelt consisting of both deciduous and coniferous trees. The extent of the treed vegetation is likely important given that based on observation through binoculars and photographs (all by ACB), we identified the prey item as a Fox Squirrel (*Sciurus niger*). While very versatile in their habitat choices, Fox Squirrels are most often found in forest patches of 40 ha or less with an open understory, or in urban neighborhoods with trees.[2] We acknowledge that our identification of the squirrel has to be qualified based on the distance we were from the bird and the fact that some of it had been eaten. However, based on the size of the prey, colour (there was both light and reddish coloured fur), the large length of intestine indicating the prey species was a herbivore (Figure 3), and the fact that Fox Squirrels are strictly diurnal[2] and do not hibernate[3] makes us reasonably confident of our identification. To the best of our knowledge, this species has not been previously recorded as a prey item for Snowy Owls in an extensive study in nearby Montana.[1] Fox Squirrels have naturally invaded the Regina area only in the past several decades.[4]

FIGURES 1-4: Photographs of Snowy owl eating. Note the length of the intestine in Figure 3. Photos taken by Anne Brigham.

We cannot be completely confident that the prey was not an American Red Squirrel (*Tamiasciurus hudsonicus*) although the local distribution of this species does not include our observation point. Red Squirrels typically prefer more heavily wooded areas although Taylor documented an instance in Manitoba where wintering red squirrels could have been exposed to Snowy Owl predation.[5]

We thank Peter Taylor for his thoughtful comments on an earlier draft of the manuscript.

1. Detienne JC, Holt D, Seidensticker MT and Pitz T (2008) Diet of Snowy Owls Wintering in West-Central Montana with Comparisons to Other North American Studies. *Journal of Raptor Research* 42:172-179.

2. Koprowski JL (1979) *Sciurus niger. Mammalian Species* (479):1-9. doi:10.2307/3504263

3. Brigham RM and Geiser F (2012) Do red squirrels (*Tamiasciurus hudsonicus*) use daily torpor during winter? *Ecoscience* 19:127-132.

4. Adam CIG (1984) The Fox Squirrel in Saskatchewan. *Blue Jay* 42:241-246.

5. Taylor P (2012) Squirrel house on the prairie. *Blue Jay* 70:259-260.

AVIAN SPECIES RESPONSE TO WETLAND RESTORATION: AN EXAMPLE IN SOUTHWESTERN MANITOBA PARKLAND

Gord Hammell
Box 37
Erickson, MB R0J 0P0
gmhammell@gmail.com

Introduction

The Intergovernmental Panel on Climate Change has declared that urgent action is needed to mitigate further climate warming if a liveable future is to be secured for all.[1] Canadian governments, provincial and federal, have realized the need to address climate change and environmental degradation and recently have budgeted millions of dollars to conservation organizations tasked with the goal of mitigating these issues.[2,3] These organizations work primarily in agricultural areas using habitat conservation as a tool to improve wildlife populations and general ecosystem health. They provide expertise and direct financial support to landowners and through voluntary agreements, deliver ecological goods and services that help promote sustainable agriculture, reduce the effects of climate change, and enhance biodiversity for the benefit of future generations. Projects such as wetland restoration and enhancement, riparian buffers, shelterbelts, afforestation and native prairie grass restoration provide ecological goods and services such as flood control, cleaner water and air, wildlife habitat, carbon sequestration, and climate resiliency.[4]

Wetland restorations are prioritized because (i) their loss in Manitoba and worldwide has been startling[5,6] and (ii) because wetlands are among the most diverse and productive wildlife habitats in the world and support biodiversity that is disproportionately high for their area.[7] An example of one such conservation project in southwestern Manitoba is a wetland restoration at 50°26'30"N, 99°49'13"W, approximately nine kilometres southeast of Erickson. This project was initiated in 2016 using joint funding from two organizations to construct the infrastructure and compensate the landowner through a 10-year agreement. Both organizations are charitable: the Manitoba Habitat Conservancy (formally Manitoba Habitat Heritage Corporation) is dedicated to conservation and restoration enhancement of fish and wildlife habitat, and ALUS Canada (Alternative Land Use Services) promotes an innovative community-developed and farmer-delivered program that produces, enhances and maintains ecosystem services on agricultural lands.[8,9] A 1.9 ha Class IV-cover type 1[10] wetland (cattail [*Typha spp.*] centre with no or very little open water area, Figure 1) was restored by plugging a large ditch dug at an unknown time in the past (>50 years). Land use around this wetland is a mixture of open and bush pasture (Figures 1 and 2). Construction was completed in the fall of 2016, resulting in a dam

FIGURE 1. Google Earth view of wetland near Erickson, Manitoba, 2012, prior to restoration in 2017. Note location of future dam and central cattail (*Typha spp.*) patch surrounded by sedges (*Carex spp.*).

FIGURE 2. Google Earth view of restored wetland near Erickson, Manitoba, July 2019, showing location of dam constructed in 2016 and floating remnants of former cattail (*Typha spp.*) patch.

approximately 1.5 m high (Figure 3). The wetland filled behind the dam in 2017 with water draining from grasslands and cultivated fields, flooding pasture and poplar (*Populus spp.*) bush and resulting in a larger (~ 3.8 ha) class V-cover type 4 wetland (open water with little emergent vegetation, Figure 2,3). Beavers (*Castor canadensis*) immediately established themselves in the new wetland (Figure 3). As of summer 2018, emergent vegetation was sparse and the cattail patch centre of the drained condition initially floated to the top after filling and has gradually disappeared since then (Figures 1-4). Duckweed (*Lemna spp.*) has grown profusely each summer, forming dense patches in wind-protected areas (Figure 2-4). Fortunately, this wetland was situated on a long-term study area for waterfowl, enabling the capture of species change data from before and after the habitat alteration. The number or presence of other avian species (e.g., blackbirds [(*Icteridae*], rails [*Rallidae*], wrens [*Troglodytidae*]), and plant and insect species (aquatic and terrestrial) may have changed but effort to accurately record such change was beyond the scope of this study. Based on published literature,[11,12] I predicted that diversity and number of species easily observed using my methods would increase after restoration. The purpose of this manuscript is to present these change results and demonstrate the positive environmental contribution of this project.

FIGURE 3. View of restored wetland near Erickson, Manitoba, August, 2022 showing dam (left of cattail [***Typha spp.***]) and beaver (***Castor canadensis***) attempts at further damming.

FIGURE 4. View of restored wetland near Erickson, Manitoba, August, 2022, showing uplands surrounding the wetland and flooded trees (***Populus spp.***) and duckweed (***Lemna spp.***) patches.

Survey methods

From 2009 to 2018, I conducted three annual roadside breeding pair surveys during 21-25 May, 31 May-4 June, and 6-12 June. These dates were chosen to best determine breeding pair numbers for the primary species under study at the time, namely, Lesser Scaup (*Aythya affinis*) and Ring-necked Duck (*A. collaris*).[13] I walked to the wetland and, using binoculars and spotting scope, viewed it from several locations to ensure complete coverage. I clapped my hands together to bring hidden birds into view. In addition, I recorded the presence of other obvious avian species, mainly waterfowl but excluding smaller passerine birds due to time constraints. To observe waterfowl broods, I surveyed the wetland as above at approximately weekly intervals until early September. I used brood age (based on juvenile plumage characteristics[14]) and size to avoid duplication in counts. Brood search effort averaged about seven visits annually. For each species, I determined the greatest number of individuals or broods recorded during any survey and used that number as the result for that year. The pre-restoration wetland may have supported broods of waterfowl and other species but was not entered to flush hidden broods

because Lesser Scaup and Ring-necked Duck broods are rarely encountered in wetlands with no open water. I chose results from the last five years of the study because I felt that these years accurately represent the before and after restoration periods.

Results

The species of wetland-associated birds recorded before and after the wetland was restored are presented in Table 1. Species representation increased after restoration. The number of waterfowl species recorded before wetland restoration was one and the number after was 13. Four other wetland avian species common to the area were seen only after the restoration, but outside the pair census period. Nine of the 13 breeding waterfowl species recorded utilized this wetland for brood-rearing for at least one of the survey years after restoration. Diving (tribe Aythyini), sea (tribe Mergini) and dabbling duck and goose (tribe Anatini) broods were recorded. Toward the end of summer, large groups (10-20 individuals) of Canada Geese (*Branta canadensis*) and Wood Ducks (*Aix sponsa*) were noted on the wetland.

Discussion

As expected, most waterfowl species common to the area now were represented after restoration.[15] As well, the two species of grebe presently common on wetlands of this size were seen at least once. Interestingly, Red-necked Grebes (*Podiceps grisegena*), an overwater nesting species, were able to successfully raise a brood during the first years after impoundment when the floating cattail remnants remained (Figure 2). Northern Pintail (*Anas acuta*), American Wigeon (*Mareca americana*), and Horned Grebe (*Podiceps auratus*), recorded locally in surveys during the 1970s, are now much reduced in breeding numbers, and were not recorded.[15,16] The absence of extensive emergent growth (cattails, bullrushes [*Scirpus spp.*], sedges [*Carex spp.*]) soon after restoration may have deterred other overwater nesting species (e.g., Canvasback [*Aythya valisineria*], Ruddy Duck [*Oxyura jamaicensis*], American Coot [*Fulica americana*]) from utilizing this wetland to greater extent and may be a reason for them not being recorded.

Comparing before and after restoration brood use of this wetland is confounded by the lack of aggressive brood flushing (beat-outs) within the closed emergent patch before inundation. Females with broods can be found in shallow wetlands as existed here before restoration, usually as they transit between nesting and brood rearing areas or move towards larger and safer, more permanent ones; in years with adequate water levels and emergent cover, shallow wetlands may be used for feeding and avoiding predators.[13,17] However, it is unlikely that species use was extensive because females with broods of most species (e.g. Lesser Scaup, Bufflehead [*Bucephala albeola*], Mallard [*Anas platyrynchos*]) prefer permanent or semi-permanent wetlands with central open water for brood rearing[13,18,19] and, in most years, this wetland prior to restoration would contain little or no water by late summer. Accordingly, these data suggest that this restored class V wetland provides greater opportunity (than existed with the pre-impounded wetland) for waterbirds to settle, establish new or expanded home ranges and/or territories, forage, raise broods and stage prior to migration. Initially, it has not provided additional overwater nesting habitat for waterbirds.

It is important to note that this wetland is newly created, shorelines are encroaching on upland pasture or woodland and emergent vegetation succession is just beginning. At the time of this writing, cattail and sedge clumps are beginning to expand around the periphery. Emergent vegetation succession can be a lengthy process because seeds or vegetative parts need to be transferred from other wetlands. [20] Other similar looking but beaver-created wetlands in the area, with shorelines also flooded into uplands, have taken more than 15 years to produce a wide ring of emergent vegetation (personnel observation). Therefore, diversity of species may increase as the wetland

TABLE 1. Greatest number of selected waterbirds (males [M], females [F], unknown gender [U]) recorded during one of three breeding pair surveys and greatest number of broods (B) recorded during subsequent brood surveys on a Manitoba wetland before (2014-2016) and after (2017-2018) water levels were raised by wetland restoration.

SPECIES	2014	2015	2016	2017	2018
Lesser Scaup (*Aythya affinis*)	0	0	0	0	1M,1F,1B
Ring-necked Duck (*A. collaris*)	0	0	0	2M, 1F, 3B	5M,5F
Bufflehead (*Bucephala albeola*)	0	0	0	1F*	6M,2F*,1B
Common Goldeneye (*B. clangula*)	0	0	0	1F*	0
Redhead (*Aythya americana*)	0	0	0	2M, 1F	0
Hooded Merganser (*Lophodytes cucullatus*)	0	0	0	1F*	0
Mallard (*Anas platyrynchos*)	3M	0	0	3M, 1F, 1B	1M, 1B
Northern Shoveler (*Spatula clypeata*)	0	0	0	1M, 1B	1M, 1F
Gadwall (*Mareca strepera*)	0	0	0	0	1M, 1F
Blue-winged Teal (*Spatula discors*)	0	0	0	5M, 1F, 2B‡	1M, 1F
Green-winged Teal (*Anas crecca*)	0	0	0	4M	0
Wood Duck (*Aix sponsa*)	0	0	0	1M, 1B	10U
Red-necked Grebe (*Podiceps grisegena*)	0	0	0	1M, 1F, 1B	1M, 1F
Pied-billed Grebe† (*Podilymbus Podiceps*)	0	0	0	1U	0
Canada Goose (*Branta canadensis*)	0	0	0	1M, 1F	2B
Great Blue Heron† (*Ardea herodias*)	0	0	0	1U	0
Spotted Sandpiper† (*Actitis macularius*)	0	0	0	1U	1U
American White Pelican† (*Pelecanus erythrorhynchos*)	0	0	0	20U	0

F* represents adult female or yearling female

† Indicates species seen outside of pair survey dates

‡ Indicates Blue-winged or Green-winged brood

matures and the developing emergent vegetation ring becomes more attractive for those plant and animal species (e.g., overwater nesting waterfowl, songbirds, muskrats [*Ondatra zibethicus*]) associated with this habitat type.[21,22] Species loss occurring when the original wetland with closed emergent cover type was flooded likely will be mitigated in time by the newly created emergent ring habitat. However, highest total waterbird numbers may occur in the early years after flooding because the early secondary successional stages often provide an abundance of plant and animal food.[23] In conclusion, I expect this new wetland to develop into one similar in function to other class V wetlands in the area and provide breeding, staging and migration stop-over habitat for a plethora of avian (especially waterfowl) and other species. Over time, this project will also provide flood control, cleaner water, carbon sequestration, and climate resiliency.[22] Alternatively, without impoundment, this water with its accompanying nutrients and provision of ecological goods and services, would be lost annually to nearby streams and eventually, the Assiniboine River spring flow and further exacerbate nutrient and flooding issues in Lake Manitoba and Lake Winnipeg.[24,25]

Partnerships between governments, delivery agencies and landowners highlight the positive environmental and societal benefits that can be achieved through cooperation. Governments are supporting such projects to work toward their goal of successful climate crises mitigation and landowners are receiving rewards for adopting these programs. Indeed, when asked why they agreed to this restoration and their level of satisfaction with it, the landowners replied that they wanted to replace the environmental benefits lost when the wetland was drained, were satisfied with the work done and remuneration received, and were pleased to see the diversity of species now present. I would urge all landowners to consider these partnerships.

Acknowledgements

I thank the owners of the property for allowing access to their land. I also thank them for their dedication to conserving and enhancing wildlife habitat and hence biodiversity, and, by their contribution, helping to mitigate the effects of climate change. I also thank the *Blue Jay* editor and an anonymous reviewer for their helpful comments.

1. Intergovernmental Panel on Climate Change-Press Release 23 March 2023 Accessed 28 March 2023. https://www.ipcc.ch/report/ar6/syr/downloads/press/IPCC_AR6_SYR_PressRelease_en.pdf

2.The Conservation and Grow Trusts (2023) Accessed 15 March 2023. https://www.mhhc.mb.ca/the-conservation-trust/

3. Agricultural Climate Solutions – On-Farm Climate Action Fund (2021) Accessed 15 March 2023. https://agriculture.canada.ca/en/programs/agricultural-climate-solutions-farm-climate-action-fund

4. Ecological Goods and Services and Natural Capital (n.d.) Accessed 29 March 2023. https://www.gov.mb.ca/agriculture/environment/ecological-goods-and-services/index.html

5. Manitoba's pothole wetlands teem with life, but they're disappearing. Accessed 29 March 2023. https://www.ducks.ca/stories/prairie-pothole-region/manitoba-pothole-wetlands-disappearing/

6. Kingsford RT, Basset A, Jackson L (2016) Wetlands: Conservation›s poor cousins. *Aquatic Conservation: Marine and Freshwater Ecosystems* 26:892-916. https://doi.org/10.1002/aqc.2709

7. Dudgeon D, Arthington AH, Gessner MO, Kawabata Z-I, Knowler DJ, Lévêque C, Naiman RJ, Prieur-Richard A-H, Soto D, Stiassny MLJ, Sullivan CA (2006) Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological Reviews* 81:163-182. https://doi.org/10.1017/S1464793105006950

8. Manitoba Habitat Heritage Corporation (n.d.) Accessed 23 March 2023. https://www.mhhc.mb.ca

9. ALUS Canada (Alternative Land Use Services) (n.d.) Accessed 23 March 2023. https://alus.ca/

10. Stewart RE, Kantrud HA (1971) Classification of natural ponds and lakes in the glaciated prairie region. Resource publication 92. United States Fish and Wildlife Service, Washington, DC, USA. Accessed 20 March 2023. https://pubs.usgs.gov/rp/092/report.pdf

11. Kantrud HA (1986) Effects of Vegetation Manipulation on Breeding Waterfowl in Prairie Wetlands—A Literature Review. United States Fish and Wildlife Service, Fish and Wildlife Technical Report 3. 15pp. Accessed 24 March 2023. https://apps.dtic.mil/sti/pdfs/ADA323112.pdf

12. Nummi P, Holopainen S (2014) Whole-community facilitation by beaver: ecosystem engineer increases waterbird diversity. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24:623-633. https://doi.org/10.1002/aqc.2437

13. Hammell GS, Singer HV, Armstrong LM (2021) Comparative reproductive parameters of sympatric Lesser Scaup (*Aythya affinis*) and Ring-necked Duck (*Aythya collaris*) in parkland Manitoba. *Canadian Field-Naturalist* 135:278-292. https://doi.org/10.22621/cfn.v135i3.2507

14. Gallop JB, Marshall WH (1954) A guide for aging duck broods in the field. Technical session report. Mississippi Flyway Council, Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana, USA.

15. Hammell GS (2014) Erickson study area: duck breeding populations and habitat, then (1970-72) and now (2008-13). *Blue Jay* 72:123-139. https://bluejayjournal.ca/indexphp/bluejay/article/view/212/209

16. Hammell G (2017) Changes to the population status of Horned Grebes (*Podiceps auratus*) and Red-necked Grebes (*Podiceps grisegena*) in southwestern Manitoba, Canada. *Canadian Field-Naturalist* 131:317-324. https://doi.org/10.22621/ cfn.v131i4.2069

17. Smith AG (1971) Ecological factors affecting waterfowl production in the Alberta parklands. United States Fish and Wildlife Service Resource Publication 98.

18. Erskine, AJ (1972) Buffleheads. Monograph Series No. 4. Canadian Wildlife Service, Ottawa.

19. Raven GH, Armstrong LM, Howerter DW, Arnold TW (2007) Wetland selection by Mallard broods in Canada's Prairie-Parklands. *The Journal of Wildlife Management* 71:2527-2531. https://doi.org/10.2193/2004-022

20. Green AJ Elmberg J (2014) Ecosystem services provided by waterbirds. *Biological Reviews* 89:105-122. https://doi.org/10.1111/brv.12045

21. Masto NM, Kaminski RM, Prince HH (2022) Hemi-marsh concept prevails? Kaminski and Prince (1981) revisited. *Journal of Wildlife Management* 86:e22301 https://doi.org/10.1002/jwmg.22301

22. Mitsch WJ, Zhang L, Stefanik KC, Nahlik AM, Anderson CJ, Bernal B, Hernandez M, Song K (2012) Creating Wetlands: Primary Succession, Water Quality Changes, and Self-Design over 15 Years. *BioScience* 62: 237-250. https://doi.org/10.1525/bio.2012.62.3.5

23. Danell K, Sjoberg K (1982) Successional Patterns of Plants, Invertebrates and Ducks in a Man-Made Lake. *Journal of Applied Ecology* 19:395-409. https://doi.org/10.2307/2403475

24. Harmful algal blooms on Lake Winnipeg. (n.d.) Accessed 12 August 2023. https://lakewinnipegfoundation.org/harmful-algal-blooms-lake-winnipeg

25. History of flooding in Manitoba (n.d.) Accessed 12 August 2023. https://www.gov.mb.ca/flooding/history/index.html

THE INFLUENCE OF WEATHER AND HUMAN DISTURBANCE ON THE REPRODUCTIVE SUCCESS OF CHIMNEY SWIFTS IN ST. ADOLPHE, MANITOBA, 2007-2013 AND 2014-2022

Barbara E. Stewart and Robert E. A. Stewart
Sila Consultants
1218 Marchand Road
Howden, MB R5A 1J6
sila.stewart@gmail.com

Introduction

The Chimney Swift (*Chaetura pelagica*) belongs to the guild of aerial insectivores (Figure 1).[1] Declines in prey abundance and the loss of nest sites through the lining, capping, or demolishing of old masonry chimneys have contributed to the significant decline of Chimney Swift populations throughout Canada.[1,2] It is protected as a Species at Risk (Threatened) in Canada and Manitoba.[3-6]

Chimney Swift reproduction has been studied in St. Adolphe, MB (2007-2009 and 2010-2013).[7,8] Here we present additional data (2014-2022) and use long-term data (2007-2022) to analyze reproductive trends and examine site-specific breeding success.

We identified anthropogenic disturbances as one of many factors affecting reproductive success.[9] Prey abundance and aerial insectivore nestling survival are known to vary in species-specific ways with weather.[10-17] Prey availability varies predictably with time of day and season but unfavorable weather is disruptive. Weather parameters interact with each other and with biotic factors in urban and agricultural landscapes.[10,16,18-20] While we were unable to assess interactions among abiotic and biotic factors, we investigated the effect of weather and inferred seasonal prey abundance variation possibly correlated with nest failures.

Methods

Five Chimney Swift nest sites on four buildings in St. Adolphe, MB (~10 km south of Winnipeg) have been monitored with the same protocol since 2007.[7,8] The time of nest site entry and exit events was recorded to the nearest second. The interval between an exit and an entry is the between-visit duration. The interval between an entry and an exit is the turnaround duration, which does not distinguish between an exchange between parents and the departure of the bird that just arrived. The speed, direction, flight characteristics of approach and departure, association with other Chimney Swifts near the nest site, and the number of Chimney Swifts seen in the air were also recorded.

Local weather conditions, including Environment and Climate Change Canada (ECCC) air quality advisories for wildfire smoke, which can affect the behaviour of aerial insects, were noted although subsequent analysis relied on weather station data.[21] Also, anthropogenic disturbances e.g., building construction and rooftop activity, were documented.[9]

Monitoring effort varied among years. Monitoring sessions usually lasted 60-90 min but ranged from 15-180 min as sampling was adapted as needed. An effort was made to monitor at least two nest sites consecutively on any given day. The comparable data enabled an assessment of the effect of weather and human disturbance on nest site use and reproductive success.

Spring nest site occupation was verified and primary breeding attempts by Chimney Swift pairs were tracked to conclusion. All secondary breeding attempts failed and were not included in data analysis. The phenology, or dates for the onset of each nesting stage, was established by interpreting the sequence and frequency of entries and exits.[7,8] Nest building (Figure 2) continues through egg laying and incubation until hatching.[22,23] Establishing the starting date of incubation based on behavior remains problematic.[8] Since 2019, >50% attendance at the nest site during an observation period >60 min, followed by turnaround times for partner exchanges of <10 min has been used increasingly to identify incubation. Incubation was confirmed by the observation of a classic incubation exchange i.e., an entry followed by an exit within 30-120 sec. Incubation exchanges between partners typically occurred once per hour.[7,8]

We compared breeding phenology from 2007-2013 with that of 2014-2022, limiting analyses to pairs starting primary nest building by 6 June because pairs

FIGURE 1. Adult Chimney Swift flying with twig in beak. Photo credit: Dave Lavigne.

that arrived after 6 June (n=6) were not successful. The precision with which nest stage dates can be established depends on the length of the sampling (monitoring) interval. We used only estimated dates, for which the sampling interval was <5 d, and calculated the median date for each nesting stage.

A breeding cycle for Chimney Swifts at St. Adolphe takes at least nine weeks.[8] With only a short breeding season at this northern latitude (~mid-May to late August), a shift of even a few days for nesting stages may be biologically significant without being statistically different. Therefore, we calculated medians for each variable (e.g., hatching day) and explored the data for weather and human disturbance factors affecting even small changes. We also used longitudinal data for pairs of birds to estimate the time between various nesting stages.

Breeding success was defined as a nesting attempt culminating in at least one fledgling, identified on the basis of 'novice' flight characteristics and intact wing margins at a time when adults are moulting.[23] Reproductive success was measured by the number of fledglings

FIGURE 2. Chimney Swift nest. Small diameter twigs are held together by sticky saliva secreted from adult salivary glands. Nests are 8.9-10.8 cm wide and 2.5-3.1 cm high; the cup shaped portion, which holds eggs, extends 4.8-7.5 cm from the vertical wall.[23] Photo credit: Rob Stewart.

and presented as two different rates: 1) the standard fledglings per number of eggs laid or number of eggs hatched; and 2) to evaluate site performance (see below), the number of fledglings per site. This distinction was required because egg counts were available for only two of the five sites. Nest failure was defined by lack of activity at a site during three consecutive daytime monitoring sessions >60 min made over two days. Chimney cleanout traps at Brodeur Bros. and Main St. were inspected to observe fallen nests, eggs/eggshells, and carcasses for the determination of clutch size and reproductive rates (hatching and fledging).

Helpers are immature or non-breeding adult Chimney Swifts which assist with nesting activities.[24] In our study, the presence of a helper was confirmed by three consecutive entries or exits by Chimney Swifts at a nest site prior to fledging. The possible presence of a helper can be behaviourally nuanced. It may be indicated by the observation of a unique entry style, a pattern and sequence of entries/exits indicating a pair plus another bird are onsite, and an increased rate of attendance compared to other nest sites, at a similar nesting stage, and monitored on the same day.[7,8] Confirmed and possible helpers were noted.

Nest site performance (2007-2022) was ranked using the following parameters: order of first occupancy in the spring; number of breeding attempts; number (%) of successful breeding attempts; number of fledglings produced based on visual or physical evidence; and number of consecutive years with successful breeding. Physical evidence of fledging comes from counts of eggshells and carcasses in the chimney cleanout trap.

Each nest site was ranked (1=best, 5=worst) separately for each nest site parameter. These ranks were then summed to generate an overall nest site performance rank. We measured the height of each chimney from ground level using a range-finder with inclinometer (Leupold RX-1600i) but did not assign a rank based on height.

Starting in 2011, local weather data became available for analysis related to nest failures.[8] Late arriving breeders are known to be unsuccessful so we limited this current analysis to only those pairs present at nest sites by 6 June.[8] There were 24 nest failures documented in 2011-2022 that satisfied the arrival date criterion and were accurately dated. Six others were excluded as they failed during gaps in monitoring and could not be accurately dated.

The availability of insects for avian aerial feeders is linked to weather.[11,13,14,16,18,25] In the absence of data on insects at St. Adolphe we used weather data as a proxy for prey availability. We defined a 'weather day' as the daylength (sunrise to sunset) in which Chimney Swifts can forage. In July at St. Adolphe, sunrise is between 05:00 and 06:00 h and sunset between 21:00 and 22:00 h. Hourly weather data represent the preceding hour, e.g., 06:00 data are for 05:00-06:00 h. We limited our analysis to daytime hours: 06:00-22:00 h.[13,19]

We examined weather data preceding known nest failure dates to detect correlates. The number of these weather days examined varied with the precision of the estimated date of failure. If the nest failure date was known, we examined three weather days: the day of failure and the two preceding days. If nest failure was estimated to occur on one of two days, we examined four weather days: failure day estimates one and two, plus the two preceding days. Similarly, if nest failure was estimated to occur on one of three consecutive days, we examined five weather days.

Manitoba Agriculture maintains a weather station located 2.7 km north of St. Adolphe (Station ID 243).[26] We received weather data as Excel files from Manitoba Agriculture. From this data set we used hourly average air temperatures and wind speeds, maximum hourly wind speeds, and hourly rainfall for weather each day.

The number of aerial insects declines when air temperatures are too low or too high.[13,15,16,25] We used lower and upper air temperature thresholds of <18.5° C and > 32° C (reduced prey) and <15.5° C and >34° C (severely reduced prey) for this study. These thresholds were based on those used to define cold snaps that correlated with nestling mortality of Tree Swallows (*Tachycineta bicolor*) at Ithaca, New York due to low prey availability.[15,16] In Louisiana, aerial insect abundance at 32.2° C and 33.9° C were the same as when the temperature was 18.5° C and 15.5° C respectively.[25] Chimney Swifts increased the between-visit feeding intervals at temperatures between 33.1° C and 36° C and again at temperatures over 36° C.[27] The 90th percentile of July maximum temperatures in Winnipeg is about 32° C, suggesting higher temperatures can be considered extreme.[28] In our study period, there were no July temperatures over 36° C.

Rain and winds can also negatively affect the availability of aerial insects, but we found no published numeric thresholds as we did for temperature. We used the ECCC protocol to report wind gusts greater than 30 kph as a threshold for 'windy'.[29] We tabulated the number of daytime hours when weather factors met the criteria, and, as the number of weather days examined varied, we expressed the results as the percent of daytime hours examined i.e., the percent of potential feeding hours examined. The presence of wildfire smoke was based on air quality advisories from ECCC. Having identified environmental data potentially associated with nest failures, we examined behaviour records for examples of behavioral changes associated with the posited reduced feeding.

Results

Fewer Chimney Swift nest sites were occupied in 2007-2013 (28 breeding attempts over seven years at five sites) than in 2014-2022 (43 breeding attempts over nine years at five sites, Table 1).[8] They were also occupied earlier in 2007-2013 than in 2014-2022 (median dates 18 and 21 May, respectively; Table 2, Figure 3).

Pairs that were ultimately successful in 2014-2022 (Tables 1, 3) typically arrived at

a nest site together or within a day of each other, and usually started nest building immediately. The mean interval between arrival and nest building was 1.9 d in 2007-13 and 0.0 d in 2014-22. The long lag in the first period is due to the protracted start at the Church in 2008. This was the only nesting data point for 2008 and we have no weather data to further assess this case. The mean would be 0.9 d if this pair were excluded (Table 2).

Using entry/exit data to estimate the onset of incubation, the median start of incubation was six days earlier in 2014-2022 than in 2007-2013 (Table 2, Figure 3) and using paired data, the duration of incubation was virtually identical (17 d, Table 2). Corresponding to the earlier start of incubation, all nesting stages were slightly earlier in 2014-2022 than 2007-2013 and the durations of most nesting stages were similar until departure (Table 2). The long period of feeding brooded nestlings at the Church in 2013 (11 d; typically 6-7 d) inflated the overall mean but is thought to be due to inconclusive monitoring. In 2014-2022, both successful and failed parents have left almost a week earlier (successful 6 d and failed 5 d earlier). The time between fledging and departure was 6 d shorter in 2014-2022.

In 2007-2009, pre-migratory groups of local birds were evident while between 2010-2013 they formed only in years with good feeding rates.[7,8] For 2014-2022, no pre-migratory groupings of local birds were seen as Chimney Swifts regularly dispersed from St. Adolphe earlier in the season. For example, concurrent monitoring of all five sites on 2 August 2018 showed all five were being used as roosts but the maximum number of Chimney Swifts counted (12) was less than expected (five pairs and four known fledglings).

The date of first fledging at one site usually marked the start of departures of unsuccessful breeders which previously had roosted in their nest sites. The median date on which successful nesting sites were last used was later in 2007-2013 (22 August, n=6, range 13 August-3 September) than in 2014-2022 (14 August, n=11, range 2-24 August). This was different than reported elsewhere because this analysis is limited to successful sites only.[8]

For corrected data from 2007-2013, the breeding success rate was lower (39%, range 20-60%) than in 2014-2022 (44%, range 20-80%; Tables 1, 3, 4 and 5). The successful fledging at SE Club Amical in 2018 was not only the first recorded success at this site but also the earliest recorded fledging date in St. Adolphe.

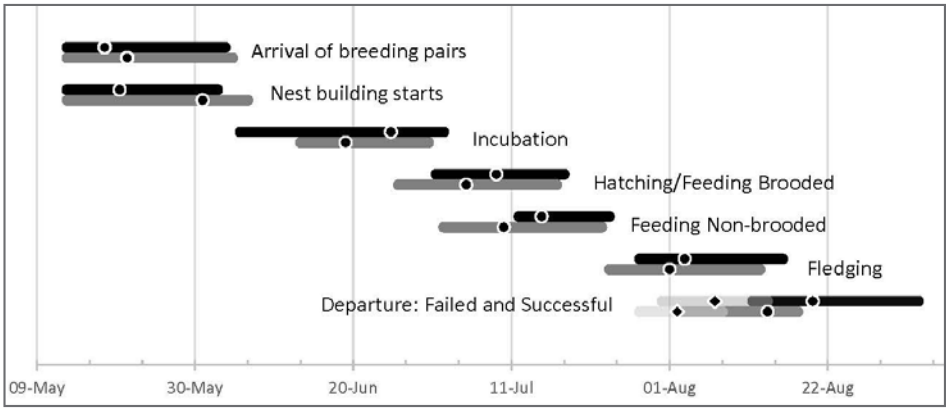

FIGURE 3. Phenology of breeding Chimney Swifts at five nest sites in St. Adolphe, MB. For each nesting stage, the range of dates (bars) and medians (●) are shown for 2007-2013 (upper, darker bar) and 2014-2022 (lower, lighter bar) for breeding pairs starting their primary nest building by 6 June with a sampling interval <5 d. Departure dates are shown for breeders that failed (median ◆; lighter bar, left) and for successful breeders (median ●; darker bar, right). Departure date ranges of failed and successful birds overlap.

There were 16 pairs of visual/physical fledgling counts. Fifteen pairs agreed or differed by a count of one bird more in physical evidence, e.g., one vs. two, two vs. three. At Main St. in 2021, there was physical evidence of five fledglings although the visual estimate was one. The rank assigned to Number of Fledglings was not affected by these data. Fewer fledglings were produced in 2007-2013 than in 2014-2022 (Table 3) although the median number of young produced per successful nest was two for each period.[8]

In 2007-2013, for primary nesting attempts initiated by a pair <4 June, nest failures (n=12) took place at three different nesting stages: incubation (33%); feeding brooded juveniles (25%); and feeding non-brooded juveniles (42%).[8] For 2014-2022, established pairs nest building by 6 June failed (n=24) at only two different stages: feeding brooded juveniles (46%) and feeding non-brooded juveniles (54%).

Some sites were more successful in consecutive years than others and we returned to the 2007-2013 data to examine these patterns. The highest number of consecutive successful breeding attempts at any nest site was four and one site was never successful two years in a row (Table 4). There were four consecutive unsuccessful breeding attempts at NE Club Amical (2018-2021) and three at SE Club Amical (2014-2017).

All the nest chimneys are brick and four of five rise from inside airconditioned buildings. The fifth, the Church chimney, is attached to two walls on the north side of the building where the below-roofline part is well shaded except to the northeast quadrat. The Church is not cooled in summer. The Church site had the best site performance rank in both reporting periods (Table 4). Other sites varied in rank but not by more than one position. Overall, Brodeur Bros. had the poorest site performance rank; it was not used every year, was often selected last by spring arriving Chimney Swifts, and had the lowest breeding success rates. Chimney height above ground ranged from 9.1-14.2 m and all but one extended into basements (Table 4).

Reproductive rates of Chimney Swifts at Brodeur Bros. and Main St., where nesting residue can be observed in the cleanouts, varied between the two reporting periods (Table 5). At Brodeur Bros., the clutch size range remained nearly the same and while the percent of eggs hatching increased there were large declines in the number fledging; breeding attempts which were successful fell (Table 5).

At Main St., clutch size became more variable, the percentage of eggs hatching and fledging rates relative to eggs laid increased, and the number of fledglings relative to the number of eggs hatched decreased. Breeding success at this site doubled between the reporting periods (Table 5). Reproductive success (number of fledglings) from all sites increased between the two periods, attributable primarily to large increases at the Church (Table 4).

The absolute and relative number

TABLE 1. Phenology at five Chimney Swift nest sites in St. Adolphe, MB, 2014-2022. Dates for the onset of nesting stages are for primary breeding attempts. Empty fields reflect missing data. Arrival dates and nest building by single birds are noted. Last known use at site=daytime (D; entries/exits) or roosting (R; roosting entries); number of birds (n).

Year (hours obs.)	Site	Arrival Date	Nest Building	Incubation	Feeding Brooded	Feeding Non-brooded	Fledge Date	Last Known Use D, R (n)
2014 (81)	SE Club Amical	30 May-2 June	<11 June		4-9 July; **FAILED 11-12 July**			18 August R (2)
	NE Club Amical	≤21 May	<11 June		13-15 July		11 August	18 August R (2)
	Brodeur Bros.	26-29 May			By 3 July		30 July	14 August R (3)
	Church	22-25 May			By 2 July; **FAILED >3-21 July**			22 July R (2)
	Main St.	≤21 May			≥10 July; **FAILED 10-21 July**			3 August R (2)
2015 (75)	SE Club Amical	20 May single night use	None initiated					N/A
	NE Club Amical	21-24 May	>9 June		6 July	12 July; **FAILED 17-24 JULY**		16 July D (2)
	Brodeur Bros.	21-24 May	~9 June		15 July; **FAILED 16 JULY**			25 July D (1)
	Church	≤20 May	4-5 June		30 June	7 July	1 August	16 August R (5)
	Main St.	≤20 May	1 June		3-6 July; **FAILED 7-12 JULY**			6 July D (2)
2016 (146)	SE Club Amical	7-14 June	7-14 June		10 July	16 July; **FAILED 18-19 July**		24 August R (1)
	NE Club Amical	17-19 May	17-19 May		4 July	9-10 July; **FAILED 16 July**		24 August R (1)
	Brodeur Bros.	*30 May-2 June*, *n*=1; 7-13 June, *n*=2	30 May-2 June		10 July; **FAILED 15 July**			27 July R (1)
	Church	17-28 May	17-28 May		3 July	9 July	30 July	17 August R (3)
	Main St.	*17-29 May*, *n*=1; 15-21 June, n=2	*30 May-2 June n=1*		14 July		12 August	17 August R (2)
2017 (75)	SE Club Amical	By 31 May	≤31 May		3-5 July; **FAILED 10 July**			8 August R (3)
	NE Club Amical	By 31 May	≤31 May		5-6 July	10 July	1 August	8 August R (2)
	Brodeur Bros.	Unoccupied all season						N/A
	Church	By 31 May	1-2 June		3-5 July	8-10 July	31 July	17 August R (4)
	Main St.	By 31 May	≤1 June		4-6 July	9-13 July	2 August	13 August R (4)
2018 (104)	SE Club Amical	20-25 May	20-25 May		25-27 June	Unk.; helper onsite	24 July	2 August R (2)
	NE Club Amical	20-21 May	20-21 May		≥28 June; **FAILED 29 June-1 July**			6 August D (2)
	Brodeur Bros.	*26-31 May*, *n*=1; 4 June, *n*=2	4 June		≥28 June; **FAILED 28 June-1 July**			31 July R (2)
	Church	16 May	16 May		1 July	6 July; **FAILED 16-18 July**		2 August R (2)
	Main St.	*21-24 May*, *n*=1; 4 June, *n*=2	21-24 May		27-30 June	2-3 July	28 July	2 August R (4)
2019 (156)	SE Club Amical	20 May	20 May	20-22 June	29 June-1 July	Unk.; heavy smoke & decreasing attendance during transition	25 July	10 August D (1)
	NE Club Amical	23 May	23 May	17 June	29-30 June	5 July; **FAILED 11-12 July**		31 July D (1; juvenile, likely from SE site)
	Brodeur Bros.	21 May	21 May	30 June	10 July; **FAILED 15-16 July**			16 July D (1)
	Church	13 May	13 May	13 June	27-28 June	3 July; **FAILED 17-18 July**		16 July D (1)
	Main St.	23 May	23 May	21 June	9 July	15 July	5-7 August	14 August D (1)
2020 (132)	SE Club Amical	19-22 May	19-22 May	19 June	9 July	15 July; **FAILED 20-21 July**		20 July D (1)
	NE Club Amical	23-27 May	23-27 May	19 June	9 July	15 July; **FAILED 27 July**		26 July D (2)
	Brodeur Bros.	18-22 May	18-22 May	17 June	3 July	9 July; **FAILED 13-14 July**		5 August R (1)
	Church	18-22 May	18-22 May	17 June	4 July	10 July	2-3 August	23 August R (2)**
	Main St.	18 May owner's report	≤1 June	19 June	10 July	Unk.; **FAILED 17-20 July**		16 July D (2)
2021 (124)	SE Club Amical	First of year observations in St. Adolphe: 14 May, *n*=3; 15 May, *n*=6; 19 May, *n*=8; no day use at any site until 27 May	27 May	18 June	7 July	13 July; **FAILED 14 July**		25 July D (1)
	NE Club Amical		31 May	18 June	6 July	12 July; **FAILED 17 July**		16 July D (1)
	Brodeur Bros.		31 May	17 June	3 July; **FAILED 7 July**			6 August D (1)
	Church		31 May	17 June	5 July	10 July	31 July	15 August R (1; likely migrant)
	Main St.		3 June	19 June	7 July	12 July	3 August	4 August D (2)
2022† (117)	SE Club Amical	Other observers reported Chimney Swifts in St. Adolphe 12 May, *n*=3 and 25 May, *n*=5	4 June	18-20 June	16 July	21 July	13 August	16 August D (3)
	NE Club Amical		4 June	21-22 June	1 July	8 July	29 July	16 August D (1)
	Brodeur Bros.		4-5 June	20-23 June	11 July; **FAILED 13-14 July**			12 July (2)
	Church		6 June	24-26 June	15 July	22 July	11 August	12 August D (1)
	Main St.		5-6 June	28 June-1 July	17 July	23 July	13 August	13 August D (2)

** At the Church aerial group sizes on 8-12 August were two adults and two juveniles. There was heavy rain during the day on 14 August (30.8 mm) and the average daytime temperature was 16.4°C. No Chimney Swifts were seen 15-17 August. The two birds seen on 23 August were likely migrants.

† In 2022, Red River flood waters prevented us monitoring until 1 June.

of helpers increased between the two periods and, more often, helpers were present at successful breeding attempts (Table 3). The success rate of attempts with a helper were indistinguishable between periods, due to small sample sizes, and across all years the success rate with a helper was 70%.

For each nest failure, the most prevalent weather parameter was considered the most likely proximal cause (Table 6). Two failures, both at Brodeur Bros. (Lines 1 and 8 in Table 6), showed no strong weather effects but were associated with visits of non-parent adult birds. The September 2011 examination of the Brodeur Bros. cleanout revealed unhatched eggs and no nest while in 2015, unhatched eggs, hatched eggs, and no nest were observed. Another failed attempt, at the Church (Line 2 in Table 6) also seemed uncorrelated with weather, although most of the hours <18.5° C were also <15.5° C, and the young were within 3-5 days of expected fledging. Of the remaining 21 failures, 17 were associated with daytime hours when air temperature was <18.5° C. The proportion of daytime hours in which winds exceeded 30 kph showed no obvious relation to nest failures (0% in 19 of 24 cases, 1.6-10% in 5 of 24; unpubl. data).

There were 21 successful breeding attempts that shared the weather events with the 24 failed attempts (2011-2022; Tables 1, 3, and 6). Six of these successes were at different nesting stages than the failures when the failures occurred. Weather/chick age interactions cannot be ruled out but we have too few data to assess the nesting stage or chick age as covariates with weather. When successes overlapped at least one failure at the same nesting stage (n=15), helpers were present at 11 nests (73%) and the other four were at prime nesting sites (Church n=2, Main St. n=2).

Nest building often started the day the birds arrived in St. Adolphe (Table 1) but was delayed in cold weather. In 2021, Chimney Swifts arrived by 14 May, but no nest building was detected until 27 May (five monitoring days 15-27 May). Although the average daytime air temperature for 15-31 May inclusive was 15.4° C, the maximum hourly daytime air temperatures fell on 20 May to 10.2° C, rose briefly on 24 May to 27.5° C, then fell again to <15° C until midday on 28 May. In the first few hours of daylight on 27 May temperatures were below freezing.

TABLE 2. Phenology (dates) of nesting stages of Chimney Swifts at St. Adolphe, MB, in 2007-2013 and 2014-2022. Median dates were calculated using data for birds which nested by 6 June and for which the sampling interval was <5 d. Paired data are a subset for which dates were available for both stages. Paired data are considered a better estimator of duration than is a comparison of medians.

NESTING STAGE	2007-2013	2014-2022	COMMENTS
Arrival	18 May *(n=14)*	21 May *(n=15)*	
Nest building	20 May *(n=12)*	31 May *(n=27)*	2022 nesting delayed by weather. Excluding 2022, $\bar{X}$=24 May *(n=22)*
Arrival to nest building ($\bar{X}$, d) (paired data)	1.9 *(n=9)*	0.0 *(n=14)*	Church was late nesting in 2008. Excluding 2008: $\bar{X}$=0.9 *(n=8)*
Incubation	25 June *(n=17)*	19 June *(n=20)*	
Hatch	9 July *(n=15)*	5 July *(n=31)*	
Incubation to hatching ($\bar{X}$, d) (paired data)	16.6 *(n=11)*	17.0, *(n=20)*	
Non-brooded	15 July *(n=12)*	10 July *(n=23)*	
Hatching to non-brooded ($\bar{X}$, d) (paired data)	6.2 *(n=10)*	5.7 *(n=23)*	Lengthy period (11 d) of feeding brooded young at the Church 2013 affected the mean. Excluding these: $\bar{X}$=5.7 *(n=9)*
Fledge	3 August *(n=10)*	1 August *(n=16)*	
Non-brooded to fledging ($\bar{X}$, d) (paired data)	20.6 *(n=9)*	22.2 *(n=14)*	
Depart successes	20 August *(n=7)*	14 August *(n=8)*	
Fledging to departure ($\bar{X}$, d) (paired data)	17.7 *(n=7)*	11.9 *(n=8)*	
Depart failures	7 August *(n=5)*	2 August *(n=5)*	

Low temperatures were also associated with reduced feeding rates. On 20 July 2020, the average daytime temperature was 20.2° C, but it had been <18.5° C between 21:00 h the night before and 09:00 h on the 20th with an overnight low of 10.4° C. At 10:55-12:10 h, non-brooded young at SE Club Amical were being fed at a rate of one visit per hour compared to an expected rate of four per hour.

High temperatures alone, or in conjunction with high winds, reduced incubation exchange and feeding rates. Incubating adults at both NE and SE Club Amical sites were exchanging once per 90 min (expected 1/h) when a heat advisory was in effect on 3 July 2020. Average air temperature from 11:00-20:00 h was 31.0° C and winds were light (wind speed average 7.5 kph, gusts average 14.7 kph). A heat and wind warning for 7 July 2018 was reflected in an average air temperature of 30.4° C, average windspeed of 31.8 kph and average gusts of 48.5 kph from 13:00-19:00 h. Feeding rates at both the Church and Main St. were reduced: Church 1/h; Main St. 2 exits, no exchange in 60 min; the expected rate for non-brooded young is 3-4/h.

There were few observations made in heavy rain. May 2022 was the rainiest May for which we have data and may have been related to an apparent lag of up to 26 days between the first sighting of a Chimney Swift in St. Adolphe on 12 May and nest building 4-6 June. Between 13 and 31 May, 123 mm of rain fell (12-year average 60.0 mm) but it was also cold (average air temperature 12.1° C).

Chimney Swift behaviour in the presence of wildfire smoke was variable. We distinguished between upper-air smoke (when there was no Air Quality Health Index advisory but when we could estimate the percent of the sky that was smoke), and low-level smoke (when an advisory was issued because humans would be in the smoke). With upper-air smoke covering 50% of the sky on 24 July 2010, (~20° C at 10:25 h; no precipitation; moderate wind), the non-brooded feeding rate at Brodeur Bros. was 3/h, slightly less than the expected rate of 4/h. Feeding conditions may have been good as evidenced by observations of many low feeding Chimney Swifts, Purple Martins (*Progne subis*) and Barn Swallows (*Hirundo rustica*). Similar behaviour was recorded with 100% smoke cover on 4 July 2015 (~28° C at 14:40 h; no precipitation; strong breeze); the brooded Church juveniles were fed at the expected rate of 2/h and both Chimney Swifts and Purple Martins fed near the ground. In low-level smoke on 6-7 July 2019, in association with air quality advisories, we recorded reduced feeding rates of non-brooded young at both Club Amical sites: 6 July - NE Club Amical 2/h, SE Club Amical 1/h; 7 July - NE Club Amical 1/h, SE Club Amical 2/h (expected 4/h). When

extremely low and dense wildfire smoke triggered air quality advisories on 16-17 August 2018 no aerial insectivores, indeed very few birds at all, were seen flying locally.

Discussion

Analysis

Methods of monitoring and assessing nesting phenology remained constant through the years with one refinement in 2019.[7,8] We attempted to improve the ability to detect incubation by using any one of three criteria: the amount of time spent at the nest site, turn-around times between partners and partner exchange rates.[8,9] There was no difference in the duration of incubation between periods and we underestimated the expected minimum duration of incubation (18 d) by 2 d.[8,22,23] We cannot determine if this difference reflects a shorter incubation period in Manitoba or an inability to precisely detect the start of incubation. Notwithstanding this imprecision, our criteria remain useful for establishing that incubation is in progress. Intensive monitoring is necessary to establish when hatching and the transition to feeding non-brooded juveniles occur; estimated fledging dates can then be calculated.

We limited our weather analysis to daytime hours when Chimney Swifts would be expected to be feeding. Longer term, or even daily, averages of weather variables were not informative. They included hours when the birds were in the chimney and protected from low temperatures, high winds, and all but the heaviest of rains, which can wet the inside walls of chimneys.[30] Even daytime averages can mask episodic events such as sudden downpours, which when averaged over 24 hours may not appear extreme. Most of the daytime hourly temperatures below 18.5° C in our study occurred in the first few hours after sunrise when the adults and young should have been ending their ~9-hour overnight fast. Chimney Swifts feed intensively in the early daylight hours and Tree Swallows are thought to be impacted by reduced prey availability as soon as abundance starts to drop.[16,17] We consider hourly data to be most applicable to assessing impacts.

In the absence of Manitoba data, we relied on information from other areas to establish temperature thresholds that

TABLE 3. Chimney Swift nesting outcomes at five St. Adolphe chimneys, 2014-2022. Helper attendance was confirmed (H) or likely (H?). Estimated fledging success is based on observations of birds entering and exiting the chimney (SE, NE Club Amical and Church) and physical evidence in cleanout traps (Brodeur Bros. and Main St.).

YEAR	SITE	BREEDING ATTEMPT	SUCCESSFUL	FLEDGE DATE	ESTIMATED. NO. FLEDGLINGS				
					VISUAL	PHYSICAL EVIDENCE			BEST EST.
						Clutch size	No. hatch	No. fledge	
2014	SE Club Amical	yes	no						
	NE Club Amical	yes	yes	11 August	2				2
	Brodeur Bros.	yes	yes (H)	30 July	1	4	4	1	1
	Church	yes	no						
	Main St.	yes	no		0	6	6	0	
	Summary	5	2						3
2015	SE Club Amical	no							
	NE Club Amical	yes	no						
	Brodeur Bros.	yes	no (H)		0	5	1	0	
	Church	yes	yes	1 August	5				5
	Main St.	yes	no		0	6	6	0	
	Summary	4	1						5
2016	SE Club Amical	yes	no (H)						
	NE Club Amical	yes	no						
	Brodeur Bros.	yes	no		0	5	4	0	
	Church	yes	yes (H?)	30 July	6				6
	Main St.	yes	yes (H?)	12 August	2	2	2	2	2
	Summary	5	2						8
2017	SE Club Amical	yes	no						
	NE Club Amical	yes	yes (H)	1 August	1				1
	Brodeur Bros.	no							
	Church	yes	yes	31 July	2				2
	Main St.	yes	yes	2 August	2	3	3	3	3
	Summary	4	3						6
2018	SE Club Amical	yes	yes (H)	24 July	2				2
	NE Club Amical	yes	no						
	Brodeur Bros.	yes	no		0	3	3	0	
	Church	yes	no						
	Main St.	yes	yes	28 July	2	8	7	2	2
	Summary	5	2						4
2019	SE Club Amical	yes	yes (H)	25 July	2				2
	NE Club Amical	yes	no						
	Brodeur Bros.	yes	no		0	4	4	0	
	Church	yes	no						
	Main St.	yes	yes (H)	5-7 August	2-3	4	4	4	4
	Summary	5	2						6
2020	SE Club Amical	yes	no						
	NE Club Amical	yes	no (H)						
	Brodeur Bros.	yes	no		0	7	7	0	
	Church	yes	yes	2-3 August	2				2
	Main St.	yes	no (H?)		0	5	5	0	
	Summary	5	1						2
2021	SE Club Amical	yes	no						
	NE Club Amical	yes	no						
	Brodeur Bros.	yes	no		0	8	6	0	
	Church	yes	yes (H)	31 July	2				2
	Main St.	yes	yes (H?)	3 August	1	5	5	5	5
	Summary	5	2						7
2022	SE Club Amical	yes	yes (H)	13 August	2-3				3
	NE Club Amical	yes	yes	29 July	2				2
	Brodeur Bros.	yes	no			5	5	0	
	Church	yes	yes (H?)	11 August	5				5
	Main St.	yes	yes	13 August	1-2	3	3	3	3
	Summary	5	4						13
	2014-2022	43	19 successful, 24 failed 10 attempts with confirmed helper: 7 successful; 3 failed 5 attempts with likely helper: 4 successful; 1 failed						54

TABLE 4. Relative performance of five Chimney Swift nest sites in St. Adolphe, MB, 2007-2013 and 2014-2022. All sites were available for use each year. Each parameter (order of first occupancy; number of breeding attempts; number (%) of successful breeding attempts; number of fledglings produced based on visual (V) or physical (P) evidence; and number of consecutive years with successful breeding attempts) was assigned a rank (1-5, best to worst) which were summed to provide an overall rank for each site in each period. Chimney above-ground heights: SE Club Amical 9.6 m; NE Club Amical 10.9 m; Brodeur Bros. 7.0 m; Church 14.2 m; Main St. 9.1 m.

YEARS	SITE	ORDER OF OCCUPANCY RANK†	BREEDING ATTEMPTS (RANK)	NO. (%) SUCCESSFUL BREEDING ATTEMPTS (RANK)	ESTIMATED NO. OF FLEDGLINGS (V OR P) BY YEAR (RANK)	CONSECUTIVE SUCCESSES (RANK)	SITE RANK
2007-2013 (7 years)	SE Club Amical	5	3* (4)	0 (0%) (4)	0 (V) (5)	0 (4)	5 (Σ=22)
	NE Club Amical	2	7 (1)	4 (58%) (1)	8 (V; 3, 2, 1, 2) (2)	1 (3)	2 (Σ=9)
	Brodeur Bros.	4	5 (3)	1 (20%) (3)	2 (P; 2) (4)	1 (3)	4 (Σ=17)
	Church	1	7 (1)	4 (57%) (1)	6 (V; 2, 1, 1, 2) (3)	3 (1)	1 (Σ=7)
	Main St.	3	6† (2)	2† (33%) (2)	9† (P; 4, 5) (1)	2 (2)	3 (Σ=10)
All Sites			**28***	**11 (39%);**	**25****		
2014-2022 (9 years)	SE Club Amical	4	8 (2)	3 (38%) (2)	7 (V; 2, 2, 3) (3)	2 (3)	4 (Σ=14)
	NE Club Amical	2	9 (1)	3 (33%) (2)	5 (V; 2, 1, 2) (4)	1 (4)	3 (Σ=13)
	Brodeur Bros.	5	8 (2)	1 (13%) (3)	1 (P; 1) (5)	1 (4)	5 (Σ=19)
	Church	1	9 (1)	6 (67%) (1)	22 (V; 5, 6, 2, 2, 2, 5) (1)	3 (2)	1 (Σ=6)
	Main St.	3	9 (1)	6 (67%) (1)	19 (P; 2, 3, 4, 5, 2, 3) (2)	4 (1)	2 (Σ=8)
All Sites			**43**	**19 (44%)**	**54**		
OVERALL 2007-2022	SE Club Amical	4	11 (4)	3 (27%) (4)	7 (V) (3)	2 (3)	4 (Σ=18)
	NE Club Amical	2	16 (1)	7 (44%) (3)	13 (V) (2)	1 (4)	3 (Σ=12)
	Brodeur Bros.	5	13 (3)	2 (15%) (5)	3 (P) (4)	1 (4)	5 (Σ=21)
	Church	1	16 (1)	10 (63%) (1)	28 (V) (1)	3 (2)	1 (Σ=6)
	Main St.	3	15† (2)	8† (53%) (2)	28 (P) (1)	4 (1)	2 (Σ=9)
All Sites			**71**	**30 (42%)**	**79**		

* Modified from Stewart and Stewart 2013 – for this current analysis, we consider only primary breeding attempt by pairs of Chimney Swifts nest building by 6 June
** n=25 best estimate of no. fledglings in Stewart and Stewart, 2013, Table 2
† No data in 2007.

TABLE 5. Chimney Swift reproductive rates at Brodeur Bros. and Main St. nest sites in St. Adolphe, MB, in 2007-2013 and 2014-2022, based on observations of physical evidence in chimney cleanout traps. Sample sizes (n) are listed for clutch size, total number of eggs hatched/total number of eggs laid, and total number of fledglings for each consecutive year in each reporting period; N/A (not applicable) indicates that no nesting attempt was made.

	BRODEUR BROS.		MAIN ST	
	2007-2013 (7 YEARS)	2014-2022 (9 YEARS)	2007-2013 (7 YEARS)	2014-2022 (9 YEARS)
Breeding Attempts (n)	5	8	7	9
Successful Breeding Attempts (n)	1	1	2	6
Successful Breeding Attempts (%)	20	12.5	33.3 (2/6)	66.7
Clutch Size Range (n)	3-7	3-8	5-6	2-8
Median Clutch Size (n)	4	5	5	5
Total No. Eggs Laid (n)	18	41	21	42
Total No. Hatched Eggs (n)	6	34	18*	41
Eggs Hatched/Eggs Laid (%)	33.3	82.9	85.7*	97.6
Total Fledglings (n)	2	1	9	19
Fledged/Eggs Laid (%)	11.1	2.4	42.8	45.2
Fledged/Eggs Hatched (%)	33.3	2.9	50.0*	46.3

*Corrects Stewart & Stewart 2013 values of n=16; 76%

would reflect prey availability. The lower thresholds of about 15.5° C and 18.5° C appear to apply to various more northern areas (New York, Illinois, Quebec).[13,15-17,19] The selection of the upper thresholds, however, was established from one study in Louisiana where insect abundance was similar at upper and lower thresholds.[25] Data for Chimney Swifts in Illinois used upper temperature brackets of 30.1-33.0° C and 33.1-36.0° C that were too broad to generate a threshold value.[17] At St. Adolphe, nest failures that were correlated with heat (32° C and 34° C) were also associated with several hours over 30° C. Local research would be required to determine if this is a more appropriate threshold than was used.

High and low temperatures, extreme rain events, high winds and smoke can all negatively affect the availability of aerial insects and are expected to become more frequent based on climate change models.[31] A comprehensive and overall assessment on different scales is necessary to understand the complexities of how weather affects Chimney Swift reproduction. For example, May 2022 was the wettest and windiest May in 11 years of weather data but, despite a delay in the start of nest building, a record number of successful breeding attempts took place that year.

Phenology

All nest sites in St. Adolphe remained accessible throughout the two study periods, so fluctuations in site occupancy reflected preferences of breeding pairs in choosing nest sites. Not all nest sites were occupied each year between 2014-2022, but there was a higher overall occupancy rate compared to 2007-2013. SE Club Amical and Brodeur Bros. were first seen to house Chimney Swifts in 2009.[8] They

were also the only two sites to remain unoccupied between 2014 and 2022. It is not known if their lack of use in 2007-2008 reflects a pattern of use/disuse or if they were newly occupied in 2009. It is not known what an unoccupied nest site means in relation to the Chimney Swift population at large. At least sometimes in St. Adolphe, when a site was unoccupied, there was a helper at another site.

The median nest building date was later in 2014-2022 than 2007-2013, largely attributable to a late start in 2022 when all pairs began nesting on 4-6 June. The regression of nest building date as a function of year showed a significant increase (later nest building) from 2007 to 2022 ($P=0.02$, $R^2=0.37$, $n=39$), driven completely by the 2022 data. Without the 2022 data, the regression was not significant ($P=0.32$, $R^2=0.03$, $n=33$). In 2022, the average temperature in May after the birds arrived (12 May) was 12.2° C with 130.3 mm of rain. Comparable temperatures were recorded in 2019 (average temperature 12.6° C) but in other years ranged from 13.9-19.0° C and only 13.8 mm of rain fell after the birds arrived in 2019. Additionally, Red River flood waters peaked at St. Adolphe on 13 May 2022, approximately 3.2 m above normal river levels and were still about 1.9 m above normal on 4 June.[32,33] We consider insufficient prey due to the cold wet weather and submerged insect-producing land the most likely cause of delayed nest building in 2022.

In general, after nest building, nesting stages progressed a few days earlier in recent years compared to 2007-2013. Both successful and unsuccessful birds left St. Adolphe earlier (5-6 d) in 2014-2022. The regression of departure date by year for successful birds was significant ($P=0.009$, $R^2=0.42$, $n=15$). The regression for failed nesters was not significant ($P=0.18$, $R^2=0.21$, $n=10$) although they too left about 5 d earlier (Table 2). The pre-migratory assemblages (<19 birds) at the Church between 2007-2013 were local family groups (adults and fledglings) plus a few migrants.[7,8] No pre-migratory groupings of Chimney Swifts formed in St. Adolphe between 2014-2022. We suggest that the earlier departure and lack of pre-migratory groups indicate prey availability levels were too low to support the birds staying.

Overall breeding success at St. Adolphe nest sites was similar between 2007-2013 and 2014-2022. Generally, only one or two nests produced fledglings each year, although reproductive success was higher in 2017 (three of four attempts) and 2022 (four of five attempts). In 2022, departure dates were also later than any others in the 2014-2022 period and personal observations indicated mosquitoes remained abundant in bothersome numbers well into August.

There was an apparent difference in the timing of nest failures, but sample sizes were small. In 2007-2013, some nests failed at the incubation stage but later all failures were when young were being fed. Survival of eggs may depend more on the condition of the parents when they arrive at the breeding area than on local resources. Some failures were associated with high temperatures (Table 6) which may be more stressful for incubating parents than for feeding parents.

Reproductive rates are based on the number of eggs laid, number of eggs hatched, and number of surviving offspring which fledge. That information can only be derived from observing cleanout trap material. Reproductive rates at Brodeur Bros. fell while at Main St. they increased between 2007-2013 and 2014-2022. A higher proportion of eggs hatched at both sites, but the number of hatchlings which survived to fledge declined significantly at Brodeur Bros. while the rate declined marginally at Main St. There was no increase in nest slippage events at Brodeur Bros., so the lack of food appears to be a primary issue. Of the two sites, the Main St. chimney is preferred by the Chimney Swifts. We interpret reproductive rate changes as evidence of lower prey availability late in the breeding season having a disproportionate effect on pairs which occupy less than optimal nest sites.

Factors associated with nesting outcomes

Reproductive success depends on the interaction of parental abilities to meet basic requirements (nest construction and feeding) and to compete when the necessities such as nesting structures (chimneys) are limited. While suitable chimneys may not be limiting at a broad scale they can be scarce locally.[34] We consider the six nest sites a limiting resource in St. Adolphe. However, prey abundance is also considered a limiting resource for songbirds during the nesting season and weather affects prey abundance, thence aerial insectivore reproductive success.[10-17,35,36] Human altered landscapes and agricultural practices also affect prey abundance and bird survival.[13,37] The ability of Chimney Swifts to locate adequate food and compete successfully for suitable nest sites are key parental assets.

Breeding Chimney Swifts in St. Adolphe demonstrated site preferences by routinely occupying some sites ahead of others during spring arrival. Chimney Swifts live about four years and marked-recaptured breeding birds are known to return to the same nest site over several years.[22,23] Therefore it is likely that some individuals returned in consecutive years over shorter periods. Our study documented that some nest chimneys were preferred over others, likely due to one or more physical attributes.[30]

While our method for measuring chimney height accurately estimated a Chimney Swift tower known to be 3.8 m tall, it lacks the precision to distinguish between chimneys of similar height. This is largely due to the recording of angles to the nearest degree. For example, if upper angles recorded for the chimney at Main St. were 14.4° instead of the reported 14°, and that at SE Club Amical were 15.5° instead of 16°, the measured chimney heights would be identical. Nonetheless, instrument error cannot account for the difference between the Church (14.4 m) and Brodeur Bros (7.0 m) which were the first and last ranked chimneys respectively or between Brodeur Bros and the next shortest chimney, Main St.

We found a chimney height threshold of about 9 m (~30'; Main St) above ground was associated with repeated successful breeding. Chimney height (above ground or above the roofline) has been identified as an important factor for nest and roost site selection in some but not all studies.[30,34,38] Total chimney depth, which also includes below ground portions, should be considered in evaluating height influences on nesting outcomes. All sites except Brodeur Bros. include chimney space below ground, so the difference in usable vertical space (depth) is greater than the reported above ground height. In Manitoba, purpose-built Chimney Swift towers >10.4 m were successful in attracting Chimney Swifts but 3.8 m towers were not.[39]

Short chimneys may render nests prone to slipping if heavy rains wet the inside walls.[40] Nest slippage may be implicated in the 2021 failure at Brodeur Bros. (Line 21 in Table 6) and nests were detected in autumn cleanout inspections at Main St. (2012) and Brodeur Bros. (2013). However, it is not known when in the season the nests fell. Chimney Swifts may nest in the part of the chimney below ground (BES, unpubl. data), so below ground chimney depth may be important for nest attachment. Tall chimneys may confer some yet to be determined beneficial attribute e.g., air flow dynamics. It remains that less successful sites still serve as sources of possible helpers and as a safe resting spot for fledglings as they develop flight proficiency.

Pre-migratory roosts at the Church chimney were consistent with early forming assemblages of Chimney Swifts where family groups join local and other migrants at larger roosts which had been used season-long or only later in migration.[7,38] Tall chimneys which are clear of adjacent foliage are used by large groups of roosting Chimney Swifts.[38] The Church was the tallest chimney but the canopy of a large adjacent tree prevented swirling pre-roost flight behaviour typical of large numbers of Chimney Swifts.

Not all failures were associated with weather events. Aggressive chasing flights near or in chimneys were observed between breeding and other non-helper adults. These were not seen with the arrival of a helper.[24] Such hostile visits often end with the visitor destroying eggs or killing young (M. Postolan, *in litt.*). At least two observed nest failures were associated with hostile incursions at Brodeur Bros.; the inability to repulse intruders may be linked to the parents' inability to secure a better nest site.

Three failures were associated with roof repairs at two sites (Club Amical in 2016 and Brodeur Bros. in 2019).[9] There were concurrent weather-related stressors (Lines 10, 11 and 16 in Table 6). In 2016, it was cool and rainy before rooftop activity

TABLE 6. Environmental events in days preceding observed Chimney Swift nest failures (n=24) in St. Adolphe, MB, 2011-2022. The precision of failure dates depended on the monitoring interval and only failures known within 72 h of the last monitoring session are shown. Weather days are the number of days for which weather was examined (see text). Nesting stages: incubation (I), feeding brooded young (B), and feeding non-brooded young (N-B). Results are presented as the proportion (%) of daylight hours in which hourly averages met the criteria of temperature and wind speed. Daytime rain is reported as total and maximum 1-hour rainfall, and the number of hours over which that rain fell. Proximal putative causes of nest failure are in **bold** denoting the event with the largest duration.

LINE	SITE (NAMES TRUNCATED TO SAVE SPACE)	DATE	WEATHER DAYS	NESTING STAGE	AGE OF CHICKS (D)	HOURS <15.5° C	HOURS <18.5° C	HOURS >32° C	HOURS >34° C	RAIN TOTAL (MM)	RAIN HOURLY MAX	HOURS WITH RAIN	COMMENTS
1	Brodeur 2011	16 July	3	I	Day 22 I	2.1%	10.4%	0.0%	0.0%	0.4	0.2	4.2%	12 July: **non-parent adult**
2	Church 2011	2 August	3	N-B	25	4.2%	**6.3%**	0.0%	0.0%	1.2	1.2	2.1%	
3	Main 2011	19 July	3	I/B	Day 19 I; 0-1	2.1%	4.2%	**22.9%**	0.0%	0.0	0.0	0.0%	25h >30°C over 3 d
4	SE Club 2012	12-13 July	4	I	Day 16-19 I	1.6%	4.7%	**9.4%**	1.6%	0.2	0.2	1.6%	20 h >30°C over 4 d
5	NE Club 2012	31 July	3	N-B	17	0.0%	8.3%	**12.5%**	6.3%	8.4	8.4	2.1%	13 h >30°C over 2 d
6	Church 2012	9-10 July	4	B	3-7	6.3%	**9.4%**	0.0%	0.0%	6.4	6.2	3.1%	9 h >30°C over 2 d
7	SE Club 2014	11-12 July	4	B	3-9	7.8%	**20.3%**	0.0%	0.0%	1.0	1.0	1.6%	
8	Brodeur 2015	16 July	3	B	2	0.0%	4.2%	0.0%	0.0%	1.9	0.9	8.3%	16 July: **non-parent adult**
9	Brodeur 2016	15 July	3	B	6	10.4%	**43.8%**	0.0%	0.0%	3.4	1.3	18.8%	15 July: smoke
10	NE Club 2016	16 July	3	N-B	13	14.6%	**25.0%**	0.0%	0.0%	1.8	1.1	6.3%	11-12, 14 July: rooftop activity
11	SE Club 2016	18-19 July	4	N-B	9-10	10.9%	**20.3%**	0.0%	0.0%	5.3	3.2	7.8%	11-12, 14 July: rooftop activity
12	SE Club 2017	10 July	3	N-B	6-8	8.3%	**18.8%**	0.0%	0.0%	0.0	0.0	0.0%	all but 1 morning of chicks' life <18.5°C from 06:00 to 08:00 h
13	NE Club 2018	29 June -1 July	5	B	2-4	5.0%	**18.8%**	0.0%	0.0%	**22.4**	**16.3**	5.0%	
14	Church 2018	16-18 July	5	N-B	16-18	11.3%	**26.3%**	0.0%	0.0%	0.0	0.0	0.0%	16-17 July: overnight low 7.0°C
15	NE Club 2019	11-12 July	4	N-B	12-14	1.6%	**17.2%**	0.0%	0.0%	**41.7**	**18.6**	**15.6%**	9-10 July: rain every hour from 16:00 to 08:00 h
16	Brodeur 2019	16 July	3	B	6-7	1.6%	4.7%	0.0%	0.0%	**32.0**	**14.9**	**10.9%**	14 July: rained all day, 15 July: rooftop activity
17	Church 2019	17-18 July	4	N-B	20-22	3.1%	**12.5%**	0.0%	0.0%	**20.5**	**12.1**	**6.3%**	9-17 July (inclusive): 103.3 mm rain
18	Brodeur 2020	13-14 July	4	N-B	11-12	4.7%	**15.6%**	0.0%	0.0%	**12.1**	**2.2**	**12.5%**	13 July: rain all day; 14 July rain after sunset
19	SE Club 2020	July 20-21	4	N-B	12-13	12.5%	**26.6%**	0.0%	0.0%	1.6	0.9	7.8%	19-20 July: overnight low 10.4°C
20	NE Club 2020	27 July	3	N-B	19	8.3%	**14.6%**	4.2%	0.0%	0.0	0.0	0.0%	
21	Brodeur 2021	7 July	3	B	5	37.5%	**50.0%**	0.0%	0.0%	0	0	0.0%	5-7 July: 37.5% of hours <15.5°C; <18.5°C for 37 h (22:00 h on 5 July to 10:00 h on 7 July); 5-6 July: smoke
22	SE Club 2021	14 July	3	N-B	8	8.3%	**14.6%**	0%	0%	1.2	0.5	4.2%	11 July: >32°C for 6 h, 1 h >34°C; 12-13 July: smoke
23	NE Club 2021	17 July	3	N-B	12	0.0%	**12.5%**	0.0%	0.0%	0.0	0.0	0.0%	16 July: smoke
24	Brodeur 2022	13-14 July	4	B	4	3.1%	**17.2%**	0.0%	0.0%	20.3	11.6	12.5%	11 July: (hatching day) temperature 06:00-10:00 h <18.5°C; 19.6 mm rain

and in 2019 it rained for two of three days preceding rooftop work. Parents may be able to compensate for disrupted feeding by more intensive foraging when the weather improves.[10] Compensatory feeding may not be possible, however, if new or additional factors interfere with feeding. Best practices would be to allow the birds a refractory period after inclement weather before conducting essential rooftop work; non-essential repairs should be deferred.[9]

Most nest failures were associated with weather events known to reduce prey availability. Almost 130 years ago it was noted that low temperatures reduced food availability.[40] The driving weather factors, however, vary with location and species. Insufficient food could lead to chick starvation rather than hypothermia since occupied chimneys have relatively stable internal temperatures compared to ambient temperatures.[30] During the nesting season, non-breeding adults and immature birds at roost sites may delay morning exit or return during the daytime to seek refuge during inclement weather but this energy saving tactic may lower nesting success for Chimney Swifts feeding young.[17]

After site selection, the most common factor associated with breeding success in St. Adolphe was the presence of a helper. In terms of feeding young when food is less available, the importance of helpers is hard to overstate. Indeed, the only two successes at Brodeur Bros., the lowest ranked chimney, were when a helper was present (Table 3).[8] Relatively higher feeding rates were often observed when a helper was present. For example, consecutive monitoring sessions were held at two sites where non-brooded juveniles were being fed on 17 July 2021. The feeding rate at the Church was 8/h with a helper present and the feeding rate at Main St. was 4/h where no helper was present. Similarly, on 29 July 2021 the feeding rate at the Church was 6/h with a helper present and the feeding rate at Main St. was 3/h with no helper present.

Helpers may contribute to higher energetic input directly to juveniles and they may prevent energy depletion in foraging parental birds. A higher proportion of helpers and higher success rates of breeding attempts associated with helpers was seen in 2014-2022 compared to 2007-2013. Helpers attended each nest site at least once during 2014-2022 (Table 3).

Helpers may move among sites. Several pairs of observations made on consecutive days recorded three adults at site A and two at site B, then the reverse pattern. We have also observed the arrival of a helper at a site 1-2 d after another site in town failed. Helpers also appear in the third week of June as new birds, late migrants, or redispersing birds arrive in St. Adolphe.[8] Helpers in St. Adolphe may therefore be adults which were recently unsuccessful breeders, non-breeding adults or juveniles. Gender of helpers we observed could not be determined but males can outnumber females.[24]

Warmer springs associated with climate change have been linked to earlier arrival of some migrants and have been identified as a hazard due to more variable spring weather.[10] The median first arrival of Chimney Swifts remained 13 May with a greater range of dates in 2014-2022. Nonetheless, breeding began slightly earlier and carried through to fledging which was in early August in both periods. Diminished food availability may have caused swifts to leave St. Adolphe earlier in recent years and precluded the formation of pre-migratory flocks.

Mosquito abatement programs, increased insecticide use, and changes in insect habitat availability may be implicated in these shifts. Using Google Earth, we calculated that urban expansion and construction of a flood-protection dike in south St. Adolphe peaked in 2016. That year 90 ha of agricultural land was bulldozed, leaving a net loss of about 29 ha by 2022. On the north side of St. Adolphe, a residential area built between 2010 and 2017 removed about 25 ha of agricultural land and woodlots. Both areas were <1 km from the farthest nest site.

Future Research

Our study provided a long-term perspective of the effect of weather on breeding activities and reproductive success. It is unknown if our results can be extrapolated to other areas of Manitoba and North America. The cluster of recent purpose-built towers and existing chimneys on buildings at the Selkirk Mental Health Centre (SMHC), Selkirk, MB, represents an opportunity for comparative studies with St. Adolphe nest sites.[41] The latest known fledging date in Manitoba is 6-8 September 2022 at SMHC tower T4.[41] The latest date of successful fledging in St. Adolphe is 16 August 2010 at Brodeur Bros.[8] The last observed Chimney Swifts in Manitoba have been recorded regularly in Selkirk (11 September 2020; 12 September 2021) compared to 2 September 2008 in St. Adolphe.[8,42,43]

Future research on the influences of local weather and climate change, insect population dynamics and agricultural practices on breeding Chimney Swifts is needed. A full assessment of the physical attributes of the St. Adolphe nest sites including chimney depth and air flow would inform management decisions to improve breeding outcomes. The development of engaging citizen science projects and obtaining meaningful support to implement the Chimney Swift recovery strategy and management plan are important next steps.[44,45]

Some nest failures were associated with multiple environmental events occurring sequentially or concurrently. Anthropogenic disturbances can cumulatively exacerbate weather stressors but can be managed in the future. Our study supports regulators who are developing a recovery strategy that identifies disturbances and formulates best practices for limiting the impacts of those disturbances in Chimney Swift habitat and at nest sites.[45]

Conclusions

We detected minor shifts in nesting phenology up to and including fledging. We attribute earlier departures from St. Adolphe in 2014-2022 to a shift in the seasonal reduction of prey availability. Cold, wet weather coincided with most nest failures although hostile intruding Chimney Swifts and human disturbance were also implicated in nest failures. Successful nesting attempts were associated with nest site quality and the presence of helpers.

All nest sites, including those with relatively poor ranks, are important to the resident flock and merit continued protection. Nest sites with poor breeding success are nonetheless valuable sources of potential breeders and helpers and provide refuge for fledglings as they develop flight competency.

The creation of new habitat, through erecting purpose-built structures and refurbishing/reopening other candidate chimneys, needs evaluation. Part of that

process should include an assessment of local habitat management to ensure a secure food supply is available.[46]

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1. COSEWIC (2018) *COSEWIC Assessment and Status Report on the Chimney Swift* (Chaetura pelagica) *in Canada 2018*. Ottawa: Committee on the Status of Endangered Wildlife in Canada, vii +49 pp. Accessed 28 February 2023. https://www.canada.ca/en/environment-climae-change/services/species-risk-public-registry.html

2. Stewart REA, Poole TF, Artuso C, Stewart BE (2017) Loss and preservation of Chimney Swift habitat in Manitoba, 2007-2016. *Blue Jay* 75(2):11-15. https://www.mbchimneyswift.com/Documents/lossandpreservation.pdf

3. *Species at Risk Act*. 2002. S.C. 2002, c. 29. *Species at Risk Act*. Government of Canada, Ottawa, Ontario, Canada. Accessed 11 November 2022. https://laws.justice.gc.ca/PDF/S-15.3.pdf

4. SARA (*Species at Risk Act*) Registry (2021) Species summary: Chimney Swift (Chaetura pelagica). Government of Canada, Ottawa, Ontario, Canada. Accessed 23 December 2022. https://species-registry.canada.ca/index-en.html#/species/951-650

5. Government of Manitoba (2016) Species and Ecosystem at Risk. Government of Manitoba, Winnipeg, Manitoba. Accessed 8 February 2023. https://www.gov.mb.ca/nrnd/fish-wildlife/wildlife/ecosystems/index.html

6. Government of Manitoba *The Endangered Species and Ecosystems Act*. 10 (1). *The Endangered Species and Ecosystems Act*., Winnipeg, Manitoba, Canada. Accessed 2 November 2022. https://web2.gov.mb.ca/laws/statutes/ccsm/_pdf.php?cap=e111

7. Stewart BE, Stewart REA (2010) Nest site use and breeding success of Chimney Swifts in St. Adolphe, MB, 2007-2009. *Blue Jay* 68(3):124-132. https://www.mbchimneyswift.com/Documents/bluejay2013.pdf

8. Stewart BE, Stewart REA (2013) Nest site use, breeding success, and reproductive rates of Chimney Swifts in St. Adolphe, MB, 2010-2013. *Blue Jay* 71(4):166-182. https://www.mbchimneyswift.com/Documents/bluejay2010.pdf

9. Poole TF, Stewart BE, Stewart REA (2022) Impact of anthropogenic disturbance on nesting Chimney Swift (*Chaetura pelagica*) including best practices for conservation. *Canadian Field- Naturalist* 136(4):364-373. https://doi.org/10.22621/cfn.v136i4.2963

10. Cox AR, Robertson RJ, Lendvai AZ, Everitt K, Bonier F (2019) Rainy springs linked to poor nestling growth in a declining avian aerial insectivore (*Tachycineta bicolor*). Proc. R. Soc. B 286 20190018. Accessed 28 February 2023. http://dx.doi.org/10.1098/rspb.2019.0018

11. Cucco M, Malacarne G (1996) Reproduction of the pallid swift (*Apus pallidus*) in relation to weather and aerial insect abundance. *Italian Journal of Zoology* 63(3):247-253. https://www.tandfonline.com/doi/pdf/10.1080/11250009609356141

12. Facey RJ, Vafidis JO, Smith JA, Vaughan IP, Thomas RJ (2020) Contrasting sensitivity of nestling and fledgling Barn Swallow *Hirundo rustica* body mass to local weather conditions. *Ibis* 162(4):1163-1174. https://orca.cardiff.ac.uk/id/eprint/131001/1/IBIS-2019-OP-092-DEC-EIC.pdf

13. Garrett DR, Pelletier F, Garant D, Bélisle M (2022) Interacting effects of cold snaps, rain, and agriculture on the fledging success of a declining aerial insectivore. *Ecological Applications* 32(7):1-16. https://doi.org/10.1002/eap.2645

14. Møller, AP (2013) Long-term trends in wind speed, insect abundance and ecology of an insectivorous bird. *Ecosphere* 4(1):1-11. http://dx.doi.org/10.1890/ES12-00310.1

15. Shipley JR, Twining CW, Taff CC, Vitousek MN, Flack A, Winkler DW (2020) Birds advancing lay dates with warming springs face greater risk of chick mortality. *PNAS* 117(41):25590-25594. https://doi.org/10.1073/pnas.2009864117

16. Winkler DW, Luo MK, Rakhimberdiev E (2013) Temperature effects on food supply and chick mortality in tree swallows (*Tachycineta bicolor*). *Oecologia* 173:129-138. https://doi.org/10.1007/s00442-013-2605-z

17. Zammuto RM, Franks EC, Preston CR (1981) Factors associated with the interval between feeding visits in brood-rearing chimney swifts. *Journal of Field Ornithology* 52(2):134-139. https://www.jstor.org/stable/4512635

18. Cusimano CA, Massa B, Morganti M (2016) Importance of meteorological variables for aeroplankton dispersal in an urban environment. *Italian Journal of Zoology* 83(2):263-269. https://www.tandfonline.com/doi/full/10.1080/11250003.2016.1171915

19. Garrett DR, Lamoureux S, Rioux Paquette S, Pelletier F, Garant D, Bélisle M (2022) Combined effects of cold snaps and agriculture on the growth rates of Tree Swallows (*Tachycineta bicolor*). *Canadian Journal of Zoology* 100(10):630-646. https://doi.org/10.1139/cjz-2021-0210

20. Rioux Paquette S, Garant D, Pelletier F, Bélisle M (2013) Seasonal patterns in Tree Swallow prey (Diptera) abundance are affected by agricultural intensification. *Ecological Applications* 23(1):122-133 https://doi.org/10.1890/12-0068.1

21. Hegedüs RS, Åkesson S, Horváth G (2007) Anomalous celestial polarization caused by forest fire smoke: why do some insects become visually disoriented under smoky skies? *Applied Optics* 46(14):2717-2726. https://doi.org/10.1364/AO.46.002717

22. Steeves TK, Kearney-McGee SB, Rubega MA, Cink CL, Collins CT (2020) Chimney Swift (*Chaetura pelagica*), version 1.0. In: Poole AF (editor) *Birds of the World*. Ithaca, NY: Cornell Lab of Ornithology. Accessed 13 January 2023. https://doi.org/10.2173/bow.chiswi.01

23. Kyle P, Kyle G (2005) *Chimney Swifts: America's Mysterious Birds Above the Fireplace*. College Station: Texas A&M University Press.

24. Dexter, RW (1952) Extra-parental cooperation in the nesting of chimney swifts. *Wilson Bull*. 63(3):133-139.

25. Glick PA (1939) The distribution of insects, spiders, and mites in the air. *U.S. Department of Agriculture Technical Bulletin* No. 673. 151 p. https://naldc.nal.usda.gov/download/CAT86200667/PDF

26. Ojo ER, Manaigre L (2021) The Manitoba Agriculture Mesonet: Technical Overview. Bull. Am. Met. Soc. 1.02(9). 19 pp. Accessed 14 July 2023. https://doi.org/10.1175/BAMS-D-20-0306.1 (The data are also available online https://web43.gov.mb.ca/climate/HourlyReport.aspx)

27. Zammuto RM, Franks EC (1981) Environmental effects on roosting behavior of Chimney Swifts. *Wilson Bull*. 93(1):77-84. https://www.jstor.org/stable/4161428

28. Weather Spark (2023) July weather in Winnipeg Canada. Accessed 13 March 2023. https://weatherspark.com/m/8367/7/Average-Weather-in-July-in-Winnipeg-Canada

29. ECCC (Environment and Climate Change Canada) (2023) Glossary. Accessed 11 March 2023. https://climate.weather.gc.ca/glossary_e.html#s_maxGust

30. le Roux CE, McFarlane Tranquilla LA, Nocera JJ (2019) Ambient temperature preferences of chimney swifts (Chaetura pelagica) for nest site selection. *J. Therm. Bio.* 80:89-93. https://doi.org/10.1016/j.jtherbio.2018.12.017

31. ECCC (Environment and Climate Change Canada) (2022) Extreme events in a changing climate: Canadas top 10 weather stories of 2022. Accessed 14 March 2023. https://www.canada.ca/en/environment-climate-change/news/2022/12/extreme-events-in-a-changing-climate-canadas-top-10-weather-stories-of-2022.html

32. Government of Manitoba (2022) Hydrologic Forecasting and Water Management, Manitoba Transportation & Infrastructure Daily Flood Sheet, Red River May 13. https://www.gov.mb.ca/mit/floodinfo/floodoutlook/forecast_centre/flood_sheets/2022/20220513%20Red%20River%20Flood%20Sheet.pdf

33. Government of Manitoba (2022) Hydrologic Forecasting and Water Management, Manitoba Transportation & Infrastructure Daily Flood Sheet, Red River June 4. https://www.gov.mb.ca/mit/floodinfo/floodoutlook/forecast_centre/flood_sheets/2022/20220604%20Red%20River%20Flood%20Sheet.pdf

34. Fitzgerald TM, van Stam E, Nocera JJ, Badzinski DS (2014) Loss of nesting sites is not a primary factor limiting northern Chimney Swift populations. *Population Ecology* 56:507-512. https://doi.org/10.1007/s10144-014-0433-6

35. Mccarty JP, Winkler DW (1999) Relative importance off [sic] environmental variables in determining the growth off [sic] nestling tree swallows *Tachycineta bicolor. Ibis* 141(2):286–296. https://doi.org/10.1111/j.1474-919X.1999.tb07551.x

36. Grames EM, Montgomery GA, Youngflesh C, Tingley MW, Elphick CS (2023) The effect of insect food availability on songbird reproductive success and chick body condition: evidence from a systematic review and meta-analysis. *Ecology Letters* 00:1-16. https://doi.org/10.1111/ele.14178

37. Grüebler MU, Morand M, Naef-Daenzer B (2008) A predictive model of the density of airborne insects in agricultural environments. *Agriculture, Ecosystems and Environment* 123(1-3):75–80. https://doi.org/10.1016/j.agee.2007.05.001

38. Laughlin AJ, Blake Hudson T, Brewer-Jensen T (2022) Dynamics of an urban Chimney Swift (*Chaetura pelagica*) roost system during autumn migration. Wilson Journal of Ornithology 134(2)269-277. https://doi.org/10.1676/21-00081

39. Firlotte N, Poole TF, Artuso C, Breiter C-JC, Burns LD, Petersen SD, Stewart BE, Stewart REA (2020) The first use of purpose-built artificial Chimney Swift habitat in Manitoba. *Blue Jay* 78(3):30-33. https://www.mbchimneyswift.com/Documents/FirstUseMB.pdf

40. Bendire, C. 1895. Life histories of North American birds, from the parrots to the grackles, with special reference to their breeding habits and eggs. US National Museum. Special Bulletin. (no. 3). 518 pp.

41. Poole TF (2022) Possible effects of placement timing on the use of replacement habitat by Chimney Swifts in Manitoba. *Blue Jay* 80(4):26-32. https://www.mbchimneyswift.com/Documents/bluejay_winter2022.pdf

42. Manitoba Chimney Swift Initiative (2020) The Last of the Swifts. Accessed 30 January 2023. https://www.mbchimneyswift.com/?s=last+seen+September

43. Manitoba Chimney Swift Initiative (2021) That's a Wrap, Folks! Accessed 30 January 2023. https://www.mbchimneyswift.com/thats-a-wrap-folks/

44. Manitoba Chimney Swift Initiative (2023) About the Manitoba Chimney Swift Initiative. Accessed 14 March 2023. https://www.mbchimneyswift.com/

45. ECCC (Environment and Climate Change Canada) (2022) Recovery Strategy for the Chimney Swift (*Chaetura pelagica*) in Canada [Proposed]. *Species at Risk* Recovery Strategy Series, Environment and Climate Change Canada, Ottawa, Ontario, Canada

46. Courtois E, Garant D, Pelletier F, Bélisle M (2021) Nonideal nest box selection by tree swallows breeding in farmlands: Evidence for an ecological trap? *Ecology and Evolution* 11(22):16296-16313. https://doi.org/10.1002/ece3.8323

PINE SISKIN FEEDING TWO FLEDGLING BROWN-HEADED COWBIRDS

Spencer G. Sealy
Spencer.Sealy@umanitoba.ca

Buried among letters and other notes received since my high school days from the late Robert (Bob) W. Nero, is an observation of probable brood parasitism by the Brown-headed Cowbird (*Molothrus ater*) on the Pine Siskin (*Spinus pinus*). Nero sent the following observations to me on 4 July 1995, stating, "If you can make use of the following information, feel free to do so…"

> June 29/'95: A male (by size) juvenile cowbird in our feeder at noon. Ruth [Nero's wife] called me to identify the bird. It begs to and is fed by a Pine Siskin… then the cowbird threatens (?) and evicts two House Sparrows [*Passer domesticus*]. Cowbird leaves, Siskin leaves, then 5 minutes later a female (by size) cowbird appears with the male cowbird… both feeding on the ground beneath the feeder. A moment later, when a Siskin lands on a branch 5 feet overhead, both cowbirds at once fly up to the twig, one on each side of the Siskin, and both beg at close range. Both cowbirds well feathered, feeding selves, but responsive to Siskin.
>
> July 3/'95: At 4:35 p.m. the female cowbird is fed by a Pine Siskin on the feeder.

Nero's observations suggest but do not confirm this as a record of Brown-headed Cowbird parasitism on the Pine Siskin. Although reported infrequently, more than one possible host species have been observed feeding the same nestling or fledged cowbirds, and other brood parasites.[1] However, the facts that only a Pine Siskin(s) was observed feeding the cowbirds in this case, despite the short period of observation, and that one of the cowbirds behaved aggressively toward another possible but infrequently recorded host species, the House Sparrow, favours the conclusion that the Pine Siskins reared the cowbirds.

Only cowbirds fledged from the siskin's nest, assuming that no siskins were being fed out of Nero's sight. The literature is replete with observations of only cowbirds being fed out of the hosts' nests, including other observations involving the Pine Siskin, which suggests if hosts' young did leave the nest, they soon died.[2] Pine Siskin has been reported infrequently as a host of the Brown-headed Cowbird[3], but in a study in Kansas, up to 28 of 51 nests (55 per cent) were parasitized.[4] In that study, and others, most cowbird nestlings died within a few days, with only a few surviving long enough to leave the nest.[4-6] The similarly low survival of cowbirds reported in nests of the congeneric American Goldfinch (*S. tristis*) has been suggested to be due to dietary inadequacy.[7] These observations reveal that both species of finch are unproductive hosts of the Brown-headed Cowbird.

The only published record of parasitism on the Pine Siskin in Manitoba was of a cowbird being fed out of the nest in Winnipeg, in June 1993.[8] The Prairie Nest Records Scheme (PNRS) contains an earlier report of a nest in Winnipeg with two siskin eggs plus one cowbird egg that the observer removed on 27 May 1974. This record is presumably the one to which Friedmann and colleagues referred.[9] Despite the abrupt reduction in clutch volume following removal of the cowbird egg, the nest remained active and two siskins left the nest "when viewed" on 11 June. Pine Siskin has been reported once as a cowbird host in Saskatchewan.[10] Details in the PNRS revealed that nest, near Turtle Lake, contained one siskin egg on 5 July 1992, but by 7 July the nest, now with one egg of host and cowbird, was abandoned, but not before the siskin had begun to build over the cowbird egg and both eggs had been punctured "by squirrels". In actuality, the eggs were probably punctured by a cowbird.[11]

Years earlier, Nero recorded Brown-headed Cowbird parasitism on another infrequently reported host, the Baltimore Oriole (*Icterus galbula*). His first observation was of an oriole that attempted, without success, to feed an earthworm to a young cowbird, on a road in Wisconsin.[12] In Manitoba, he examined a deserted Baltimore Oriole nest that contained two unincubated cowbird eggs, which he speculated had been laid before any oriole eggs were laid, thus, possibly being the cause of desertion.[13] Nero's observations predated results of experiments that simulated natural parasitism on the Baltimore Oriole that revealed ejection of cowbird eggs usually within minutes of laying[14], when oriole eggs were present for comparison.[15]

Acknowledgements

These observations, which Bob Nero sent to me long ago, should have been reported at the time instead of becoming buried in my files. Nero's keen eye for all things in the natural world was well known to readers through his extensive writings and poems, and it was revealed again in his recognition of the significance of cowbird parasitism on the Pine Siskin and other infrequently reported host species. I thank Andrea Benville, Ryan Fisher and Randall Mooi for uncovering records of parasitism on Pine Siskin filed in the Prairie Nest Records Scheme.

1. Sealy SG, Lorenzana JC (1997) Feeding of nestling and fledgling brood parasites by individuals other than the foster parents: a review. *Canadian Journal of Zoology* 75:1739-1752.

2. Rasmussen JL, Sealy SG (2006) Hosts feeding only Brown-headed Cowbird fledglings: where are the host young? *Journal of Field Ornithology* 77:269-279.

3. Friedmann H, Kiff LF (1985). The parasitic cowbirds and their hosts. *Proceedings of the Western Foundation of Vertebrate Zoology* 2:226-302.

4. Hill RA (1976) Host-parasite relationships of the Brown-headed Cowbird in a prairie habitat in west-central Kansas. *Wilson Bulletin* 88:555-565.

5. Perry AE (1965) The nesting of the Pine Siskin in Nebraska. *Wilson Bulletin* 77:243-250.

6. Rolfs ME, Ely CA, Wilson JK, Hill RA (1974) Pine Siskin nesting in Kansas. *Bulletin of the Kansas Ornithological Society* 25:26-28.

7. Middleton ALA (1991) Failure of Brown-headed Cowbird parasitism in nests of the American Goldfinch. *Journal of Field Ornithology* 62:200-203.

8. Parsons RJ (2003) Pine Siskin. Pages 392-393 *in* The Birds of Manitoba, Manitoba Naturalists Society, Winnipeg.

9. Friedmann H, Kiff LF, Rothstein SI (1977) A further contribution to knowledge of the host relations of the parasitic cowbirds. *Smithsonian Contributions to Zoology*, number 235.

10. Sealy SG (2019) Brown-headed Cowbird. Pages 636-638 *in* Birds of Saskatchewan (Smith AR, Houston CS, Roy JF, editors). Nature Saskatchewan, Regina.

11. Sealy SG (1994) Removal of Yellow Warbler eggs in association with cowbird parasitism. *Condor* 94:40-54.

12. Nero RW (1949) Baltimore Oriole and young cowbird. *Passenger Pigeon* 11:132.

13. Nero RW (1971) Brown-headed Cowbird parasitizes Baltimore Oriole. *Blue Jay* 29:16.

14. Sealy SG, Neudorf DL (1995) Male Northern Orioles eject cowbird eggs: implications for the evolution of rejection behavior. *Condor* 97:369-375.

15. Rothstein SI (1977) Cowbird parasitism and egg recognition of the Northern Oriole. *Wilson Bulletin* 89:21-32.

Spencer Sealy was among several budding ornithologists fortunate to have come under Bob Nero's mentorship during their high school years in Saskatchewan. As Spencer progressed through university, Bob lent his wisdom and keen editorial eyes to many articles Spencer prepared for Blue Jay. *Both Bob and Spencer eventually moved to Manitoba and — although they pursued different paths — in the ensuing years, they continued to talk about the Great Gray Owls banded, and the nests observed, years earlier.*

CALL FOR APPLICATIONS TO THE 2024 MARGARET SKEEL GRADUATE STUDENT SCHOLARSHIP

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SEARCHING FOR A RATTLESNAKE HIBERNACULUM AT CHECKERBOARD HILL, SASKATCHEWAN

Doug Adams
127 Avondale Road
Saskatoon, SK S7H 5C6
dougadams@sasktel.net

While working as a naturalist in Saskatchewan, I was aware of only three general areas in the province where a prairie rattlesnake (*Crotalus viridis*) was most likely to be found: Grasslands National Park; along the South Saskatchewan River as it crosses the Alberta/SK border, between Empress, AB and Estuary, SK; and the Checkerboard Hill area near Leader, SK. The latter location was the only one I had yet to visit, so I decided to spend the afternoon of 26 September 2022 on and around Checkerboard Hill looking for a rattlesnake hibernaculum (Figure 1). With a sunny, 24°C day in the forecast, I was hoping that any snake having returned to its hibernaculum by this time would be out and about and easy to find. I was also hoping that by this time of the year, a fair number of the snakes would be back, increasing my chances of finding at least one snake.

I was searching for a large crevasse, or hole, deep enough to allow snakes to disappear below ground for the winter. I was 90 minutes into my search when my "hibernaculum" radar started tingling. There, on the eastern slope of a low hill, was a large opening in the ground, the size of an abandoned badger hole (Figures 2 and 3).

I had not seen a single hole since arriving — not even a gopher hole — occupied or abandoned. Knowing what I was about to see, the absence of any rodent activity in the area made perfectly good sense.

I poked the pasture sage along the rim of the hole with the end of my tripod, which was serving double duty as my snake stick and camera support. Instantly, a thin, three- to four-week-old rattler, about 25 cm in length, which was hiding in the silver foliage, plunged into the deep hole and disappeared from sight.

FIGURE 1. View of South Saskatchewan River from Checkerboard Hill Lookout

FIGURE 2. Thicket at the base of the eastern slope of the hibernaculum hill. The clumps of pasture sage in between the camera and the thicket mark the locations of the entrances to the hibernaculum.

Its dramatic escape reminded me of a diver jumping off a tall cliff and plunging headfirst into the deep, dark ocean below. I had found my first rattlesnake. This young snake probably wasn't born alone — a female rattlesnake may have up to 20 live young at one time.

It was the rattling that caught my immediate attention, a sound that continued for 23 seconds — another snake, and it was close by. I had to establish its location before taking another step. This individual, with the ability to rattle its tail, was at least a year older than the first snake. I forced my eyes to search the ground inch by inch. And there it was. Snake number two, stretched to its full length of about 60 cm. It disappeared into a small, mouse-sized hole 2 m from the large hole that drew my attention to this particular location in the first place.

FIGURE 3. One of the entrances to the hibernaculum. Notice the bushy pasture sage from which the young snake plummeted into the deep hole that went straight down.

FIGURE 4. Rattlesnake number two, with two tail segments, disappearing down a well-hidden mouse-sized hole.

FIGURE 5. A closeup, using my cell phone, of the three- to-four-week-old snake on the move.

Seeing the snake retreat into such a small hole made the afternoon even more exciting. In Grasslands National Park, where I have seen rattlesnakes on several different occasions, the snakes use large holes, sizeable boulders or sagebrush as a means of escaping, not small mouse-sized holes.

I ventured to the top of the small hill and then slowly walked down another section of the eastern slope. Two more three- to four-week-old rattlesnakes quickly disappeared into two other abandoned badger holes.

I made my way back to the first hole, only to find a snake out in the open. I only managed to take two photos before it disappeared down another mouse-sized hole (Figure 4). Was this another snake or the same snake that had rattled its tail earlier? It was impossible for me to know.

I went back to the top of the hill to check on spots I may have missed the first time. As I came down from the top again, a young of the year snake was trying to make its way to the thicket, only metres away (Figure 5). I was able to videotape its movements before it disappeared into

the thick vegetation. At this point in the afternoon, I had encountered at least five individuals of the Checkerboard Hill rattlesnake population.

The snake head count had not changed for about 30 minutes, so I decided to head back to the car. There was another low hill adjacent to the hibernaculum hill. I slowly walked to the crest of the hill where I was forced to stop. Four metres in front of me was the largest rattlesnake of the day, moving across the exact same path I was intending to take. Its estimated 100 cm body was marked with regularly spaced, dark splotches extending along its entire length. I truly believe, and I'm not being anthropomorphic, that the snake seemed to be as surprised to see me as I was to see it.

The snake's slow and deliberate reaction seemed to indicate that it was not in a rush to find safety. I was able to get my tripod set up and take some photos while the snake slowly lifted its head off the ground and cautiously turned around. Its slow retreat was captured in a series of photographs. Notice that the tail section of its body was kept relatively motionless while the head and anterior section moved slowly in the direction from which the snake had come (Figures 6-14). Once the snake's entire body was pointed in the same direction, it moved much more quickly (Figures 13 and 14). It disappeared into a thicket, having never made a sound the entire time.

FIGURE 6. First photograph, in the series, showing the largest snake. It's about to make an "about face" maneuver, snake-style.

FIGURE 7. Second in the series. Notice how the posterior section of its body, for the most part, remains in the same place during the series of photographs.

FIGURE 8. Third in the series.

FIGURE 9. Fourth in the series. Snake doubling back on itself while keeping its eyes on me.

FIGURE 10. Fifth in the series. Notice tail with seven segments.

FIGURE 11. Sixth in the series. Again, notice that the last section of its body has moved very little during the slow retreat.

FIGURE 12. Seventh in the series.

FIGURE 13. Eighth in the series. Entire body now pointing in the same direction. The seven tail segments are still visible.

FIGURE 14. Last in the series. Now moving with a lot more urgency.

BEING A GOOD ANCESTOR

Lorne Fitch, P. Biol.
lafitch@shaw.ca

Since I have more years behind me than ahead of me, I am persuaded to think more about the future, the one beyond me. Although the past has some nostalgic elements to it, as Mark Twain observed, "The older I get, the more clearly I remember things that never happened." I have become more focused on an intrusive, contemplative, and compelling question that we all should ask ourselves. When we pass from this life, what will we leave behind?

The answer to this question becomes the starting point to a commitment to being a good ancestor, someone unwilling to impose harm or unwarranted risk to future people. Marian Wright Edelman, a civil rights activist, said of this, "Be a good ancestor. Stand for something bigger than yourself. Add value to the Earth during your sojourn."

This appeals to me since I don't want the children of the future cursing me, a ghost from their past, for limiting their opportunities and security. As Kevin Van Tighem, conservationist and nature writer says, "One hits a fulcrum in life where one transitions from being a descendent and starts worrying about being a good ancestor."

This might start with self-awareness, not self-indulgence. Ellen Maloy, a nature writer, remarked, "Stay curious. Know where you are — your biological address. Get to know your neighbors — plants, creatures, who lives there, who died there, who is blessed, cursed, what is absent or in danger or in need of your help. Pay attention to the weather, to what breaks your heart, to what lifts your heart. Write it down." Articulating these things makes it easier to communicate with others, to encourage them to look deeply at what is important as a legacy.

Each of us is just one link in a chain that passes from yesterday into tomorrow. Like one definition of stewardship, which is people planting trees they know they will never sit in the shade of, our lives and accomplishments are transitory. The way we make them meaningful is to ensure we pass the torch to others and ensure it is lit.

Very rarely do big things get done in one generation — it takes several. It's also a question of scale. Climate change is a huge elephant and as a hunter friend wisely points out, "It takes a big gun to shoot an elephant." Positive outcomes (and personal rewards) may well happen after we're gone. But what's important is that progress was made and we had a hand in that achievement.

I hope the answer to what we leave behind isn't a bunch of unnecessary stuff, a feature of over-consumption. "We have multiplied our possessions, but reduced our values," wisely intones Bob Moorehead, author of *Words Aptly Spoken*. Our consumer culture is killing the Earth — colonizing the future — leaving future generations unable to protect themselves, rendering them powerless.

We would be well advised to fall back to the old mantra of re-use it, wear it out, make it do, and do without. It's not painless, it takes resolve, but we use less of Earth's resources in the process. If we were more fixated on the cost of stuff, beyond the price tag, we might become more conscious consumers. If we were to wean ourselves of defining our lives by stuff, the Earth would benefit. As a bonus, the next generation isn't stuck sifting through our stuff, trying to figure out what to do with it.

Traditional societies venerated their elders because they were repositories of experience and wisdom. A generation is seldom given enough power to foresee the lingering effects of its labour, but there are always a few survivors who, at the end of their lives, have a chance to look back over their shoulders at what has been gained or lost. They are worth listening to for it affords the opportunity to avoid past mistakes and to build on successful decisions.

The best, most valuable bequests for our children include teaching them critical thinking skills, the ability to use information to make wise decisions, and leaving a quality environment in which there are still opportunities and choices to make. To hold ourselves accountable for acting like better ancestors, we'd be wise to encourage young people to be more vocal about what matters and to question the way things are done. We should listen to youth at every opportunity, around dinner and conference tables. When we exercise our vote in elections and invest in companies, the interests of the youngest living generation need to be at the top of our priority lists.

I know it's hard to get beyond the immediacy of today — finishing up a project, remembering to fill the car with gas, and contemplating dinner. Today stretches into the near future, to an upcoming and much anticipated vacation. But contemplating paying off the mortgage is just so far into a vague tomorrow it seems unreachable. That's the dilemma of thinking about and planning for the future — it just seems so far off.

Our descendants own the future, but the decisions and actions we make now will tremendously impact generations to come. As John W. Dafoe, a Canadian journalist, noted, "It would be well to bear in mind that the present of today was the future of yesterday and that it is what it is because of the human actions, the human decisions of yesterday. Therefore, the future will be what we make it."

Even though we build the future everyday imagining it eludes us. We think we cannot plan well for something we cannot see, especially the future. The greatest discovery in each generation is that we can alter the future by changing what we do today. Instead of treating the future as an abstraction we can use factual knowledge to allow an informed choice to be made about tomorrow's options.

As a pathway to a sustainable future, thought, planning, and foresight allow today's decisions to be measured against tomorrow's realities. Then we can start to answer the question, how do we imagine the future and what do we want it to be?

Hopefully the answer centers around a quality environment.

In the annals of shipwrecks there is always the cautionary tale of those who drowned trying to take their gold with them. Apparently, gold is not a good life preserver. Modern life has been made so easy, so convenient, and so unbearably comfortable we lose track of what really counts. Each of us have choices to make. Maintaining healthy ecosystems and restoring damaged ones are clear choices. Alternately we could blindly accept the temporary fruits of using up, abusing, or neglecting the things that actually support us.

How about an investment in the things that assure us (and generations to come) of fresh air to breath, fresh water to drink, fertile soil, biodiversity, and ecological integrity? That would be a life jacket for subsequent generations (and our own) rather than starter castles, adult toys, and investment portfolios.

Accomplishing these fundamental survival goals means we have to invest in:

- comprehensive land and resource use planning that recognizes limits;
- the creation of parks, protected areas, and wildlife refuges;
- biodiversity protection and recovery of species at risk;
- the removal, or limitation of many toxic chemicals from our lives;
- work towards dealing with climate change;
- a transition to clean energy usage; and,
- sustainable and regenerative forms of economic activity.

For societies, it's never been more important to think ahead to future generations. A meaningful way to give to the future is to think bigger and leave behind something that can be stewarded — and used and adapted over time — as a legacy. Don Ruzicka, a land steward, has an additional element in the recipe: "You have to put something in if you want something back." This also means leaving behind resources with an eye to how they might endure for multiple generations, without prescribing too narrowly what each generation does with them.

It would serve subsequent generations well if we acted like tenants of the Earth and renters of its resources, not owners with a penchant for exploiting everything in our time here. Each generation borrows from the next and should remember that any debts accrued will fall to the next group.

Hilton Pharis, a foothills rancher, once confided in me that he wanted to leave his ranch better than he found it. I thought, this could only come from someone profoundly aware of his responsibility to others. To do that the Pharis family committed to lessening the footprint of grazing, fixing the damaged landscape bits, and living within the constraints of the land. The goal was to bequeath the land to the next generation, as Hilton's generation had been given it, and possibly in better shape.

This is inspirational — live lightly, do little harm, make do with less, and leave it as you found it, maybe better. It seems like a starting formula for a good ancestor's Hippocratic Oath.

Lorne Fitch is a Professional Biologist, a retired Fish and Wildlife Biologist and a former Adjunct Professor with the University of Calgary. He is the author of Streams of Consequence — Dispatches from the Conservation World.

NATURE SASKATCHEWAN 2023 AWARD WINNERS

Each year at the Fall Meet, Nature Saskatchewan recognizes outstanding service and contributions that Society members, and/or affiliate and partner organizations have made towards Nature Saskatchewan's objectives and goals.

RECIPIENT OF THE NATURE SASKATCHEWAN 2023 CONSERVATION AWARD:
STAN SHADICK AND DOUG WELYKHOLOWA

The Conservation Award is presented to an individual/organization whose total contribution to conservation is outstanding, whether in relation to a particular project, or in a number of roles over a period of years.

Stan Shadick

In 1970, at the age of 15, Stan joined the Saskatoon Nature Society (SNS) board as a director and has served on the board many times since, totalling 50 years of service to SNS between 1970 and 2021. He was president twice — in 1981-82 and in 2011-12, and also served as President of Nature Saskatchewan in 1984-85.

Stan is best known for organizing and leading field trips. In addition to organizing field trips for the Canadian Nature Federation, he has led innumerable SNS field trips for the last 50 years and has been the longtime field-trip committee chair — a role which he continues to hold. In his book, "For the Love of Nature: History of the Saskatoon Nature Society 1980-2005", Attila Chanady (former conservation director of Nature Saskatchewan) writes: "The success of the Society's field trip program was in no small measure due to the level of professionalism brought to it by Stan Shadick, field trip and tour organizer, coordinator and leader par excellence. Stan's organizational skills and commitment to the Society in general over many, many years were indeed quite remarkable."

With respect to outreach and conservation activities, Stan initiated the fall bird count in 1979 to complement the spring count that began in 1957 and has been organizing those counts continuously since then. More recently, he was one of two Regional Coordinators from 2018-2021 for the Saskatchewan Breeding Bird Atlas. Stan was on the initial organizing committee for "Nature Notes" in 1989. Beginning in the 1980s, he

organized and presented workshops in beginning and more advanced birding, as well as his other favourite hobby — astronomy. From 1971 to 2023, he has organized the SNS's Rare Bird Alert. He has promoted the Society on television, served on a committee discussing the formation of the Meewasin Valley Authority, and made various submissions to the City of Saskatoon and Meewasin on local conservation issues. In 2004, he was the recipient of Meewasin's Conservation Award. Most recently at our AGM in March 2023, Stan was honoured with Life Membership in the SNS, which is only bestowed on rare occasions to persons who have rendered distinguished service to the Society.

In addition to his lifelong service to the SNS, Stan has strongly supported Living Sky Wildlife Rehabilitation (LSWR) — a non-profit, registered charity run by his spouse, Jan Shadick, which provides a safe place for injured and orphaned wild animals to grow and mend until they can return to their natural habitat while encouraging public tolerance and understanding of wildlife. More recently, Stan has developed a suite of privately led field trips for birders all over the province called "Saskatoon Custom Bird Tours" of which half of the proceeds are donated to LSWR to support its ongoing operations.

Doug Welykholowa

In 2005, Doug Welykholowa joined the Loon Initiatives Committee (LIC), bringing dedication and energy to the table. He possesses a set of skills, and a passion, which he voluntarily continues to contribute to the LIC. Initially, Doug assisted with the monitoring, recording and reporting, contributing the use of and covering expenses associated with his watercraft and the project. Within a short while he was asked to assume responsibilities for the LIC as the partnership's chair person. Each year, he strengthened the "loon work" by reaching out to park administrators. He also developed forms to record observations and reports, collecting and saving them to assist with an annual report requested by the Canadian Lakes Loon Survey a federal group working within Birds Canada.

He has contributed articles to YFBTA's newsletter and to Nature Saskatchewan's *Blue Jay* magazine. Doug is a superb organizer and he can be a strong advocate. He is enthusiastic and persistent. He is also a skilled artist (one can gain a sense of this talent when examining the maps of the loon territories that are part of his annual reports). He has also produced educational materials that have been used in the park administration office.

Doug applied for financial support to the Saskatchewan Wildlife Federation, with funds used to develop brochures and lakefront signage currently in use in the park. He also successfully appealed to the Madge Lake Cabin Owners' Association to join the citizen science group. He has assisted with deploying buoys marking loon territories and assisted with the installation of the signage.

Recipients of Nature Saskatchewan's Conservation Award are advocates. There should be evidence of meritorious work. It is expected that a recipient has displayed an outstanding contribution to conservation over a period of years. Doug's work "ticks every box". He continues to work within YFBTA and continues as chairperson of the LIC.

RECIPIENT OF THE NATURE SASKATCHEWAN 2023 CLIFF SHAW AWARD: PHILIP S. TAYLOR

Each year, the Editor of *Blue Jay* chooses the recipient of the Cliff Shaw Award. This award acknowledges an article that appeared in the most recent four issues of Blue Jay, which merits special recognition for its contribution in any branch of natural history. In 2023, Philip Taylor was chosen to receive the Cliff Shaw Award for his articles "New Records and Changes in the Status of Saskatchewan Birds to 31 December 2021" and "New and Notable Records of Saskatchewan Birds: 2022", which appeared in the Fall 2022 (volume 80.3) and Spring 2023 (volume 81.1) issues of *Blue Jay*, respectively.

In 2019, the more than 700-page compendium *Birds of Saskatchewan* was published, providing a comprehensive look at all the birds reported in the province over a 200-year period, up until December 31, 2016. Since then, a number of observations and classification changes have been made that would result in some revisions to the accounts in the book, should it be updated. Without an official bird records committee to accumulate and review important new bird information for the province, Saskatchewan has a variety of sources where records appear, including sites like eBird but also in social media bird groups. Recognizing the importance of reviewing, collecting and compiling this new information on birds, Philip took on the time-consuming task of checking the sources of bird observations and information, collecting the records of significance, keeping up to date notes on the status of species and species names, and working with others in the birding and records community to detail and present the information.

Philip's first contribution details six new species confirmed for Saskatchewan, five hypothetical species being upgraded to confirmed, one additional species being added to the hypothetical list, and new information for another 15 species considered to be accidentals in Saskatchewan. On top of that, details of notable observations are provided, information for six common names being changed by the American Ornithological Society are given, and COSEWIC status changes are listed. His second contribution, which covers the year from December 31, 2021 to December 31, 2022, provides important records of 23 species encountered during the year, including one new species for Saskatchewan and one hypothetical species becoming confirmed and upgraded to accidental.

Thanks to Philip's efforts, along with those who worked tirelessly on *Birds of Saskatchewan* before him, one can use these sources together to have an up to date and comprehensive overview of all bird species observed in Saskatchewan.

SKIING IN A WONDERLAND: WINTER ECOLOGY

Robert E. Wrigley
Winnipeg, MB
robertwrigley@mts.net

As I hustled across the parking lot to go skiing in Winnipeg's Assiniboine Forest this afternoon, my boots made the most pleasant crunching sounds (like munching on toast) on the packed snow. Instead of the old-fashioned cable bindings of my first skis in the early 1970s, I now sported a convenient one-click toe binding, and off I went, shifting from leg to leg with long, smooth glides. It was a beautiful afternoon with a temperature of -8 °C, and the brilliant sunlight created countless sparkles of pure delight bouncing off delicate crystals, which had settled onto the top layer of snow.

This fresh white blanket, reflecting over 50 per cent of the solar radiation back into space, reminded me of marzipan icing on a wedding cake, punctured here and there with long, thin stalks of golden-yellow grass. Everywhere I looked, snake-like cylinders of snow wound their way, back and forth, along sloping tree branches, and white caps perched like perfectly shaped bread buns on the top of every stump, all appearing like magic from last-night's gentle snowfall. I was surrounded by a cornucopia of snow sculptures clinging to each shrub and tree. It was so exhilarating to be immersed in Nature's dazzling-white art gallery, to enjoy at my heart's content, and admission was free. I examined one particularly graceful snow sculpture at eye level, and dared touch it with my tongue, transforming the delicate crystals to liquid in an instant. What a story might these water molecules (consisting of bonded hydrogen and oxygen atoms) tell about their recent journey, leaping from the surface of the mid-Pacific Ocean, climbing and swirling up into vapoury clouds high into the atmosphere, and

Rime frost (as in this photo) forms under heavy fog conditions (the previous night), causing the supercooled water droplets to freeze on contact with thin objects. Similar-looking hoarfrost develops as water molecules undergo direct sublimation on objects, without foggy air. Calm air permits the formation of beautiful crystal formations, which eventually shower to the ground and evaporate. Photo credit: R. Wrigley.

Who can refrain from experiencing delight at entering a hoar-frosted forest. Photo credit: R. Wrigley.

The play between snow cohesiveness and gravity present some truly remarkable, snake-like creations on downed trees. Photo credit: R. Wrigley.

then borne by easterly flowing winds over forests, mountains, and prairies, all the while destined to land at my particular spot. Although I could not see them, trillions of these frozen water molecules were leaping back into the air by the astonishing process of sublimation. These molecular migrants have been circulating among the hydrosphere, atmosphere, geosphere, and biosphere ever since they arrived on Earth, bound within countless asteroids, four billion years ago — a period known as the Late Heavy Bombardment.

As I glanced up into the tree canopy, the craggy spires of oaks and aspens reminded me of skeletons, having lost in the autumn their mantle of yellow leaves. I paused often to admire the bold patterns on the Aspen trunks — pitch-black patches and streaks against the white-powdered bark. Numerous fine scratch marks revealed the past passage of a squirrel (Red, Gray, or Northern Flying Squirrel), or an Eastern Chipmunk — the former three still active all winter, the latter species now hibernating deep below the frost line. Black circles on the trunks marked the former sites of branches that had long since died and tumbled to the ground, their demise the result of decreasing levels of light reaching them as the trees matured. At the base of the oldest trees, yellow and gray lichens had gained a foothold amid crusty-black expansion cracks in the bark, simulating the splitting pants of a girth-gaining senior. I could see on some trunks perfectly aligned series of horizontal holes drilled long ago by a Yellow-bellied Sapsucker (called a 'zap-zucker' by my young son) desirous of licking up sweet sap. During the warm season, these temporary sap flows also provided insects and squirrels with a source of energy.

I paused to admire the round, spiky, papery husks of Wild Cucumber strung like Christmas lights from a long vine clambering among the branches of a willow. The bright-red stems of Red-osier Dogwood then caught my eye, always a treat to see piercing the white snow. White-tailed Deer tracks were evident everywhere, crisscrossing the nature trails, yet I have seldom seen a deer here, and then mainly when they meander along the park's surrounding roads. They must bed down in secluded spots during the daytime.

The only sounds I heard most of the time were the alternating swish-swish of my skis and the squeaks from the steel points of the poles penetrating the

A 'snow ghost' clings onto the side of an old split Aspen trunk. Photo credit: R. Wrigley.

A Yellow-bellied Sapsucker pauses to examine its handiwork in accessing tree sap. Photo credit: Larry de March.

The leaf and twig summer nest of a Red Squirrel in willows may be reoccupied in subsequent years by nesting birds. This nest would be hidden once the trees leaf out. Photo credit: R. Wrigley.

Aspen trunk with a woodpecker hole and black markings; the result of trunk expansion, animal damage, sites of old branches, and fungal attack. The white chalk that rubs off readily consists of shed, mature cork cells which permit sunlight to reach the photosynthetic cells under the cambium layer. Some photosynthesis occurs in early spring, well before leaves develop. Photo credit: R. Wrigley.

What began as possibly a small hole left behind from a dead branch has been enlarged into a fine nesting site for small mammals (e.g., Northern Flying Squirrel), birds, and insects. Photo credit: R. Wrigley.

Tracks of two deer crisscross in the forest. Note the hoof drags. Photo credit: R. Wrigley.

This Red-osier Dogwood shrub has been browsed repeatedly over the years by deer and rabbits. Photo credit: R. Wrigley.

packed trail. Then, from a distance, a lone Black-capped Chickadee called, and I answered its greeting by whistling a high-pitched 'dee-dee-dee.' In seconds, the inquisitive little bird flew over in my direction. As it flitted nervously from branch to branch only a metre or two away, its keen eyes scanning for food, I marvelled that such a tiny creature could survive our winters, when insects were securely hidden under frozen bark, and most seeds were covered by snow. This bird can remember rewarding sites in its home range to search for food and sleeping quarters in a tree hollow, and can even enter a state of hypothermia overnight to save energy. Then I heard a far-off triple croaking of a Common Raven, and I did my best imitation by exhaling air over my flapping tongue (which I had practised with ravens on the tundra). Sure enough, 10 seconds later, the raven came over to investigate, and spotting the intrusive impersonator, it banked in a graceful arc and glided away.

When I paused to catch my breath, with the deep silence surrounding me, it was difficult to fathom that in only a couple of months, tens of thousands of birds of dozens of species, having spent the winter from the southern United States to South America, would arrive in these woods, with males singing incessantly to claim territories and to attract a mate. Farther along the trail, I must have intruded onto the territory of Red Squirrel, because it churred boldly, clearly annoyed, and then made itself scarce. I then pulled back some loose bark off a fallen log and uncovered two hibernating red and black click beetles, which during the warm seasons can flip high into the air like 'tiddlywinks' when disturbed by a predator. I then thought of the many Woods Frogs I was passing by, each huddled in a near-death frozen state, tucked into the leaf litter.

Farther down a trail I came across a

The Black-capped Chickadee is inquisitive, often approaching remarkably close to skiers. Photo credit: Jim Reimer.

The attractively coloured and winter-hardy Black-billed Magpie is a common species in rural landscapes, often entering cities and towns across the prairies. Photo credit: Jim Reimer.

A White-tailed Deer buck bedded down for the day. Photo credit: Larry de March.

40-cm-high mound of earth and sticks with partially bare earth sides (the snow having fallen off), exposing the dark soil to the warming rays of the sun. It was the home of mound or thatching ants. Over two metres below the surface, the hibernating colony likely consisted of around 100 queens and 40,000 workers, all awaiting the warming temperatures of March, which would enable the ants to commence their designated chores.

Skiing on, I came across scattered pieces of fur and a string of intestine of an Eastern Cottontail Rabbit. Tracks in the snow revealed that a Red Fox had fed well last night. On rare occasions I have found where an Ermine has pursued and devoured a mouse, perhaps lining its own nest with mouse fur. Then I found the delicate trail of a Deer Mouse on the surface, which I could distinguish from a Southern Red-backed Vole by the long lengths of the hops and the obvious long tail mark in the snow. The tracks always led to a plunge hole down into the lattice-like subnivean world amid the frozen leaf litter. An unused hole was usually edged in fine ice crystals, as water vapour from below froze on striking the cold air. I wondered about the accumulation of carbon dioxide trapped at ground level. It is thought that mouse tunnels rising to the surface allow gaseous exchange to occur, for there remains considerable activity of a host of animal life under the insulating cover of snow. In addition to mice, there are shrews, spiders, springtails, centipedes, lice, mites, roundworms, and other tiny lifeforms that continue to thrive in the leaf litter and soil, responding to the slight heat arising from deep underground.

When I come across a creek bed in a field, I can never resist being drawn down into its inviting valley, and not only because it provides an instant reprieve from a chilling wind. The creek banks are a wonderland of snow sculptures deposited by the wind. A broken grass or weed stem, twisting round and round in the wind, etches a perfect circle on the surface of the packed snow, just as occurs on a sand dune. Later in the afternoon, I noticed that my shadow, which had leapt so energetically ahead of me at the start of the trail, now decided to follow me at a slow pace as I returned to the parking lot.

Anyone who skis in wild areas will have stories to tell about coming across

Squirrels and rabbits must deal with leaping over the snow cover, while birds have the luxury of flitting from branch to branch, in traversing the landscape. Photo credit: R. Wrigley.

The 12-mm Poplar Click Beetle *(Ampedus apicatus)* is covered with dense, touch-sensitive hairs (called setae) which collect debris, perhaps contributing to camouflage protection from birds. Usually protected by an insulating cover of snow while hidden under bark or soil, insects like click beetles can survive intense cold due to physiological adaptations. Photo credit: Thilina Hettiarachchi.

The forest-dwelling Southern Red-backed Vole plows its way over the snow rather than jumping, as does the Eastern Deer Mouse. Photo credit: R. Wrigley.

wildlife. On one occasion, I was striding along, lost in thought, when there was a sudden explosion in front of my ski tips, which really startled me. I had come across a Spruce Grouse sleeping under the snow. Several times I have found the plunge hole and wing marks in the snow where a large owl (likely a Great Horned) thrust down its taloned legs in hopes of capturing a mouse. While skiing in Riding Mountain National Park, my wife and I were enjoying the solitude of the boreal forest early one morning when I heard the unmistakable sounds of a bull Moose thrashing its antlers against a shrub. I cautiously peered over a slight rise and observed the massive animal glaring back in my direction. That impressive rack convinced us immediately to intrude no further on his territory, especially while the rut may have still been underway.

On another occasion, as a friend and I were driving down the street that borders the Assiniboine Forest, on our way for a morning ski, we noticed two White-tailed Deer bucks suddenly start bounding alongside us, parallel to the road. Seeing that they would not veer off into the adjacent field, we presumed they wanted to return to forest, so I slowed down to give them a chance to cross the road safely. Unfortunately, the road was icy, and as the first buck reached the pavement at considerable speed, its four legs spread out awkwardly, and it slid upright into the snowbank, managed to recover its balance, and then headed off into the woods. Its companion decided to follow, but its front legs swept out to one side mid-way across the road, and it went down heavily on its side, striking its head rather hard on the pavement. Its right antler snapped off at the base and went skidding along with the deer, which finally slammed into the bank. I thought the animal might have suffered a severe injury, such as a broken leg or concussion, but it rose quickly, and made its way into the forest. I felt some guilt for having caused the accident, but hoped the deer had learned how to better react to traffic. Deer-vehicle collisions are sadly

Tracks of a Deer Mouse, which emerged from its subnivean tunnel at the base of a sapling. Note the long tail marks. Photo credit: R. Wrigley.

Strong winter winds burst apart the sturdy flowering heads of cattails, scattering the seeds across the snow. Photo credit: R. Wrigley.

Evidence where Great-horned Owls captured a mouse in deep snow (left photo by R. Wrigley) and an Eastern Cottontail (right photo by Larry de March).

not uncommon on busy roads through forested areas.

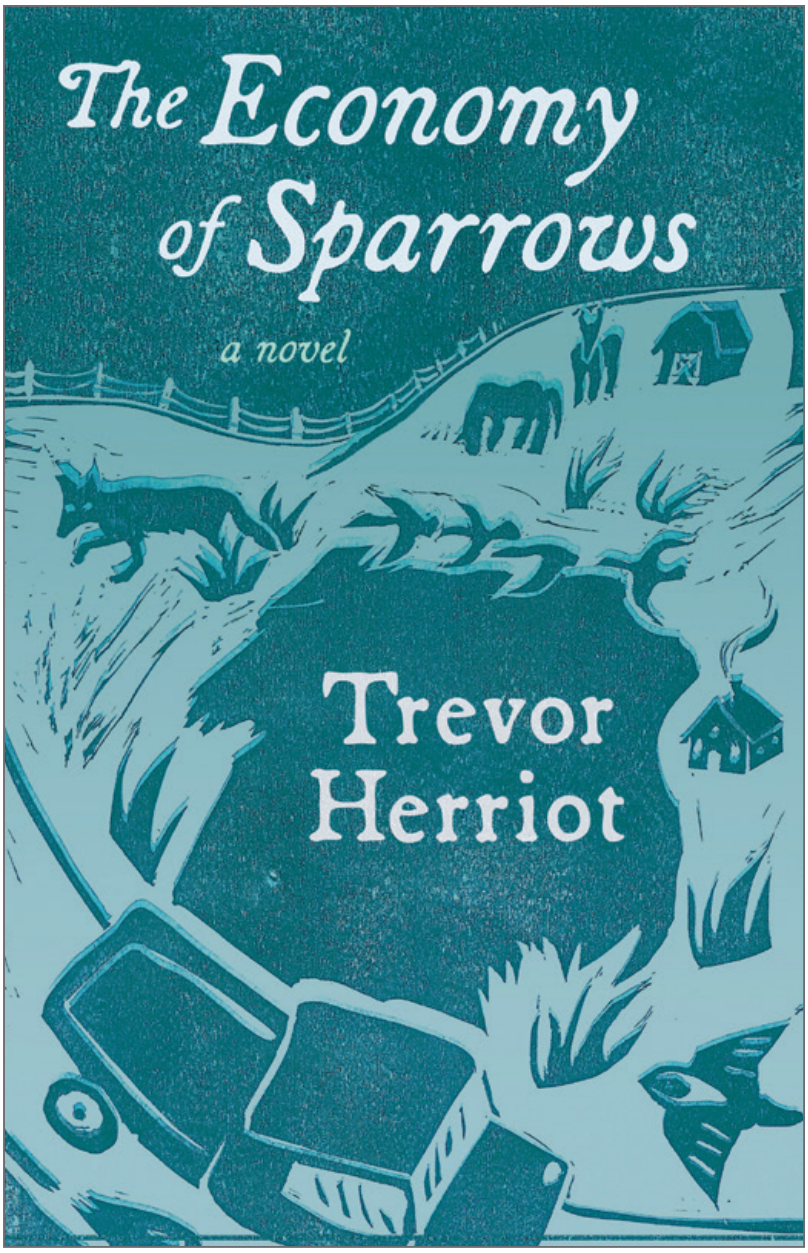
With snow on the ground for four to five months in Manitoba, skiing is a wonderful way to enjoy bright sunny days outdoors. Even on frigid days with a windchill, trails winding through a forest provide shelter until one's body warms up from the exercise. There is plenty to investigate on each excursion, revealed with a sense of curiosity and a little knowledge.

This article was first published in Nature Manitoba's newsletter.

Dazzling-white sculptures abound where a playful wind decides to deposit its load of snow crystals. Photo credit: R. Wrigley.

THE ECONOMY OF SPARROWS:
DEBUT NOVEL A SHIFT IN HERRIOT'S BASELINE

Ashley Martin
Regina, SK



In seven books spanning more than two decades, Trevor Herriot has intimately detailed the Prairies and grasslands in memoir, science and fact. In his eighth book, *The Economy of Sparrows*, he adopts a new tack — fiction.

Herriot began work on his first novel, released in September by Thistledown Press, nearly a decade ago. It started as historical fiction featuring, chiefly, William Spreadborough, a bird collector who explored Western Canada in the late 1800s and early 1900s.

"I became fascinated by this guy, because he had spent a whole spring and summer on the land where we have property south of Indian Head, right by Deep Lake and Cherry Lake, and his bird records are some of the earliest ones in that part of the prairies," said Herriot.

"Something about walking that landscape, seeing the birds there today and then comparing it with his records from more than a century ago, really lit something in me, in my curiosity. … I just felt like that was such a complex mix, I couldn't pull it off in nonfiction. I needed the latitude and the freedom that a novel would give me."

The Economy of Sparrows is centred on Nell Rowan, who has returned to her family's century farm in southern Saskatchewan.

From the first pages of the book, we're immersed in Nell's appreciation of nature, as she hears "the first purple finch of the year, right on schedule … nipping winter-parched berries" from a mountain ash tree. We meet her dog Lily, her chickens, her friends and neighbours, and Carmelita, a teenager in foster care who comes to stay with Nell. We learn about Nell's deceased mother. And we discover what Herriot calls her "private obsession" with Spreadborough.

While working as a night janitor at the Canadian Museum of Nature in Ottawa, Nell spent every spare moment in the archives, learning all she could about Spreadborough. She kept a detailed scrapbook about the man and his work.

Herriot's own knowledge of Spreadborough did not require decades in an archive. He leaned on archivists at the national museum, who fed him information through email. Bill Waiser's 1989 book *The Field Naturalist: John Macoun, the Geological Survey and Natural Science* was also an "invaluable" resource.

Herriot fact-checked his bird references against *Birds of Saskatchewan*, and consulted old issues of the *Blue Jay* as he tackled "shifting baseline syndrome" as a theme in the novel.

Herriot has almost all of the journal's back issues dating to the late 1940s, which show "landscapes that I know are gone now. Like right on the edge of Regina … there was a piece of prairie there that would have 30 pairs of chestnut-collared longspurs (in the early 1960s). Well, I can't find a chestnut-collared longspur within 100 kilometres of the city right now."

Nell observes similar changes in her world. She encounters only seven pairs of western grebes on a lake where, as a child, she saw 40.

She tracks the birds in her area because, Herriot writes, "Without old records to compare to the new data we collect, we're giving in to collective amnesia."

Trevor Herriot poses with his collection of *Blue Jay* back issues, dating to the late 1940s.

Nell delights in bird watching, but is discouraged by her findings. "She envied other birders who coped by posting their data on eBird in the faith that they were tracking a decline that policy-makers would one day act upon."

In Spreadborough's day — as he scouted the west on the dime of a Canadian government interested in settlement — science was used primarily to promote agricultural values, says Herriot, adding that "things haven't really changed."

"We're still kind of stuck on that same path where we priorize the agrarian worldview, without enough interest in that larger, older, deeper understanding of us belonging to nature," said Herriot, adding that agricultural development is a main driver of biodiversity decline.

His novel's title captures this, and each chapter begins with a citation from Taverner's *Birds of Western Canada*, which considers birds only in relation to their "economy" or impact on agriculture.

When Nell, Carmelita and neighbour Vivian embark on a bird survey, they find drained wetlands and a former trail covered by canola as farmers crop corner to corner, which incites a defence from Vivian.

In writing this book, Herriot kept in mind the rural Saskatchewanians he has met over the past two decades.

"They like their neighbours, the big farmer neighbours around them," said Herriot, "(but they're) feeling sad by seeing the landscape change so rapidly, that wetlands are disappearing, and Aspen bushes are disappearing, and the shelterbelts and hedgerows are being bulldozed, burned and buried.

"I wanted to write something that would be compelling for those people … because I believe there are a lot of people like that out there."

Ashley Martin is a communications professional and former journalist with the Regina Leader-Post. She enjoys gardening and reading.

POETRY

P persevering
O overly cautious
L living on the floe
A always caring for their young
R rulers of the ice world
B braving harsh winds
E ever stoic
A anxious about their future
R roaming relentlessly
S searching for ringed seal

Brian K Jeffery
5800 4th Avenue
Regina, SK S4T 0K3

POETRY

Harsh wings blowing cold
Ice crystals carving the snow
Curled up sled dogs, sleep

Brian K Jeffery
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Regina, SK S4T 0K3

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FALL MEET PROVIDED CHANCE TO LEARN NATURAL HISTORY

Grace Pidborchynski
Habitat Stewardship Coordinator
Nature Saskatchewan

On the prairies, we are so lucky to have the opportunity to observe the transition into the autumn season, and what better time to do this than at a Nature Saskatchewan Fall Meet?!

The Fall Meet started on Friday, September 22 in Regina, where attendees came together, mingle with other members and watch a presentation from our special guest of the evening, Tory Hartley-Cox. Tory was Nature Saskatchewan's 2022 Graduate Student Scholarship recipient, for her research on Great Horned Owls on the grasslands. Tory's work provides insight into how vegetation on the prairies influences decisions by Great Horned Owls on where to hunt, as well as their prey. On Saturday morning, we were off to Indian Head to tour the area and learn about its natural history. While Saturday morning brought rain showers, that didn't deter any of us from continuing on! Our first visit was to Nature Saskatchewan President Lorne Scott's farm and the Heritage Tree Farm.

The Heritage Tree Farm is a site that Lorne and Bill Schroeder partnered on to save tree genetics from the closed Prairie Farm Rehabilitation Administration tree nursery. It contains rows of trees and shrubs grown from seed strains and other varieties that came from the administration. Bill delivered the history of this tree farm and, while standing there, I could feel the passion that went into this amazing project.

Our next stop of the day was at Cherry Lake. There, we stopped to eat a bagged lunch provided by the Indian Head Bakery while learning about the biodiversity and natural history of the area. We had also hoped to see some migrating birds on the lake, as this is the time of year that many birds are migrating from their summer grounds. A few of us did get the chance to see a Belted Kingfisher and a Great Blue Heron!

After spending some time walking around the grounds, we all hopped back on the bus to our next stop — Red Fox Lake. Another wonderful place to see the changing colours of fall, I was reminded why autumn is my favourite season.

Our last stop before heading back into town was at a pasture that had buffalo rubbing stones. To the untrained eye, it may have just looked like a regular stone left behind in the glacial retreat. To a buffalo on the prairie, a lone stone was the best back-scratching technology they had. Buffalo would rub their bodies against these rocks to rid themselves of their winter coats or to satisfy a bug bite in the summer. The rock we saw had one corner completely worn down and polished from the repetitive use of buffalo over many generations.

Once we got back to Indian Head, we had a wonderful turkey dinner catered by the Indian Head Royal Purple Elks. With full stomachs, we listened to Bill Schroeder launch his book, Trees Against the Wind: The Birth of Prairie Shelterbelts, which tells the story of the Prairie Farm Rehabilitation Administration's origin, the devoted staff, and the prairie farmers who planted trees to help their land.

Thanks to everyone who helped make the fall meet a success, including all those who came out to join us over the weekend and those who made the event possible. We hope to see everyone at the 2024 Nature Saskatchewan meets in Saskatoon (June 21 to 23) and Regina (September 13-14) to help celebrate Nature Saskatchewan's 75th anniversary!

RECENT OCCURRENCE AND CONFIRMED NESTING OF THE BLACK-NECKED STILT IN THE BATTLEFORDS AREA, SASKATCHEWAN

Spencer G. Sealy
Winnipeg, MB R3T 0J5
Spencer.Sealy@umanitoba.ca

Orval Beland
Denholm, SK S0M 0R0

Introduction

The Black-necked Stilt (*Himantopus mexicanus*; hereafter, stilt) has expanded its range northward in western Canada in recent decades.[1-3] In Saskatchewan, widespread observations and reports of stilts nesting in several areas have increased since the late 1980s and post-breeding flocks have been recorded in late summer.[4,5] Analyses of these and additional records have led to the suggestion that the northward expansion has established the Black-necked Stilt as a regular breeder on the Canadian Prairies, but the species' sensitivity to fluctuating water levels may find individuals nesting at one site in one year and at different sites the next.[6] Observations we report here made over several decades in the Battlefords area are consistent with these findings.

We report the first observations and nesting behaviour of the Black-necked Stilt in the Battlefords area of west-central Saskatchewan over a period of 60 years. Sealy observed birds south of Battleford in the late 1950s and early 1960s, and during short visits to the area through 2023, but the first stilts, a pair, were not observed until 2016. Beland, who returned to take up residence near the family farm south of Denholm in 2000, observed individual stilts and adults with young between 2018 and 2022, but neither of us recorded stilts in 2023, by which time some of the smaller wetlands were dry. Our observations augment those reported to eBird and confirm the stilt's recent occurrence and nesting in another part of Saskatchewan, the Battlefords area.

Observations

We observed stilts at mostly unnamed wetlands (hereafter, sites) of various size (Figure 1), each identified by latitude and longitude. We refer to local, unofficial names of wetlands if available. Most observations were made from roads that passed alongside or divided the sites. This reduced disturbance but precluded searching habitat for nests and young; parts of some of the larger wetlands were inaccessible. Nevertheless, nesting was confirmed when developed young and broods became visible and, in at least one case, the date one family group left the area. Defensive behaviour exhibited by many presumed pairs also strongly suggested nesting. American Avocets (*Recurvirostra americana*; hereafter, avocets) nested at many sites where stilts were recorded.

Battleford

Sealy moved with his family to Battleford in early July 1958 and observed birds at all seasons through the late summer of 1961 before moving on to university. Except for spending the late spring and summer there in 1962, visits to the Battlefords generally of a few days occurred in the ensuing decades at various times of the year, including the post-breeding season in many years, a few breeding seasons in some of the early years, and during the breeding and post-breeding seasons over most of the last 10 years. Although different habitats and wetlands were visited south and southwest of Battleford during each visit, six wetlands were surveyed during each visit (see below). One putative pair of stilts was observed in 2016, several stilts, including pairs, were observed in 2019, and a single stilt was observed in 2022 (there were no visits during the pandemic in 2020 and 2021). Stilts were not observed at any sites in 2023. Aggressive defense by individuals toward the observer and probable pairs suggested nesting. We recorded some adults as male, with their glossy black backs that contrasted with the brown heads of females, and in males, bills that contrasted sharply with white underparts and very long pinkish legs.[10]

Observation Sites

N52.66762°, W108.29985°
("Fisher's Lake" / "Galbraith's Lake"; site 1 in Figure 1)

At 09:40 hr on 25 June 2016, an agitated male stilt was observed flying back and forth between a flooded area on one side of a road to the other side that separated the two large "lakes". Later that day, a male and female that behaved as a mated pair were observed for 20 minutes beginning at 12:50 hr. The single female observed the following day performed the well-described "broken-wing" display, frequently crouching on the road as if incubating eggs before moving to another spot and repeating the performance.[7] Up to five avocets loafed within 30 m on the shore during each observation period.

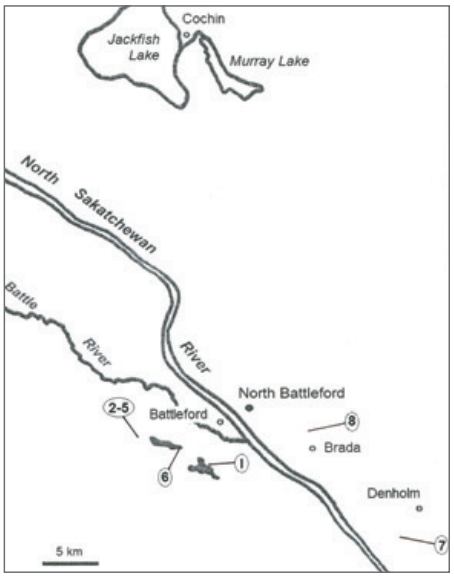

FIGURE 1. Map of the Battlefords area, showing locations of wetland sites 1-8 where Black-necked Stilts were recorded, south and west of Battleford, and southwest of Denholm, in at least one year from 2016 to 2022. No stilts were observed in 2023. Map prepared by N.L. Sealy.

Stilts were not observed at this site in 2019, or 2022 and 2023.

N52.68957°, W108.42545°
(four unnamed wetlands, within 5 km; sites 2-5 in Figure 1)

On 18 June 2019, defensive behaviour suggested nesting. Stilts and avocets were present at each site. Three stilts, plus apparently a mated pair, were observed at sites 2 and 3, respectively. Seven stilts and up to nine avocets behaved aggressively at sites 4 (Figure 2) and 5, which were about 150 m apart and separated by a road and cropland. Stilts flew back and forth between these sites. No stilts were observed in 2016, or 2022 and 2023.

N52.681939°, W108.42545°
(Winniford Lake; site 6 in Figure 1)

A single male foraged amid dead trees at the flooded edge of Winniford Lake, about 10:30 hr on 8 and 9 June 2022; the contrast between this habitat (Figure 3) and that of site 4 (Figure 2) is evident. The bird was absent at 12:00 hr on 19 June and not seen again. The water level of this lake was receding when the bird was first observed, and the site was dry on 15 September. No stilts were observed there in 2016 or 2019 when the water level was high.

Denholm

Beland returned to reside near the family farm south of Denholm in 2000. Beginning in 2006 he recorded natural history observations, particularly of birds at two sites, which permitted recognition of the first appearance of stilts in the area, late in the season of 2018, and eventually to confirm nesting. No stilts were observed in 2019, 2021 or 2023 because sloughs previously visited were dry, but several pairs were recorded in 2020 and 2022, and juveniles were recorded. Most observations were made from a vehicle; in 2022, observations were made almost daily.

Observation Sites

N52.60847°, W108.04246°
(unnamed wetland, 2 km NW Beland home; site 7 in Figure 1)

The first observations of stilts were of two adults (with "redder legs and blacker feathers") and apparently two young (family group?) on 24 August 2018. The pair may have nested out of sight at the far end of this large wetland or the group had moved into the area during the post-breeding period, prior to migration. The same (?) family group was observed until 26 August but was gone the following day.

Stilts were observed almost daily from 8 June through 24 August 2020, beginning with at least three individuals engaged in courtship displays on 8 June, and one-to-four adults were recorded through 6 July. Presumed family groups observed from 7 through 29 July generally consisted of two adults with one or two young, possibly the same family, but not all young were visible every day. On 30 July, four different stilts were observed, three of them apparently young. Adults with young were recorded almost daily through 24 August, with the first flying young observed on 6 August; by 10 August all young were flying. No stilts were observed from 25-31 August. Family groups were most visible when they foraged in shallow water near the road that divided the wetland. Up to three broods may have been reared at this wetland given that on 4 August, one adult with one young were observed, but later, two adults and two young were recorded on the road as well as one adult with three young at the west end of this wetland.

At least two family groups were confirmed, first on 18 June 2022 and daily through 5 July, and also from 31 July to 14 August, the last day family groups were seen. The number of young observed, generally with one adult, was between one and four, depending upon their visibility or whether they were from other

FIGURE 2. Black-necked Stilts and American Avocet at site 4, 18 June 2019. Habitat at this site contrasts sharply with that of site 6 shown in Figure 3. No stilts were observed at this site in 2016, 2022 or 2023. Photo credit: N.L. Sealy.

FIGURE 3. Male Black-necked Stilt (centre), foraging in different habitat (site 6), a flooded backwater of Winniford Lake, Saskatchewan, 8 June 2022. This site was dry on 15 September 2022, and in June 2023. Photo credit: N.L. Sealy.

groups. No stilts were observed from 15-18 August, but Gerard Beland (pers. comm., 6 September 2022) observed nine to 11 stilts "one day in late August."

N52.72927°, W108.18134°
("Charabin Marsh", 1.6 km N Brada; site 8 in Figure 1)

On 8 June 2022, Sealy observed at least 13 stilts and 22 avocets; many individuals of both species exhibited defensive behaviour and one avocet could be seen incubating. Beland recorded at least six adults (3 June), "many adults" (25 June), at least 10 adults and 12 "very young" stilts and at least seven adults and eight young avocets (30 June) and two avocets but no stilts (23 July), by which time the water level was low. This site was under cultivation in 2023.

Discussion

Our observations of Black-necked Stilts generally fit the pattern revealed by other recent reports from elsewhere in Saskatchewan. Of the 44 observations (some possibly of the same birds) in the area submitted by birders to eBird between 2018 and 2022[8], most were observed in May and June, but 20 birds were observed during the post-breeding season at Jackfish Lake (Figure 1) in August 2016, and six were recorded at Brada Marsh in August of both 2018 and 2019.

Our observations confirmed that individuals moved into the area and nested in the same year, but the same or different individuals used different wetlands in subsequent years, possibly because of changing water levels. No stilts were recorded near Denholm in 2019, whereas the largest number of stilts was observed that year and several pairs apparently nested south of Battleford. One stilt was observed south of Battleford in 2022, whereas several pairs nested at Denholm. Our observations confirmed that the birds' use of local wetlands may change from year to year.

Several authors[5,6] noted that stilts that moved northward in recent years were possibly forced there by drier nesting conditions brought about by the deepening drought in the southwestern United States and the species' core breeding area.[9] Will the Black-necked Stilt's breeding range shrink again when the southern droughts recede?

Acknowledgements

Bev Beland and Noreen Sealy offered support in the field; Noreen prepared the map. Annie McLeod extracted records of Black-necked Stilts from the Battlefords area from eBird checklists. We thank Philip S. Taylor for helpful comments on drafts of the manuscript and for pointing out a couple of references.

1. Gyug LW, Weir JT (2017) American Avocet and Black-necked Stilt breeding status and population trends at Kelowna, British Columbia, 1997-2015. *British Columbia Birds* 17:2-12.

2. Koes R (2003) Black-necked Stilt. Page 167 *in* The Birds of Manitoba, Manitoba Naturalists Society, Winnipeg.

3. Dekker DR, Lister R, Thormin TW, Weseloh DV, Weseloh LM (1979) Black-necked Stilts nesting near Edmonton, Alberta. *Canadian Field-Naturalist* 93:68-69.

4. Smith AR (2019) Black-necked Stilt. Pages 225-226 *in* Birds of Saskatchewan (Smith AR, CS Houston CS, Roy JF, editors). Nature Saskatchewan, Regina.

5. Taylor PS (2023) New and notable records of Saskatchewan birds: 2022. *Blue Jay* 81(1):6-17.

6. Gratto-Trevor CL (2002) Increasing numbers of Black-necked Stilts in Canada. *North American Birds* 2002:246-250.

7. Robinson JA, Reid JM, Skorupa JP, Oring LW (1999) Black-necked Stilt (*Himantopus mexicanus*), version 1.0. *in* The Birds of North America Online (A. Poole, editor). Cornell Lab of Ornithology, Ithaca, NY, USA. http://bna.birds.cornell.edu/bna/species/449

8. eBird (2012) eBird: an online database of bird distribution and abundance [web application]. eBird, Ithaca, NY. http://www.ebird.org, accessed 12 April 2023.

9. Williams AP, Cook BI, Smerdon JE (2022) Rapid intensification of the emerging southwestern North America megadrought in 2020-2021. *Nature Climate Change* 12:232-234.

STEWARDS OF SASKATCHEWAN UPDATE: SUMMER SEASON A SUCCESS!

Emily Putz
Habitat Stewardship Coordinator,
Nature Saskatchewan

Nature Saskatchewan's Stewards of Saskatchewan programs enjoyed another successful field season. This summer, staff visited 146 potential participants across southern Saskatchewan and 84 stewards joined the programs! All together, 1,117 stewards are conserving and monitoring 989,156 acres of prairie habitat and 213 miles of shoreline habitat for species at risk. Staff were also able to sit down and catch up with 147 long-time participants, 60 of which received site specific Beneficial Management Practices (BMP) plans that detail life cycle milestones and recommend specific habitat needs for target species.

Work was also completed on a number of new Monarch initiatives through the Stewards of Saskatchewan Banner Program in 2023. A new "wanted" poster for Monarchs was distributed to RM offices in target areas, a new best management practices plan was shared with stewards supporting Monarch habitat, and we piloted our new milkweed monitoring initiative that is helping to fill the gaps on knowledge of these butterflies' habitat use in their prairie range. We were blown away by the positive response to this pilot, and look forward to expanding it in the future.

While some of our staff were busy scouring the countryside for species at risk during grid road searches, our rare plant crews were boots on the ground on the native prairie. The plant crew surveyed 91 quarter sections this summer for target rare plants, finding new occurrences of federally-listed Tiny Cryptantha and Dwarf Woolly-heads on nine new quarter sections! They also revisited 41 quarter sections with previously known occurrences to monitor how those populations are doing. Previously known occurrences were observed on 32 quarter sections and were found to be in fair to good health. A huge highlight of the season was the discovery of thousands of Tiny Cryptantha plants. This species is incredibly rare, hard to spot, and hasn't been found by Rare Plant Rescue staff in more than 10 years!

Census is also well underway for 2023. The Shrubs for Shrikes census is 45 per cent complete with 56 pairs, 48 singles, and 34 juvenile Loggerhead Shrikes reported so far. Plovers on Shore is 57 per cent complete with one pair, four singles, and eight juvenile Piping Plovers reported. Operation Burrowing Owl is 35 per cent complete with 13 pairs, two singles, and 31 juveniles reported so far, which is already more young reported than in all of 2022 with only 13 young recorded by census completion! Last but not least, the Stewards of Saskatchewan Banner Program is 27 per cent complete with 817 Barn Swallows, 56 Ferruginous Hawks, two Short-eared Owls, 18 badgers, 74 Sprague's Pipits, four Bobolinks, 34 Common Nighthawks, 93 Northern Leopard Frogs, 11 Tiger Salamanders, and 42 Monarch butterflies reported so far through the census. These primary results join more than 60 other species sightings that were submitted by the public this summer through our toll-free HOOTline.

Program success is only possible through participating stewards conserving important habitat and sharing species observations. We thank you! Nature Saskatchewan would also like to give a big shout-out and thank you to Nathanial Hak, Elizabeth Walker, Grace Pidborchynski, Amy Bailey, Danica Nasedkin, Brandon Melnechenko, and Justin Kentel. The amount of work accomplished in this 2023 field season would not be possible without you!

Burrowing Owl. Photo credit: Nick Saunders.

HUMAN NATURE

Alora Sweeney
Summer 2022 Rare Plant Rescue Assistant
Nature Saskatchewan

Anyone who isn't from Saskatchewan will tell you that all it's known for is being flat. So flat in fact, that you can "watch your dog run away for days" or so the saying goes. However, if you give it an honest look, you'll quickly come to realize that is not the case.

Growing up, the times I looked forward to the most were spending family time at our cabin in Candle Lake, which is among the boreal wetlands of Northern Saskatchewan. My favourite go-to spot is the Gem Lakes in Narrow Hills Provincial Park. This is a beautiful area with meandering conifer-covered hills and seven remote, emerald green lakes that make you question if you're still in Saskatchewan or if you've been magically transported to British Columbia. It was here that I discovered Saskatchewan was not all flat prairies like everyone told me it was.

To some, wetlands may be seen as an undesirable place to be. But for me, they taught me to slow down and appreciate the little things, as it's the little things that keep everything functioning. I recall being surprised at how small I felt while exploring these highly diverse and productive habitats. From the tiniest invertebrates to biggest mammals, I came to realize that everything is interconnected and integral to the health of the local ecosystem. The more I explored my forested backyard, the more my love and fascination for the micro-communities surrounding me grew.

During my time working with Nature Saskatchewan, and having the chance to travel southern Saskatchewan, my eyes were opened to the surprising layers of biodiversity found in our native prairie ecosystems. When you travel to areas like Eastend, Cypress Hills, the Great Sand Hills, and Big Muddy, you understand just how rich Saskatchewan's geography is.

Saskatchewan boasts some of the most diverse landscapes in Canada, and it fills me with pride to have the opportunity, through Nature Saskatchewan, to explore and advocate for this wonderful province. Next time you get bored, take the time to explore around or even just have a sit in your closest natural area and discover something new, you never know what you'll find!

MYSTERY PHOTO

WINTER 2023

QUESTION:
What bird left this impression in the snow, after a cold winter's night, at Gord Hammell's farm near Erickson, MB?

Photo credit: Gord Hammell.

FALL 2023

ANSWER:
The beetle featured in the Fall 2023 Mystery Photo is *Antherophagus ochraceus*, a species of silken fungus beetle. *A. ochraceus*, along with some other members of Cryptophagidae, engage in phoresy, which is an association between two organisms in which one travels on the body of another, without being a parasite. Adult beetles feed at flowers, but the larvae feed in the nests of bumblebees. So, the beetles use the bees to hitch a ride to and from these two habitats, which is what is occurring in this photo.

Thank you to scientist and naturalist John Acorn for the information on this beetle and its behaviour.

Photo credit: Paule Hjertaas.

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SASK LOTTERIES