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COVER: A pair of Canada Lynx (*Lynx canadensis*) kittens at their den site before being ear-tagged by biologists in early summer of 2019. Lynx populations rise and fall with the availability of their cyclic prey. See the article by Jung (pp. 17–19) about the first observations of adult lynx using a novel food source during the low phase of their preferred prey. Photo: Peter Mather.

The Canadian Field-Naturalist

Note

A highly anomalous Red-winged Blackbird (*Agelaius phoeniceus*) song

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Abstract

Red-winged Blackbird (*Agelaius phoeniceus*) is a highly vocal species with a repertoire of similar, yet acoustically distinct songs. These songs may be altered drastically if, as a nestling, the male goes deaf or becomes acoustically isolated. In deaf Red-winged Blackbirds, these dramatic song alterations may present as songs bearing slight resemblance to the introductory phrase of their normal song. Here, we present a Red-winged Blackbird song observed in Ottawa, Ontario, Canada, that is far outside any normal variation in Red-winged Blackbird songs. Given the individual's age and the consistency of the anomalous song, it is possible that this is a deaf bird.

Key words: Red-winged Blackbird; song development; song anomaly; deaf; deafness in birds; song physiology; bioacoustics

Red-winged Blackbird (*Agelaius phoeniceus*) is a common and widespread species native to North America. The males' raucous "*konk-la-reeee*" song (Nero 1984) and impressive "song spread" display—raising their red epaulets, hunching their shoulders, and spreading their tail (Nero 1956; Orians and Christman 1968; Yasukawa 1979)—can be heard and seen throughout the breeding season in a variety of habitats (Nero 1984). Marler *et al.* (1972) describe this song as the Red-winged Blackbird's "full song" or "stereotypical song", because it is the only one that remains stable on a long-term basis. Male Red-winged Blackbirds can have a repertoire of upwards of nine distinct songs, all containing an introductory phrase (variations of the "*konk-la-*" component) and a trill phrase (various modulations and tones of the "*reeee*" component; Marler *et al.* 1972; Yasukawa *et al.* 1980). Figure 1 shows two examples of Red-winged Blackbird songs within the normal range of variation. Several other examples are archived in the Macaulay Library (Anonymous 2022).

Similar to many other songbirds, Red-winged Blackbirds learn their stereotypical songs by copying modelled behaviour early in life (Kroodsma and Baylis 1982). Song development in Red-winged Blackbirds follows a trajectory characterized by three phases typical of other passerines: a highly variable, noisy, and unstructured "subsong"; a less noisy, less variable "plastic song", which may change from day-to-day; and the stereotypical "full song", which remains consistent over repeated breeding seasons (Marler *et al.* 1972). Song development is hindered in males that become deaf or are acoustically isolated as nestlings. Deaf nestlings will develop a song that has little to no resemblance to a full song, whereas males that are acoustically isolated as nestlings will develop an abnormal song with some resemblance to a full song (Marler *et al.* 1972).

On 17 April 2021 at 0843 eastern daylight time (EDT), we observed a male Red-winged Blackbird singing a distinctive and unusual two-note song that was not within any normal variation of Red-winged Blackbird songs. This bird was at the entrance to a marsh complex in Ottawa, Ontario, Canada (45.3449°N, 75.8606°W), known locally as "Nortel Marsh". The bird was perched atop a tree and singing the two-note song regularly while performing its "song spread" display. We recorded the song on a cellphone (Galaxy S9 SM-G960W; Samsung Electronics Co. Ltd., South Korea) using the free Android

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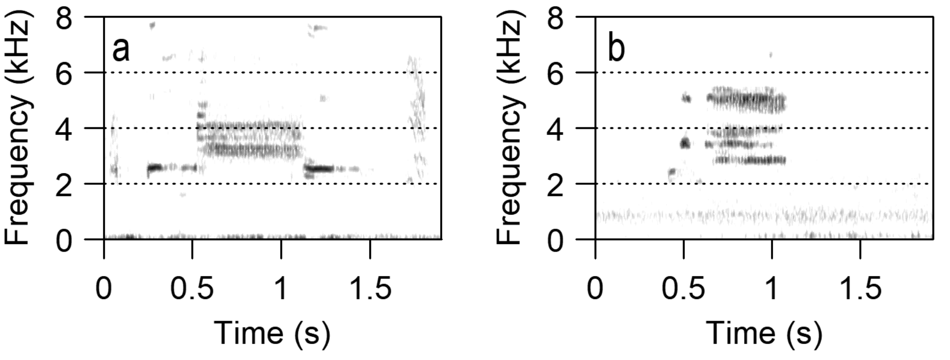

FIGURE 1. Spectrograms of two Red-winged Blackbird (*Agelaius phoeniceus*) songs within the normal range of song variation. Song a was recorded by A.D.B. in Delta, British Columbia, Canada, 24 July 2021. Song b was recorded by B.P.M.E. in Guelph, Ontario, Canada, 1 July 2017.

application MyRecorder v1.01.41.0414.

On 25 April 2021 at 0612 EDT, B.P.M.E. heard the same song again at the marsh and quickly rediscovered the same individual giving this distinctive song, this time while it was sitting atop a utility pole at the entrance. B.P.M.E. recorded its song again using the same recording equipment. During the 10-min session on 25 April and the roughly 5 min observed on 17 April, the bird gave no other song or call.

Both recordings were processed using the free software, Audacity 3.0.0 (https://www.audacityteam.org/). Background noise was removed using the *noise reduction* function and selecting a sample of white noise from the clips to filter out. The transformed recordings were subsequently amplified by 6–10 dB, depending on the clip. The sound files were then converted to spectrograms using the R packages "tuneR" (Ligges *et al.* 2018) and "seewave" (Sueur *et al.* 2008). Figure 2 shows spectrograms for four bouts of the song across the two days. A sound clip of the 25 April encounter was archived in the Macaulay Library (https://macaulaylibrary.org/asset/330098611).

Several indicators suggest that this is, indeed, the "full song" of this individual. The timing at which the observations took place (i.e., mid-April during spring migration) indicates that this individual cannot be a juvenile hatched in the current year that is still developing its song. The use of the "song spread" territorial display also suggests that the bird is at least a year old (Wright and Wright 1944), at which point it would have developed its full song (Marler *et al.* 1972). In addition, the song remained consistent across a span of several days (Figure 2a versus 2b,c,d), and consistent on the same day (Figure 2, b versus c versus d).

In all four recordings presented here, the tones are roughly in the 2 kHz range (±100 Hz). In a typical Red-winged Blackbird's full song, although the introductory phrase comprises several tones simultaneously, several introductory phrases contain at least one tone in the 2-kHz range. It is possible that the two-note song presented here is a small portion of a slow version of an introductory "*konk-la-*" phrase that lacks the complexity of the simultaneous notes.

Given that the observed anomalous song stayed consistent across several recording sessions spanning more than a week and did not appear to transition from a seemingly underdeveloped song into a more developed song, we suggest that this bird could be deaf, rather than acoustically isolated as a nestling. Marler *et al.* (1972) found that acoustically isolated birds still made the full repertoire of sounds, even though they tended to be more variable than birds singing the stereotypical song. That is, the songs of acoustically isolated birds still maintained many of the normal traits of stereotypical songs. However, Marler *et al.* (1972) found that surgically deafened birds sang songs that either maintained little-to-none of the normal traits of a stereotypical song or partly resembled portions of the introductory phrase, which appears to align with the song of this individual. Although male Red-winged Blackbirds are also known to modify their songs in response to anthropogenic noise, most modifications involve only small tonal shifts, decreases in introductory phrase syllables, or changes in trill length (Hanna *et al.* 2011; Cartwright *et al.* 2014; Ríos-Chelén *et al.* 2015).

One alternative cause of the anomalous song in this individual could be a nutritional deficiency while it was a nestling. Nowicki *et al.* (1998, 2002) have hypothesized that a decrease in nutrition as a nestling may lead to impaired brain development, which could lead to lower song quality in passerines. Some evidence supports this theory: Spencer *et al.* (2003) found a decrease in song duration, syllables (both total syllables and variation in syllables), and peak

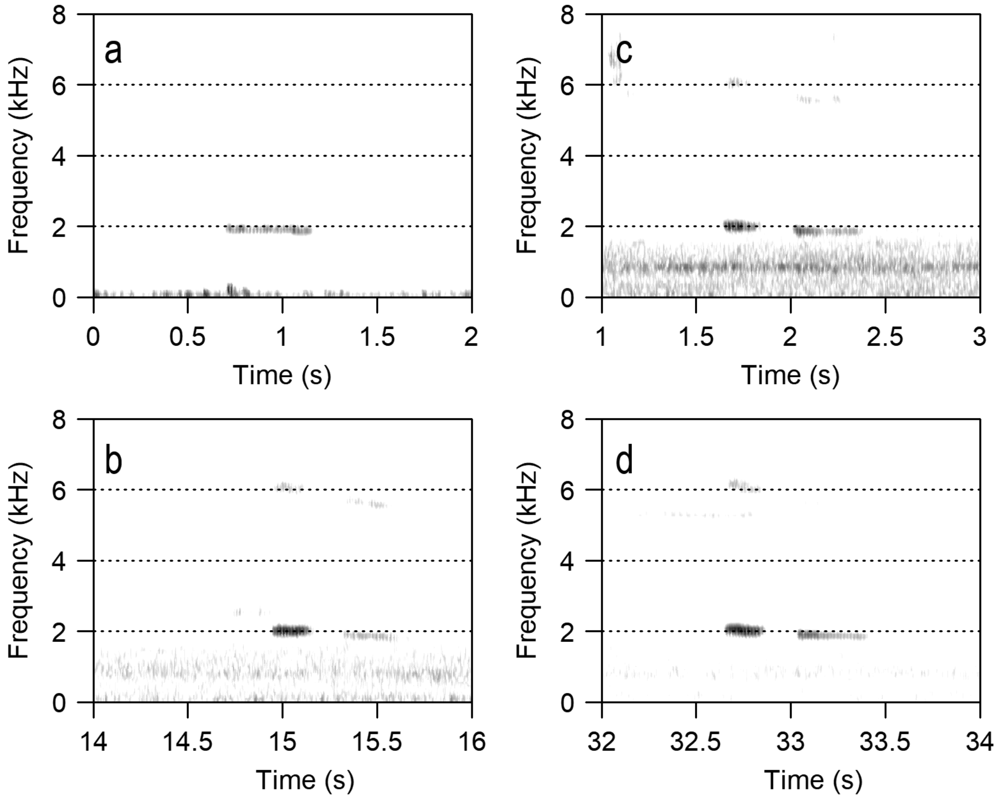

FIGURE 2. Spectrograms of the anomalous two-note Red-winged Blackbird (*Agelaius phoeniceus*) song, with one bout recorded 17 April 2021 (a), and three more bouts (b–d) recorded 25 April 2021. All instances were recorded at Nortel Marsh in Ottawa, Ontario, Canada (45.3449°N, 75.8606°W).

frequency in Zebra Finch (*Taeniopygia guttata*) that were subject to a restricted diet as nestlings, and Schmidt *et al.* (2013) found a decrease in song repertoire, syllable repertoire, and song learning in Song Sparrow (*Melospiza melodia*) that were subjected to a restricted diet as nestlings. However, in both cases, the birds still maintained several normal parts of their species' stereotypical songs, which does not align with the song presented by the Red-winged Blackbird described here. Although this nutritional stress hypothesis is still an ongoing area of research among several bird species (Searcy and Nowicki 2019), it appears so far that a nutritional deficiency reduces song quality to a much lesser extent than deafness in nestlings.

In Red-winged Blackbirds, as with most passerine species, song vocalization is necessary for maintaining territory during the breeding season (Nero 1956; Peek 1972; Yasukawa 1979), and for attracting potential mates (Yasukawa 1979). Song quality in passerines tends to influence female bird response, in that females will respond more favourably to males with higher quality songs and larger song repertoires (Ballentine *et al.* 2004; Nowicki and Searcy 2005). Although we did not collect additional data related to breeding evidence for this individual, it is likely that the extreme difference in song quality compared with a normal range of Red-winged Blackbird song may cause this male to have lower breeding success during its lifetime. Although we believe the cause of the anomalous song in this bird is deafness, an alternative hypothesis could be nutritional deficiencies. As climates and habitats continue to change, it is important to take note of unusual songs, as the causes can reflect environmental conditions and the consequences can contribute to the breeding success, and possibly the evolutionary trajectory, of the species.

Author Contributions

Writing – Original Draft: B.P.M.E.; Writing – Review & Editing: B.P.M.E., A.D.B., W.B.E., E.J.H., and S.S.S.; Conceptualization: B.P.M.E.; Investigation: B.P.M.E., A.D.B., W.B.E., E.J.H., and S.S.S.; Formal Analysis: B.P.M.E.

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Note

First report of Eastern Red-backed Salamander (*Plethodon cinereus*) on Newfoundland

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Abstract
The island of Newfoundland has no native amphibian taxa, although six species of Anura (i.e., frogs and toads) have been introduced since European colonisation, four of which have established self-sustaining populations. Here, we document Eastern Red-backed Salamander (*Plethodon cinereus*) on Newfoundland for the first time, in what appears to be a self-sustaining population near Conception Bay South. This is the first species of Caudata (i.e., newts and salamanders) to have been introduced to the island, as well as the first occurrence of Eastern Red-backed Salamander establishing a population outside its native range. The impact that this non-native species might have on forest ecosystems on Newfoundland is unclear and further study is required to determine whether eradication of the species from Newfoundland is necessary or feasible.

Key words: Caudata; introduced species; invasion biology; island biology; new distribution record; non-native; Plethodontidae

The introduction and subsequent spread of non-native species can often result in negative ecological (Elton 1958; Bellard *et al*. 2016; Duenas *et al*. 2021) and economic consequences (Hoffmann and Broadhurst 2016; Paini *et al*. 2016). However, not all non-native introductions become invasive (i.e., either having negative effects on native flora and fauna or expanding their extralimital range beyond their initial colonisation site). Ecological and socioeconomic impacts of non-native introductions vary greatly and depend on the species, ecosystem, and other context-dependant factors (Hawkins *et al*. 2015; Bacher *et al*. 2018).

The assessed impacts of 126 species of non-native amphibians have ranged from minimal concern to massive, irreparable effects (Kumschick *et al*. 2017; Measey *et al*. 2020). Although there are currently no known introductions of amphibians to Canada from outside the country, a number of domestic invasives have been introduced to novel regions within Canada. For example, American Bullfrog (*Lithobates catesbeianus*), native to southeastern Canada, was introduced into British Columbia in the 1930s and is negatively impacting native amphibians and invertebrates (Govindarajulu *et al*. 2006; Monello *et al*. 2006; Jancowski and Orchard 2013; Novak and Goater 2013).

Although Labrador supports seven species of native amphibians—two salamanders (Blue-spotted Salamander [*Ambystoma laterale*] and Northern Two-lined Salamander [*Eurycea bislineata*]), four frogs (Mink Frog [*Lithobates septentrionalis*], Northern Leopard Frog [*Lithobates pipiens*], Spring Peeper [*Pseudacris crucifer*], and Wood Frog [*Lithobates sylvaticus*]), and one toad (American Toad [*Anaxyrus americanus*]; Notzl *et al*. 2013)—the adjacent island of Newfoundland had no native amphibians, but now supports the densest assemblage of introduced amphibians in Canada (Buckle 1971; Warkentin *et al*. 2003). Since European colonisation, six anurans have been introduced, four of which have established self-sustaining populations (Maret 1867; Buckle 1971; Warkentin *et al*. 2003). Green Frog (*Lithobates clamitans*) arrived in Newfoundland during the mid-1800s, presumably via unintentional introductions associated with the transport of agricultural products, such as hay, imported from Nova Scotia to the St. John's area (Maret 1867; Warkentin *et al*. 2003). Since then, Green Frog has spread broadly across the island. During the 1960s, American Toad, Chorus Frog (*Pseudacris*

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triseriata), Northern Leopard Frog, and Wood Frog were intentionally introduced from southern Ontario to western Newfoundland, predominately around the Corner Brook area (Buckle 1971). Of these, only American Toad and Wood Frog have established resident populations. Toads have been steadily spreading eastward across the island (Warkentin *et al*. 2003). In the early 2000s, Mink Frog was also found to be breeding in Newfoundland in the Corner Brook area (Warkentin *et al*. 2003). Here, we document another non-native amphibian and the first salamander, Eastern Red-backed Salamander (*Plethodon cinereus*), introduced to Newfoundland and note potential implications and possible actions.

On 18 May 2021, while clearing piles of old, degraded, timber from around a building and yard during renovations, L.K. discovered five Eastern Red-backed Salamanders on a single property in Conception Bay South, Newfoundland (47.4858°N, 52.9758°W, ~530 km east of the closest native population in Cape Breton, Nova Scotia). Habitat at the site consisted of large spruce (*Picea* sp.) and birch (*Betula* sp.) woodlots with open agricultural fields nearby and is similar to some of the species' native deciduous, coniferous, and mixed-wood forest habitats from eastern Nova Scotia to northwestern Ontario (Gilhen 1984). Human disturbance is generally low in the area where L.K. observed the salamanders. Two additional individuals were observed on 23 May 2021: a juvenile (snout–vent length [SVL] = 21 mm; Figure 1a) and an adult (SVL = 41 mm; Figure 1b). All individuals were found within 100 m of each other, although adjacent properties have not yet been searched. The chance observations and lack of permits prevented the collection of specimen vouchers; however, photo vouchers are presented (Figure 1). Four of the seven specimens were of the red-backed (striped) colour phase and three were the lead-backed (unstriped) colour phase (Table 1), the two most common phenotypes for the species (Moore and Ouellet 2014). Using ImageJ (version 1.53; Schneider *et al.* 2012), we estimated SVL (±1 mm), the distance from the tip of the snout to the inferred vent location at the posterior of its pelvic girdle, based on photographs that included a coin for scale. These measurements were used to differentiate adults from juveniles. Sexual maturity for males and females is attained at 36.5 and 41 mm, respectively (Leclair *et al.* 2006). Based on where the observations occurred, the individual colour patterns (Table 1), and the species' small home range (24 m^2; Kleeberger and Werner 1982) and high site fidelity (Placyk and Graves 2001), we presume that all seven salamanders are distinct individuals. Furthermore, the presence of a juvenile suggests that this non-native population may be reproducing. L.K. has a 25-year history with this property and the surrounding

FIGURE 1. a. A juvenile Eastern Red-backed Salamander (*Plethodon cinereus*; estimated snout–vent length, SVL = 21 mm) discovered under a pile of timber. b. An adult Eastern Red-backed Salamander (estimated SVL = 41 mm) discovered under a piece of degrading and weathered particle board, both near a property in Conception Bay South, Newfoundland, Canada. Photos: L. King.

Table 1. Red-backed Salamanders (*Plethodon cinereus*) observed in 2021 in Conception Bay South, Newfoundland.

ID no.	Date found	Anthropogenic cover	Life stage	Colouration phase	SVL, mm
1	18 May	Degrading, wet lumber	Adult	Lead-backed	N/A
2	18 May	Degrading, wet lumber	Adult	Lead-backed	48
3	18 May	Degrading, wet lumber	Adult	Red-backed	34
4	18 May	Degrading, wet lumber	Adult	Lead-backed	N/A
5	18 May	Degrading, wet lumber	Adult	Red-backed	N/A
6	23 May	Degrading, wet lumber	Juvenile	Red-backed	21
7	23 May	Degrading, wet particle board	Adult	Red-backed	41

Note: SVL = snout to vent length, measured on photographs.

landscape and is unaware of any local knowledge of previous observations of these animals or how they were introduced.

The ability to survive and reproduce in a novel landscape is critical if non-native introduced populations are to successfully establish, spread, and become invasive (Williamson 1996). Invasive species are those that can overcome the challenges posed by novel ecosystems and sustain multigenerational populations in areas well beyond their initial site of introduction (see Richardson *et al.* 2011). Because the initial introduction site in Newfoundland is unknown, we cannot determine if the species is currently invasive, as defined by Richardson *et al.* (2011). Yet, ecological conditions across the island seem favourable for these salamanders. Moore *et al.* (2018) examined the current climatic niche of Eastern Red-backed Salamander across its native range and modelled how the species' distribution could shift in response to climate change. They noted that although the species was not yet present on Newfoundland, the current available climatic niche was suitable (Moore *et al.* 2018). Furthermore, being a generalist invertebrate predator (Maglia 1996) allows Eastern Red-backed Salamander to consume a wide array of potential prey items. Also, unlike many other species of Canadian salamander, it reproduces terrestrially using direct development, with eggs deposited in moist microenvironments under woody debris or rocks. Thus, this species does not require standing bodies of water to produce young (Montgomery 1901; Wake and Marks 1993). Newfoundland, therefore, represents a landscape that is quite suitable for this species to survive and propagate.

Eastern Red-backed Salamander has a slow dispersal rate (<2 m per year; Ousterhout and Liebgold 2010), only traversing an average of 90 m annually within the home range (Kleeberger and Werner 1982). However, larger, one-off dispersal events have been observed (e.g., 143 m through a forested habitat [Sterrett *et al.* 2015] or 300–500 m through open areas to colonize recently restored habitat [Smith and Smith 2017]). Thus, if this species is able to establish self-sustaining populations, they possess a reasonable capacity to spread elsewhere in the Conception Bay South area and to other localities on Newfoundland.

The discovery of this salamander on Newfoundland raises several questions surrounding (1) its invasion pathway and route (i.e., how they got there and from where), (2) the extent and status of the current Conception Bay South population (i.e., established or ephemeral), (3) whether the species is established elsewhere on Newfoundland, and (4) the impact this non-native species may have on local ecosystems.

Although there are no clear answers to these questions, we can use prior knowledge of this species and previous amphibian introductions to Newfoundland to speculate about likely outcomes. First, the invasion pathway for the Conception Bay South population is unknown. The most likely source is accidental transport, similar to the Green Frog introduction (Maret 1867; Warkentin *et al*. 2003). However, the source may also be related to escaped/released pets or an intentional release, as, globally, these are two of the most common invasive pathways for non-native amphibians (Hulme *et al.* 2008) and would be similar to the American Toad and Wood Frog introductions to Newfoundland (Buckle 1971). Genetic investigations from across the species broad distribution may determine the source population. The cryptic nature may have allowed this salamander to remain undetected for longer than other non-native anuran species that have been introduced to Newfoundland. For example, Mink Frog on Newfoundland was detected by frog-call monitoring (Warkentin *et al*. 2003). As salamanders do not vocalize to the same extent as most frogs and toads, it is possible that Eastern Red-backed Salamander has been present on Newfoundland for some time and may be more widely distributed than our few specimens from a single locality indicate.

Finally, it is important to consider the potential impacts this amphibian may have on Newfoundland ecosystems. Given that it was not recognized as an amphibian species with non-native/invasive populations during global reviews by Kumschick *et al*. (2017) and Measey *et al*. (2016, 2020), our observation may be the first account of this species establishing a population outside its native range and, thus, the impacts of its introduction have not been previously studied. Within its native range, Eastern Red-backed Salamander is considered one of the most abundant vertebrates in deciduous forests, achieving densities up to 2.8 individuals/m^2 (Burton and Likens 1975; Mathis 1991) and the species is a significant predator of forest floor invertebrate decomposers (Walton 2013). Research has demonstrated agonistic intraguild interactions between Eastern Red-backed Salamanders and native spiders, relating to cover objects and competition, that can drive altered spatial distribution of these arthropod predators on the landscape (Hickerson *et al*. 2012, 2017). As such, the presence of this salamander in Newfoundland could result in novel trophic interactions and potential shifts in nutrient cycling and ecosystem energy flow.

In conclusion, we have documented the presence of a likely breeding non-native population of Eastern Red-backed Salamander on Newfoundland. There is ample opportunity for future research to determine how this introduction occurred and how this widespread and common North American salamander behaves and impacts other wildlife when introduced to a novel ecosystem. Studies such as these will be necessary in determining whether eradication of the species from Newfoundland is warranted, necessary, or achievable.

Author Contributions

Writing – Original Draft: J.B.G.; Writing – Review & Editing: J.B.G., L.K., and J.L.R.; Conceptualization: J.B.G., L.K., and J.L.R.; Observation: L.K.

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Note

Key observations of flexed-leg urination in the free-ranging Gray Wolf (*Canis lupus*)

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Abstract
Flexed-leg urination (FLU) in female Gray Wolves (*Canis lupus*) has been little studied in the wild. Captive females in packs do not exhibit FLU unless they are both mature and dominant to an associate female, but these characteristics have not been confirmed in free-ranging wolves. We present observations of wolves in Yellowstone National Park that accord with those of wolves in captivity, extend our knowledge of FLU in Gray Wolf, pose additional questions about it, and suggest new areas of study to better understand it.

Key words: Behaviour; *Canis lupus*; flexed-leg urination; FLU; Gray Wolf; pair bonding; scent-marking; territoriality; Yellowstone

Scent-marking is pervasive in the Canidae (Kleiman 1966) and information about its functions and contexts has been accumulating gradually (Peters and Mech 1975). However, little is known about flexed-leg urination (FLU) in female Gray Wolves (*Canis lupus*) except that dominant, mature females paired with males exhibit it. FLU is similar to raised-leg urination (RLU) in males, but the hind leg is not lifted as high; the female is still in a partial squat with knees bent and the leg that is off the ground is only slightly out to the side or even angled forward. RLU is presumed to be used to aim urine above the ground onto prominent objects, such as stumps, snowbanks, etc., and FLU might also function to aim urine similarly, to whatever extent the female anatomy allows. Such directed urination in both sexes has long been explained as territory marking and pair-bonding behaviour as opposed to male standing urination and female squat urination (SQU), which are thought to be used for elimination (Harrington and Asa 2003). Double-marking, i.e., RLU by a male accompanied by FLU by a female, is thought to indicate a bond between a mated pair (Rothman and Mech 1979).

However, some aspects of FLU do not accord with the view that its only functions are territory marking and pair-bonding: FLU is not practised by immature female wolves nor subordinate, mature female wolves, at least in captivity (Asa *et al*. 1990). Also, even at empty food caches, only mature, dominant females use FLU (Harrington 1981). If marking served only to signal possession of territory or mate, why wouldn't any female use FLU? Even very young pups are highly possessive, cache food (Packard 2003), and defend it (Mech *et al.* 1999). Thus, much more information about wolf FLU is necessary to better understand its etiology and function. Here we describe observations of FLU in a free-ranging wolf pack and extend the findings of Asa *et al*. (1990) that, in captive wolf packs, only females that were both mature and dominant or vying for dominance displayed FLU.

From 16 May 2000 to 29 September 2001, R.M. made these observations of the Druid Peak Pack in Yellowstone National Park. At 27 wolves, this was the largest pack in the park and included four females that bred in 2000 and 21 pups. This pack was unusual, as most wolf packs include a single breeding pair and their offspring of one or two years (Mech and Boitani 2003). Several members of the Druid Peak Pack were radio-collared (Smith *et al.* 2015). They and their packmates were also located and observed from the ground using binoculars and a 60× spotting scope during daylight. Each wolf was individually identifiable by a combination of radio frequency and/or natural body markings. During early 2000, the pack consisted of the dominant pair (male 21 and female 40 [at least 6-years old]), female 42 (40's same-aged sister), 3-year-old females (103, 105, and 106), and a 2-year-old male (163; McIntyre 2020). The Druid Peak Pack was observed during 442 days of the 494-day study; R.M. tape-recorded his descriptions as he made them and transcribed his records into a computer the same day.

Until early May 2000, the only scent-marking R.M. had observed by the members of this pack were RLU by wolf 21 and FLU by wolf 40, although wolves could have marked differently during the night when observations were not made. On 8 May 2000, wolf 40 was killed, apparently by wolf 42 and other pack members (McIntyre 2020). The first time FLU was observed in wolf 42 was on 16 May when she marked a bush, followed by RLU at the same location by wolf 21. Subsequently, wolf 42 was observed using FLU regularly, often followed by wolf 21 using RLU to double mark locations.

None of the other females were observed using FLU until almost a year later, even though wolves 105 and 106 had, along with 40, also denned and produced pups in 2000 (McIntyre 2020). On 9 April 2001, when 4 years old, 106 was first seen using FLU, just before pinning her same-aged sister, wolf 103. Notably, wolf 42 was still the dominant female in the pack at that time, although she was not with 106 when the latter was observed exhibiting FLU.

On 29 September 2001, an outsider male that male 21 allowed to join the pack was travelling together with 4-year-old female 105. When he did RLU, she sniffed the site and did FLU there, which was the first time wolf 105 was observed to use FLU, even though she was dominant to 103. Later, the new male did RLU, and 105 sniffed the site, scratched the ground, and did a momentary SQU that appeared to be scent-marking rather than urination strictly for elimination. The male then did RLU, and 105 did FLU at his site.

The 16 May 2000 observation of FLU by wolf 42 confirms Asa *et al.*'s (1990) finding in captive wolf packs that females do not exhibit FLU unless they are dominant to an associated female. This is significant, as it is the first confirmation that Asa *et al.*'s conclusion applies to free-ranging wolves and was not an artifact of captivity. The 9 April 2001 observation of wolf 106 is similarly supportive, but adds the new element that although 106 was dominant to 103 in that setting, 106 was not the highest-ranking female in the pack.

The observations that 3-year-old subordinate females did not use FLU despite being mature enough to have produced pups in 2000 further support the results of Asa *et al.* (1990). These observations also raise the question of the function of FLU. Apparently, FLU, which is usually one component of double marking by mated pairs, was not necessary to allow those females to pair long enough with males to breed. Alternately, the 3-year-old females that produced offspring might have double-marked when first paired but ceased using a FLU later.

The 29 September 2001 observation of 105 contrasts with those of Asa *et al.* (1990), because 105 was dominant to female 103, yet still did not use FLU until she met a male that used RLU. This observation introduces another element into the question of what factors are necessary and sufficient to elicit FLU. In this case, the trigger seems to have been the RLU of a potential mate. Whatever is common between gaining dominant status and being presented with a potential mate is unclear from a social perspective. Even the physiological link between gaining dominance and using FLU is obscure, given that there appears to be no difference in estradiol secretion between females that exhibit FLU and those that do not, although they do differ in testosterone level (Asa *et al.* 1990).

Although all factors required for FLU in wolves are not necessarily known, our observations combined with those of Asa *et al.* (1990) indicate that at least sexual maturity and either dominance or the presence of a male using RLU are the minimum necessary conditions. This work raises other questions. For example, are there links between genetic relatedness, dominance, and FLU patterns? Are females that display FLU reproductively more successful than those that do not? Is there seasonal variation (breeding versus non-breeding season) or spatial variation (territory edges, trails, carcasses, common-scent posts) in urination patterns? Our observations extend knowledge of FLU in Gray Wolves, pose additional questions about it, and suggest new areas of study to better understand it.

Author Contributions

Writing – Original Draft: L.D.M. and R.M.; Writing – Review & Editing: L.D.M. and R.M.; Conceptualization: L.D.M.; Investigation: R.M.; Methodology: R.M.; Formal Analysis: L.D.M. and R.M.

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Note

A male Little Brown Myotis (*Myotis lucifugus*) recaptured after 28 years at the same site in southwest Saskatchewan, Canada

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Abstract
Little Brown Myotis (*Myotis lucifugus*) is one of the most common and widely distributed mammals in Canada and has been recorded to live over 30 years in the wild. As part of a long-term bat research project in Cypress Hills Interprovincial Park, Saskatchewan, we recaptured a male Little Brown Bat in a mist net over Battle Creek on 12 June 2021. The bat was recaptured within 100 m of where it was first captured and banded as an adult in 1993, indicating that this bat was at least 29 years old and exhibited repeated use of the same summer flying, foraging, and drinking site. The bat was not caught in the intervening years; therefore, its frequency of use of this site is unknown. In eastern North America, this species has declined because of high mortality rates associated with White-nose Syndrome (WNS). WNS has been moving westward and has now been detected in eastern and western Saskatchewan. Understanding aspects of the natural history of Little Brown Bat, including longevity, is important before WNS is detected in a region and leads us to advocate continued marking of individuals (e.g., banding, PIT tagging) to continue learning about bat longevity and survival before and after WNS infection.

Key words: Chiroptera; Cypress Hills; Little Brown Myotis; longevity; site fidelity; *Myotis lucifugus;* southwest Saskatchewan

Longevity among the nearly 6500 recognized mammalian species (Burgin *et al.* 2018) is highly variable, but on average, larger species have greater longevity (Austad and Fischer 1991; de Magalhães *et al.* 2007). For example, 1000 kg Bowhead Whale (*Balaena mysticetus*) regularly live over 100 years and can surpass 200 years (Rosa *et al.* 2013), while 4–6 g Least Shrew (*Cryptotis parva*) rarely exceed two years (Mock 1982; Hutchinson *et al.* 2015). After accounting for body size, bats (order Chiroptera) are the longest-lived mammals, with maximum longevity three times that of size-equivalent, non-flying mammals (Austad and Fischer 1991; Brunet-Rossinni and Austad 2004; de Magalhães *et al.* 2007). Longevity of wild bats is likely underestimated because bats are relatively difficult to capture (nocturnal and flying) and recaptures are rare.

The oldest recaptured Little Brown Myotis (*Myotis lucifugus*) was 34 years old (New York, USA; Davis and Hitchcock 1995), and the oldest resighted one was a 38-year-old male (Cadomin Cave, Alberta, Canada; Lausen *et al.* 2022). In the United States, male *M. lucifugus* aged 18, 24, 25, and 32 years were recaptured in two hibernacula near Warrentown, Wisconsin (White *et al.* 2019). In Canada, one female, aged 16 years, and two males, aged 29 and 30 years, were recaptured in an abandoned mine tunnel near Craigmont, Ontario (Keen and Hitchcock 1980). Most recaptures of long-lived *M. lucifugus* tend to be males. This difference is postulated to be the case because males hibernate longer compared with females and/or males do not incur the additional energetic demands females endure during pregnancy and lactation (Podlutsky *et al.* 2005).

R.M.B. and coworkers have studied bats in Cypress Hills Interprovincial Park, Saskatchewan (49°34′N, 109°53′W), since 1991. Methods for capturing and marking bats have not changed substantially over this time. We deploy mist nets across familiar locations along a prominent stream, Battle Creek, and capture bats while they are flying, foraging, and/or drinking. Our work follows accepted ethical methods for the study of bats in the field with appropriate permissions (Sikes 2016). In 2015, a female *M. lucifugus* was recaptured in Cypress Hills 23 years after it was originally captured in 1993 (Florko *et al.* 2017). On 12 June 2021, we captured a male *M. lucifugus* that had been banded as an adult on 18 June 1993 (Figure 1). This bat was, therefore, at least 29 years of age, representing the oldest *M. lucifugus* recorded for Saskatchewan. The individual had first been captured in a mist net across Battle Creek and had been banded with the prospect of future recaptures contributing to demographic information. After 28 years, the bat appeared to be in excellent condition and had glossy fur and sharp teeth (Figure 2).

The bat was recaptured less than 100 m from its original capture site along the same section of Battle Creek near Fort Walsh National Historic Site. Site fidelity has been noted in *M. lucifugus* but most of what we know comes from records of bats in hibernacula that are visited over multiple years or adult female bats recaptured or resighted at maternity colonies (as reviewed in Lewis 1995). Return observations at a hibernaculum reveal that, across four consecutive years, an individual *M. lucifugus* was found within 4 m of its original recovery location (White *et al.* 2019), and maternity roost fidelity in *M. lucifugus* is known to be as long as 18 years from Yukon, Canada (Slough and Jung 2020).

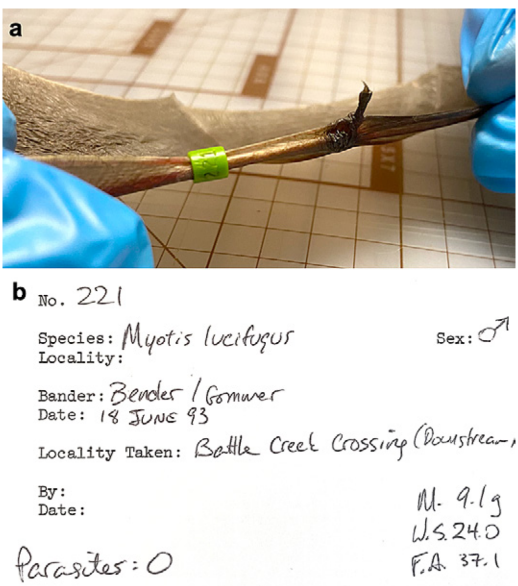

FIGURE 1. a. Green plastic split-ring numeric band on the right forearm of a 29-year-old recaptured Little Brown Myotis (*Myotis lucifugus*). b. Original capture data card from 18 June 1993. Photos: J. Christiansen.

For forest dwelling bats, records of site fidelity at locations other than roost sites or hibernacula are rare (as summarized in Perry 2011), especially for males that are not constrained to forage near a maternity colony. Recapturing females over foraging, flying, and drinking sites near maternity colonies may be expected, even over many years, because of philopatry (Burland *et al*. 2001; Flanders *et al*. 2016). The previous report from the Cypress Hills of a 23-year-old adult female *M. lucifugus* (Florko *et al*. 2017) is notable, but perhaps not unprecedented given that the bat was initially captured at a nearby maternity colony. However, recapturing the male *M. lucifugus* less than 100 m from its original capture site after 28 years is noteworthy and indicates some level of site fidelity. This bat was not recaptured between 1993 and 2021 despite similar netting effort in most years. Although the frequency that this bat returned to the same area is not known, the recapture is especially noteworthy, and to our knowledge represents a record for a male bat returning to a foraging, flying, and drinking site. We are aware of a previous estimate that 6–8% of female *M. lucifugus* have fidelity to foraging sites for at least 10 years in Yukon, Canada (Slough and Jung 2020). However, our observation from the Cypress Hills is important, not only because it demonstrates longevity, but it also suggests limited male dispersal in the summering grounds of a *M. lucifugus*.

Although *M. lucifugus* was until recently one of the most common and widely distributed bat species in North America, eastern North American populations have drastically declined since the emergence of the fungal disease White-nose Syndrome (WNS) in New York in 2006 (Frick *et al.* 2010, 2015). WNS was first detected in western North America near Seattle, Washington, in 2016 (Lorch *et al.* 2016) and has been recorded in two states (North Dakota 2018–2020; Montana 2019–2021) and one province (Manitoba 2017–2021) adjacent to Saskatchewan (White-nose Syndrome Response Team 2021). WNS is the primary reason (COSEWIC 2013) *M. lucifugus* is now listed as Endangered in Canada (SARA Registry 2021). Because WNS has now been detected in eastern and western Saskatchewan (White-nose Syndrome Response Team 2021), preinfection data on the natural history of *M. lucifugus* may be increasingly valuable and difficult to obtain, leading us to advocate

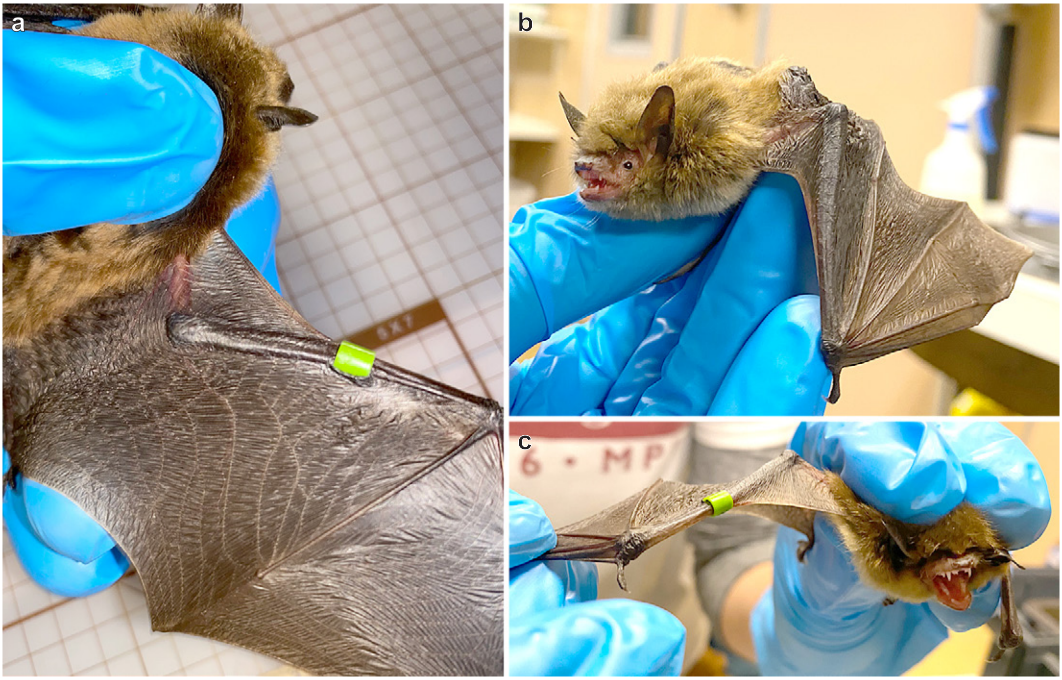

FIGURE 2. Banded male Little Brown Myotis (*Myotis lucifugus*) at least 29 years of age, recaptured in Cypress Hills Interprovincial Park, Saskatchewan on 12 June 2021. Photos: J. Christiansen.

continued marking of individuals (e.g., banding, PIT tagging). Even single observations of longevity and movement or return of an individual, such as that presented here for *M. lucifugus*, may have implications for understanding summer behaviour and ecology, as well as disease dynamics and conservation of *M. lucifugus*.

Author Contributions

Writing – Original Draft Preparation: J.J.A.C.; Writing – Review & Editing: D.M.G., D.J.B., D.L.G., M.C.K.-R., and R.M.B.; Investigation: J.J.A.C., D.M.G., D.J.B., D.L.G., and M.C.K.-R.; Supervision: M.C.K.-R. and R.M.B.; Funding Acquisition: R.M.B.

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Note

Raven (*Corvus corax*) as a novel food item for lynx (*Lynx canadensis*)

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Abstract

Canada Lynx (*Lynx canadensis*) is a specialist predator of Snowshoe Hare (*Lepus americanus*), which dominates its diet. However, hare populations cycle over 9–11 years, and many lynx disperse or starve during cyclic lows of their prey. Here, I report observations of Canada Lynx scavenging and attempting to prey on Common Raven (*Corvus corax*). In addition, I provide a brief review of birds as a food item of lynx. These are the first observations of ravens as a food source for lynx and may be a response to lynx being malnourished. The value of these observations is that they highlight the adaptability of some lynx to opportunistically use novel prey species during the decline phase of cyclic Snowshoe Hare.

Key words: *Corvus corax*; diet; *Lynx canadensis*; predation; scavenging

Canada Lynx (*Lynx canadensis*) is a specialist predator of Snowshoe Hare (*Lepus americanus*), which dominates its diet, particularly in high-latitude boreal forests (O'Donoghue *et al*. 1997, 1998a,b; Mowat and Slough 1998, 2003; Roth *et al*. 2007; Ivan and Shenk 2016). However, hare populations cycle from periods of high to low density with a periodicity of 9–11 years (Elton and Nicholson 1942; Krebs *et al*. 2018; Oli *et al*. 2020), leaving few hare available as prey in years of low abundance. For lynx that are unable to secure enough hare to meet their energetic demands, it becomes critical that they find alternative food sources. Red Squirrel (*Tamiasciurus hudsonicus*) is their main alternate prey (Brand *et al*. 1976; O'Donoghue *et al*. 1997, 1998a,b). Other species appear to be rarely eaten by lynx, but occasional prey include ungulates, small rodents, grouse, and other birds (Saunders 1963; van Zyll de Jong 1966; Parker *et al*. 1983; Staples 1995; Squires and Ruggerio 2007; Hanson and Moen 2008; Ivan and Shenk 2016). Lynx may also switch to scavenging during periods of low hare abundance (Brand *et al*. 1976). Here, I report observations of Canada Lynx scavenging or attempting to prey on Common Raven (*Corvus corax*) during cyclic lows in hare abundance (Boonstra *et al*. 2018).

On 2 March 2010, wildlife officials were alerted to two Canada Lynx in a small patch of trees behind a restaurant in the middle of the village of Haines Junction, Yukon, Canada (60.753°N, 137.513°W). The lynx were observed actively eating a raven and sitting by its carcass (Figure 1) for more than two days. The raven was believed to have been electrocuted on the powerline above where the carcass was found. Local wildlife officials noted that the lynx appeared malnourished and desperate, not wanting to leave the raven remains (L. Larocque and R. Oborne pers. comm. 3 March 2010), or their persistence may have been related to other potential attractants (e.g., food waste). Officials were able to capture the lynx with a snare pole and the lynx were subsequently translocated out of town to a shrubby meadow where hare tracks were relatively abundant.

In an earlier instance, on 25 September 2000, I observed a Canada Lynx cross the Alaska Highway about 2 km east of the Haines Junction. It was moving toward a public landfill, so I followed it. Once at the landfill, I used 8 × 30 binoculars to observe the individual crouching and watching a group of about 25 ravens feeding on refuse. It began stalking the nearest raven, which was about 30 m away. The lynx pounced at the raven when it was within 3–5 m, but missed, and the raven flew away. The lynx immediately ran toward another nearby raven that was still on the ground. When the lynx was about 10 m away,

FIGURE 1. Canada Lynx (*Lynx canadensis*) scavenging a Common Raven (*Corvus corax*) carcass in Haines Junction, Yukon, Canada. Photo: Lorne Larocque.

the raven flew up and the lynx jumped about 1.5 m into the air after it, swiping at the raven with its outstretched paw. Again, the lynx missed, and the raven flew away. The lynx then sat down and watched the remaining ravens that were foraging about 25 m away. After ~3 min, the lynx left the landfill and was not seen again.

Birds are not a major component of lynx diets. Although uncommon, grouse are the most frequently observed birds in lynx stomachs or scat, or found killed during snow-tracking (e.g., Staples 1995; O'Donoghue *et al.* 1998a; Squires and Ruggiero 2007). In total, 14 bird species have been recorded at least once in the diet of Canada Lynx (Table 1). No other bird species have been reported as a food item for Canada Lynx. However, several studies have indicated unidentified bird remains in lynx diets, and they may include other species, most notably passerines (e.g., Saunders 1963; Staples 1995). Many of the observations of birds in lynx diets are from the southern portion of their range (e.g., Newfoundland, Colorado, Minnesota; Table 1), where their dietary niche appears broader than in high-latitude boreal forests (O'Donoghue *et al*. 1998a,b; Roth *et al.* 2007; Squires and Ruggerio 2007; Ivan and Shenk 2016).

This is the first record of lynx foraging on ravens, one of the most common resident birds in the northern boreal forest. These observations are of value because they add to our knowledge of the foraging behaviour and diet of Canada Lynx, especially when hares occur at low densities. Observations of lynx focussing on raven as a food item occurred when hare were at (or near) cyclic lows, with densities in southwestern Yukon of <0.2 hare/ha (peak density was 1–2 hares/ha; Boonstra *et al*. 2018; Oli *et al*. 2020). Lynx are not known to focus on ravens as prey; however, when hare densities are low and lynx likely malnourished, locally abundant species such as ravens may become attractive as prey to lynx. Moreover, with a mass of 1–2 kg, Common Ravens are heavier than other birds, making them a potentially substantial food item when hare are scarce.

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TABLE 1. Species of birds observed as food items used by Canada Lynx (*Lynx canadensis*).

Species	Location	Source*
Ruffed Grouse (*Bonasa umbellus*)	Alberta, Minnesota, Nova Scotia, Yukon	2–4, 6, 8
Spruce Grouse (*Falcipennis canadensis*)	Alaska, Minnesota, Montana, Newfoundland, Yukon	1, 5–8
Dusky Grouse (*Dendragapus obscurus*)	Colorado, Montana	7, 9
Willow Ptarmigan (*Lagopus lagopus*)	Newfoundland, Yukon	1, 6
White-tailed Ptarmigan (*Lagopus leucura*)	Colorado	9
Green-winged Teal (*Anas crecca*)	Newfoundland	1
Black Duck (*Anas rubripes*)	Newfoundland	1
Mallard (*Anas platyrhynchos*)	Alaska, Alberta	2, 5
Northern Flicker (*Colaptes auratus*)	Newfoundland	1
Three-toed Woodpecker (*Picoides dorsalis*)	Colorado, Alaska	5, 9
Fox Sparrow (*Passerella iliaca*)	Newfoundland	1
Canada Jay (*Perisoreus canadensis*)	Colorado, Nova Scotia	4, 9
Blue Jay (*Cyanocitta cristata*)	Minnesota	8
Common Raven (*Corvus corax*)	Yukon	This study

*Sources: 1 = Saunders 1963; 2 = van Zyll de Jong 1966; 3 = Brand *et al*. 1976; 4 = Parker *et al*. 1983; 5 = Staples 1995; 6 = O'Donoghue *et al*. 1998a,b; 7 = Squires and Ruggerio 2007; 8 = Hanson and Moen 2008; 9 = Ivan and Shenk 2016. Bird names follow the American Ornithological Society as the taxonomic authority (Chesser *et al.* 2021).

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Serum biochemistry suggests a physiological response to environmental stress in a native urban Eastern Gray Squirrel (*Sciurus carolinensis*) population

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Abstract
Urban wildlife populations experience human-driven environmental changes that can be both beneficial and detrimental to individual health. We measured body condition and serum chemistry (electrolyte levels, markers of kidney and liver function, protein, glucose, and cholesterol) in a native urban and rural population of Eastern Gray Squirrel (*Sciurus carolinensis*) to assess whether we could detect physiological responses to environmental stressors or dietary differences. We found no differences in body condition between habitats and no evidence of malnutrition at either site. However, urban squirrels had higher blood glucose, lower potassium, phosphorus, chloride, and albumin:globulin ratios. These results align with previous findings of increased dietary sugar in cities and suggest that urban populations of gray squirrels are under greater environmental stress than rural populations, providing future directions for studying physiological responses to urbanization.

Key words: Eastern Gray Squirrel; metabolic disorder; nutrition; serum chemistry; urbanization

Introduction
Successful urban colonizing wildlife tends to be generalist, opportunistic omnivores that can thrive in a variety of habitats by quickly taking advantage of new resources (McKinney 2002). However, cities also pose new demands on urban animals. Relative to natural areas cities are generally hotter, noisier, more polluted, harbour denser populations of urban species, and have excesses of low-quality food in the form of human supplemental feeding and food waste (Alberti *et al.* 2016; Birnie-Gauvin *et al.* 2016). Such environmental stressors can have physiological repercussions for wildlife, including changes in immune function, oxidative stress levels, nutritional state, and metabolism (Bradley and Altizer 2007; Isaksson 2015; Birnie-Gauvin *et al.* 2016; Murray *et al.* 2019). However, the benefits of greater access to high-calorie human-derived foods year-round may outweigh the costs to individual health related to environmental stressors.

There is mounting evidence—largely among mammalian omnivores—of physiological responses to urban diets that mirror symptoms associated with diets high in carbohydrates and saturated fats in humans, such as increasing trends in obesity (Mendoza *et al.* 2007), elevated risk of cardiovascular disease, Type 2 diabetes, and other metabolic disorders (Heidemann *et al.* 2008; Eckel *et al.* 2010). For instance, greater body mass in urban-dwelling individuals has been reported in laboratory and feral rats (Klimentidis *et al.* 2011), foxes (Harrison 1997; Cypher and Frost 1999), Baboon (*Papio cynocephalus*; Bank *et al*. 2003), Florida Key Deer (*Odocoileus virginianus clavium*; Harveson *et al.* 2007), and Raccoon (*Procyon lotor*; Schulte-Hostedde *et al.* 2018). Urban American Crows (*Corvus brachyrhynchos*) have been shown to have elevated plasma cholesterol (Townsend *et al.* 2019), and Grizzly Bears (*Ursus arctos*) with access to human food subsidies have higher carbohydrate and lower protein levels than those in more natural habitats (Coogan *et al.* 2018). Whether these symptoms indicate poor health is uncertain. Thus, human food subsidies appear to represent a double-edged sword: increased calorie intake may positively influence body condition, survival, and reproductive success, but at the same time its limited nutrient quality may make it detrimental to animals' general health (Weaver *et al.* 2014).

Food subsidies are partly responsible for increased abundances and high population densities in successful urban species like rats, White-tailed Deer (*Odocoileus virginianus*), Raccoons, and Eastern Gray Squirrel (*Sciurus carolinensis*; Adams 1994; Parker and Nilon 2008). Higher than natural population densities of urban species in cities can increase the risk of disease and parasite transmission (Bradley and Alizer 2007). In addition, predator–prey dynamics are altered in cities due to both changes in community composition and because predators can subsidize their diet with human-derived food sources (Rodewald *et al.* 2011; Oro *et al.* 2013), allowing prey species to proliferate. The combination of heightened disease risk, increased stress, and exposure to pollutants has made urban wildlife generally less healthy than their rural counterparts (Murray *et al.* 2019).

We conducted a pilot observational study of serum biochemistry in Eastern Gray Squirrel aimed at detecting and identifying signs of physiological stress associated with reduced habitat quality or dietary differences in an urban environment. Serum biochemistry analysis is an effective way to measure population-level health, as it is a good indicator of disease state, nutritional status, and habitat quality (Hanks 1981). If we assume that rural individuals living in more natural environments generally have blood biochemistry parameters within normal ranges, then we can treat those results as a baseline from which deviations in urban individuals could point to health issues related to environmental stress. Eastern Gray Squirrels are opportunistic omnivores with a wide dietary breadth, typically consisting of the nuts, flowers, and buds of a variety of hardwood trees (such as oak, hickory, and beech), fungi, insects, cultivated crops, and, from time to time, small animals and bones (Koprowski 1994; McAllister *et al.* 2016). Eastern Gray Squirrels are a seasonal fat-accumulating, non-hibernating species that rely on lipid reserves and food caches while overwintering (Koprowski 1994). Their abundance is positively associated with human food provisioning (Parker and Nilon 2008; Bonnington *et al.* 2014), and they are frequently observed feeding on high-calorie human food waste (Vinopal 2017; Mahdawi 2018; https://www.reddit.com/r/SquirrelsEatingPizza/), suggesting their success in human-dominated habitats is partly associated with increased resources which allows them to accumulate more fat during autumn and have reliable access to food in winter apart from their cached reserves. We measured body condition and used serum chemistry analyses to assess electrolyte levels, markers of kidney and liver function, protein, glucose, and cholesterol, to get a general picture of population health in urban and rural squirrels. We hypothesized that different habitat qualities in urban and rural environments would produce different serum biochemistry profiles. We predicted profiles for urban Eastern Gray Squirrels would indicate physiological symptoms associated with environmental stress, such as abnormal liver, kidney, or immune functions. Additionally, similar to previous studies of urban mammals, we specifically expected to find higher glucose, cholesterol, and body condition in urban Eastern Gray Squirrels that would suggest increased consumption of anthropogenic food.

Methods

Sampling

Eastern Gray Squirrels were sampled from May to June 2019 at two sites with differing levels of human disturbance, near the northern limit of their native range. Here, squirrels typically breed twice a year (Koprowski *et al.* 2001), with breeding bouts typically beginning in mid-March and mid-July. The urban site was a ~10 ha park located on the University of Manitoba campus, Winnipeg, Manitoba (49.81°N, 97.14°W). Relative to natural forests it is sparsely treed and is adjacent to a river, a suburb, and bordered by major roads on two sides. This park experiences high human foot traffic. Squirrels at this site have easy access to birdfeeders and human food waste in trash cans and litter. Our second site was a rural hardwood forest patch of ~34 ha located in southern Manitoba (49.24°N, 98.01°W). The forest is bordered by agricultural land and a road (at a distance of 47 m), and has minimal human food waste. Crops surrounding this forest patch are corn, dry beans, soybeans, canola, and grains. These food items are not outside the Eastern Gray Squirrel's normal dietary range; however, gray squirrels typically preferably consume hardwood seeds when they are available, as they are in this forest stand (Korschgen 1981; Koprowski 1994).

Squirrels were trapped using Tomahawk live traps (Tomahawk Live Trap Co., Tomahawk, Wisconsin, USA) baited with peanut butter, then restrained in a capture bag (Koprowski 2002) without anesthetic. Sex, approximate age (adult or juvenile), weight (g), reproductive status (scrotal or non-scrotal for males; pregnant, lactating, or non-lactating for females), and body length (cm) from the base of the skull to the base of the tail was recorded for each individual. We implanted passive integrated transponder (PIT) tags for later identification. All animals were handled in a consistent order to minimize variation in serum analytes across individuals, recording routine measurements before taking blood samples. We measured body condition by taking the residuals from a linear regression of mass on body size (here, spine length). This method corrects for the effects of an individual's structural size on its mass (Schulte-Hostedde *et* *al.* 2001, 2005). We estimated body condition independently for the sexes within each location. Juveniles were excluded from body condition calculations (Table 1). Squirrels were released after capture.

Serum samples and tests

Blood samples were collected from six urban and nine rural individuals (Table 1). Samples were taken at the urban site between 13 and 15 May 2019 and the rural site between 7 and 14 June 2019. Blood (≤1 mL) was drawn on-site from the femoral vein using a syringe without anticoagulant and stored on ice until delivery to the Manitoba Veterinary Diagnostics Services lab (Department of Manitoba Agriculture Food and Rural Development, Winnipeg, Manitoba). Samples were processed within 12 h of capture. Serum biochemistry profiles were run for each sample, consisting of the following tests: sodium, potassium, chloride, urea, creatinine, calcium, phosphorus, magnesium, amylase, lipase, alkaline phosphatase (ALKP), gamma-glutamyl transferase (GGT), bilirubin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatine kinase, glucose, cholesterol, total protein, albumin, and globulin. Some tests were omitted when sample volume was lacking; thus, we do not report results for amylase, lipase, or creatine kinase. Sample sizes for each comparison are given in Table 1. Because this is the first serum biochemical comparison between urban and rural gray squirrel populations and such comparisons in wildlife, in general, are still rare, our strategy was to quantify as broad a range of blood markers as possible, including those that required rapid testing, within the tight early summer non-reproductive period to provide a baseline status upon which we could build future work.

Statistical analysis

All analyses were done in R version 3.6.1 (R Core Team 2013). We first plotted and visually inspected the data using boxplots, then tested differences in serum variables between sites using non-parametric Kruskal-Wallis tests due to small sample size and unbalanced groups. We found no sex differences for serum measurements (Figures 1–3), thus did not include sex as a factor in our analyses.

Results

Body mass for adults were similar between urban and rural study sites (Table 1). There were no detectable differences in body condition between sexes.

TABLE 1. Body condition and serum parameters in urban and rural Eastern Gray Squirrel (*Sciurus carolinensis*), Manitoba, Canada. Sample sizes differ when individuals were excluded due to age (mass and body condition) or low serum sample volume. Significant differences were found in serum parameters of urban and rural squirrels shown in bold.

	Urban		Rural		χ^2	*P*
	n	Median (range)	*n*	Median (range)		
Mass (g)	6	709.75 (577.00–737.50)	7	611.00 (570.00–785.00)	—	—
Body condition	6	36.73 (−85.35–54.84)	7	−21.84 (−65.79–95.91)	0.02	0.89
Sodium (mmol/L)	6	144.50 (142.00–149.00)	9	146.00 (141.00–150.00)	0.80	0.37
Potassium (mmol/L)	**6**	**5.15 (4.30–10.30)**	**9**	**8.70 (5.80–14.40)**	**5.57**	**0.02**
Chloride (mmol/L)	**6**	**113.00 (112.00–116.00)**	**9**	**117.00 (113.00–120.00)**	**5.95**	**0.01**
Calcium (mmol/L)	6	2.34 (2.12–2.41)	8	2.23 (2.04–2.31)	2.40	0.12
Phosphorus (mmol/L)	**6**	**1.79 (1.34–2.43)**	**8**	**3.20 (2.62–4.12)**	**9.60**	**<0.01**
Magnesium (mmol/L)	6	1.23 (1.03–1.32)	8	1.25 (1.00–1.60)	0.10	0.75
Urea (mmol/L)	6	7.65 (5.00–13.30)	9	8.70 (7.60–13.40)	3.37	0.07
Creatinine (mmol/L)	6	46.50 (40.00–50.00)	9	50.00 (41.00–91.00)	1.01	0.31
Total bilirubin (μmol/L)	6	0.00 (0.00–0.00)	8	0.00 (0.00–2.00)	1.62	0.20
ALKP (U/L)	6	622.00 (271.00–1010.00)	8	924.00 (180.00–1385.00)	2.02	0.16
GGT (U/L)	6	10.00 (5.00–15.00)	8	10.50 (7.00–46.00)	0.71	0.40
ALT (U/L)	**6**	**3.00 (3.00–14.00)**	**8**	**10.00 (3.00–51.00)**	**3.73**	**0.05**
AST (U/L)	6	128.00 (69.00–246.00)	8	175.50 (92.00–394.00)	1.67	0.20
Glucose (mmol/L)	**6**	**7.45 (6.10–10.90)**	**9**	**5.00 (2.50–6.70)**	**8.70**	**<0.01**
Cholesterol (mmol/L)	6	5.35 (4.45–6.78)	8	4.84 (3.19–5.76)	1.07	0.30
Total protein (g/L)	6	68.50 (61.00–85.00)	9	66.00 (59.00–85.00)	0.28	0.59
Albumin (g/L)	6	38.00 (31.00–44.00)	8	36.50 (32.00–53.00)	0.07	0.80
Globulin (g/L)	6	31.50 (29.00–41.00)	8	29.50 (24.00–32.00)	3.10	0.08
Albumin:Globulin	**6**	**1.15 (1.00–1.30)**	**8**	**1.30 (1.10–1.70)**	**3.91**	**0.05**

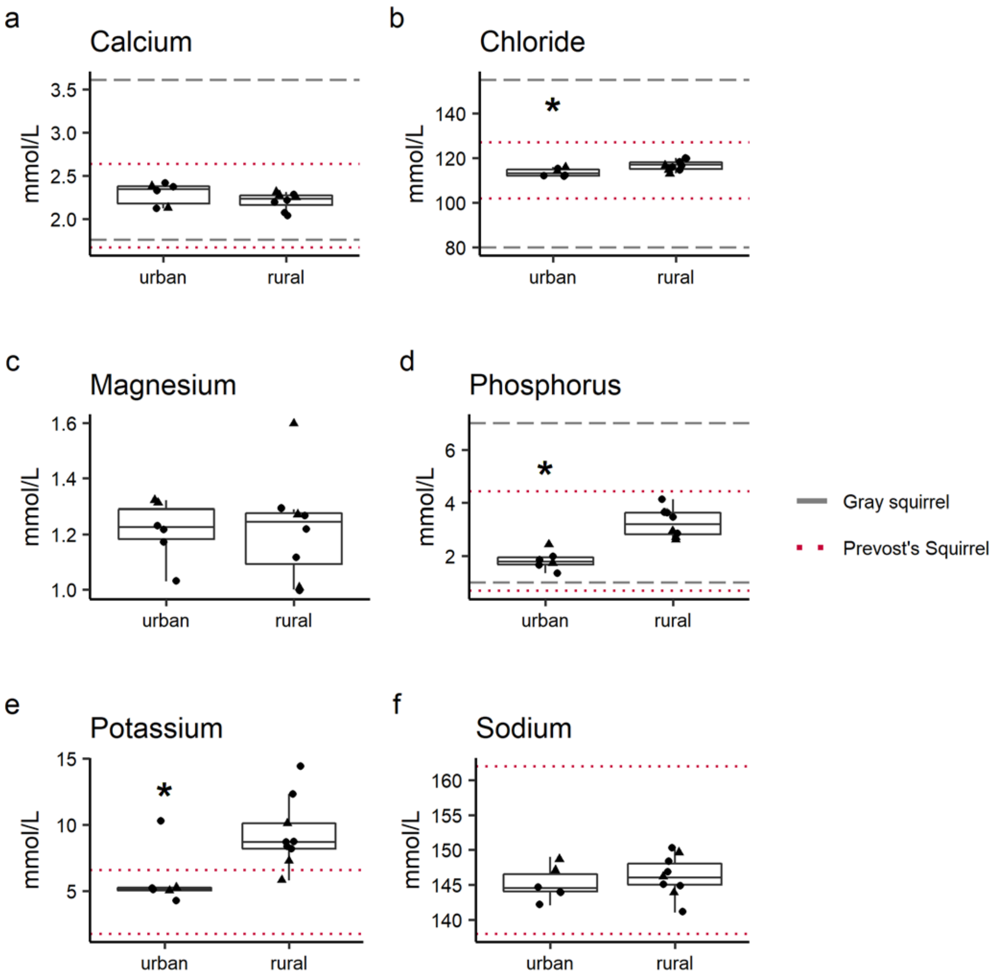

FIGURE 1. Boxplots for serum electrolytes in urban and rural Eastern Gray Squirrel (*Sciurus carolinensis*), Manitoba, Canada. Circles are females, triangles are males. Available reference ranges for gray squirrel (Hoff *et al.* 1976; Koprowski 1994) and for Prevost's Squirrel (*Callosciurus prevostii*; Teare 2013) are shown. Asteriks (*) indicate significant differences between urban and rural populations ($P < 0.05$).

Two females at each site were lactating, however, no squirrels were detectably pregnant. Serum profiles for lactating females were not outliers, therefore they were retained for further analysis.

Urban squirrels had significantly higher glucose levels than those from the rural site ($P < 0.01$, $\chi^2_1 = 8.70$; Table 1; Figure 1), as we expected. Cholesterol levels did not detectably differ (Table 1; Figure 1). Among serum ions, potassium ($P = 0.02$, $\chi^2_1 = 5.57$), phosphorus ($P < 0.01$, $\chi^2_1 = 9.6$), and chloride ($P = 0.01$, $\chi^2_1 = 5.95$) were significantly lower in urban squirrels (Table 1; Figure 1). Sodium, calcium, and magnesium levels were comparable at both sites (Table 1; Figure 1).

ALT was significantly lower at the urban site ($P = 0.05$, $\chi^2_1 = 3.73$; Table 1; Figure 2). A majority (5/6) of urban squirrels had concentrations below the detection limit of 3 U/L (Figure 2). We did not detect any differences in other serum enzymes (ALKP, GGT, AST; Figure 2). Total bilirubin, creatinine, urea, total protein levels, as well as albumin and globulin were similar at both sites (Table 1; Figures 2 and 3). The ratio of albumin to globulin (A:G ratio) was significantly higher in rural squirrels ($P = 0.05$, $\chi^2_1 = 3.91$; Table 1; Figure 3).

Discussion

In general, serum parameters at both sites were within published ranges for Eastern Gray Squirrels (Hoff *et al.* 1976; Koprowski 1994) and reference

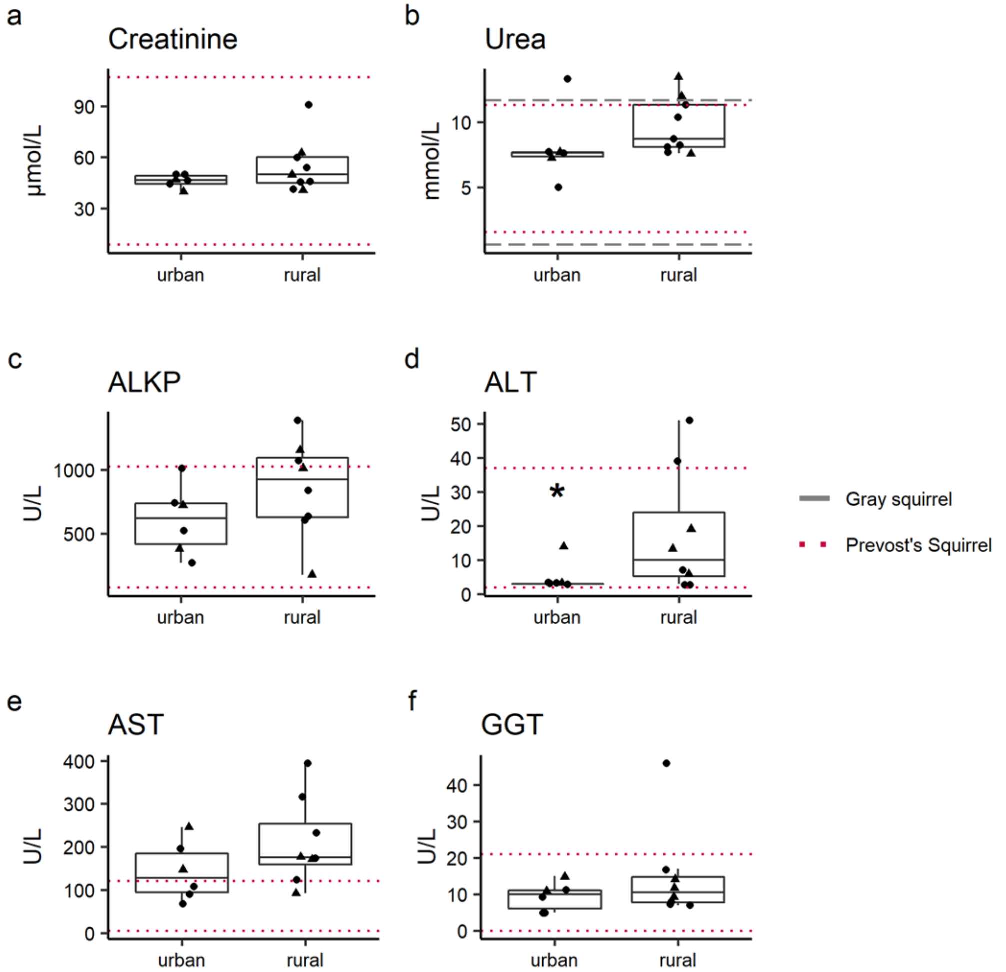

FIGURE 2. Boxplots for creatinine, urea, and enzymatic markers for liver and kidney function in urban and rural Eastern Gray Squirrel (*Sciurus carolinensis*). Circles are females, triangles are males. Available reference ranges for gray squirrel (Hoff *et al.* 1976; Koprowski 1994) and for Prevost's Squirrel (*Callosciurus prevostii*; Teare 2013) are shown. ALKP = Alkaline phosphatase; ALT = alanine aminotransferase (note: 5/ 6 urban grey squirrels had levels below the detectable limit of 3 U/L); AST = aspartate aminotransferase; GGT = gamma-glutamyl transferase. Asteriks (*) indicate significant differences between urban and rural populations ($P < 0.05$).

ranges for another member of Sciuridae, Prevost's Squirrel (*Callosciurus prevostii*; Teare 2013; Figures 1–3). We found no difference in body condition between sites, therefore the chemistry value differences were not likely to be strongly related to body condition as measured by size-corrected weight. Although serum analytes were not correlated with body condition, they were suggestive of differences in habitat quality and nutritional status between our urban and rural sites.

We found elevated blood glucose in urban squirrels, supporting our expectation that individuals with easy access to human food waste have higher sugar intake. This result was consistent with previous findings in Raccoons and Baboons (Banks *et al.* 2003; Schulte-Hostedde *et al.* 2018), potentially reflecting a more general trend among urban mammalian omnivores. In addition to increased blood sugar, chloride, phosphorus, and potassium concentrations differed across urban and rural populations. Electrolyte abnormalities frequently co-occur with metabolic disorders in humans (Liamis *et al.* 2014), however, these results might reflect differing compositions of anthropogenic versus natural foods rather than physiological responses to a change in diet (Choi *et al.* 2002).

Given similar body conditions between urban and

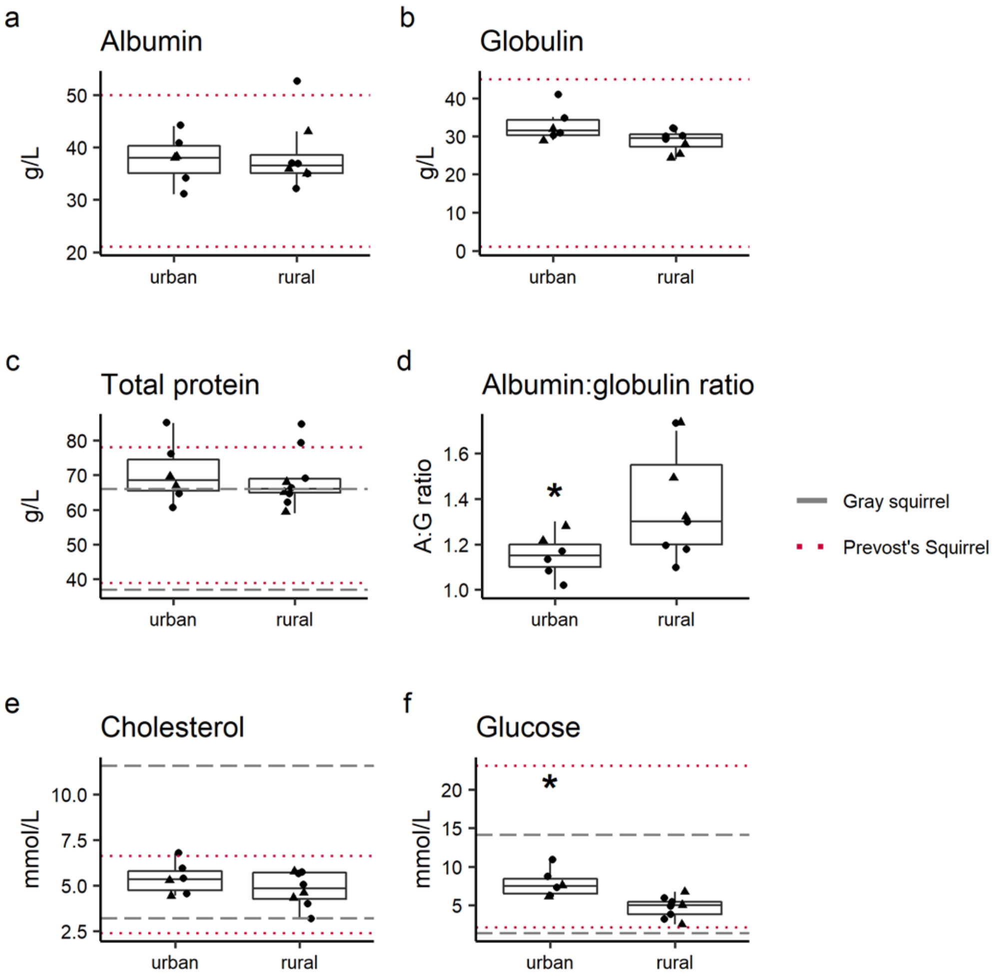

FIGURE 3. Boxplots for serum protein, cholesterol, and glucose in urban and rural Eastern Gray Squirrel (*Sciurus carolinensis*), Manitoba, Canada. Circles are females, triangles are males. Available reference ranges for gray squirrel (Hoff *et al.* 1976; Koprowski 1994) and for Prevost's Squirrel (*Callosciurus prevostii*; Teare 2013) are shown. Asteriks (*) indicate significant differences between urban and rural populations ($P < 0.05$).

rural sites, and that glucose values were within previously published ranges, it is unclear if these squirrels are at risk of developing metabolic disorders. Due to their ecology and physiology, Eastern Gray Squirrels may have mechanisms in place for regulating body mass and fat accumulation that reduces the risk of metabolic disturbance while accumulating lipid reserves. Indeed, increased access to supplemental food may help autumn weight gain in gray squirrels—similar to Grizzly Bears, which are better able to optimize food intake to maximize weight gain before hibernation when they have access to anthropogenic food (Coogan and Raubenheimer 2016; Coogan *et al.* 2018). These characteristics suggest that Eastern Gray Squirrels may be pre-adapted to exploit human food wastes, and are perhaps robust to major health consequences of urban diets.

We also note interesting patterns concerning serum protein markers. Serum albumin reflects long-term protein status, while urea levels shift in response to short-term protein availability (Caldeira *et al.* 2007). Creatinine is reduced when muscle mass decreases due to protein catabolism in the body (Caldeira *et al.* 2007; Robert and Schwanz 2013). Although we did not find statistically detectable differences between populations in creatinine and urea, in both cases they tended to be lower in urban populations. Total protein was not different between sites and was on the high margin compared to previously published ranges (Hoff *et al.* 1976; Koprowski 1994), indicating that neither population was malnourished with respect to protein intake. However, we found significantly lower ratios of albumin to globulin (A:G ratios) in urban squirrels. Globulin is expected to increase after infection and is also positively associated with inflammatory responses and nutritional stress (Kilgas *et al.* 2006). Individuals in better physiological condition have higher A:G ratios. This result is interesting but difficult to interpret at this stage because inflammation is typically an early physiological response to many kinds of stressors. Previous studies using transcriptomic data report candidate genes associated with metabolism and immunity that are under selection in cities, and greater expression of genes involved in the inflammatory response in urban populations (Harris *et al.* 2013; Watson *et al.* 2017). This result aligns with general trends of greater physiological stress associated with environmental stressors in urban populations, but the underlying causes remain to be explored.

There are few published studies of serum biochemistry in gray squirrels, making inferences about individual health difficult. Our values were well within reported ranges in Hoff *et al.* (1976; Figures 1–3). We note, however, that those ranges were obtained from samples taken year-round, and thus might obscure potential seasonal variation in analyte levels. Seasonal variation in diet and food intake in Eastern Gray Squirrels (Koprowski 1994) would also drive seasonal differences in blood chemistry, making the comparison of our values to annual averages in serum parameters not ideal. We also note sampling dates across these urban and rural sites differed by roughly a month, but it seems unlikely that this gap would affect food availability as vegetation phenology appears similar for these sites at this temporal scale. Trees in southern Manitoba begin producing leaves and bloom in early April (e.g., Bur Oak [*Quercus macrocarpa* Michaux], Red Pine [*Pinus resinosa* Aiton], Eastern White Pine [*Pinus strobus* L.], White Spruce [*Picea glauca* (Moench) Voss], and Black Spruce [*Picea mariana* (Miller) Britton, Sterns & Poggenburgh]); Ahlgren 1957; Lechowicz 1984) and both sites are fully leafed by mid-May.

Our main findings—higher glucose, shifts in electrolyte balance, and lower A:G ratio—suggest that this urban squirrel population is consuming anthropogenic food and is exhibiting a physiological stress response to poorer habitat quality compared to the rural site. We note that this was an exploratory comparison of serum biochemistry between urban and rural Eastern Gray Squirrel populations, and results should be interpreted as hypothesis generating. Sample sizes were small in terms of the number of individuals captured and broad in terms of the number of blood markers analyzed. Many of the variables examined here can vary based on several factors such as age, individual health, time since last meal, and stress associated with capture and handling. Here, all squirrels were baited, captured, and handled in the same way, in essence controlling for these effects on serum biochemistry. However, in future the effects of stress and food intake on glucose might be minimized by measuring glycated serum proteins (as in Schulte-Hostedde *et al.* 2018), which is an indicator of circulating blood sugar integrated over a longer period rather than instantaneous measurements of serum glucose concentrations. Future studies examining the risk of metabolic disorders in Eastern Gray Squirrels could additionally measure circulating hormone levels, such as insulin, and urine glucose to encompass the main symptoms used to diagnose metabolic disorders in other species (Heidt *et al.* 1984; Greco 2001; Ciobotaru 2013). Quantifying corticosteroid levels from plasma or fur would provide an indication of physiological stress over short and long periods, respectively. Furthermore, pinpointing causes of inflammation would be informative for identifying specific features of urbanization that have physiological effects on wildlife. Potential sources of inflammation could be untangled using hematological tests to distinguish between infection (parasitic, viral, or bacterial), or other chronic influences (e.g., diet, pollution). We note that we obtained blood smears for urban individuals (n = 6) and a small subset of the rural individuals presented here (n = 2), but due to lack of rural samples were unable to make a formal comparison. However, among those individuals for which we did obtain samples, no blood parasites were detected.

The effects of urban environmental stressors on individual health have important impacts on population and evolutionary dynamics. Although increased resources allow synanthropic species to reach much higher densities in cities, as our results demonstrate, greater abundance does not always correspond to good overall health (Fedriani *et al.* 2001; Murray *et al.* 2015; Schulte-Hostedde *et al*. 2018), meaning large urban populations may suffer higher mortality. Food provisioning can have indirect consequences on survival by promoting the spread of disease and parasites in denser populations (Orams 2002; Oro *et al.* 2013) that are weakened by poor nutrition and stress. In this way, supplemental food may be an important selection pressure in cities shaping evolution in successful urban species within and outside their native range. What this means for population demographics in the long-term is unclear, even for species that do well in cities. The consequences of human food waste reverberate throughout levels of the urban ecosystem, and understanding these complex relationships is important for wildlife health and our ability to control populations of synanthropic species in cities.

Author Contributions

Writing – Original Draft: C.S.; Writing – Review & Editing: C.S., R.P.K., J.R.T., and C.J.G.; Conceptualization: C.S., R.P.K., J.R.T., and C.J.G.; Investigation: C.S. and R.P.K.; Methodology: C.S., J.R.T., and C.J.G.; Formal Analysis: C.S. and C.J.G.; Funding Acquisition: C.S., R.P.K., and C.J.G.

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SUPPLEMENTARY MATERIAL:

Appendix S1. Raw data used in analyses.

Watson, H., E. Videvall, M.N. Andersson, and C. Isaksson. 2017. Transcriptome analysis of a wild bird reveals physiological responses to the urban environment. Scientific Reports 7: 1–10. https://doi.org/10.1038/srep44180

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Foraging patterns vary with the degree of sociality among Common Loon (*Gavia immer*) overwintering on a freshwater lake

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Abstract
Little is known about the behaviour of Common Loon (*Gavia immer*) during the critical overwintering period, let alone the behaviour of the small, but increasing number of loons that overwinter on freshwater lakes in North America. We examined the diurnal time-activity budgets of Common Loon overwintering on a large reservoir in northwest South Carolina between 2018 and 2020. Similar to previous studies of breeding individuals and individuals that overwinter in marine waters, loons (n = 132) overwintering on this reservoir spent most of their time (52%) foraging. However, we found distinct differences in the activity budgets of individuals associated with their degree of sociality. Solitary birds (individuals spending 0–20% of time within 20 m of conspecifics) spent significantly more time foraging than did those that were either loosely-social (>20–<70% of time within 20 m of conspecifics) or strongly-social (70–100% of time). Although solitary loons made as many foraging dives as social birds, their dives were much longer, likely reflecting dives for larger predatory fish. In contrast, social individuals made much shorter, shallower dives, often foraging on shallower baitfish that they appear to pursue to the water surface and consume collectively. Such findings add to our understanding of loon winter behaviour and raise interesting questions regarding social behaviour and the short- and long-term trade-offs associated with social foraging in this species.

Key words: Common Loon; *Gavia immer*; wintering behaviour; sociality

Introduction

Seasonal changes in the behaviour of many birds often correspond to shifting individual needs and environmental conditions during breeding, migrating, and overwintering (Jachowski and Singh 2015; Pasquier 2019). Common Loon (*Gavia immer*) is a long-lived waterbird that defends all-purpose territories on freshwater lakes throughout parts of the northern United States, Canada, and Greenland during the breeding season, but overwinters primarily on coastal and offshore marine waters of North America and Europe (McIntyre 1988; Paruk *et al.* 2021a). As visual underwater pursuit predators, adults spend approximately half of daylight hours during the breeding season foraging for fish and invertebrates to meet the extensive energetic requirements for themselves and their chicks (Evers 1994; Mager 1995; Paruk 1999; Nocera and Taylor 2000; Gingras and Paszkowski 2006). However, relatively little is known about their overwintering behaviour. Behavioural scan samples of small overwintering groups indicate that foraging time varies greatly with location, ranging from 23 to 38% of daily activities off the coast of Rhode Island (Daub 1989; Ford and Gieg 1995) to 55 to 68% off the coast of Virginia (McIntyre 1978) and Florida (Vlietstra 2000). While such dissimilarities may result, in part, from differences in sampling protocols (Nocera and Taylor 2000), they may also reflect variation in foraging strategies associated with individual needs and/or variability of regional environmental conditions. These overwintering strategies are important to understand because of the foraging challenges and other threats posed by marine environments. The threats include increased predation risk (Vlietstra 1998) and exposure to pathogens and parasites (e.g., White *et al.* 1976; Kinsella and Forrester 1999; Sidor *et al.* 2003), biotoxins (McKernan and Scheffer 1942), and environmental contaminants

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such as oil (e.g., Camphuysen *et al.* 2010) and mercury (e.g., Alexander 1991). In addition, possible synergistic effects (e.g., Forrester *et al.* 1997; Augspurger *et al.* 1998) may affect overwintering survival (see review by Spitzer 1995) as well as the ability of individuals to prepare for the ensuing challenges of a protracted spring migration (Kenow *et al.* 2002; Gray *et al.* 2014).

A small, yet increasing number of loons are choosing to overwinter on freshwater lakes and reservoirs in North America rather than in marine waters (Clapp *et al.* 1982; Kenow *et al.* 2002, 2009; Campbell *et al.* 2008; Paruk *et al.* 2014, 2021b; Meehan *et al.* 2018), and these numbers are predicted to increase over the next few decades with a changing climate (e.g., Langham *et al.* 2015a,b). In the advent of these changes, it is important to better understand the activities of loons using freshwater lakes and how these behaviours may affect short- and long-term health of loon populations. Initial observations indicate that, unlike loons that overwinter in marine habitats, loons on freshwater lakes exhibit a high degree of sociality, which may be associated with different environmental conditions such as increased lake clarity and high abundance of forage fish that favour group foraging (Paruk *et al.* 2021b). However, we lack a basic understanding of the diurnal activities of these individuals, whether these behaviours differ substantially from those observed during the breeding season or while overwintering on marine waters, and whether they vary with the degree of sociality.

We studied the diurnal time-activity budgets of loons overwintering on a freshwater reservoir in northwest South Carolina. Our objectives were to: 1) determine the percent time individuals dedicate to various behaviours, 2) quantify the frequency and duration of their individual foraging dives, 3) conduct preliminary examinations of whether loon behaviour varies with time of day and geographic location, and 4) compare/contrast the activities of loons, including dive frequencies, durations, and frequencies of vocalizations they gave when solitary or with conspecifics.

Study Site

The State of South Carolina, in partnership with Duke Energy, created Lake Jocassee (34.9813°N, 82.9233°W; Figure 1). The lake incorporates a watershed area of 383 km^2, has a surface area of ~30 km^2, and a maximum depth at 107 m (mean 48 m) at a surface elevation of 340 m (Rodriguez 2013). Most of Lake Jocassee's roughly 121 km of shoreline is undeveloped, surrounded mostly by natural areas and state parks. Only 37 private residences exist along the lakeshore, concentrated near the southwestern arm of the Whitewater River and south of the dam. Duke Energy has divided Lake Jocassee into four ecological zones (Figure 1) where surface temperature and average water depth, chlorophyll *a* concentration and density of zooplankton (within 10 m of the water surface), and forage fish are measured (Rodriguez 2013).

Lake Jocassee appears to be a highly suitable overwintering loon habitat: it is an extremely oligotrophic (lake wide total phosphorus concentration of <0.0055 mg/L and total nitrogen of <0.1510 mg/L; Rodriguez 2013), monomictic lake stocked annually with predatory Rainbow Trout (*Oncorhynchus mykiss*) and Brown Trout (*Salmo trutta*; Rodriguez 2013). These fishes, as well as Redeye Bass (*Micropterus coosae*) and Largemouth Bass (*Micropterus salmoides*), feed on a planktivorous pelagic forage fish community consisting of ~75% Blueback Herring (*Alosa aestivalis*) and ~25% Threadfin Shad (*Dorosoma petenense*) introduced into Lake Jocassee in the early 1970s (Davis and Foltz 1991; Rodriguez 2013). In contrast to Blueback Herring, Threadfin Shad are sensitive to lower water temperatures in that they can become immobilized at temperatures below 14°C and experience significant die-offs at temperatures below 9–12°C (Griffith 1978 cited in Rodriguez 2013). Consequently, the size of the forage fish community is positively correlated with the minimum winter surface water temperatures that can drop to 9–11°C between January and February (Rodriguez 2013).

Lake Jocassee is an overwintering site for roughly 125–150 Common Loon (from whole-lake surveys, we counted 150 individuals in 2018, 151 individuals in 2019, and 138 in 2020) as well as a staging site for many more individuals during spring and fall migration (as many as 1000 individuals in a single day during spring 'fallouts' due to poor weather; B.W. pers. obs.). Generally, loons begin to arrive on Lake Jocassee in mid-October and many remain throughout the winter when adults complete their prebasic moult with a synchronous remigial moult and later complete their definitive prealternate moult (Woolfenden 1967; Paruk *et al.* 2021a). Loons are seen on the lake until mid-April although non-breeding juveniles and adults are observed occasionally on the lake in late spring and summer. The distribution of loons that overwinter on Lake Jocassee does not appear to be random: greater densities (40.2 ± 2.7 [SE] loons/km^2) are found in zone 4 (Figure 1) than in zone 2 (19.5 ± 1.7) and zone 1 (18.5 ± 4.0, the main basin), which are greater than those in zone 3 (4.5 ± 0.4; Paruk *et al.* 2021b). As has been seen at other wintering areas (Paruk *et al.* 2015), loons exhibit high winter site fidelity on Lake Jocassee. We observed nine of the 10 loons we banded on Lake Jocassee in subsequent years and each was re-observed in the same lake zone.

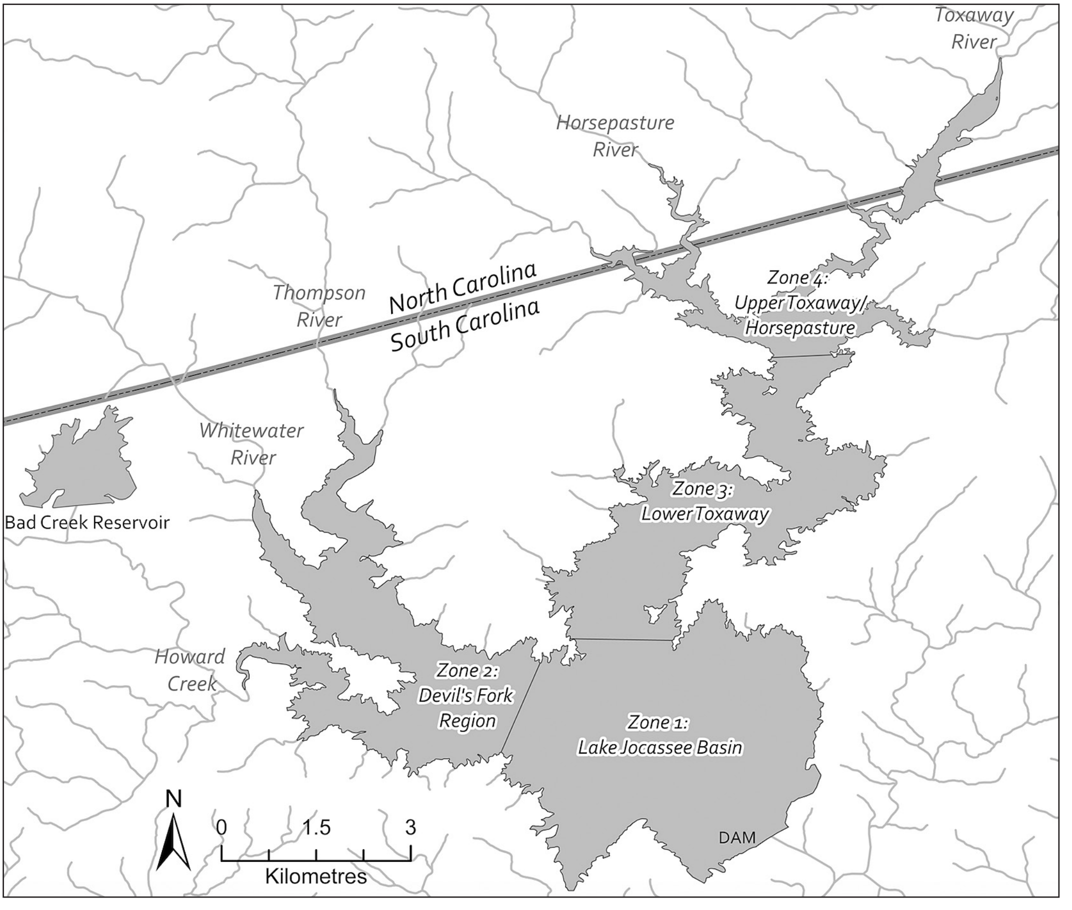

FIGURE 1. Map of Lake Jocassee, South Carolina, indicating the four main geographic zones Duke Energy established (Rodriguez 2013).

Methods

Behavioural sampling

We examined the behaviour of 132 individual loons between January and March for three successive years (2018–2020). Using teams of 3–7 observers, we generated time-activity budgets from 30 2-min instantaneous scan samples on each focal bird over a 1-h observation period between 0700 and 1815 h from either boat or shore throughout all regions of the lake. We only lost sight of individuals during 16 of the 132 observation periods; of these the mean number of scan samples for which we could not locate focal individuals was 2.6 (~5 min). We identified and tracked individuals based on either distinctive plumage patterns (n = 127) or a unique combination of coloured leg bands (n = 5; see Strong *et al.* 1987) from our banding efforts (see Evers 1993 for protocol). To minimize the likelihood of conducting 1-h observations of the same unbanded individual twice, we sampled birds with individually distinct plumages from different zones or regions within each zone each day. Although we conducted repeated observations of banded individuals within each year and over multiple years, we only included the most recent behavioural sample for banded individuals in our analyses to minimize non-independence of individual samples even when the same individual was observed over multiple years. It is still possible that over the three years we observed the same individual twice even though we tried to minimize potential repeated sampling.

At each instantaneous 2-min scan sample, we recorded the individual's behaviour (foraging, locomotion, resting, self-maintenance, agonistic; see Table 1), the distance between the bird and the nearest conspecific (in loon 'body lengths', equivalent to 0.75 m, following del Hoyo *et al.* 1992), and, if the focal individual was within 20 m of other loons, the number of conspecifics in a social group (i.e., within 20 m of a

TABLE 1. Definitions of Common Loon (*Gavia immer*) behaviours.

Behavioural state	Description/definition
Foraging	Periods of sustained diving (<30 s intervals between dives) by individuals.
Locomotion	Surface swimming, involving active paddling of legs that created a noticeable wake in water.
Resting	Drifting on the surface of the water with little paddling of legs. Includes periods of sleeping with head tucked into back of body.
Self-maintenance	Includes periods of activities associated with preening and bathing.
Agonistic	Includes periods of aggression, e.g., vulture posturing, active chasing, and/or lunging toward conspecific or interspecific individuals.

conspecific). During each 1-h observation period, we continuously recorded the occurrence and duration (to the nearest s) of each focal individual's underwater dive and counted the number of audible vocalizations (hoots, mews, wails, tremolos, and yodels; see Paruk *et al.* 2021a) that focal individuals ('individual' vocalizations) or individuals within 20 m of focal individual (i.e., 'group' vocalizations) produced. We recorded the latitude and longitude, surface water and air temperature at the beginning and end of each 1-h observation period, and, weather permitting, the Secchi depth of water clarity at our location.

Analysis

We calculated individual time-activity budgets by determining the proportion of the 2-min instantaneous scan samples within the 1-h observation period individuals spent in each behaviour and calculated the frequency (#/h) and mean duration (to the nearest s) of dives. We examined all behavioural data for normality with the Shapiro-Wilk Goodness-of-fit Test and, when appropriate, normalized time-activity budget proportions by logit-transformation by adding minimum non-zero proportion to both the numerator and denominator functions of the transformation to prevent transformations to undefined values of ∞ and $-\infty$ when proportion values were equal to 0 or 1, respectively (Warton and Hui 2011; Douma and Weedon 2018), although we present proportions as non-transformed values. We used factorial analysis of variance (ANOVA) and corresponding *post hoc* tests to examine differences in loon activities among periods of the day: early morning (0700–0915), late morning (0916–1130), afternoon (1131–1345), late afternoon (1346–1600), and early evening (1601–1815), following Vlietstra (1998). We also used factorial ANOVA to examine differences in the behaviour of individuals in the four zones. We used JMP version 14.3 (2018, SAS Institute, Cary, North Carolina, USA) for all descriptive and analytical procedures and accepted experiment-wide statistical significance at $P < 0.05$. We report values as means ($\bar{x}$) ± SE.

Results

Activity budgets of individual Common Loons overwintering on Lake Jocassee

Individual loons (n = 132) overwintering on Lake Jocassee spent most of their time foraging (52.2 ± 2.4%), followed by locomotion (19.9 ± 1.4%), resting (16.8 ± 1.6%), and self-maintenance (11.2 ± 1.1%). They spent an extremely small amount of time (0.08 ± 0.05%) in agonistic activities and did not display any territorial behaviour. The proportion of time individuals dedicated to these activities did not differ with time of day ($F_{4,127} \leq 1.5$, $P \geq 0.21$ for all comparisons) nor among the four zones in Lake Jocassee ($F_{3,128} \leq 2.0$, $P \geq 0.12$ for all comparisons). On average, individuals dove 23.1 ± 1.3/h (range 0–90) with an average dive duration of 55.8 ± 2.1 s (range 9.2–134.0). Both the frequency ($F_{4,123}$ =1.1, P = 0.36) of diving and the duration of dives ($F_{4,121}$ = 0.62, P = 0.65) did not vary with time of day. Most of the 1.0 ± 1.0 vocalizations/h were hoots (2.9 ± 1.07/h) and mews (0.9 ± 0.8/h), but individuals also produced, albeit infrequently, wails (0.1 ± 0.0/h), tremolos (0.1 ± 0.1/h), and yodels (0.01 ± 0.01/h).

Collectively, loons spent 43.7 ± 3.3% of their time within 20 m of conspecifics. The size of conspecific groups varied between two and 18 individuals (average group size for each focal individual weighted by time spent in each group = 3.55 ± 0.15 individuals; median = 3; Figure 2). The proportion of time an individual spent in groups was not related to the time of day ($F_{4,127}$ = 1.49, P = 0.21) nor with water clarity ($F_{1,55}$ = 0.03, P = 0.86). However, those individuals (n = 89) that spent part of the observation period both alone (>20 m from a conspecific) and with other loons (<20 m) spent significantly more time foraging (P = 0.0002) and made longer dives (P < 0.001) when solitary than when they were part of a group, but did not differ in the rates they gave each type of vocalization (Table 2).

There were distinct differences in the degree of sociality among individuals as shown by the distribution of the proportion of the 1-h observation

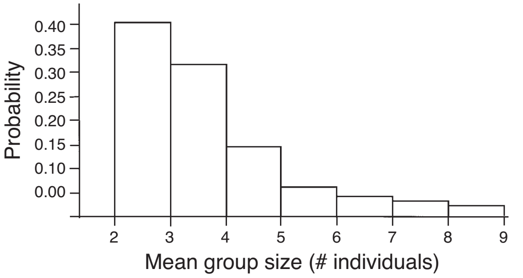

FIGURE 2. Probability distribution of mean group size, weighted by proportion time spent within 20 m of various numbers of conspecifics, of individual Common Loon (*Gavia immer*) overwintering on Lake Jocassee, South Carolina, 2018–2020.

period the population spent <20 m of a conspecific. We could best categorize these individuals into three groups based upon the means and inflection points of a best fit 3-normal mixture (−2 × Log-likelihood = 2.62; AIC_c = 19.79; Figure 3) generated from an examination of all available continuous models (normal, 2-normal mixture, 3-normal mixture, exponential, sinh-arcsinh normal, Johnson-Su, and GLog) with JMP version 14.3. 'Solitary' individuals spent a relatively small percent (0–20%, $\bar{x}$ = 3.92%, n = 53) of daily activities <20 m from conspecifics and rarely, if ever, approached nearby conspecifics. Other individuals exhibited a degree of sociality in which they were drawn to, and interacted with conspecifics during the observation period, but could be differentiated into two groups based upon the duration of time they spent with conspecifics. Strongly social birds spent a relatively high percent (70–100%, $\bar{x}$ = 90.10%, n = 46) of their time with conspecifics, rarely spending any time alone, while 'loosely-social' individuals, spent a moderate percent (>20–<70%, $\bar{x}$ = 45.46%, n = 33) of their time with conspecifics but also spent time alone.

Although solitary, loosely-social, and strongly-social individuals inhabited each zone, the distribution of these individuals varied across the four geographic zones of the lake (Pearson χ^2_6 = 22.66, n = 132, P < 0.001; Table 3). Equal numbers of solitary and social individuals inhabited zones 1 and 3 while more of the lake's social individuals inhabited zones 2 and 4. A greater proportion of individuals we observed in Zones 1 and 3 of Lake Jocassee were solitary and thus the proportion of time these individuals were <20

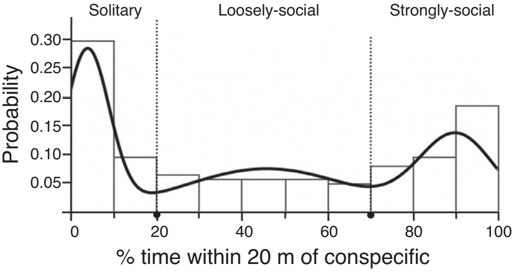

FIGURE 3. Probability distribution of the proportion of time Common Loon (*Gavia immer*; n = 132) overwintering at Lake Jocassee, South Carolina, spent within 20 m of a conspecific, with superimposed best fit 3-normal distribution (solid curve) and separation of individuals into solitary, loosely-social, and strongly-social categories based upon inflection points of this curve.

TABLE 2. Paired comparisons of the mean (± 1 SE) percent of time individual Common Loon (*Gavia immer*; n = 93) dedicated to behavioural states, dive frequencies, dive durations, and frequencies of calls given when solitary and when in a conspecific group (<20 m).

Parameter	Solitary (>20 m)	Group (<20 m)	$\|t\|$*	P
Foraging (% time)	61.9 ± 2.9	45.9 ± 3.4	3.94	0.0002
Locomotion (% time)	17.6 ± 2.0	25.7 ± 2.7	1.92	0.0577
Resting (% time)	11.5 ± 2.2	16.3 ± 2.4	1.17	0.2452
Self-maintenance (% time)	8.9 ± 1.4	12.1 ± 1.8	1.29	0.2013
Agonistic (% time)	0.0 ± 0.0	0.2 ± 0.2	1.00	0.3200
Dive rate (#/h)	24.2 ± 1.4	26.6 ± 2.7	0.83	0.4070
Dive duration (s)	63.3 ± 2.6	40.4 ± 2.6	8.41	<0.0001
Call rate (#/h)	2.2 ± 0.4	2.9 ± 1.2	0.55	0.5855
Hoot rate (#/h)	2.0 ± 0.4	1.7 ± 0.4	1.05	0.2946
Mew rate (#/h)	0.2 ± 0.1	1.2 ± 1.2	0.88	0.3809
Wail rate (#/h)	0.06 ± 0.03	0.05 ± 0.04	0.03	0.9782
Tremolo rate (#/h)	0.02 ± 0.02	0.00 ± 0.00	1.00	0.3199
Yodel rate (#/h)	0	0	—	—

*Values would be negative in cases where Group > Solitary.

TABLE 3. Limnological measurments and behavioural differences among individual Common Loon (*Gavia immer*) inhabiting each zone of Lake Jocassee, South Carolina, 2018–2020.

Parameter	Zone 1	Zone 2	Zone 3	Zone 4	*F*	df	*P*
Limnological parameter*							
$\bar{x}$ Depth (m)	57.7	44.7	47.4	36.1			
$\bar{x}$ Min. surface temp. (°C)	9.9	10.2	10.2	10.1			
$\bar{x}$ Chl *a* @ 0–10 m (mg/m^3)	1.79	2.18	2.37	3.10			
$\bar{x}$ Total zooplankton (#/m^3)	13 167	10 601	19 374	21 014			
$\bar{x}$ Fall forage fish density (#/ha)	1360	608	1077	2744			
$\bar{x}$ Surface water temp (°C)	11.3 ± 0.1	11.6 ± 0.1	11.3 ± 0.2	11.7 ± 0.1	2.54	3,118	0.0500
$\bar{x}$ Secchi depth (m)	6.66 ± 0.28	6.28 ± 0.24	6.05 ± 0.32	5.08 ± 0.25	6.68	3,53	0.0007
# Individuals by social type	49	38	18	27			
# Solitary	25	11	10	7			
# Loosely-social	13	4	6	10			
# Strongly-social	11	23	2	10			
Behavioural state							
$\bar{x}$ Foraging (% time)	45.6 ± 3.9	52.5 ± 4.4	59.9 ± 6.5	58.9 ± 5.3	1.52	3,128	0.2114
$\bar{x}$ Locomotion (% time)	23.9 ± 2.4	19.0 ± 2.7	18.2 ± 4.0	15.5 ± 3.2	2.01	3,128	0.1160
$\bar{x}$ Resting (% time)	18.3 ± 2.6	17.3 ± 3.0	15.4 ± 4.46	12.8 ± 3.6	0.46	3,128	0.7111
$\bar{x}$ Self-maintenance (% time)	11.6 ± 1.9	12.0 ± 2.1	6.2 ± 3.1	12.7 ± 2.5	1.38	3,128	0.2523
$\bar{x}$ Agonistic (% time)	0.14 ± 0.09	0.00 ± 0.11	0.00 ± 0.16	0.13 ± 0.13	0.47	3,128	0.7030
<20 m of conspecific (% time)	34.3 ± 5.0	59.9 ± 5.7	28.9 ± 8.3	49.82 ± 6.81	4.77	3,121	0.0035
Dive frequency (#/h)	17.90 ± 2.10	25.01 ± 2.40	21.49 ± 3.44	30.62 ± 2.81	4.68	3,125	0.0039
Dive duration (s)	57.70 ± 3.80	51.68 ± 4.20	69.00 ± 6.19	49.98 ± 4.91	2.38	3,122	0.0448

*From Gutierrez (2013).

m of a conspecific was significantly lower than individuals we observed in zones 2 and 4 (Table 3).

Solitary individuals spent more time foraging than both loosely-social individuals (t_{129} = 2.45, P = 0.0158) and strongly-social (t_{129} = 4.82, P < 0.0001; Table 4) individuals. Although solitary individuals dove as often as social individuals, their dives were much longer than those of loosely-social (t_{123} = 2.77, P < 0.01) and strongly-social (t_{123} = 6.22, P < 0.0001) individuals (Table 4). Solitary individuals also spent significantly less time in locomotion (t_{129} = 3.91, P < 0.0001), resting (t_{129} = 2.55, P = 0.02), and self-maintenance (t_{129} = 2.13, P = 0.04) activities in comparison to strongly-social individuals (Table 4). Both types of social individuals dove as frequently as solitary individuals, but made shorter dives, often feeding as groups upon schools of Bluefin Herring and Threadfin Shad that came to the water surface. Among social individuals, loosely-social individuals spent more time foraging (t_{129} = 1.87, P = 0.03) and made longer foraging dives (t_{123} = 2.75, P < 0.01) than strongly-social individuals, but invested less time in self-maintenance (t_{129} = 2.26, P = 0.03; Table 4). There was no difference in the rate each type (solitary, loosely-social, and strongly-social) of individual vocalized (Table 4).

Discussion

Suitability of freshwater habitats for overwintering loons

Similar to the habitats they select for breeding (Hammond *et al.* 2012) and migrating (Kenow *et al.* 2018), loons likely select overwintering sites that meet the substantial foraging requirements of a visual underwater pursuit predator. These tend to be shallow areas (e.g., <35 m; Winiarski *et al.* 2013) of lower turbidity (e.g., Haney 1990; Thompson and Price 2006) and moderate productivity (e.g., chlorophyll *a* concentration >2 mg/m^3; Winiarski *et al.* 2013). The clearer waters of southern inland lakes with large forage fish communities such as Lake Jocassee provide suitable, if not ideal habitat for overwintering loons. Individuals choosing to overwinter on freshwater lakes would be exposed to fewer predators (particularly from underwater), possibly a different array of

TABLE 4. Mean (± 1 SE) time dedicated to various behavioural states, and mean (± 1 SE) dive frequencies, dive durations, and call frequencies of solitary, loosely-social, and strongly-social Common Loon (*Gavia immer*) overwintering at Lake Jocassee, South Carolina, 2018–2020.

Parameter	Solitary (n = 53)	Loosely-social (n = 33)	Strongly-social (n = 46)	F	df	P
Foraging (% time)	63.2 ± 3.5	54.5 ± 4.5	38.0 ± 3.8	11.64	2,129	<0.0001
Locomotion (% time)	13.8 ± 2.2	21.1 ± 2.8	26.1 ± 2.4	8.08	2,129	0.0005
Resting (% time)	12.9 ± 2.5	16.5 ± 3.2	20.6 ± 2.7	3.08	2,129	0.0494
Self-maintenance (% time)	10.0 ± 1.7	7.5 ± 2.2	15.3 ± 1.9	3.28	2,129	0.0410
Agonistic (% time)	0.00 ± 0.09	0.30 ± 0.10	0.00 ± 0.10	2.96	2,129	0.0555
Dive rate (#/hr)	22.8 ± 2.2	24.7 ± 2.7	22.6 ± 2.3	0.21	2,125	0.8130
Dive duration (sec)	69.5 ± 3.2	55.1 ± 4.1	40.4 ± 3.4	19.20	2,123	<0.0001
Call rate (#/hr)	2.5 ± 0.7	5.1 ± 1.5	4.9 ± 2.5	0.78	2,129	0.4621
Hoot rate (#/hr)	2.2 ± 0.8	4.6 ± 1.0	2.4 ± 0.9	1.98	2,129	0.1428
Mew rate (#/hr)	0.06 ± 0.05	0.31 ± 0.31	2.41 ± 2.39	0.83	2,129	0.4382
Wail rate (#/hr)	0.10 ± 0.04	0.09 ± 0.07	0.11 ± 0.08	0.02	2,129	0.9834
Tremolo rate (#/hr)	0.14 ± 0.14	0.09 ± 0.07	0.00 ± 0.00	0.54	2,129	0.5859
Yodel rate (#/hr)	0.02 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.63	2,129	0.5354

parasites and potential pathogens, and may also experience lower metabolic costs, such as those posed from maintaining active salt glands that could indirectly hamper growth, immunocompetence, moult, and accumulation of fuel reserves sufficient for migration (e.g., Gutiérrez *et al.* 2011; Gutiérrez 2014). Individuals overwintering in freshwater lakes may also experience substantial carry-over benefits associated with migratory phenology and arrival time on breeding lakes as well as breeding performance and condition (e.g., Inger *et al.* 2010; Rotics *et al.* 2018). Because these associated short- and potentially long-term fitness advantages may be considerable, it is not surprising that more individuals are choosing to overwinter on freshwater lakes and reservoirs throughout much of North America, not just within the Piedmont and Southeastern Coastal Bird Conservation Regions (Meehan *et al.* 2018), that include Lake Jocassee. Further comparisons of the migratory phenology, physical health and condition, and reproductive success of these individuals with those that overwinter in marine habitats would facilitate more rigourous examinations of these potential benefits.

Time-activity budgets of loons wintering on Lake Jocassee

Collectively, the diurnal activity budgets of Common Loons overwintering on the clear, protected, and prey-rich waters of Lake Jocassee do not differ from those of loons on breeding lakes as well as from loons overwintering on marine waters along the coast of Virginia (McIntyre 1978), Florida (Vlietstra 1998, 2000), and Rhode Island (Daub 1989; Ford and Gieg 1995). Individuals spent most of their time (~50% of daily activities) foraging and to a lesser extent among activities associated with resting, locomotion, and self-maintenance. Likewise, the collective frequencies and durations of dives made by loons on Lake Jocassee are similar to loons foraging on similar prey types on breeding (e.g., Reimchen and Douglas 1980; Alvo and Berrill 1992; Nocera and Burgess 2002; Gingras and Paszkowski 2006) and overwintering (e.g., Stewart 1967; Kinnear 1978; Dickson 1980) lakes. These findings are consistent with the notion that foraging is a large component of the daily activities of Common Loons (McIntyre 1988), and upon first glance may indeed be fixed (i.e., ~50% of daily activities) temporally within and between seasons (Nocera and Burgess 2002) to meet the energetic demands of these waterbirds.

However, closer inspection of these activity budgets on Lake Jocassee reveals the time loons spend foraging is flexible depending upon the foraging strategy they adopt. Similar to other piscivorous waterbirds (e.g., Kersten *et al.* 1991; McMahon and Evans 1992), the time loons on Lake Jocassee dedicate to foraging appears to vary significantly with their degree of social organization. Perhaps best exhibited by loosely-social loons, these behaviours likely reflect the dynamics of a fission-fusion social system (Silk *et al.* 2014) whereby they use a fluid, cooperative foraging strategy that involves shifts from uncoordinated individual foraging tactics with high inter-individual distance to highly coordinated, if not cooperative, group foraging tactics with low inter-individual distance to effectively harvest clumped aggregations of feeder fish at the water surface. Other loons, however, appear to adopt a more strict social foraging strategy where they spend most, if not all of their daily time, including their time foraging, in a social group. These strongly-social individuals, more frequently observed within zones 2 and 4 within the reservoir, spend significantly less time foraging (~39%) but appear to cooperatively locate and consume large schools of small schoolling fish that come to the water surface. As shown by their shorter foraging times, social individuals likely spend less time and energy to collectively search for, pursue, and catch multiple individuals within schools of smaller forage fish (thereby increasing individual foraging efficiency; e.g., Götmark *et al.* 1986) but must share access to the school of prey with conspecifics.

In contrast, solitary individuals found more frequently within zones 1 and 3, which include the more open Jocassee basin and the Lower Toxaway arms of Lake Jocassee, use a foraging strategy where they spend more time foraging (~64%) and make longer foraging dives. We believe solitary individuals are likely foraging for larger, more difficult to catch fish found in the deeper waters of Lake Jocassee, as longer dives among Common Loon are associated with this type of prey (Alvo and Berrill 1992; Barr 1996; Kenow *et al.* 2018). This is supported by our occasional observations of solitary loons surfacing at times with bass and trout, as well as Channel Catfish (*Ictalurus punctatus*) that are found at greater depths in Lake Jocassee. Such a solitary foraging strategy is physiologically costlier (see reviews by Butler and Jones 1997; Kooyman and Ponganis 1998; Butler 2000; Kenow *et al.* 2018) and likely results in lower intake rates (Butler 2000), but it also provides greater energetic benefits per intake. How these social and solitary foraging strategies help loons meet the changing metabolic demands of overwintering and preparing for spring migration merit further consideration of composition and intake rates of various prey types by individuals.

Such differences in foraging strategies may reflect inherent differences in body size, sex, personality type, and/or age, as well as differences in experience and body condition (see reviews by Giraldeau and Caracao 2000; Krause and Ruxton 2002; Sih *et al.* 2004). For example, although we did not detect such differences in our study, anecdotal differences in overwintering foraging behaviour between juveniles and adults have been observed in northern Europe (Byrkjedal 2011), as have shifts in the foraging depths of migratory female loons staging on the Laurentian Great Lakes (Kenow *et al.* 2018). Similarly, we currently do not know the migratory routes nor the locations where these individuals breed and whether their overwintering foraging strategies are similar to those during the breeding season. Additionally, although our initial examinations did not find a relationship between foraging strategy type and primary productivity nor fall forage fish densities within each ecological zone of Lake Jocassee, closer examination of the availability and distribution of forage and predatory fish, as well as limnological features of specific regions within each zone is warranted, as foraging strategy may be related to these (e.g., Carr and MacDonald 1986; McMahon and Evans 1992; also see review by Krause and Ruxton 2002). Such possibilities warrant further examinations of the short- and long-term trade-offs associated with solitary and group foraging.

Sociality among overwintering loons

The degree of sociality loons exhibit during nonbreeding seasons likely reflects trade-offs associated with the benefits and consequences of group living. Following the breeding season, Common Loon often congregate in large groups before (McIntyre 1983) and during (Powers and Cherry 1983; Evans *et al.* 1994; Kratter 2009) migration to overwintering sites. Because most (~90%; McIntyre 1978; Daub 1989; Ford and Gieg 1995; Vlietstra 2000) individuals that overwinter in coastal and offshore waters are largely alone and at times aggressive (Byrkjedal 2011, 2017), if not territorial (McIntyre 1978), it has been generalized that nonbreeding loons are mostly solitary (Crook 1965) and lack social organization (Matthysen 1993). However, loons overwintering in marine areas periodically aggregate in both small (two individuals) and large (200–1000 individuals) groups (Teulings 1973; Jodice 1993; Spitzer 1995; Vlietstra 2000; Byrkjedal 2011; Long and Paruk 2014). Selective advantages of group living within certain environmental and social conditions can include shared protection from winter storms (Stocking *et al.* 2018), protection from predation via dilution or distraction effects (Vlietstra 1998), and/or through enhanced vigilance against predation by sharks and large fishes (Vlietstra 1998, 2000). Indeed, such sociality may provide protective benefits (see reviews by Clark and Mangel 1986; Krause and Ruxton 2002; Davies *et al.* 2012) that should be examined further across this species' broad overwintering range.

Our study reveals that sociality may also provide significant foraging benefits to loons overwintering on freshwater lakes. Social foraging is believed to be adaptive when food is localized in patches and the detection of patches of food by flocks is greater than that by individuals (see reviews by Crook 1965; Pulliam and Millikan 1982). Indeed the foraging benefits associated with sociality may be particularly beneficial for loons overwintering on freshwater lakes, such as Jocassee, where predation risks are extremely low and food resources, particularly foraging fish, are abundant and aggregately distributed. Loons likely experience increased benefits associated with cooperation and coordination of foraging for these schoolling fish as group size increases; however, they also likely experience increased costs associated with competition for those fish (see reviews by Krause and Ruxton 2002; Davies *et al.* 2012). Although we observed little, if any, overt aggression among conspecifics, let alone any anecdotal increase in individual aggression with group size, closer examinations of how competitive and cooperative relationships between group members influence optimal group size under varying environmental conditions in this system, as well as within other marine and freshwater ecosystems during the breeding, migratory, and overwintering seasons, would be worth future exploration.

Conclusions

Freshwater lakes and reservoirs in southern North America, such as Lake Jocassee in South Carolina, potentially provide substantial, if not ideal habitats for overwintering Common Loon. As observed on breeding lakes as well as on marine environments, loons overwintering here forage for most of the day. However, these loons vary in their foraging behaviour in association with a degree of sociality that is not typically observed among loons overwintering in marine environments. Individuals that are strongly social, spending most of their time with conspecifics, spend less time foraging but make shorter dives, often collectively if not cooperatively, for forage fish that are found closer to the water surface. In contrast, other individuals on Lake Jocassee adopt a solitary strategy in which they rarely come within 20 m of a conspecific, spend a greater proportion of time foraging, but make longer dives, presumably for predatory fish that are found in deeper waters. Each strategy likely reflects each individual's abilities to optimally meet the metabolic demands associated with overwintering and preparing for spring migration; however, much research is needed to further evaluate the costs and benefits associated with each strategy. Lastly, we hope to look more closely at whether there are changes in the strategies of individuals from year to year or during the course of a winter by banding more birds and spending more time observing these marked individuals during the course of a winter.

Author Contributions

Writing – Original Draft: J.N.M.; Writing – Review & Editing: J.N.M., J.D.P., S.A., and B.W.; Conceptualization: J.N.M. and J.D.P.; Investigation: J.N.M., J.D.P., S.A., and B.W.; Methodology: J.N.M., J.D.P., S.A., and B.W.; Formal Analysis: J.N.M.; Funding Acquisition: J.N.M., J.D.P., and B.W.

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Note

First record of Azalea Sawfly (*Euura lipovskyi*, Hymenoptera: Tenthredinidae) in Canada

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Abstract
Azalea Sawfly (*Euura lipovskyi*) larvae found feeding on foliage and flowers of cultivated Flame Azalea (*Rhododendron calendulaceum*) in Ottawa, Ontario, in late May 2021 are the first records of this sawfly in Canada. The native range of Azalea Sawfly includes the eastern United States, but the species has extended its distribution recently to the Pacific northwest of North America and Europe. Recorded foodplants include *Rhododendron calendulaceum*, *Rhododendron luteum*, *Rhododendron obtrusum*, *Rhododendron occidentale*, *Rhododendron molle*, *Rhododendron viscosum*, and possibly Early Azalea (*Rhododendron prinophyllum*), all in *Rhododendron* section *Pentanthera*. The new combinations *Euura lipovskyi* and *Euura azaleae* are proposed.

Key words: Hymenoptera; Tenthredinidae; *Euura lipovskyi*; Azalea Sawfly; range extension; Ottawa; Canada; *Rhododendron calendulaceum*; Flame Azalea; invasive; pest

On 22–24 May 2021, we found Azalea Sawfly (*Euura lipovskyi* (Smith, 1974) comb. nov.) larvae on cultivated Flame Azalea (*Rhododendron calendulaceum* (Michaux) Torrey) in Ottawa, Ontario. This species is a new record for Canada based on a recently compiled list (Goulet and Bennett 2021). Azalea Sawfly has been described from the eastern United States (Smith 1974). It is a familiar species on ornamental deciduous rhododendrons (azaleas), such as Flame Azalea and Swamp Azalea (*Rhododendron viscosum* (L.) Torrey), both native to the eastern United States, and the introduced *Rhododendron molle* (Blume) G. Don from China and Japan (Macek and Šípek 2015). Azalea Sawfly has recently been reported as a new invasive species in Europe (Macek and Šípek 2015), where *Rhododendron luteum* Sweet and *Rhododendron obtusum* (Lindley) Planchon have been added to the list of its hosts. It has also been recorded recently as a range extension in Oregon and Washington (Collman and Bush 2016; Looney *et al.* 2016), where reported foodplants include Western Azalea (*Rhododendron occidentale* Torrey and A. Gray).

All of these hostplant species are in the *Rhododendron* section *Pentanthera* (Kron 1993), and there are no members of this group in eastern Canada, as Early Azalea (*Rhododendron prinophyllum* (Small) Millais) was excluded from southern Quebec (Judd and Kron 2009). The native range of Flame Azalea extends from West Virginia south to Georgia in the Appalachian Mountains (McDonald 2001; Judd and Kron 2009). The section *Pentanthera* is very different from well-known, native eastern Canadian members of the genus (i.e., Rhodora [*Rhododendron canadense* (L.) Torrey] and Common Labrador Tea [*Rhododendron groenlandicum* (Oeder) Krom & Judd]), and thus Azalea Sawfly may not represent a threat to those species.

The sawfly larvae were found on cultivated Flame Azalea in two locations: an urban garden south of Agriculture and Agri-Food Canada's Central Experimental Farm (CEF) and in the CEF Arboretum, 2.1 km to the north (see vouchers below). Larvae were 1–2 cm long and solitary or in groups of two or three. Defoliation, involving the reduction of leaves to a midvein, was characteristic (Figure 1a,b). Defoliation was complete on parts of the shrub, but larvae appeared to have difficulty reaching flowers, perhaps because of glandular hair on the flower stalks

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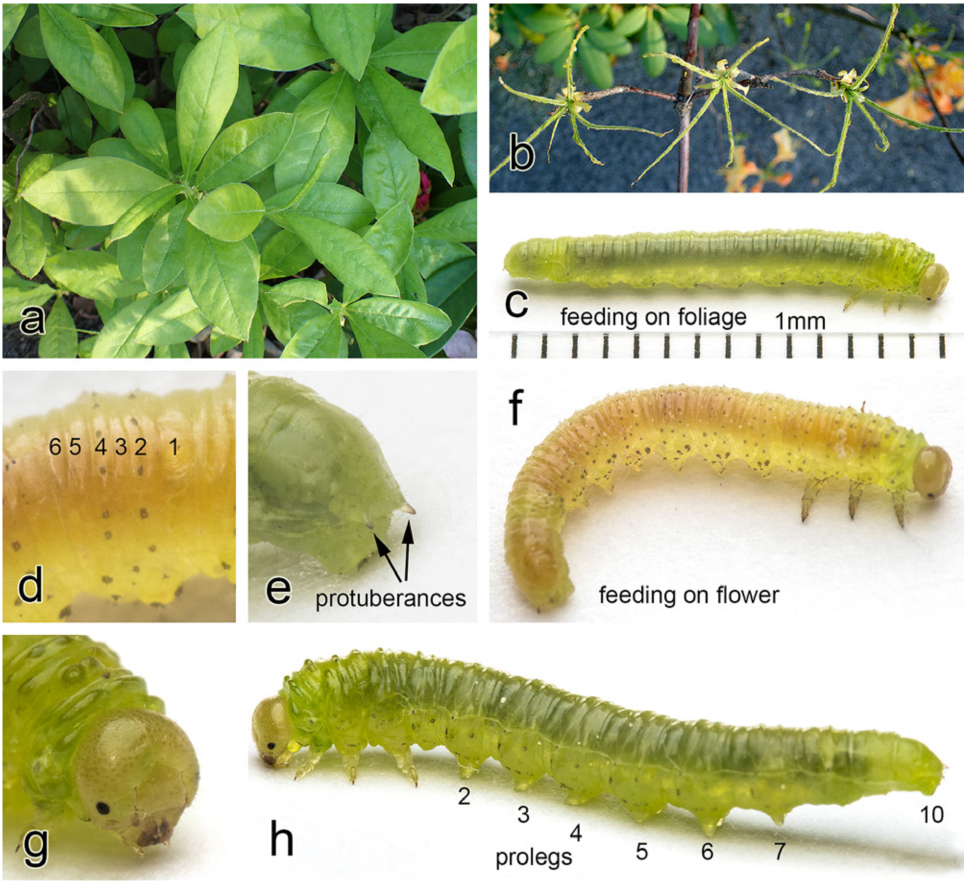

FIGURE 1. Leaves of Flame Azalea (*Rhododendron calendulaceum*) and Azalea Sawfly (*Euura lipovskyi*) larvae at Ottawa, Ontario, 24 May 2021. a. Normal leaves. b. Leaves consumed by Azalea Sawfly leaving only the midrib. c. Near fully grown larva that fed on leaves. d. Oblique view showing annulets. e. Abdominal segment 10 with protuberances. f. Near fully grown larva that fed on flowers. g. Frontal view showing occiput. h. Lateral view showing abdominal prolegs. Photos a and b: P.M. Catling and B. Kostiuk. Photos c–h: H. Goulet.

and the floral tube. Larvae switched to flowers, as buds opened when defoliation was more or less complete. We counted up to 100 larvae on a shrub. These were isolated plantings and no others are known in the vicinity. We found sawfly larvae feeding on yellow, orange, and red colour variants of this variable species (Hyatt and McLellan 2006).

Only a few decades ago, the only rhododendron able to be grown in Ottawa was the most cold-hardy PJM cultivar series of hybrids (*R. carolinianum* × *sempervirens* cross). More recently, various hard- and soft-leaved species can be grown and other shrubs previously confined to more southern regions such as Eastern Redbud (*Cercis canadensis* L.) are also grown in Ottawa. Many gardeners attribute this northern movement of hardiness zones to climate warming. Azalea Sawfly may have moved north due to climate warming either independently or transported in soils accompanying shrubs from further south sold in local garden centres. There is no definite evidence for the nursery trade serving as a vector because the sawflies have not been seen at nurseries in Ottawa in May when the plants are sold. Regardless of how Azalea Sawfly arrived, it does seem to be a result of climate warming. Because it already occurs in Wisconsin, New York, and New England (Macek and Šípek 2015), its occurrence in southern Canada is not surprising.

The larvae of this sawfly, up to 2 cm long, with a pale brown greyish head, are mainly pale to dark green when feeding on leaves (Figures 1c) or mostly light orange when feeding on orange flowers (Figure 1f). For a more detailed description, see Macek and Šípek (2015).

Smith (1974) recorded three species of sawflies feeding on azaleas. They consist of one species of Argidae, *Arge azaleae* Smith, under the name *Arge clavicornis* (Fabricius) in Smith (1974), and two species of Tenthredinidae, *Euura azaleae* (Marlatt) Goulet comb. nov. (see Prous *et al.* 2014 and Taeger *et al.* 2018), under the name *Amauronematus azaleae* (Marlatt) , and *Euura lipovskyi* (Smith) Goulet comb. nov. (see Prous *et al.* 2014 and Taeger *et al.* 2018) under the name *Nematus lipovskyi* Smith. Smith (1974, 1989) characterized adults, but larvae are more frequently encountered and seen causing damage. The presence of only three annulets, a broad longitudinal stripe from occiput to clypeus, and lack of caudal protuberances on the abdominal segment 10 (Smith 1989, under the name *A. azaleae*) quickly characterize the larvae of *E. azaleae*. The tenthredinid larvae of *E. lipovskyi* and *E. azaleae* share the presence of a pair of short caudal protuberances (Figure 1e), the lack of a pair of prolegs on abdominal segment 8 (Figure 1h), and six annulets or abdominal folds (folds easily seen in dorsal view; Figure 1d). Larvae of *E. lipovskyi* have small setae on annulets 2 and 4 (Figure 1d), while those of *E. azaleae* have small setae on annulets 2 and 3.

The only lepidopteran larva likely to be confused with Azalea Sawfly is that of Oblique Banded Leafroller (*Choristoneura rosaceana* (Harris)), in Tortricidae. It is roughly the same size, usually has a pale green body, but differs in having a brown or black prothoracic shield and it rolls and ties leaves together so that the damage is not at all similar. Many other Lepidoptera larvae feed on azalea foliage but are distinctive in colour, size, and behaviour. Regardless, sawfly larvae are easily distinguished from Lepidoptera larvae, which have four pairs of prolegs and 4–6 ocelli on each side of the head. Sawflies have 6–7 pairs of abdominal prolegs (Figure 1h) and a single ocellus on each side of the head (Figure 1g,h).

We have received a report of a sawfly on the "Northern Lights" azalea cultivar from Toronto, Ontario. If this was *E. lipovskyi*, its range would be extended within Canada, and a complex hybrid involving Early Azalea would be added to the list of hosts.

Voucher specimens

CANADA, ONTARIO: Ottawa, Sanford Avenue, 45.3722°N, 75.7102°W, 22 May 2021, *H. Goulet, P.M. Catling, B. Kostiuk*, Canadian National Collection of Insects (CNC HG 001); Ottawa, Central Experimental Farm Arboretum, 45.3911°N, 75.7046°W, 24 May 2021, *P.M.C., B.K.* (CNC PMC 001).

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Note

Apparent wing-assisted incline running in a Common Grackle (*Quiscalus quiscula*)

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Sakich, N.B. 2022. Apparent wing-assisted incline running in a Common Grackle (*Quiscalus quiscula*). Canadian Field-Naturalist 136(1): 45–48. https://doi.org/10.22621/cfn.v136i1.2861

Abstract

Wing-assisted incline running (WAIR) has been observed in bird taxa from multiple clades. Its wide phylogenetic distribution in modern birds suggests that it is an ancestral trait for class Aves. WAIR as a behaviour is speculated to predate the evolution of full-powered flight, and to have formed a behavioural and physiological stepping stone between terrestrial and aerial life. Here I report an observation of apparent WAIR in a Common Grackle (*Quiscalus quiscula*) photographed incidentally on a trail camera deployed in an urban backyard in Guelph, Ontario, Canada. To my knowledge this is the first documented observation of apparent WAIR for the family Icteridae. Furthermore, it highlights the value of non-systematic use of trail cameras for making unique natural history observations.

Key words: Wing-assisted incline running; WAIR; Common Grackle; *Quiscalus quiscula*; Icteridae; blackbird; urban wildlife; trail camera; camera trap; natural history

Wing-assisted incline running (WAIR) is a behaviour where birds use force generated by flapping their wings to assist them in climbing steep inclines (Dial 2003a). It is used to escape from terrestrial predators and gain access to elevated surfaces (Dial 2003a; Dial *et al.* 2006; Jackson *et al.* 2009; Heers *et al.* 2014). There are no reports of WAIR being used to assist insect hawking/fly catching, although domestic chickens will sometimes spontaneously engage in WAIR if presented with a ramp (LeBlanc *et al.* 2018).

WAIR has been recorded among diverse avian species. For example, it has been observed in eight species in seven genera of Galliformes (pheasants, turkeys, grouse, partridges, and quail; Dial 2003a; Dial *et al.* 2006, 2008; Jackson *et al.* 2009; Dial and Jackson 2011; UM Flight Lab 2016; Tobalske *et al.* 2017; LeBlanc *et al.* 2018; Viola *et al.* 2019), in two species in two genera of Charadriiformes (shorebirds and allies; UM Flight Lab 2016), in Strigiformes (owls; Heers *et al.* 2014; UM Flight Lab 2016), and in one species each of Tinamiformes (tinamous; UM Flight Lab 2016), Columbiformes (pigeons and doves; Jackson *et al.* 2011), Psittaciformes (parrots; Berg *et al.* 2013), Apodiformes (swifts and hummingbirds), Pelecaniformes (pelicans, cormorants, and allies), Procellariiformes (tube-nosed seabirds), Accipitriformes (eagles, hawks, and allies), and Falconiformes (falcons; UM Flight Lab 2016). At a finer phylogenetic scale, within just the Passeriformes, it has also been observed in disparate lineages. These observations include one species each of Emberizidae (buntings and allies), Turdidae (thrushes), and Corvidae (crows, jays, and magpies; UM Flight Lab 2016), one species of Passerellidae (New World sparrows; Jackson *et al.* 2009), and in Parulidae (New World warblers; Jackson *et al.* 2009). WAIR in birds has been observed in both the laboratory (e.g., Jackson *et al.* 2011; Tobalske *et al.* 2017; LeBlanc *et al.* 2018) and the field (e.g., Berg *et al.* 2013).

The occurrence of WAIR across a wide range of avian phylogeny has led to the conclusion by some that it is an ancestral trait for Aves (UM Flight Lab 2016). Furthermore, WAIR requires less exertion of upper-body muscles (Jackson *et al.* 2011) and less sophisticated biomechanical and physiological adaptations (Dial 2003a; Heers *et al.* 2014) than full-powered flight and can be performed by animals incapable of such flight (Dial 2003a; Dial *et al.* 2006, 2008; Heers *et al.* 2014; Tobalske *et al.* 2017). Some

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speculate that WAIR evolved before powered flight in the lineage that led to modern birds (Dial 2003b; Dial *et al.* 2006, 2008; Heers *et al.* 2014) and that it was instrumental in the evolution of powered flight in that it provided maniraptoran dinosaurs with a transitional step between being terrestrial and being capable of powered flight (Dial 2003a,b; Dial *et al.* 2006, 2008; Heers *et al.* 2014). However, despite the phylogenetically wide breadth of the taxa in which WAIR has been noted, recorded observations are still currently limited to a tiny fraction of the ~10 000 (Jetz *et al.* 2012) extant, described species of birds. Here, I report an incidental observation of WAIR in a species in which it has not, to my knowledge, been previously recorded: Common Grackle (*Quiscalus quiscula*).

I recorded the observation with a Campark T20 trail camera (Campark Electronics Co., Ltd., Shenzhen, Guangdong, China) deployed in an urban backyard in Guelph, Ontario, Canada, for the purposes of non-research incidental wildlife observation. The camera was mounted ~80 cm above ground, facing a corner of the house. The camera was set to take a sequence of three still photographs each time its motion sensor was triggered, with a minimum pause time between sequences of 30 s. Image resolution was set to 16 megapixels (image size of 5376 × 3024 pixels) and motion sensor sensitivity was set to "Low".

At 1150 on 1 June 2021, the camera captured a sequence of three photographs of a Common Grackle (Figure 1), positively identified based on its long tail relative to its body size, its "lanky" shape, and its dark plumage with a faintly visible patch of iridescence near the shoulder (Cornell Lab of Ornithology 2019). The bird had a tarsal length of ~27 mm, estimated using ImageJ version 1.53a (Abràmoff *et al.* 2004) and the known length of the central portion of the supportive strut of the table in Figure 1c. This tarsal length suggests that the bird was female (Willson *et al.* 1971).

In the first two photos in the sequence taken over ≤1 s, the bird is apparently standing still beneath a table, facing the wall of the house (Figure 1a,b). Then, less than 1 s later, the bird clambers up the wall, its wings held above its head in a mid-flap posture (Figure 1c,d). The bird's right leg can be seen dangling below its body, while the faint outline of its left foot can be seen raised to its breast, just slightly below its shoulders (Figure 1c,d), indicating that it was in mid-stride, moving upward or upward and to the right on the wall.

An alternative explanation is that the bird was merely "bouncing off" the wall in the second immediately following takeoff. However, because in reversing its position in Figure 1c, the bird would have crashed into the table behind it, there had to be at least some upward movement. This upward movement, combined with the bird's foot being planted on the wall, qualifies this behaviour as WAIR.

Figure 1. The initiation of a bout of apparent wing-assisted incline running by a Common Grackle (*Quiscalus quiscula*) captured in three consecutive photographs (a–c) taken by a trail camera and d. photograph c cropped to highlight the bird. In a–c the bird is circled for clarity. Photos: Nicholas B. Sakich.

For how long and over what distance this bird sustained apparent WAIR is unknown, because of the camera's 30-s minimum pause between image sequences. What caused the apparent WAIR, as opposed to the bird taking off in the standard manner in a direction not facing the wall, is also unclear. However, a Domestic Cat (*Felis catus*) heading from the street into this backyard was photographed by this camera at 1031 on the same day. Although the cat was not recorded by another trail camera that faced the backyard, it could have remained in the backyard until the sequence of grackle photos was taken. Therefore, it is possible that the grackle scaled the wall as the least vulnerable escape route from the cat.

Common Grackles using WAIR to avoid predators would match with WAIR's use in other bird taxa (Dial 2003a). It may also have been a startle response to movement inside the building, as a shape visible in the window to the left of and behind the bird does appear to change in the photo sequence (Figure 1a–c). Although I do not know anything about the behaviour of the grackle before the first image was taken, one might also speculate that the bird's choice of WAIR over a standard take-off method may have been a result of the bird having fatigued flight muscles from prolonged flying, as WAIR requires less exertion of the flight muscles than full-powered flight to traverse the same distance (Jackson *et al.* 2011). It is noteworthy that WAIR is often preferentially used over full-powered flight among flight-capable birds that also perform WAIR (Dial *et al.* 2006).

Yet another possibility is that the bird was pursuing small prey (e.g., a fly) on the wall. Other bird species have been documented to forage along buildings, taking advantage of the attraction of prey species to windows (Robertson *et al.* 2010) or ventilation (Mikula *et al.* 2013). Both Common Grackle and its relatives have been documented catching flying insects on the wing (Bartlett 1956; McNicholl 1981).

To my knowledge, this is the first recorded observation of apparent WAIR for Icteridae (blackbirds, orioles, and allies). If so, Icteridae join at least five other passerine families in which WAIR has been observed and further strengthen existing knowledge that WAIR is displayed widely across the avian phylogeny, thus lending further credence to the idea that WAIR played a central role in the evolution of avian powered flight.

My observation would not have occurred had it not been for the non-systematic use of a trail camera for urban wildlife observation. Much has been published about the value of systematic camera trapping for monitoring wildlife populations (e.g., Rowcliffe and Carbone 2008; Swann and Perkins 2014). However, the increasing miniaturization and decreasing cost of electronics puts technology like trail cameras in the hands of more and more amateur wildlife enthusiasts. Citizen science initiatives, such as iNaturalist (https://www.inaturalist.org/) have provided invaluable data for everything from assessing animal movement (Vardi *et al.* 2021) to discovering new species (Winterton 2020). The increasing use of trail cameras has the potential to greatly expand the amount and types of data generated and could be incorporated into environmental education.

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The Canadian Field-Naturalist

A tribute to James Edwin Cruise, Ph.D., L.L.D., 1925–2021

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Introduction

During the middle 1800s, Jim's Irish ancestors lived in Norfolk County, Ontario. They supplemented a meagre farm income by boarding itinerant lumbermen during the winter months. The loggers slept on hay in the barn and were served an unvarying diet of porridge and lamb stew. Early on, Norfolk's loggers had cut the pines, up to 30.5 m tall and 1.2 m in diameter, used for masts by the Royal Navy. By the middle 1800s, timber from a dozen tree species was being cut, largely for shipping across Lake Erie to the United States.

Jim was born on 26 June 1925, almost a century later, in the eastern part of the county, in Port Dover. At the time, it was a fishing village with the largest freshwater fleet in the world, based partly on Lake Erie's Blue Pike (*Sander vitreus glaucus*), a fish that would soon be harvested to extinction. Jim's life is the fascinating journey of a great gentleman in a time of great change, an influential field biologist, and a close friend.

Early Days in Norfolk and the War

The hamlet of Marburg, where Jim grew up, included the farm and the one-room schoolhouse that he attended with two other students in his class. It was 6 km north-northeast of Port Dover on the Haldimand Clay Plain. Although he did leave Marburg, he returned to it, and spent most of his life there.

Jim's parents met in Grace Church in Port Dover where his father sang in the choir for 61 years. The four Cruise kids also sang in the choir (Figure 1). They drove there every Sunday on unforgiving roads, regardless of the conditions.

Jim always loved nature and when five years old he looked after his own garden. School at Marburg was a happy memory. On sunny spring days the students and the teacher would walk down to Black Creek. The limestone floor of the creek was good for wading and Jim collected crayfish and frogs in its deeper pools.

In 1937 things changed to a more stressful life that was split between high schools in Port Dover and Simcoe. At the time Jim was a beekeeper and he gave a presentation at school on beekeeping. His knowledge and enthusiasm contributed to a very

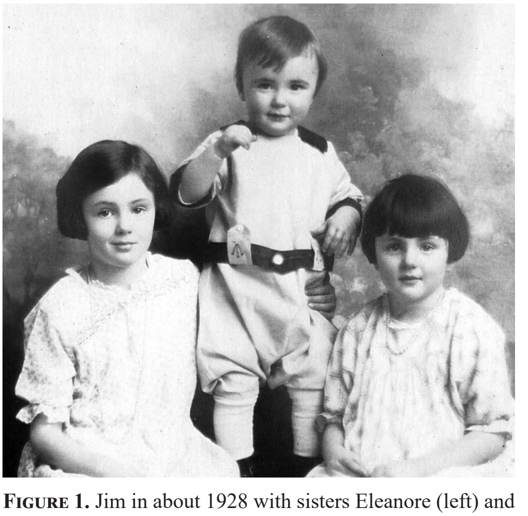

Figure 1. Jim in about 1928 with sisters Eleanore (left) and Isabel (right). Jim also had a younger brother, George (also deceased), who was a clever mechanic and provided Jim with a series of cars beginning in high school days. Photo: courtesy of Mr. Monte Smith, Port Dover.

successful presentation. Afterwards, he was asked to be a speaker when one was needed. In later grades Jim drove a 1927 Chevy to school and he gathered the same several fellow students from the countryside route each day. Smaller children were sometimes buried in quilts in the back seat. It was a circuitous route often blocked by mud or snow. They were always in a hurry but rarely on time. The "Marburg Express" gang was an anticipated arrival at the principal's office some time after school had started.

In 1943 Jim enlisted with the Royal Canadian Air Force. He was selected to train as a navigator which involved 'book learning'. This was a good fit and Jim received the Dominion Skyways Proficiency Award as top of his class. He was soon Sergeant and Commissioned Pilot Officer, and later became a Navigation Instructor and a Flying Officer. At 20 years of age, following VE Day (Victory in Europe, 30 May 1945), Jim was tasked with numerous flights across the English Channel to evacuate wounded troops. These were also his "drug dealing days", as he called them. He received a ration of 300 cigarettes a month, which was highly valuable, and these, along with the rations of others, he sold on the streets of Copenhagen to buy gifts for the children of his fellow servicemen.

FIGURE 2. Jim in about 1954 when he graduated from University of Toronto. Photo: courtesy of Mr. Monte Smith, Port Dover.

University of Toronto as an Undergraduate

Jim had finished high school in 1942 with a dream of teaching agricultural science and biology, but the family could not afford to send him to the Agricultural College at Guelph as he hoped. However, when he returned from the war in 1946, the Department of Veterans Affairs was willing to assist in his further education. He was accepted by Victoria College at the University of Toronto. He served as President of South House, and also as President of the Men's Residence Council. His leadership and administrative talents were becoming clearer.

The Cornell Years

Following graduation from the University of Toronto in 1950, Jim (Figure 2) went to Cornell University in Ithaca, New York: just the kind of place he needed. One of the original eight Ivy League Colleges, it had a strong reputation for academic excellence. Its botanical resources were extraordinary. Its libraries were well stocked and its collections well curated. It has been rated among the top 20 universities worldwide (QS World University Rankings 2022). Regarding botany, there was the Bailey Hortorium, a major centre for the study of wild and cultivated plants, with associated greenhouses and gardens. Liberty Hyde Bailey, who started it, is best known for his books on cultivated plants, 65 books in total, and over 1000 articles concerning plant growth, ecology, and systematics.

Jim completed an M.Sc. degree in plant physiology under the direction of Dr. D.G. Clarke in 1951, and a Ph.D. under the direction of Dr. W.C. Muenscher in 1954 (see Bibliography). Jim was influenced here by talented staff and by his close friend William (Bill) Dress who stayed at Cornell and became Chief Curator and Professor Emeritus. After his Ph.D., Jim continued at Cornell teaching, then moved to Princeton, and a New Jersey college. The move into a 1771 house in New Jersey was memorable, but he was not there long. He spent almost 13 years in New York and New Jersey, but his parents were weary of managing the farm so he returned home in 1962, to Marburg and the Botany Department of the University of Toronto.

Botany Professor and Associate Dean 1963 to 1975, University of Toronto (U of T)

It was during this period that Jim made his greatest contribution to botany, especially to teaching systematics, ecology, and phytogeography. He was an entertaining and charismatic teacher and made botany important and interesting in a way few others could. His classes were always full and he was loved by his students who could not help but learn. He had an uncanny ability to remember faces and names. By the second lecture he knew everyone and his door was always open to his students. He set the path for hundreds of knowledgeable and eager biologists.

Field trips and individual plant collecting projects were frequent in his courses and his students learned how to enjoy plants everywhere. He took his students into vacant city lots, industrial areas, and markets. He took his classes on longer, weekend trips to his Marburg farm, where 40 students (Figure 3) slept on hay in the barn and visited some of the best examples of Carolinian habitats in southwestern Ontario.

In 1968, a handful of graduate students in systematic botany accompanied professors Jim Cruise and Jack Maze, and several support staff, on a major field expedition and training session to Washington State and Oregon. This was a special treat and the first excursion of its kind at the Botany Department. The group left Toronto by train from Union Station and headed west to Vancouver (Figure 4). From there, the field party made its way initially into Washington State by rented cars to experience the diversity of its ecosystems from the temperate rain forest of the Olympic Peninsula to the dry scrublands in the east. Stops along the way provided opportunities for collecting specimens, and in the evenings, time was spent in identifying and pressing plants (Figure 5). One characteristic of Jim, as noted by one of his graduate students, was his immaculate appearance: not a hair out of place or a wrinkle in his pants or shirt when he came out of the tent in the morning.

In view of the successful outing to northwestern USA, another excursion was made in 1969, organized and led by Jim. The group, consisting of students, Botany staff, and some spouses, left Toronto in a cavalcade of cars. This trip was to provide students with first-hand experience in vegetational changes with climate and topography while moving southward. The field party travelled down the Appalachians of the eastern United States, camping that first evening in forested bear country. In the middle of the night, the sleeping Drs. Dengler awoke to an inquisitive bear ripping open the seam of their tent. A bit of shouting resulted but no major harm was done. Continuing south through Longleaf Pine (*Pinus palustris* Miller) country, the party made its way through the Florida panhandle ending up finally in hot, humid New Orleans. That in itself was a special experience—spending the night in a quaint hotel in the Bourbon Street area. What an opportunity to wander through this famous locale absorbing the sights and sounds! The return trip provided quite a contrast in the landscape going northward along the Mississippi lowlands and cotton fields. A side visit arranged by Jim to a historic former plantation mansion was an interesting interlude on the homeward drive. The comradery among students and staff, as was the case the year before (Figure 6), was heartwarming and memorable.

Jim often had lunch with the support staff, stores managers, greenhouse staff, and lab technicians. A rowdy group of as many as twenty sat at a long table. They joked and played cribbage, and Jim was sorely missed when he was not there. Few if any other professors were part of this group. Jim could fit in anywhere.

The herbarium at U of T, a dried plant collection with the international acronym 'TRT', was a major resource with a half million specimens (Figure 7; Text box 1). Jim was the curator. It was the leading collection representing the flora of Ontario, and was consulted on an ongoing basis for specimens from Ontario and other parts of Canada. Herbarium guests were welcomed, some of them for months at a time. They included scholars and characters such as Bernard Boivin, Bill Dore, John McNeill, and Herb

FIGURE 3. Lunch during a weekend field trip at Marburg, Norfolk County, Ontario in June 1973. The field trip was attended by 40 students and it is possible to identify four future university biology professors, high school teachers, major conservation leaders, and prominent nature writers in this photo. Photo: Jim Cruise.

Wagner—all part of the education to be had at the herbarium in those days. Jim made himself available to explain the herbarium, check plant identities, and provide access to his own library as well as the herbarium's library. Jim's herbarium was an experiment in teaching that yielded great results, in publications for sure, but most importantly in students who went on to become teachers, researchers, wildlife managers, and conservationists themselves.

FIGURE 4. Jim Cruise on the train westward to Vancouver and Washington State, on a field excursion with Botany students and staff. He had just received a special libation offered by one of the students. Photo: E. Haber.

Jim was also responsive to the spirit of the times—the 1960s and 1970s—and encouraged his students in their interactions with senior program staff of the provincial government, just across Queen's Park from the herbarium, on the day's emerging issues of endangered species and park system development, among others. The herbarium was on the speed dial of Toronto hospitals for calls about ingested toxins; Toronto port agents needed their problems solved as well. Jim received requests by mail and phone, and in those days, people could just walk in. A curator with Jim's knowledge and kindness, who made the herbarium's resources fully accessible, was a benefit to the public as a whole. Anyone of the herbarium group would happily take over, as best they could, if Jim was away (Text box 2; Figure 8).

Jim contributed directly to some of the important research and conservation initiatives of the day. He directed the international seed exchange program gathering and identifying seed and producing accurate lists of available seeds to be sent around the world for research, especially on economically important plants. He developed protocols and surveyed areas

FIGURE 5. Jim Cruise and Jack Maze, both to the right of the plant press, overseeing students grappling with the task of identifying one of the day's collections in Washington State. Photo: E. Haber.

FIGURE 6. Mealtime was always a happy occasion for Jim Cruise (right side of table) and the Botany field party after a long day of driving and plant collecting in Washington State. On the left side of the table is Botany Chairman Tom Hutchinson (wearing glasses and hat, is also very happy). Photo: E. Haber.

FIGURE 7. Botany Building, University of Toronto. Photo taken 7 June 1932, from the northeast showing the main entrance. The greenhouse can be seen on the left, behind the building. This is what the building looked like during the years that Jim Cruise was there in the 1960s and 1970s. The herbarium (TRT) was on the third floor above the entrance and offices of curators were beside it on the north side. Photo: University of Toronto Archives, public domain.

for the International Biological Program (IBP) to help identify priority sites for protection of significant natural areas. After one of these survey missions, he spent three days in hospital following a close encounter with Poison Sumac (*Toxicodendron vernix* (L.) Kuntze) shrubs. His students were quick to point out that they thought a plant like Poison Sumac would have been among the thousands of plants he recognized and he was supplied with the appropriate references upon his return to work. Actually, Jim had made a sensible choice of either drowning in quicksand or pulling himself out with the plant he recognised only too well!

Developing forest classifications benefitted from Jim's help and he contributed to numerous ecological and phytogeographic studies. In particular he carried on the traditions of previous U of T plant systematist, Dr. James H. Soper, in emphasizing field studies, floristics, and phytogeography (Haber 2012). He also introduced biosystematics techniques including

TEXT BOX 1. An educational and training hub of its own.

The University of Toronto dried plant collection, curated and managed by Jim, included a few large rooms on the third floor overlooking University Avenue. You never knew what you were going to find going on there. There may be 100 small aquariums being made with glass cutters and silicone to house newborn snakes as part of a study of their food preferences for an ecological paper (later published in *The Canadian Field-Naturalist*). Another day there may be a foul smell coming from the herbarium rooms where stomachs of White-tailed Deer (*Odocoileus virginianus*) were being examined to enable a better understanding of their ecology. The tables may be covered with plant materials to be sorted and analyzed for heavy metals. To many students the herbarium was home away from home and there were many regular visitors. A retired schoolteacher, Emerson Whiting, came to work on the flora of Muskoka. Renowned artist Walter Coucill RCA, came in often to use herbarium resources to improve his paintings. Legendary Quetico Park Naturalist Shan Walshe was often in to work on his Quetico flora published by U of T in 1980. There was always something happening. Other professors often dropped by including a stereotactic neurosurgeon from the medical sciences building next door who was a frequent casual visitor for lunch. People gathered there and learned there and made life-long friends there. It was a result of Jim's indulgence in encouraging the use of the space.

TEXT BOX 2. Jim's Team.

Jim's core botany team changed over the years because students and technicians come and go. Among those who were part of the systematic botany team, but not at the time of Figure 8, were Victoria Connolly, John E. Dawson, Dale Leadbeater, Katherine M. Lindsay, Dave Marchand, Cathy Pointing (now Keddy), Nancy Purcell, John L. Riley, and Ron Thorpe. All of these people were encouraged to help operate the herbarium and worked together as a family. Some are authors of this tribute and all would agree with the sentiments expressed here.

FIGURE 8. Jim surrounded by his botany staff and students in the early 1970s in an illustration that was made for the retirement party of Botany Chairman, Nick Badenhuizen. Clockwise from the top around the circle is Hamda Saifi (Herbarium Technician), Paul Catling (General Technician), Leila Gad (General Technician), John Grear (Associate Professor), Sheila McKay (Graduate Student), and Erich Haber (Graduate Student). Photo: E. Haber.

cytology, thin-layer chromatography, biostatistics, anatomy, and ecology to the tools of plant taxonomy at U of T.

During Jim's decade as professor of botany, he accepted numerous administrative and committee positions. He was President of the Ontario Society of Biologists, Secretary of the Canadian Botanical Association, and a consultant to the National Science Foundation in Washington, DC, as well as serving in various editorial roles. He taught regular classes, and played the central role in the supervisory meetings of his own seven graduate students (Table 1), as well as those of other professors. He authored and co-authored a number of articles and papers (see Bibliography). His interactions with graduate students were always most enjoyable and encouraging. He allowed his graduate students a great deal of latitude in their work, accompanied by serious and valuable advice. His patience was unique. No doubt Jim was ambitious but he was fundamentally a gentleman, who earned his support and respect through natural kindness more than anything else.

Jim became Associate Chairman of Botany in 1971. He was gravitating toward administration and leadership and, in 1972, he was invited to become Associate Dean of Science and Mathematics. He served in this position until 1975, but still maintained his ties with the Botany Department and its herbarium. He was responsible for 600 faculty members and he chaired 65 tenure committees.

The Museum, 1975 to 1985

Jim became the ninth director of the Royal Ontario Museum (ROM) on 1 July 1975, and he left a decade later on 30 June 1985 (Figure 9). Jim's appointment rocked museum circles far and wide because he was unknown in the museum domain. People thought that he had come out of nowhere. Of course, the U of T or Cornell, were hardly "nowhere", even if Marburg was new to them. Regardless, it was a strategic appointment. Rapid change was needed at the ROM. No one was better able to manage the stress and the diversity of opinions than Jim, and no one seemed better at calming the Board of Directors and successfully encouraging the donation of many millions of dollars.

One of Jim's publications, based on a speech to the Empire Club on 27 April 1978 (Cruise 1978), provides an insightful outline of the past, present, and future of the ROM. He reminded listeners that, at the time, it was regarded as one of the world's 10 best museums. Jim described its inception in 1851, its development since, and some of its unique features. His anecdotes were delightful as always. The ROM was then and is today Canada's largest field-research institution, with research and conservation activities around the world, and with more than one million visitors each year.

One of Jim's most enjoyable experiences at the ROM was in 1983. A tour for Queen Elizabeth II and Prince Philip was poorly conceived and became awkward with people not knowing what to say or do. Jim, near the front of the procession, went to the Queen's side and initiated a conversation that they both

TABLE 1. List of completed graduate work (all University of Toronto) supervised by J.E. Cruise. Author, degree, completion date, and title.

Author	Degree	Completion date	Title
Haber, E.	M.Sc.	1967	Systematic studies of *Circaea* in Ontario
Haber, E.	Ph.D.	1971	A biosystematics study of the eastern North American species of the genus *Pyrola*
Thorpe, R.C.	M.Sc.	1972	Floral and dispersal biology of *Polygala paucifolia* in Algonquin Park, Ontario
Dawson, J.E.	M.Sc. (Pro parte)	1973	Systematic and ecological study of the Ontario taxa of *Parnassia*
McKay, S.M.	M.Sc. (Pro parte)	1973	Biosystematic study of the genus *Amelanchier* in Ontario
Riley, J.L.	M.Sc.	1980	The flora and phytogeography of the Hudson Bay lowlands
Catling, P.M.	Ph.D.	1980	Systematics of *Spiranthes* in northeastern North America

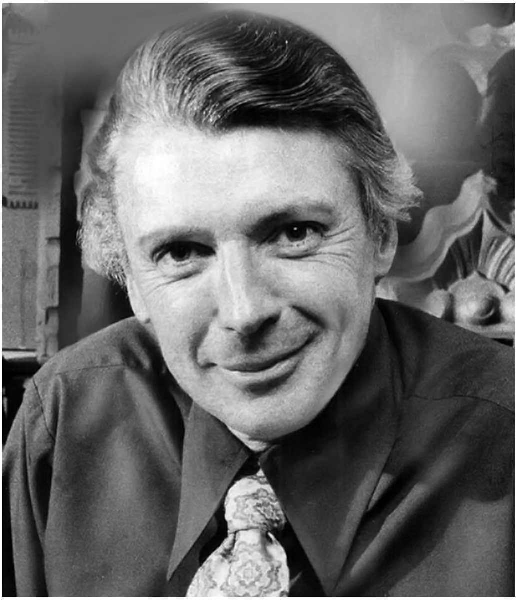

FIGURE 9. Jim in about 1975 when he took the position of Director of the Royal Ontario Museum. Photo: Toronto Star Archives, public domain.

enjoyed for half an hour—while Jim took over the tour of the "Georgian Canada Exhibition". Of course, Jim remembered everything, partly because he had signed the letters requesting the loans of the priceless objects. Imagine him saying: "Your Majesty, you may wish to know that this particular Queen Anne lady's writing table we have borrowed from your Royal collections at Windsor".

When Jim left the university, he continued to supervise his graduate students who met with him regularly in a lofty balcony above the front entrance and overlooking the main rotunda and a spiral staircase with walls of blue and orange sodalite and the back-painted gold mosaic ceiling above. It was created for the 1933 addition to the museum by the first director of archaeology, Charles T. Currelly. The expansion of the ROM that Jim completed won the Governor General's Medal in Architecture in 1989.

Jim's work at the ROM had many facets. He had to manage his board, deal with museum expansion, special exhibits, minerals, textiles, archeology, Chinese and Egyptian artifacts, etc., and he had to allocate his time among all of these areas. He loved all of it as was evident from the way in which his eyes sparkled when he talked about any of it. He was especially proud of the life sciences departments, and he was among those who understood that field biology and the life science collections were essential to discovery and conservation. He knew that every museum person is at least half educator and showman, as he was himself. And he shared the opinion of C.H.D. Clarke, Ontario's Chief of Fish and Wildlife Branch, that "no institution in Canada means more to naturalists than the Royal Ontario Museum" (Barr 1983: 14). The museum was home to the Brodie Club, which started the Federation of Ontario Naturalists (details in Taylor 1981), which gave rise to the Nature Conservancy of Canada, all of them based on the same timeless kinship. (A special issue of *Seasons* [Parsons 1983] is dedicated to the big story of natural history work at the ROM. It is an interesting read.)

Always a Collector

The gardens around the Marburg farm steadily grew as did the number of buildings. By the 1970s and 1980s there were spectacular perennial beds with unusual plants (Figure 10) and many trees and shrubs restricted to the Carolinian ecoregion. Screaming peacocks were chased by Fallow Deer (*Dama dama*), and several semi-domesticated breeds of guinea fowl ran over the lawns. In the fields were Long-horned and Aberdeen Angus cattle, llamas, and emus. Easter Egg (*Araucanus*) chickens were laying pink and blue eggs. In 1963 a dam was built across the small creek creating a beautiful and extensive pond (24 281 m^2). A variety of unusual swans soon arrived. Shelves in the house displayed one of the best collections of Quimper (pronounced "cam-pair") pottery in Canada (a tin-glazed, hand painted pottery from Brittany). There was a collection of a few hundred Moustache Cups, apple peelers, fossils, arrowheads, farm tools, etc. Jim operated his own museum, botanical garden, and zoological park.

Back to Marburg

After splitting his time between Toronto and Marburg for a few decades, Jim returned full-time to Marburg after leaving the ROM at age 60 (Colaicovo 1985). He turned Marburg into a major horticultural showplace. He specialized in wild plants, showy cultivated plants, and agricultural crops. He was the one to beat at the Norfolk County Fair; he would tell tales of his second prize for a 271-pound squash in 1994.

Jim met hundreds of busloads of visitors at the foot of his driveway and provided a free tour packed with information about unusual and spectacular plants, ecology, gardening, and agriculture. Some of the Eva Brook Donly Museum Garden tours that he welcomed included more than 1000 people in a day. He hosted church, society, and family picnics and became well-known to many thousands of people. Guests from as far away as Japan were introduced to rural Canada at Jim's farm. He lectured at the Simcoe/Norfolk Regional Campus of Fanshawe College, chaired many local committees, and was an active member of numerous clubs and societies. He became an honorary life member of some of these groups, including the Norfolk Historical Society in 2015.

FIGURE 10. American Lotus (*Nelumbo lutea* (Willdenow) Persoon), one of the well over 1000 species in Jim's gardens, was one of his favourites. If Jim was told the bus would be another 20 minutes, he could easily fill in the time and keep everyone together by talking about this plant alone. He would discuss its evolution, habitats, dispersal, pollination, uses, distribution, and value for dry bouquets. Photo: Liz West, Massachussetts. CC-BY-2.0.

The Marburg farm, so well known to naturalists and horticulturists, was sold to family in 1997. Jim then moved to a house on Highway 6 with an acre (4047 m^2) of land. It had been a hill of blow sand 70 years earlier. At the time he acquired it, there was just a dense thicket of wild raspberries. Truckloads of these were removed to prepare a biodiversity-rich habitat full of rare plants and many species of restricted range. Surely it is no surprise that he turned this into a spectacular teaching opportunity and again had many visitors (McMillan 2012). It was here that he established an outstanding collection of peonies.

Jim moved to Parkview Meadows Retirement Village in Townsend early in 2013. Here, in his late 80s and early 90s, he took visitors on tours of the pond trail and woods nearby. Naturally, he also had a garden at Townsend where he grew native plants and was eager to show them off. He was mentally and physically well for most of this time and an authoritative speaker. In late 2021, he spent a short time in hospital in Simcoe and passed away on 27 November at almost 96.5 years of age (Tong 2022).

Commemoration

Jim never married, but he was very close to his large family and many friends. He was always surrounded by activity, always seemed to have an audience, and influenced many thousands to love and enjoy nature. People came to him for advice on diverse subjects and for his good judgement. He had numerous achievements in many different fields and received equally diverse awards and honours. Among those not already mentioned were: a Queen's silver Jubilee Medal in 1977, Honorary Doctor of Laws and Letters from University of Guelph in 1982, Ontario Heritage Foundation Award in 2006, Silver Fir Award (the highest honor of the Ontario Horticultural Association) in 2006, and he became an 'Honorary Master Gardener' of the Master Gardeners of Ontario in 2013. *Chrysopsis cruiseana* Dress (= *Chrysopsis gossypina* subsp. *cruiseana*) was named in his honour (Dress 1954) by the compiler of Hortus III and Curator of the Bailey Hortorium at Cornell (Dress 1954).

Jim contributed to field biology and ecology in most of the ways it is possible to do so: as leader, administrator, editor, researcher, innovator, and advocate, but particularly as an exemplary teacher and a close friend.

Acknowledgements

Jim's nephew, Mr. Monte Smith of Port Dover, kindly provided some documents and photographs used here. He also commented on the final draft. Kodachrome slides provided by E. Haber were converted to digital images by Stephen Haber. Brenda Kostiuk assisted with gathering information.

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A tribute to George W. Scotter, 1933–2021

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Describing George Scotter is not easy. Many words come to mind, like curious naturalist, scientist, research director, teacher, conservationist, advocate for parks and wild places, wildflower fancier, and writer. All of them applied at different stages of his life.

George was born and raised in the shadows of the Rockies in southwestern Alberta and credited frequent family visits to the mountains of Waterton/Glacier National Parks with stimulating an insatiable appetite for natural history that developed into a lifelong vocation. He lived and worked in or near the Rockies and northern Canada throughout his life, probing into the lives of native plants, mammals, and birds.

Trained in ecology, botany (Figure 1), taxonomy, and wildlife management, George worked for more than 30 years for Environment Canada's Canadian Wildlife Service based in Edmonton. There, he served as a wildlife biologist, parks research program leader, research scientist, and research director. He also was a professor at Utah State University and directed research for the Utah Division of Wildlife Resources under the Federal Aid in Wildlife Restoration Program. He was a professor in the Department of Recreation Administration and lectured in the Department of Geography and the Faculty of Science at the University of Alberta. He also served as an adjunct professor in Forest Science at the University of Alberta and at the Natural Resources Institute, University of Manitoba.

Figure 1. George on a botanical survey in northern Saskatchewan, 1960. Photo: unknown.

The Far North called him early in his career (Figures 2, 3). George worked on the forage and range requirements of Barren-ground Caribou (*Rangifer tarandus*), an important food source for residents of northern Canada. Following that he studied the potential of the Reindeer (*Rangifer tarandus*) industry in the Mackenzie Delta.

George's emphasis changed in 1968 when he began studies of alpine ecology in the Sunshine area of Banff National Park and trail use by visitors in Waterton Lakes National Park. He was instrumental in introducing controlled burning into the grasslands of Prince Albert and Waterton Lakes National Parks, a practice that is now common. He and associates carried out pioneering studies on visitor impacts on sensitive landscapes in such places as Lake O'Hara in Yoho National Park, the summit area of Mount Revelstoke National Park, Lake Louise and Egypt Lake in Banff National Park, Tonquin Valley in Jasper National Park, and Waterton Lakes National Park. These studies emphasized environmental restoration, use limits, and promoted the use of native plants.

Although reluctant to leave field research, George served as Research Director of the Canadian Wildlife Service from 1978 until his retirement in 1991 but was still involved in some field work, including the first release of Swift Fox (*Vulpes velox*) in Saskatchewan and Alberta, which occurred on private land and in Grasslands National Park from 1983 to 1977 (Figure 4). He was known for his research management ability and especially as a mentor, encouraging and supporting younger scientists within the organization. With never enough money to adequately support ongoing research, one colleague remarked that "Scotter could find money even on the branches of trees".

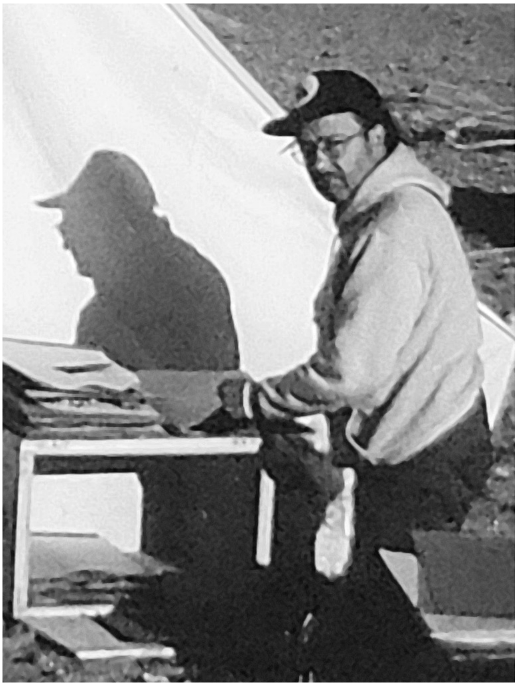

FIGURE 2. George in a field camp at Wager Bay, Northwest Territories. Photo: Geoff Holroyd.

During the 1984 political decimation of the Canadian Wildlife Service, George moved to Ottawa where he found employment for 82 laid-off staff members.

To compensate for the reduced research capabilities caused by the layoffs, George proposed, at a Colloquium on Wildlife Conservation, the establishment of wildlife research institutes at Canadian universities. Although the proposal was considered at the Federal-Provincial/Territorial Wildlife Conference in 1987, only a modified version was ever implemented.

For many years George served as the Canadian Wildlife Service representative on the Beverly-Kaminuriak Caribou Management Board and its successor organizations. The board emerged as a ground-breaking model of cooperation for the successful amalgamation of scientific and traditional knowledge for game management.

George participated as the team leader in preparing planning documents for ten potential national park reserves in northern Canada and southern British Columbia. The first area documented was the South Nahanni. Not content with only preparing a detailed report, he realized the critical importance of public awareness about the iconic Nahanni's potential as a national park. Through both a lecture series that extended from Victoria to Montreal and articles in various magazines, he informed Canadians about its heritage resources. Consequently, the Honourable Jean Chrétien and Prime Minister Pierre Trudeau received many letters supporting the park proposal, leading to its eventual establishment as the Nahanni National

FIGURE 3. George with a Polar Bear (*Ursus maritimus*) immobilized on the west coast of Hudson's Bay as part of a Canadian Wildlife Service long-term study of population dynamics. Photo: unknown.

FIGURE 4. George releasing a Swift Fox (*Vulpes velox*) in 1983 in extreme southwest Saskatchewan as part of the first release of what eventually would total 932 animals and be a significant conservation success story. Photo: unknown; caption information courtesy of Lu Carbyn (CWS, retired).

Park Reserve. George recalled that the initial report was criticized for recommending too large of an area, and the size that gained protection was much smaller. However, by 2009, Nahanni National Park Reserve had been increased by about nine-fold to include nearly the entire watershed. George's role in the establishment of Nahanni is documented in *The Magnificent Nahanni, the Struggle to Protect a Wild Place* by Dr. Gordon Nelson (2017).

Together with an interdisciplinary group of associates, George continued working on establishing national parks in the North. They evaluated many potential sites: Horton/Anderson rivers (1979), Banks Island (1980), Bathurst Inlet (1980), Axel Heiberg Island (1981), Bylot Island (1983), Wager Bay (1987), Melville Hills (1992), and the Western High Arctic (1992).

Retiring from the Canadian Wildlife Service in 1991, George and his wife, Etta, moved to Kelowna, British Columbia. From there he continued to do research on the recovery of a subalpine meadow from visitor impact at Lake O'Hara (Figure 5) and conducted a regional analysis of the Western High Arctic for Parks Canada. In 1998 he studied the British Columbia Interior Dry Plateau for Parks Canada, recommending that part of southern Okanagan, with its host of endangered species and habitats, be considered for national park status. He promoted the concept through presentations to the public, writing, and meetings with politicians.

George maintained his interest in the flora of the Rockies and revised his popular book (Scotter and Flygare 2011) on wildflowers of the Rockies. On a few occasions he was the keynote speaker and field

FIGURE 5. Revisiting Lake O'Hara in Yoho National Park in 2010, one of George's favourite places, where in the early 1970s he studied visitor impacts on the fragile alpine meadows. Photo: Troy Scotter.

trip leader at the North American Rock Garden Society conference in Banff and at the Waterton Wildflower Festival. He also taught classes on wildflowers and led field trips for the Society for Learning in Retirement at Kelowna.

George served as a member or chairman of several committees including Canadian Committee for the International Biological Program, Matador project, University of Saskatchewan (1968–1972); co-chair, with Dr. Valerius Geist, on the Canadian Committee for the International Biological Program, Conservation of Terrestrial Communities, Subcommittee for the forested and montane zones of the Yukon and Northwest Territories (1969–1972); chairman of the big game technical session, Northwest Section of the Wildlife Society (1971); chairman, range ecology session, First International Reindeer/Caribou (1972); member of workshop on Panel 6, Impact of Man on Mountain Ecosystems, Program on Man and the Biosphere (MAB), United Nations Educational, Scientific and Cultural Organization (1973); president of the International Mountain Section, Society for Range Management (1979–1980); member of the Beverly-Kaminuriak Caribou Management Board (1983–1988); co-chair of Special Session 6, Cooperating with Indigenous People to Manage Fish and Wildlife at the North American Wildlife Conference (1991); member and/or chairman of the TD Friends of the Environment Foundation for southeastern British Columbia (5 years); and director of the Central Okanagan Parks and Wildlife Trust, now the Central Okanagan Land Trust (1993–1996).

George served as a national director and Vice-President of the Canadian Nature Federation from 1972 to 1975 and as President during 1975–1976. During that time, he was instrumental in identifying land and financial support that led to the establishment of the Clifford E. Lee Nature Sanctuary near Edmonton. He was an active member of several other conservation groups and professional societies.

He was the 1985 winner of the J.B. Harkin Award from the Canadian Parks and Wilderness Society. The citation (reproduced in Courtney 2021: 5) reads:

> For his long-term, effective and dedicated role as a Canadian Wildlife Service scientist and as a citizen conservationist in advancing wildlife studies and national park identification, planning and management, notably in northern Canada.

Nature Canada also honoured him with the Douglas H. Pimlott Award in 2016, its highest honour, for his lifetime contributions to conservation.

He was the recipient of other awards including the Queen's Silver Jubilee Medal in 1977. He received the Public Service Merit Awards in both 1985 and 1987. He was also presented with a Pendleton Creation Turtle blanket at the Wildflower Festival for his contributions to Waterton Lakes National Park.

Over a period of more than 55 years, George wrote four books and published more than 185 articles in scientific journals, popular magazines, and newsletters (see Bibliography). In addition, he authored or coauthored 56 unpublished reports.

George dedicated much of his life to the preservation of nature and embraced all creatures within it. His passion for nature went beyond merely observing its splendour. He felt that in a world where habitat continues to vanish and the list of endangered species grows longer each year, the only real hope for conservation lies in an informed and concerned public. Through more than 250 presentations, field trips, and writing George endeavoured to educate and encourage awareness and appreciation of the natural world. Audiences for those activities ranged from girl guides and senior citizens to naturalist and professional groups. He was a popular speaker and engaging communicator.

An inveterate collector, eight months before George died a Yukon botanical curator, Bruce Bennett, contacted him asking how many plants he had collected during his career. George answered him with a quip: "I never thought about numbers, but I'm glad you asked that question because it gave me something to do during isolation imposed on me by COVID-19". By contacting upwards of 19 herbaria across North America and Europe where he sent specimens, he ended up replying "I'm confident that my total number of collected plants exceeds 35 000", which may place him among top Canadian botanists. He later revised that total to 36 149 consisting principally of his specialties: 17 231 lichens and 10 236 bryophytes, noting that numbers will increase as "several herbaria have yet to complete digitizing their collections". His numerous collections are a testament to his enthusiasm for field studies. For his many contributions, four species have been named in his honour: Scotter's Lichen (*Cladonia scotteri* Ahti & E.S. Hansen), Scotter's Draba (*Draba scotteri* G.A. Mulligan), *Erigeron scotteri* Boivin (synonymized with Snow Fleabane [*Erigeron nivalis* Nuttall]), and Scotter's Tortula Moss (*Tortula scotteri* Zander & Steere; synonymized with *Hilpertia velenovskyi* (Schiffin.) R.H. Zander).

George considered himself lucky; he seldom distinguished between his vocation and his avocation. Long hours and personal expenditures on projects of interest were part of the game. He considered himself to be a generalist, a polymath, living in a specialists' world. He was a voracious reader and life-long learner. His passion for the natural world has run throughout his life's work. Even as an octogenarian, his knowledge and love for nature remained unbounded as did his advocacy for parks and wilderness.

George valued his relationship with family and close friends with whom he faithfully kept in regular contact. His wife, Etta, and their two children were taken to the field and involved in research to the extent possible. Etta spent many days editing drafts of his numerous reports and publications. George and Etta travelled extensively during retirement and enjoyed an active life. Time for hobbies was limited, but George was an avid dahlia grower, and he enjoyed a game of duplicate bridge.

George died on 14 July 2021 at Kelowna, British Columbia, leaving a natural world a bit better known and better protected from his years of work. As requested, his ashes were scattered on an alpine meadow straddling the Alberta and British Columbia border. He left this world with the belief that there would be more natural history to be studied and more mountains to be climbed.

Acknowledgements

I am grateful to George, a valued friend for many years, for background material that he passed on to me about his career, accomplishments, and life. He had requested that I submit a tribute to *The Canadian Field-Naturalist* a couple of years before he died, so I am carrying out his wishes. Thanks to Troy Scotter, George's son, for providing most of the bibliography's DOIs.

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Book Reviews

Book Review Editor's Note: *The Canadian Field-Naturalist* is a peer-reviewed scientific journal publishing papers on ecology, behaviour, taxonomy, conservation, and other topics relevant to Canadian natural history. In line with this mandate, we review books with a Canadian connection, including those on any species (native or non-native) that inhabits Canada, as well as books covering topics of global relevance, including climate change, biodiversity, species extinction, habitat loss, evolution, and field research experiences.

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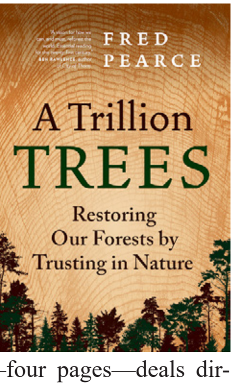
Conservation and Climate Change

A Trillion Trees: Restoring Our Forests by Trusting in Nature

By Fred Pearce. 2022. Greystone Books. 335 pages, 34.95 CAD, Hardcover.



In *A Trillion Trees: Restoring Our Forests by Trusting in Nature*, Fred Pearce offers a sober but not overly pessimistic response to the much-discussed Crowther-Bastin theory that a global reforestation campaign to plant a trillion trees might significantly correct our planetary carbon crisis (see Crowther *et al.* 2015 and Bastin *et al.* 2019). Yet only a surprisingly short segment—four pages—deals directly with the one trillion tree proposal of the book's title.

A few years ago, there arrived an innovative and promising proposal for the Earth's excess carbon problem, and it was welcomed with wide media coverage. Bronson Griscom of The Nature Conservancy argued that "nature-based solutions" could at least initially absorb up to ~23.6 billion tonnes of carbon dioxide a year and, when combined with emissions elimination, the carbon drawdown solution could be in hand (Griscom *et al.* 2017; The Nature Conservancy 2017). Thomas Crowther *et al.* (2015), together with Jean-Francois Bastin *et al.* (2019), developed a technique to map the existing global forest cover and spaces where trees might potentially grow outside of human settlement and agricultural zones. They calculated there was room for a trillion trees, give or take—enough to absorb 205 gigatonnes of excess carbon, which happens to be in the ballpark of what is warming the Earth (300 gigatonnes have been added since the 1800s; see Crowther *et al.* 2015). If true, and the growth was successful and sustainable, it could quickly solve the carbon problem through biological sequestration—the natural absorption and storage of carbon dioxide by plants and vegetation, including trees. It has been estimated that nature-based solutions could provide 30% of the Paris Agreement temperature goals (see Griscom *et al.* 2017). Canada has a plan to plant two billion trees (Government of Canada 2022).

A primary critique of the trillion tree proposal comes from those who are concerned that carbon offsets might discourage de-industrialization. They argue that focussing the public's attention on tree-planting takes away from the larger issue of reducing fossil fuels. The authors of the original trillion tree proposal issued three corrections to their study (Bastin *et al.* 2019), which included a statement that they were wrong to claim "tree restoration is the most effective solution to climate change to date" (Bastin *et al*. 2020: online). Since then, even Crowther has walked back some of his original arguments (Greenfield 2021).

Pearce makes clear at the start of his book that if we want a trillion more trees on our planet—and he believes we should—a large-scale, global project to plant them is entirely unnecessary. Instead, he argues for a primarily naturalized process of tree regeneration and forest expansion supported by Indigenous foresters and small-scale farmers, progressive urban greening policy, and with strategic attention given to key fast-growing regions of the globe. Human-engineered planting is not excluded from the book, but Pearce defers to the well-known (to naturalists) process of ecological succession. He travels the globe in search of a variety of reforestation and afforestation methods, successes, and failures, all while retaining some enthusiasm for the possibility that biological sequestration might work.

But the benefits of reforestation vary region to region. Pearce tells us in *A Trillion Trees* that the conifer forests of Siberia and parts of Canada produce five times more global heating than cooling because their transpiration rates are low, unlike in the Amazon tropics. Pearce also explains that the albedo effect of tree cover absorbing sunlight that otherwise would be reflected by snow can mean that planting trees in the north is counterproductive.

Overall, the expansion of forests worldwide seems to be a worthy project. And, by my calculations, with one million expert tree planters from around the world you could (in theory) "replant" the Earth with a trillion trees in one very optimistic year. Professional tree planters can plant 2000–5000 trees a day (Chaplin 2020); one million professionals × 3000 trees per day × 333 days = ~1 trillion trees. With a 75% tree survival rate and using Crowther *et al.*'s (relatively high) cost of 30 cents paid out per tree (Crowther *et al.* 2015), the overall price tag is chump change, in my opinion. Crowther *et al.* estimated it could cost as little as $300 billion. A conservative estimate by Austin *et al.* (2020) was that it would cost $12 trillion over 30 years. Whatever the imprecision of all these numbers, and the glossing over of the many logistical problems, including growing the seedlings, transport into—and housing tree-planters in—remote areas, drone planting limitations, opening of roads, and biodiversity problems, the project seems feasible over a relatively short length of time. Either way, it seems a deal at any price if trees alone could save the planet from anthropogenic carbon abuse and climate disaster.

What might surprise many is that most forests are neither pristine nor original, even the old ones. One estimate is that up to half the Earth's ice-free surface was under cultivation by humans 6000 years ago (p. 96). That surface is now "almost all marked by extensive human occupation and alterations", says Pearce, although the destruction of trees globally "peaked at the end of the twentieth century" (pp. 7–8). Amazonian forests, therefore, are descendants of human-domesticated species. While 16 000 species persist in those tropics, a mere 227 species "hyperdominate" because of cultivation preferences (p. 88). There is evidence for this in Cambodia and Borneo too, and from the Americas to the Congo. This feeds into Pearce's primary hypothesis that given time and space, the Earth's forests and soils will regenerate themselves. Nature is resilient.

Trees can capture carbon, but they can also contribute to global warming. Trees emit oxygen, and water vapour that creates clouds that reflects sunlight, but also volatile organic compounds (VOCs). The latter may—counterintuitively—cause a buildup of methane (Unger 2014). That balancing act and debate regarding trees as carbon sinks or as liabilities continues.

There is some urgency to the tree expansion problem. In one paper authored by 225 researchers, Pearce found data showing that once daytime temperatures reach 32°C, tree growth declines rapidly and carbon emissions quadruple (Sullivan *et al.* 2020). Wildfires are also increasing, transforming some forests into grasslands. Yet fires are also necessary for new growth and for removing underbrush, and human-prescribed fires known as controlled burning are still a good idea because they can reduce the risk of out-of-control fires from thick undergrowth, grass, and dead branches.

The human impacts of poor forest management are hard to miss. That includes the effects of large-scale conversion of rainforests to rubber plantations and for palm oil. Two-thirds of deforestation in the tropics originates from displacement by large-scale commercial agriculture (p. 137). And unfortunately, the rate of destruction has increased by 43% in the five years since the New York Declaration on Forests in 2014 (p. 143).

More than 40% of European Union timber is cut to produce energy from combustion (p. 129). The Drax power station in North Yorkshire, England, produces more carbon dioxide from burning wood pellets than the combined emissions of 124 nations (p. 130). It is difficult to believe that trees grown in Mississippi, dried and processed into pellets, then transported across the Atlantic by ship to the Drax power plant in central England, could be burned efficiently, even if the forests in Mississippi are being expanded to fit that purpose. The trees removed would need to be replaced tree for tree and in a timely way to be carbon neutral, *A Trillion Trees* points out. Converting 10 of Europe's largest coal-burning power plants to biomass-burning would consume the equivalent of an annual 40 million tonnes of wood pellets (equivalent to half of Germany's Black Forest; p. 133). One possibly sensible option is to deploy bioenergy with carbon capture and storage technology (BECCS), which would bury the carbon dioxide that is expelled.

More than 3.5 billion cubic feet (99 million m^3) of timber—10% of the total trade—was logged illegally in the 2010s (p. 123). China is a major culprit and comes in for pointed criticism in the book. Although banning cutting in their own natural forests, the Chinese have processed timber from elsewhere, including half of the tropical hardwood trade, much of it illegal. This includes "buying okoum*é* from West Africa, meranti from Borneo, teak from Myanmar, greenheart from Guyana, rosewood from Ghana and merbau from Indonesian New Guinea" (p. 124), with Europe as a major market for these "Chinese" timber products and raw logs. Some progress has been seen as a result of a new 2020 Chinese law cracking down on the contraband trade.

There is some more good news. The extent of deforestation may not be as severe as first thought—much of forest loss has regrowth potential. The ratios also vary, with the greatest amount of 'permanent' forest removal happening in Southeast Asia and Latin America, and the least in North America, Russia, and Africa (p. 153).

Animal species are demonstrably more resilient than some think. While El Salvador saw a loss of its pristine forests to coffee and sugar plantations, only three of its 500 bird species were eliminated, leading Pearce to suggest that "even a limited amount of forest can sustain a vast variety of wildlife" (p. 155). And while we should prioritize intact forests, "degraded" forested areas overall may be restored over time. The debate is over the best way to accomplish that. The second half of *A Trillion Trees* delves into this subject area.

We know that trees can return because Europe's trees have successfully regrown since their lowest point in the 1850s, replacing twice as many as were consumed, although not necessarily with the original species, nor with the desired diversity (p. 172). And, key to the book's primary thesis that tree-planting should not be our focus, there is some effort to allow for natural regeneration through the process of succession. If forests were left to regrow for 60 years, they might capture close to the Intergovernmental Panel on Climate Change (IPCC) target of 200 billion carbon tonnes. Succession success has been observed in Puerto Rico, El Salvador, and even parts of Brazil (p. 203).

But is the pace of recovery fast enough? According to Robin Chazdon (2014), 80% of tree species can be anticipated to return in 20 years, and (possibly) 100% in 50 years. Human planting, such as proposed by Bastin and Crowther, is more expensive and probably less successful. However, where there is an absence of trees in the periphery of zones available to regenerate trees lost, a "founder stand" can be planted to hasten the process. The other advantage of natural regeneration is that ecosystems that have altered due to the impact of clearance or climate change will adapt and develop the most effective restoration sequence, which (again) may not result in the original or even indigenous species dominating, but a more durable replacement. For that reason, it may be necessary to boost rare and endangered species.

Contrary to the theory of the tragedy of the commons, there is a good case to be made (and a Nobel Prize for economics citation) for community-owned forests (as distinct from state-owned and "protected" parks), and there is some evidence of success from Nepal, Mexico, Guatemala, the Democratic Republic of the Congo, Ghana, and the mangrove swamps of Tanzania. An estimated half of the world's forests are likely locally- and community-owned (p. 248). The problem has been cattle ranching to service international clients or, in many cases, ill-managed subsistence farming. Large-scale commercial sawmills with markets in the USA, Europe, and Asia are also doing much of the damage.

Pearce also aims a sharp rebuke at "fortress conservationists" who call for removal of Indigenous Peoples from protected areas, even though Indigenous Peoples can be among the most responsible protectors of the land and forests. While *A Trillion Trees* makes a convincing case for the collective property rights of these populations practicing sustainable forest management, some readers may quibble with occasional pronouncements (pp. 231, 240) about "superior" Indigenous knowledge.

This is a good read and a necessary catch-up reference outlining many of the environmental debates around a very current and urgent topic.

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ROBIN COLLINS
Ottawa, ON, Canada

NEW TITLES

Prepared by Jessica Sims

If you are interested in reviewing a book on this list, please contact Jessica Sims (bookrevieweditor@canadianfieldnaturalist.ca). This list covers a range of upcoming and new releases in field biology, ecology, and natural history. We also welcome your suggestions for new titles and offers to review unlisted books with a Canadian connection, including those on any species (native or non-native) that inhabits Canada, or books covering topics of global relevance, including climate change, biodiversity, species extinction, habitat loss, evolution, and field research experiences.

Please note: Books marked with a * have already been assigned to a *Canadian Field-Naturalist* reviewer. All other books are available for review and review copies of books marked with a † have been explicitly offered by publishers.

Currency Codes: CAD Canadian Dollars, AUD Australian Dollars, USD United States Dollars, EUR Euros, GBP British Pounds.

BIOLOGY

A Natural History of the Future: What the Laws of Biology Tell Us about the Destiny of the Human Species. By Rob Dunn. 2021. Basic Books. 320 pages, 38.00 CAD, Hardcover, 21.99 CAD, E-book.

The Individual in the Animal Kingdom. By Julian S. Huxley. Foreword by Richard Gawne and Jacobus J. Boomsma. 2022. MIT Press. 192 pages, 34.53 CAD, Hardcover, 27.19 CAD, E-book. First published in 1912.

Life in the Open Ocean: the Biology of Pelagic Species. By Joseph J. Torres and Thomas G. Bailey. 2022. Wiley. 1008 pages, 113.95 CAD, Hardcover.

†The Parrot in the Mirror: How Evolving to be like Birds Makes us Human. By Antone Martinho-Truswell. 2022. Oxford University Press. 224 pages, 19 black and white images, and four colour plates, 24.95 USD, Hardcover.

Sex in City Plants, Animals, Fungi, and More: a Guide to Reproductive Diversity. By Kenneth D. Frank. 2022. Columbia University Press. 208 pages, 39.00 CAD, Paper.

Sounds Wild and Broken: Sonic Marvels, Evolution's Creativity, and the Crisis of Sensory Extinction. By David George Haskell. 2022. Viking. 448 pages, 39.00 CAD, Hardcover, 16.99 CAD, E-book.

BOTANY

Field Study: Meditations on a Year at the Herbarium. By Helen Humphreys. 2021. ECW Press. 232 pages, 32.95 CAD, Hardcover, 14.39 CAD, E-book.

Floral Diagrams: an Aid to Understanding Flower Morphology and Evolution. Second Edition. By Louis P. Ronse De Craene. 2022. Cambridge University Press. 500 pages and 28 new diagrams, 68.95 CAD, Paper.

Gifted Earth: the Ethnobotany of the Quinault and Neighboring Tribes. By Douglas Deur in Cooperation with the Quinault Indian Nation. 2022. Oregon State University Press. 272 pages, 36.95 CAD, Paper.

Hidden Beauty: an Exploration of Qatar's Native and Naturalised Flora. By Renee Richer and Sabrina Knees. 2022. Akkadia Press. 532 pages, 134.00 GBP, Hardcover.

Kaplan's Principles of Plant Morphology. First Edition. By Donald Kaplan and Chelsea D. Specht. 2022. CRC Press. 1317 pages and 1848 black and white illustrations, 484.00 CAD, Hardcover.

Native and Ornamental Conifers in the Pacific Northwest: Identification, Botany, and Natural History. By Elizabeth A. Price. 2022. Oregon State University Press. 344 pages, 30.95 CAD, Paper.

Nepenthes: the Tropical Pitcher Plants, Volumes 1, 2, and 3. By Stewart McPherson. 2022. Redfern Natural History. 1350 pages and 3000+ colour photos, 149.97 GBP, Paper.

Now is the Time for Trees: Make an Impact by Planting the Earth's Most Valuable Resource. By Arbor Day Foundation, Dan Lambe, and Lorene Edwards Forkner. 2022. Timber Press. 216 pages, 26.95 CAD, Paper.

Ontario's Old-Growth Forests. Second Edition. By Michael Henry and Peter Quinby. 2021. Fitzhenry & Whiteside. 224 pages, 40.00 CAD, Hardcover.

Shrubs to Know in Pacific Northwest Forests. By Edward C. Jensen. 2022. Oregon State University Press. 148 pages, 18.95 CAD, Paper.

†Stelar Evolution and Morphology in Selected Taxa based on Vasculotaxy (*studium novum*). Second Edition. By Kevin R. Aulenback. 2022. Kevin

Aulenback. 264 pages and 258 figures and illustrations, 149.95 CAD, Paper.

Urban Lichens: a Field Guide for Northeastern North America. By Jessica L. Allen and James C. Lendemer. Illustrated by Jordan R. Hoffman. 2021. Yale University Press. 168 pages and 121 colour illustrations, 33.95 CAD, Paper.

Conservation and Climate Change

The Atlas of a Changing Climate: Our Evolving Planet Visualized with More Than 100 Maps, Charts, and Infographics. By Brian Buma. 2021. Timber Press. 280 pages, 48.00 CAD, Hardcover.

Birds, Beasts and Bedlam: Turning My Farm into an Ark for Lost Species. By Derek Gow. 2022. Chelsea Green Publishing. 208 pages, 25.00 USD, Hardcover.

A Blue New Deal: Why We Need a New Politics for the Ocean. By Chris Armstrong. 2022. Yale University Press. 272 pages, 39.00 CAD, Hardcover, 29.99 CAD, E-book.

A Brief History of the Earth's Climate: Everyone's Guide to the Science of Climate Change. By Steven Earle. 2021. New Society Publishers. 208 pages, 19.99 CAD, Paper, 15.99 CAD, E-book.

The Chimpanzee Whisperer: a Life of Love and Loss, Compassion and Conservation. By Stany Nyandwi. 2022. Arcade. 232 pages, 36.99 CAD, Hardcover.

Ever Green: Saving Big Forests to Save the Planet. By John W. Reid and Thomas E. Lovejoy. 2022. W.W. Norton. 320 pages, 40.00 CAD, Hardcover, 30.99 CAD, E-book.

Global Warming of 1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-Industrial Levels in Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate Poverty. By Intergovernmental Panel on Climate Change (IPCC). 2022. Cambridge University Press. 630 pages, 114.95 CAD, Paper. Freely available as PDF from https://www.ipcc.ch/sr15/.

Hurricane Lizards and Plastic Squid: the Fraught and Fascinating Biology of Climate Change. By Thor Hanson. 2021. Basic Books. 304 pages, 35.00 CAD, Hardcover, 20.99 CAD, E-book.

†Infectious Disease Ecology and Conservation. By Johannes Foufopoulos, Gary A. Wobeser, and Hamish McCallum. 2022. Oxford University Press. 304 pages, 80 colour images, and 13 tables, 100.00 USD, Hardcover, 91.99 CAD, Paper.

Is Science Enough? Forty Critical Questions About Climate Justice. By Aviva Chomsky. 2022. Beacon Press. 240 pages, 22.00 CAD, Paper.

Life on the Rocks: Building a Future for Coral Reefs. By Juli Berwald. 2022. Riverhead Books. 352 pages, 37.00 CAD, Hardcover, 16.99 CAD, E-book.

Managing Environmental Conflict: an Earth Institute Sustainability Primer. By Joshua D. Fisher. 2022. Columbia University Press. 216 pages, 104.00 CAD, Hardcover.

The Nature of Tomorrow: a History of the Environmental Future. By Michael Rawson. 2021. Yale University Press. 248 pages, 39.00 CAD, Hardcover, 29.99 CAD, E-book.

Save Our Species: Endangered Animals and How You Can Save Them. By Dominic Couzens. Illustrated by Sarah Edmonds. 2021. HarperCollins. 240 pages, 19.99 CAD, Hardcover.

Security and Conservation: the Politics of the Illegal Wildlife Trade. By Rosaleen Duffy. 2022. Yale University Press. 304 pages, 45.50 CAD, Hardcover, 34.99 CAD, E-book.

The Treeline: the Last Forest and the Future of Life on Earth. By Ben Rawlence. 2022. St. Martin's Publishing Group. 320 pages, 39.99 CAD, Hardcover, 15.99 CAD, E-book.

Wetlands Conservation: Current Challenges and Future Strategies. Edited by Sanjeev Sharma and Pardeep Singh. 2021. Wiley. 320 pages, 165.00 USD, Hardcover.

†Wilder: How Rewilding is Transforming Conservation and Changing the World. By Millie Kerr. 2022. Bloomsbury Sigma. 320 pages, 37.00 CAD, Hardcover, 20.79 CAD, E-book.

Why Conserve Nature? Perspectives on Meanings and Motivations. By Stephen Trudgill. 2022. Cambridge University Press. 412 pages, 126.95 CAD, Hardcover.

Ecology

The Great Eagles: Their Evolution, Ecology, and Conservation. By Michael O'Neal Campbell. 2022. CRC Press. 624 pages, 399.50 CAD, Hardcover.

Insect Ecology: an Ecosystem Approach. Fifth Edition. By Timothy Schowalter. 2022. Academic Press. 942 pages, 224 CAD, Hardcover.

†Methods for Ecological Research on Terrestrial Small Mammals. By Robert McCleery, Ara Monadjem,

L. Mike Conner, James D. Austin, and Peter John Taylor. 2022. Johns Hopkins University Press. 380 pages, 59.95 USD, Hardcover or E-book.

Mycorrhizal Dynamics in Ecological Systems. By Michael F. Allen. 2022. Cambridge University Press. 318 pages, 105.00 USD, Hardcover, 49.99 USD, Paper, 40.00 USD, E-book.

Vultures of the World: Essential Ecology and Conservation. By Keith L. Bildstein. 2022. Cornell University Press. 256 pages, 47.95 CAD, Hardcover, 16.99 CAD, E-book.

Watersheds: a Practical Handbook for Healthy Water. Second Edition. By Clive Dobson and Gregor Gilpin Beck. 2022. Firefly Books. 160 pages and 100+ illustrations, 19.95 CAD, Paper.

Worlds of Gray and Green: Mineral Extraction as Ecological Practice. By Sebastián Ureta and Patricio Flores. 2022. University of California Press. 162 pages, 85.00 USD, Hardcover, 29.95 USD, Paper or E-book.

Entomology

Endless Forms: the Secret World of Wasps. By Seirian Sumner. 2022. HarperCollins. 400 pages, 35.99 CAD, Hardcover, 14.99 CAD, E-book.

The Guests of Ants: How Myrmecophiles Interact with Their Hosts. By Bert Hölldobler and Christina L. Kwapich. 2022. Belknap Press. 576 pages, 205 colour photographs, and 15 colour illustrations, 69.95 USD, Hardcover.

The Insect Crisis: the Fall of the Tiny Empires That Run the World. By Oliver Milman. 2022. W.W. Norton. 272 pages, 36.95 CAD, Hardcover, 26.59 CAD, E-book.

Insect Diapause. By David L. Denlinger. 2022. Cambridge University Press. 464 pages, 74.95 CAD, Hardcover.

Pollinators in Crisis: How We Can All Give Them a Helping Hand. By Michael Fogden. Photographs by Patricia Fogden. 2022. NatureBureau. 184 pages, 24.50 GBP, Hardcover.

***Tiger Beetles of Manitoba: Life History, Ecology and Microsculpture**. By Robert E. Wrigley. 2022. Robert E. Wrigley. 106 pages and 80 images, 20.00 CAD, Paper.

Herpetology

Amphibian Biology, Volume 9, Part 5: the Conservation and Biogeography of Amphibians in the Caribbean. Edited by Neftalí Ríos-López and Harold Heatwole. 2022. Pelagic Publishing. 576 pages, 120.00 GBP, Hardcover.

Sea Turtles to Sidewinders: a Guide to the Most Fascinating Reptiles and Amphibians of the West. By Charles Hood, Erin Westeen, and Jose Gabriel Martinez-Fonseca. 2022. Timber Press. 26.95 CAD, Paper, 15.99 CAD, E-book.

The Secret Life of the Adder: the Vanishing Viper. By Nicholas Milton. 2022. White Owl. 168 pages, 49.95 USD, Hardcover, 13.49 USD, E-book.

Ornithology

Around the World in 80 Birds. By Mike Unwin. Illustrated by Ryuto Miyake. 2022. Laurence King Publishing. 224 pages, 35.99 CAD, Hardcover.

†Bird Migration: a New Understanding. By John Rappole. 2022. Johns Hopkins University Press. 344 pages, 34.95 USD, Hardcover or E-book.

Birds and Us: a 12,000-Year History from Cave Art to Conservation. By Tim Birkhead. 2022. Princeton University Press. 496 pages, 35.00 USD, Hardcover.

Conservation of Marine Birds. First Edition. Edited by Lindsay Young and Eric Vanderwerf. 2022. Academic Press. 441 pages, 150.00 CAD, Paper.

Gulls of North America. By Fred Shaffer, III. 2022. Schiffer Publishing. 288 pages and 500+ colour photos, 28.99 CAD, Paper.

Halcyon Journey: in Search of the Belted Kingfisher. By Marina Richie. Illustrated by Ram Papish. 2022. Oregon State University Press. 264 pages, 19 black and white images, and one map, 30.95 CAD, Paper.

Hummingbirds: a Celebration of Nature's Jewels. By Glenn Bartley and Andy Swash. Illustrated by Jeanne Melchels. 2022. Princeton University Press. 288 pages, 550 colour photos, 25 colour illustrations, and 57 black and white illustrations, 47.99 CAD, Hardcover, 34.99 CAD, E-book.

Learning the Birds: a Midlife Adventure. By Susan Fox Rogers. 2022. Three Hills. 320 pages, 28.95 USD, Hardcover, 13.99 USD, E-book.

The Origin and Distribution of Birds in Coastal Alaska and British Columbia: the Lost Manuscript of Ornithologist Harry S. Swarth. By Christopher W. Swarth. 2022. Oregon State University Press. 170 pages, 36.95 CAD, Paper.

The Screaming Sky: in Pursuit of Swifts. By Charles Foster. 2021. Little Toller Books. 185 pages, 12.00 GBP, Paper, 9.99 CAD, E-book. Hardcover edition published in 2021.

†The Secret Perfume of Birds: Uncovering the Science of Avian Scent. By Danielle Whittaker. 2022. Johns Hopkins University Press. 296 pages, 27.95 USD, Hardcover or E-book.

Zoology

†Annelida. By Greg Rouse, Fredrik Pleijel, and Ekin Tilic. 2022. Oxford University Press. 432 pages, 155 colour line figures and illustrations, and 16 colour gallery illustrations, 165.00 USD, Hardcover.

†Field Guide to Whales, Dolphins and Porpoises. By Mark Carwardine. Illustrations by Martin Camm. 2022. Bloomsbury Wildlife. 288 pages and 500+ illustrations, 29.00 CAD, Paper, 20.89 CAD, E-book.

†The Hair Scale Identification Guide to Terrestrial Carnivores of Canada. By Justin Kestler. 2022. Pelagic Publishing. 128 pages, 30.00 GBP, Paper.

The Kootenay Wolves: Five Years Following a Wild Wolf Pack. By John E. Marriott. 2022. Rocky Mountain Books. 176 pages, 45.00 CAD, Hardcover.

A Miscellany of Bats. By M. Brock Fenton and Jens Rydell. 2022. Pelagic Publishing. 208 pages, 54.00 CAD, Paper.

Oribatid Mites: Biodiversity, Taxonomy and Ecology. By Valerie Behan-Pelletier and Zoë Lindo. 2022. CRC Press. 376 pages, 130.00 USD, Hardcover.

Primate Cognitive Studies. By Bennett L. Schwartz and Michael J. Beran. 2022. Cambridge University Press. 500 pages, 149.95 CAD, Hardcover.

The Process of Animal Domestication. By Marcelo Sánchez-Villagra. 2022. Princeton University Press. 352 pages, 110.00 USD, Hardcover, 45.00 USD, Paper.

Reindeer Reflections: Lessons from an Ancient Culture. By Jerry Haigh. 2021. Rocky Mountain Books. 280 pages, 32.00 CAD, Hardcover.

The Rise and Reign of the Mammals: a New History, from the Shadow of the Dinosaurs to Us. By Steve Brusatte. 2022. Mariner Books. 528 pages, 36.99 CAD, Hardcover, 14.99 CAD, E-book.

The Social Lives of Animals: How Co-operation Conquered the Natural World. By Ashley Ward. 2022. Basic Books. 384 pages, 38.00 CAD, Hardcover, 21.99 CAD, E-book.

†Why Sharks Matter: a Deep Dive with the World's Most Misunderstood Predator. By David Shiffman. 2022. Johns Hopkins University Press. 383 pages, 24.95 USD, Hardcover or E-book.

Other

†30 Animals That Made Us Smarter: Stories of the Natural World That Inspired Human Ingenuity. By Patrick Aryee. 2022. Island Press. 384 pages and 42 illustrations, 25.00 USD, Paper, 24.99 USD, E-book.

The Accidental Ecosystem: People and Wildlife in American Cities. By Peter S. Alagona. 2022. University of California Press. 296 pages, 29.95 USD, Hardcover or E-book.

A Brief History of Earth: Four Billion Years in Eight Chapters. By Andrew H. Knoll. 2021. Custom House. 272 pages, 30.00 CAD, Hardcover.

A Clouded Leopard in the Middle of the Road: New Thinking about Roads, People, and Wildlife. By Darryl Jones. 2022. Cornell University Press. 272 pages, 25.95 CAD, Paper, 10.29 CAD, E-book.

Our Common Ground: a History of America's Public Lands. By John D. Leshy. 2022. Yale University Press. 736 pages, 58.50 CAD, Hardcover, 44.99 CAD, E-book.

The Complete Guide to Restoring Your Soil: Improve Water Retention and Infiltration, Support Microorganisms and Other Soil Life, Capture More Sunlight, and Build Better Soil with No-Till, Cover Crops, and Carbon-Based Soil Amendments. By Dale Strickler. 2021. Storey Publishing. 352 pages, 33.95 CAD, Paper.

Dark Days at Noon: the Future of Fire. By Edward Struzik. 2022. McGill-Queens University Press. 320 pages, 39.95 CAD, Hardcover.

Diary of a Young Naturalist. By Dara McAnulty. 2021. Greystone. 226 pages, 29.95 CAD, Hardcover.

The Fallen Stones: Chasing Butterflies, Discovering Mayan Secrets, and Looking for Hope Along the Way. By Diana Marcum. 2022. Little A. 220 pages, 34.95 CAD, Hardcover.

Forest School for Grown-ups: Explore the Wisdom of the Woods. By Richard Irvine. Illustrated by Paul Oakley. 2022. Chronicle Books. 160 pages, 39.95 CAD, Hardcover, 17.59 CAD, E-book.

How to Forage for Mushrooms without Dying: an Absolute Beginner's Guide to Identifying 29 Wild,

Edible Mushrooms. By Frank Hyman. 2021. Storey Publishing. 256 pages, 22.95 CAD, Paper.

Islands of Abandonment: Nature Rebounding in the Post-Human Landscape. By Cal Flyn. 2021. Viking. 384 pages, 35.25 CAD, Hardcover, 24.00 CAD, Paper, 16.99 CAD, E-book.

Large Rivers: Geomorphology and Management. Second Edition. Edited by Avijit Gupta. 2022. Wiley. 1104 pages, 306.00 CAD, Hardcover.

The Lives of Fungi: a Natural History of Our Planet's Decomposers. By Britt Bunyard. 2022. Princeton University Press. 288 pages, 29.95 USD, Hardcover.

National Parks Forever: Fifty Years of Fighting and a Case for Independence. By Jonathan Jarvis and T. Destry Jarvis. 2022. University of Chicago Press. 240 pages, 34.53 CAD, Paper, 24.99 CAD, E-book.

Nature is a Human Right: Why We're Fighting for Green in a Gray World. By Ellen Miles. 2022. DK. 320 pages, 25.99 CAD, Hardcover.

Nature Writing for Every Day of the Year. Edited by Jane McMorland Hunter. 2021. Batsford. 464 pages, 39.99 CAD, Hardcover.

One Inch from Disaster: True Tales from the Wilds of British Columbia. By Kelly Randall Ricketts. 2022. Harbour Publishing. 256 pages, 22.95 CAD, Paper, 12.79 CAD, E-book.

Otherlands: Journeys in Earth's Extinct Ecosystems. By Thomas Halliday. 2022. Allen Lane. 416 pages, 36.00 CAD, Hardcover, 16.99 CAD, E-book.

Rivers Run Through Us: a Natural and Human History of Great Rivers of North America. By Eric B. Taylor. 2021. Rocky Mountain Books. 464 pages, 38.00 CAD, Hardcover.

Swamp Songs: Journeys through Marsh, Meadow, and Other Wetlands. By Tom Blass. 2022. Bloomsbury. 336 pages, 18.86 CAD, E-book.

†Tree Story: the History of the World Written in Rings. By Valerie Trouet. 2022. Johns Hopkins University Press. 264 pages, 27.00 USD, Hardcover, 19.95 USD, Paper or E-book.

†Urban Wild: 52 Ways to Find Wildness on Your Doorstep. By Helen Rook. 2022. Bloomsbury Wildlife. 224 pages, 38.00 CAD, Hardcover, 21.29 CAD, E-book.

Visions of Nature: How Landscape Photography Shaped Settler Colonialism. By Jarrod Hore. 2022. University of California Press. 352 pages, 107.00 CAD, Hardcover, 37.95 CAD, Paper, 29.89 CAD, E-book.

Wildlife Photography Fieldcraft. By Susan Young. 2022. Pelagic Publishing. 240 pages, 24.99 GBP, Paper.

The Women Who Saved the English Countryside. By Matthew Kelly. 2022. Yale University Press. 400 pages, 47.09 CAD, Hardcover, 34.99 CAD, E-book.

A World Without Soil: the Past, Present, and Precarious Future of the Earth Beneath Our Feet. By Jo Handelsman and contribution by Kayla Cohen. 2021. Yale University Press. 272 pages, 36.50 CAD, Hardcover, 27.99 CAD, E-book.

The Zone: Rediscovering Our Natural Self. By Rob Wood. 2022. Rocky Mountain Books. 112 pages, 15.00 CAD Paper, 7.19 CAD, E-book.

The Canadian Field-Naturalist

News and Comment

Compiled by Amanda E. Martin

Upcoming Meetings and Workshops

Mycological Society of America Annual Meeting

The annual meeting of the Mycological Society of America to be held 10–14 July 2022 as a hybrid event, with online content and an in-person meeting at the Hilton University of Florida Conference Center Gainesville, Gainesville, Florida. The theme of the conference is: 'Mycology in the Swamp'. Registration is currently open. More information is available at https://msafungi.org/2022-msa-annual-meeting-mycology-in-the-swamp/.

ICUW 2022: International Conference on Urban Wildlife

The International Conference on Urban Wildlife to be held as an online meeting 12–13 July 2022. Registration is currently open. More information is available at https://waset.org/urban-wildlife-conference-in-july-2022-in-ottawa.

Mothapalooza 2022

Mothapalooza 2022 to be held 15–17 July 2022 at the Highlands Nature Sanctuary, Arc of Appalachia Preserve System, Bainbridge, Ohio. More information is available at https://arcofappalachia.org/mothapalooza/.

North American Congress for Conservation Biology

The North American Congress for Conservation Biology to be held 16–21 July 2022 as a hybrid event, with online content and an in-person meeting at the Silver Legacy, Reno, Nevada. The theme of the conference is: 'Restoring Connections and Building Resilience in a Changed World'. Registration is currently open. More information is available at https://scbnorthamerica.org/index.php/naccb-2022/.

Wilson Ornithological Society Annual Meeting

The 103rd annual meeting of the Wilson Ornithological Society to be held 17–20 July 2022 at the DoubleTree by Hilton Hotel, Santa Fe, New Mexico. Registration is currently open. More information is available at https://wos2022.org/. The Wilson Ornithological Society will also be holding an online, post-meeting event on 25 July 2022. See https://wos2022.org/post-meeting-virtual-event/ for details.

Acadian Entomological Society Annual Meeting

The 79th annual meeting of the Acadian Entomological Society to be held 22 July 2022 as a hybrid event, with online content and an in-person meeting at the Dalhousie University Agricultural Campus, Truro, Nova Scotia. The theme of the conference is: 'Tentatively out of Torpor'. Registration is currently open. More information is available at https://www.acadianes.ca/.

Botany 2022

Botany 2022 to be held 24–27 July 2022 as a hybrid event, with online content and an in-person meeting at the Dena'ina Center, Anchorage, Alaska. The theme of the conference is: 'Plants at the Extreme!' Registration is currently open. More information is available at https://2022.botanyconference.org/.

Conservation and Biology of Tortoises and Freshwater Turtles Annual Symposium

The 20th annual symposium on the Conservation and Biology of Tortoises and Freshwater Turtles, hosted by the Turtle Survival Alliance and IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, to be held 7–11 August 2022 as a hybrid event, with online content and an in-person meeting at the Loews Ventana Canyon Resort, Tucson, Arizona. Registration is currently open. More information is available at https://turtlesurvival.org/2022symposium/.

Northeast Partners in Amphibian and Reptile Conservation Annual Meeting

The annual meeting of the Northeast Partners in Amphibian and Reptile Conservation to be held 10–12 August 2022 at the Canaan Valley Resort & Conference Center, West Virginia. Registration is currently open. More information is available at http://northeastparc.org/next-meeting-info/.

ESACSEE 2022

The joint meeting of the Ecological Society of America Meeting (ESA) and Canadian Society for Ecology and Evolution (CSEE) to be held 14–19 August 2022 as a hybrid event, with online content and an in-person meeting at the Palais des congrès de Montréal, Montréal, Quebec. The theme of the conference is: 'A Change is Gonna Come'. Registration is currently open. More information is available at https://www.esa.org/montreal2022/.

American Fisheries Society

The 152nd annual meeting of the American Fisheries Society (AFS), hosted by the American Fisheries Society, President Leanne Roulson, the AFS Western Division, and the Washington – British Columbia Chapter, to be held 21–25 August 2022 as a hybrid event, with online content and an in-person meeting at the Spokane Convention Center, Spokane, Washington. The theme of the conference is: 'What Do Fish Mean to Us?' Registration is currently open. More information is available at https://afsannualmeeting.fisheries.org/.

James Fletcher Award for *The Canadian Field-Naturalist* Volume 135

The James Fletcher Award is awarded to the authors of the "best" paper published in a volume of *The Canadian Field-Naturalist* (CFN). The award is in its sixth year. The award honours James Fletcher, founder of the Ottawa Field-Naturalists' Club (OFNC) and the first editor of CFN's earliest iteration, *Transactions of the Ottawa Field-Naturalists' Club*. The editorial team of CFN sifted through all papers in Volume 135 of CFN and came up with a list of the top four papers. From these top four, the committee selected the top paper. The award for Volume 135 of CFN goes to:

Emma S. Lehmberg, Graydon McKee, and Michael D. Rennie. Hiding in plain sight: combining field-naturalist observations and herbarium records to reveal phenological change. Canadian Field-Naturalist 135(4): 361–376. https://doi.org/10.22621/cfn.v135i4.2567

– A study combining 80 years of voucher specimens and local natural history observations to find some surprising results about the effects of climate change on flowering times near Thunder Bay, Ontario.

Congratulations to Emma Lehmberg and co-authors for their excellent paper.

Honourable Mentions (in chronological order):

Irwin M. Brodo, Robert E. Lee, Colin Freebury, Pak Yau Wong, Christopher J. Lewis, and R. Troy McMullin. Additions to the lichens, allied fungi, and lichenicolous fungi of the Ottawa region in Ontario and Quebec, with reflections on a changing biota. Canadian Field-Naturalist 135(1): 1–27. https://doi.org/10.22621/cfn.v135i1.2557

– An update to the inventory of lichens, allied fungi, and their parasites in the Ottawa region, increasing the number of known species from 391 (in 1988) to 543 (current) through the review of voucher specimens at the Canadian Museum of Nature collected by the authors and others.

Hugo Reis Medeiros, John E. Maunder, Sean Haughian, and Karen A. Harper. Abundance and arboreal tendencies of slugs in forested wetlands of southwestern Nova Scotia, Canada. Canadian Field-

Naturalist 135(3): 305–316. https://doi.org/10.22621/cfn.v135i3.2677

– Use of a novel technique (pitfall traps in trees) to document abundance and arboreal tendencies of native and non-native slugs, a potential threat to native slugs and at-risk lichens in Nova Scotia.

Courtney C. Irvine and Lucy D. Patterson. Status and declining trend of Sparrow's-egg Lady's-slipper (*Cypripedium passerinum*) orchids in Pukaskwa National Park, Ontario, Canada. Canadian Field-Naturalist 135(4): 387–395. https://doi.org/10.22621/cfn.v135i4.2723

– Long-term monitoring (1979–2019) of a disjunct population of Sparrow's-egg Lady's-slipper (*Cypripedium passerinum*) orchids in Pukaskwa National Park, Ontario reveals a decline in number of colonies and lack of recruitment due to changing habitat conditions caused by natural and anthropogenic factors, suggesting an increased risk of extirpation.

Congratulations to these finalists. We would also like to show our appreciation to all authors who chose to share their interesting and valuable field-based studies with the readers of Volume 135 of *The Canadian Field-Naturalist*.

WILLIAM HALLIDAY, AMANDA E. MARTIN,
and DWAYNE A.W. LEPITZKI
OFNC Publication Committee

In Memoriam: Theresa (Aniskowicz) Fowler (27 March 1948–13 May 2022)

Canada recently lost another champion of biodiversity and former member of COSEWIC (Committee on the Status of Endangered Wildlife in Canada; see also Lepitzki 2021), when Theresa (Aniskowicz) Fowler (Figure 1) passed away after a lengthy battle with cancer at Shawville, Quebec. She first attended COSEWIC meetings in the 1990s, as the conservation director for the Canadian Nature Federation (now Nature Canada), when that non-government organization along with World Wildlife Fund Canada and the Canadian Wildlife Federation were COSEWIC members. Soon after she started working at the Canadian Wildlife Service (CWS), she continued her association and became a CWS member of COSEWIC. In 1994, the mandate of COSEWIC expanded to include lichens, mosses, and invertebrates, the latter with the formation of the Lepidoptera and Mollusca Working Group (COSEWIC 2021), which she helped establish and chair, eventually sharing the chairing duties with Dr. Gerry Mackie (University of Guelph). D.A.W.L. first 'met' Theresa when she was responsible for shepherding the 1997 Status Report on Banff Springs Snail (*Physella johnsoni*) through the status assessment process. In 2000, the invertebrate working group split into the Mollusca and Lepidoptera Specialist Subcommittees (SC), which later evolved into the current Arthropods SC. For a while she also co-chaired the Arthropods SC with Dr. Paul Catling (Honorary OFNC member and Associate Editor of *The Canadian Field Naturalist* [CFN]). There has always been a close association between CFN and COSEWIC (Lepitzki 2017).

FIGURE 1. Theresa Fowler at the spring 2008 COSEWIC wildlife species assessment meeting, Yellowknife, Northwest Territories. Photo: Erich Haber (former Vascular Plants SC Co-chair).

Theresa was knowledgeable, thorough, and passionate about her work; it was evident when she spoke during species assessment meetings that every report she reviewed was subjected to a high level of scrutiny. The stack of binders containing the printed status reports was a trade mark.

Of course that wasn't all she did as she gave a considerable amount of advice to senior management, managed staff, and wrote many government documents related to various wildlife issues and mentored many individuals, including one who became her successor on COSEWIC following her retirement.

In her personal life, Theresa was a gifted photographer, amazing gardener, sang in a choir, and spearheaded a local committee which advocated successfully against a project deemed to have a negative environmental impact on the region where she lived.

She had dogs and cats over the years and also took in orphaned baby skunks, raccoons, chipmunks, squirrels, an injured butterfly, and more recently, an injured owl.

Theresa will be remembered by many for her contribution to the conservation of biodiversity in Canada but also because she was a genuine, good person, respected, and well-liked by those who knew her.

Her obituary can be found at https://ottawacitizen.remembering.ca/obituary/theresa-fowler-1085186992.

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S. SHEPPARD
COSEWIC Secretariat (retired)

D.A.W. LEPITZKI
CFN Editor-in-Chief
Member of COSEWIC
Co-chair Mollusc SC of COSEWIC

The Canadian Field-Naturalist

Draft Minutes of the 143rd Annual Business Meeting (ABM) of the Ottawa Field-Naturalists' Club, 11 January 2022

Held by Zoom meeting during COVID-19 pandemic.
Chairperson: Jakob Mueller, President

The Zoom meeting was attended by 55 participants. The minutes of the previous ABM, the financial statements, Treasurer's Report, and Annual Reports of the Ottawa Field-Naturalists' Club (OFNC) Committees for 2020–2021 had previously been available on the Club's website. During the meeting, relevant documents were projected on the screen for the audience's reference.

Jakob Mueller called the meeting to order at 7:35 p.m. and welcomed the participants.

The Zoom host, Ken Young, explained how the Zoom meeting and voting would work.

1. Approval of the Agenda

It was moved by Jakob Mueller, seconded by Janette Niwa, that the Agenda be accepted as distributed.

Carried

2. Minutes of the Previous Annual Business Meeting (ABM)

It was moved by Elizabeth Moore, seconded by Diane Lepage, that the minutes of the 142nd ABM be accepted as distributed and published in *The Canadian Field Naturalist* (CFN).

The motion was opened to discussion. Annie Bélair reported that she had been advised that, with respect to Item 8, Fenja Brodo had not, in fact, been the first to work with a computer on *Trail & Landscape* (T&L) and asked that the minutes of the 142nd ABM be amended to reflect this.

Jakob Mueller brought the motion that the minutes of the 142nd ABM, as amended, be accepted as distributed and published in CFN, to the vote.

Carried

3. Business Arising from the Minutes

a) Ethical Investing:

Catherine Hessian, Investment Manager, responded to a question that had been asked at the 2021 ABM as to whether the Club has an ethical investing policy.

The Finance Committee of the OFNC reviewed best practices of ethical investing, that is taking account of environmental, social, and governance (ESG) criteria when making investments. We concluded that the Investment Manager will continue to exercise discretion in choosing bond investments that do not conflict with OFNC's mandate. She can handle ethical issues on a case-by-case basis. There are two reasons for not adopting a specific policy: the difficulty of defining criteria to be used and the limited choice of investment instruments available to the OFNC.

An additional level of oversight is being added in the form of an annual investments review to the Board of Directors. The Board of Directors could then advise of ethical issues with any of the issuers. The Board can also be pro-active in informing the Investment Manager of ethical issues that arise. The Investment Manager would take these judgements into account in choosing issuers.

4. Treasurer's Report by Ann Mackenzie

The Ottawa Field-Naturalists' Club continues to remain in a solid financial position. For the second year in a row, revenues have exceeded expenses by a very comfortable margin. This is a result of generous donations combined with reduced expenses as COVID limited the scope of some Club activities.

We were pleased to be able to have a plant sale this year. This is the major fundraiser for the Fletcher Wildlife Garden (FWG) and is very popular in the Ottawa community. In 2020 it had to be cancelled with only minor sales. This year it was made a virtual event with ordering and paying online and then curbside pick-up. It was so popular that it raised the most money ever: \$7813 compared to \$6736 two years previously.

There were a few very large donations to the General Fund and one to the FWG resulting in increased revenue. Safe Wings continues to attract considerable donations totalling over \$11 000 this year. Many of the donors are not members of the Club but are expressing their appreciation for the work of the Safe Wings volunteers. On the other side of the equation, the expenses of running such a large and complex operation are considerable, also totalling about \$11 000.

Both the revenues and expenses for CFN are staying about the same. The publication schedule does not correspond to the financial year with variations between years that appear to be greater than they are in fact. Author's Charges in particular appear to have decreased substantially but that is because of a change of invoicing practices last year that artificially raised them. We are expecting higher printing costs for both the CFN and T&L in the coming year.

Research grant payments continue to be lower than normal as the pandemic delayed some of the field work. Costs for bookkeeping services took a significant spike and are now more in line with industry standards. At the same time, the level of service has improved.

The Club made a $10 000 donation to purchase land in the Alfred Bog through the Nature Conservancy. Conserving this peat bog just south of Ottawa has been a priority for the OFNC since the early 1980s. We were pleased to have this most recent chance to further enhance its protection.

We are not anticipating any significant changes from a financial perspective in the coming year.

It was moved by Ann MacKenzie, seconded by Ken Young, that the Financial Statements be accepted as a fair representation of the financial position of the Club as of 30 September 2021.

Carried

Approved financial statements available online at: https://www.canadianfieldnaturalist.ca/index.php/cfn/article/view/3017/2843

5. Nomination of the Accounting Firm

It was moved by Ann MacKenzie, seconded by Ken Young, that the accounting firm of Welch LLP be contracted to conduct a review of the OFNC's accounts for the fiscal year ending 30 September 2022.

Carried

In response to a question as to why the Club's accounts are not audited, Ann advised that an entity such as the OFNC is not required by the government to be audited. An audit would be expensive and involve a significant workload. As a number of people are involved in the Club's finances, it is unlikely that mismanagement by any particular individual would go unnoticed.

6. Committee Annual Reports

It was moved by Elizabeth Moore, seconded by Annie Bélair, that the Committee Annual Reports be accepted as distributed.

Carried

7. Report of the Nominating Committee by Diane Lepage (Chair)

The Board is almost unchanged from last year. Dwayne Lepitzki, who had been an *ex-officio* member, decided not to remain on the Board once it was decided that all Board members would be full directors. Both the Chair of Membership, Henry Steger, and the Chair of Finance, Ken Young, have indicated that they wish to step aside when a replacement is available. Until that time they will both continue on the Board.

Relevant Excerpts from the OFNC Constitution (revised February 2000)

> Article 8 – The Council shall consist of the officers of the Club and up to eighteen additional members, all members of the Club.
>
> Article 12 – The officers of the Club and other members of the Council shall be elected annually at the Annual Business Meeting. The nomination of sufficient persons for election to the various offices and membership of the Council shall be the responsibility of the Nominating Committee, which shall act in the manner prescribed in the By-Laws.
>
> The Council shall, at the earliest possible date, appoint chairs and members of Standing and ad hoc committees and Editor and Business Managers, as required for club publications.

Nominated Officers	**Official Duty**
Jakob Mueller	President
Owen Clarkin	1st Vice President
(vacant)	2nd Vice President
Elizabeth Moore	Recording Secretary
Ann MacKenzie	Treasurer

Nominated Members of the Board of Directors (alphabetical order)

Annie Bélair	Janette Niwa
Robert Cermak	Gordon Robertson
Edward Farnworth	Henry Steger
Catherine Hessian	Ken Young
Diane Kitching	Eleanor Zurbrigg
Diane Lepage	

It was moved by Diane Lepage, seconded by Ann MacKenzie, that this slate of nominees for Officers and other Members of the Board of Directors of the OFNC for 2022 be accepted.

Carried

Nominating Committee suggestions to the Board Members for Chairs of Committees and other positions in the OFNC

Positions of Members of the Board of Directors

Awards Committee	Eleanor Zurbrigg
Birds Committee	Robert Cermak
Conservation Committee	Owen Clarkin
Education & Publicity Committee	Gordon Robertson
Events Committee	Jakob Mueller
Fletcher Wildlife	Edward Farnworth,

	Representative
Finance Committee	Ken Young
Investment Manager	Catherine Hessian
Macoun Field Club	Diane Kitching, Representative
Membership Committee	Henry Steger
Safe Wings	Janette Niwa, Representative
Publications Committee	Annie Bélair, Representative
Editor, *Trail & Landscape*	Annie Bélair

Positions of people not on the Board of Directors

Chair, Publications	Jeff Saarela
Editor, *Canadian Field-Naturalist*	Dwayne Lepitzki
Chair, Macoun Field Club	Rob Lee
Chair, Safe Wings Ottawa	Anouk Hoedeman
Webmaster	Sandra Garland
Ontario Nature Representative	Diane Holmes

8. New Business and General Discussion

a) Colacem L'Orignal Cement Plant

Fenja Brodo inquired about the outcome of the effort, reported at the 2021 ABM, to overturn planning permission for the construction of a cement plant by Colacem Canada Inc. in L'Orignal, Ontario. The OFNC had supported a study of the likely emissions from the plant in which it was shown that the emissions projected by Colacem were substantially underestimated. Diane Lepage advised the meeting that, regrettably, the appeal had failed.

b) General Discussion

In response to questions and comments from members, the participation of OFNC in various initiatives and areas of concern was discussed:

(i) City proposal to extend Brian Coburn Boulevard across the northern fringe of the Mer Bleue wetland complex—OFNC had released a statement supporting the National Capital Commission's position that the City's preferred plan is a poor choice from an ecological standpoint. These concerns had been covered by *The Ottawa Citizen* and CTV. Ontario Nature has taken an interest and has published a statement expressing their concern.

(ii) City of Ottawa policy changes regarding the environment and development—Owen Clarkin, OFNC Chair of Conservation, was commended by a member for his work in drawing the attention of the community to the negative effects of City policy on the environment.

(iii) Ottawa Hospital Civic Campus—Jakob Mueller noted that the Club had felt that it was not within the Club's mandate to become involved in the politics of the establishment of the new hospital site.

(iv) Degraded Woodland Areas—The attention of the meeting was drawn to the degradation of a number of local forested areas and concern expressed that this degradation would be used as a reason to develop these areas. The damage caused to trees by invasive species and increasingly frequent storms associated with climate change was discussed. Ann MacKenzie called upon members to become involved in their communities so that their voices are heard with respect to environmental matters.

(v) Gatineau—it was noted that greenspace had been a major issue in the recent Gatineau municipal elections. Hope was expressed that the Club would become more involved on the Gatineau side of the Ottawa River. It was noted that this is the intention of the Club.

(vi) Richmond Fen—concern was expressed about the effects of development around this area. It was noted that OFNC has been involved in some bird studies in the area but that it is very difficult to access.

(vii) Land preservation—it was noted that OFNC has contributed to land acquisitions made recently by both Ontario Nature and the Nature Conservancy.

10. Adjournment

It was moved by Jakob Mueller, seconded by Eleanor Zurbrigg, that the meeting be adjourned.

Carried

ELIZABETH MOORE
Recording Secretary

Post-business presentations

After the meeting was adjourned, Diane Lepage presented a challenging multiple choice identification quiz based on some of her wildlife photographs.

Janette Niwa and Deb Doherty then reported on some of the activities being carried out by Safe Wings. The presentation focussed on collision prevention and particularly on the work being done by several students at the University of Ottawa to mitigate collisions on campus.

The post-business part of the meeting concluded with a presentation by Owen Clarkin on the Elm Zigzag Sawfly (EZS). Elm Zigzag Sawfly is native to Asia but has recently been identified in North America and is potentially another threat to our native elms. The Conservation Committee was responsible for the first report of this insect in Ontario and has since identified it in numerous sites in Eastern Ontario.

Annual Reports of OFNC Committees for October 2020–September 2021

Awards Committee

The Awards Committee manages the process to annually recognize and thank those Ottawa Field-Naturalists' Club (OFNC) members and other qualified persons who, by virtue of their efforts and talents, are deserving of special recognition. In late 2020, nominations were received and evaluated (see awards criteria at http://ofnc.ca/about-ofnc/awards), and recommended to the Board of Directors for approval. Biographies were written for each award recipient for inclusion in the Club's publications and posting on the website. The awards were announced in December 2020 and presented virtually (by Zoom) in November 2021. Each recipient's name, type of award, and short rationale for recognition follow below.

- Joan Heyding and Ian Gough—Member of the Year Award. For fostering the development of amateur mycology in the Club.
- Daniel Buckles and Debra Huron—Conservation Award for a Non-member. For their long dedication to the historic Bur Oak trees in the Champlain Park neighbourhood of Ottawa.
- Jeffery E. Harrison—Honorary Member. For his significant role in the founding and development of the Fletcher Wildlife Garden and long-time service to the Club.
- Frederick Schueler and Aleta Karstad—Honorary Member. For lifetime natural history and conservation efforts in eastern Ontario and Canada.
- Robert G. Forsyth—Honorary Member. For outstanding contributions to Canadian malacology.

Eleanor Zurbrigg, Chair

Birds Committee

Birds Committee (10 members), Bird Records Subcommittee (12 members including alternate voting members), and Bird Feeders Sub-committee (Chair coordinates and fills in when needed and five volunteers) coordinated OFNC bird-related activities and directed and encouraged interest in birds within and outside the OFNC area.

A committee member, Nina Stavlund, administered the OFNC's Facebook group (2402 members on 7 December 2021) which is a place for OFNC members and non-members to discuss ideas and exchange information relating to all aspects of natural history, club outings, and club initiatives, as well as for prospective members to get a feel for what the OFNC is about. Current member age and gender demographics are:

Age range	Women		Men		Custom gender	
	no.	%	no.	%	no	%
13–17	0	0	0	0	0	0
18–24	26	1.1	16	0.7	4	0.2
25–34	233	10.2	104	4.6	4	0.2
35–44	311	13.7	125	5.5	5	0.2
45–54	320	14	132	5.8	7	0.3
55–64	326	14.3	170	7.5	6	0.3
65+	307	13.5	179	7.9	3	0.1
Total	1523		726		29	

A committee member, Derek Dunnett, provided weekly provincial (Birdnews) reports of OFNC area (Ottawa–Gatineau) bird sightings which, with photos by local photographers, was also provided on OFNC Facebook and the OFNC website. OFNC Facebook posts, comments, and reactions are most frequent on Fridays when this report is posted.

Committee members provided articles on a variety of subjects in *Trail & Landscape*, led OFNC field trips, participated in the OFNC Website Working Group, improved Birds content on the website, and responded to bird related enquires from members and the public.

OFNC Birds Committee and the Club des ornithologues de l'Outaouais (COO) organized the 102nd Ottawa–Gatineau Christmas Bird Count on 20 December 2020. Temperatures ranged from –4 to 0°C, with persistent snow and then drizzle over much of the count circle. 164 field observers plus 35 feeder watchers found 76 species. Highlights included one each of Field Sparrow, Cackling Goose, Double-crested Cormorant, and Short-eared Owl; a record four Red-bellied Woodpeckers; and 10 Hoary Redpolls, including one *hornemanni*. Record highs were also set for Wood Duck (11), Wild Turkey (274), White-breasted

Nuthatch (632), Bohemian Waxwing (5136), and Northern Cardinal (741); and eight Barred Owl tied a record high. American Crow was easily the most abundant species with a roost estimated at 20 000. Good numbers were recorded for Common Raven (144), Red-breasted Nuthatch (165), Hermit Thrush (five), Cedar Waxwing (223), and Common Redpoll (1966). Other winter finches recorded included Evening Grosbeak (106), Pine Grosbeak (115), White-winged Crossbill (40), and Pine Siskin (28).

The “OFNC Rare Bird Data Project”, led by Jeff Skevington, which will enter documentation of historically important OFNC rare bird sightings into eBird, was started. This project will provide a permanent record of OFNC rare bird sightings on eBird for worldwide birders, science, and conservation.

BOB CERMAK, Chair

Conservation Committee

The year started with us producing the final report for our 2020 survey of Voyageur Provincial Park for the vulnerable (S3) tree species Red Spruce. We found three populations of the species at the park during our survey, and sent our final report to Ontario Parks.

Our multi-year survey for Red Spruce in eastern Ontario (Ottawa, and east) is effectively over, with our committee discovering a population of the species at Pinhey Forest in February 2021 via targetted “appropriate habitat” searching. No other populations have been found since then in eastern Ontario at Ottawa or east, during a busy year in which we visited many locations. This is a long stretch of no new results for our group, and suggestive that we are “done” with our main push of searching for Red Spruce at Ottawa and east in Ontario. A final report of our findings is in preparation.

A lengthy provincial COVID-related stay-at-home order caused us to essentially miss the spring 2021 season, with commencement of growing season fieldwork activities only starting in June.

An incidental finding of Two-lined Salamander at Voyageur Provincial Park in 2020 led to our committee also applying for and receiving permission to conduct a survey for salamanders at Voyageur Provincial Park (Principle Investigator Jakob Mueller): this survey is in progress and will be ongoing throughout 2022.

A major project this year by our group was an extensive survey for a new insect to North America: Elm Zigzag Sawfly (EZS). Elm Zigzag Sawfly is a potential new threat to the already endangered (IUCN) American Elm (and our other two elms) and was discovered near Montreal in summer 2020. Elm Zigzag Sawfly was incidentally found in photos we took at Voyageur Provincial Park in September 2020. We casually checked for EZS at Cooper Marsh Conservation Area in July 2021 and found its unmistakable feeding tracks on the first elm we inspected! This caused us to search for EZS throughout eastern Ontario from July to October, and we found it to be continuously present from the eastern tip of the province to as far west as Dunrobin Shore, Carleton Place, and Mallorytown. We reported our findings to the Canadian Food Inspection Agency, collected samples of the insect for the Canadian Forest Service, and alerted contacts to be on the lookout for EZS in upstate New York, where it is likely present but not documented, and Vermont. This was a rare chance to document the spread of a rapidly moving exotic insect invasion, and while we were hoping to “not find” this potential new pest as much as we did, we are glad that OFNC was able to provide leadership and show the already widespread extent of its spread shortly after its discovery on the continent. See the map below: OFNC members are responsible for all of the data points west of Vaudreuil-Soulanges, Quebec. A final report of our findings is in preparation.

We continued two long-term biodiversity monitoring projects at Lavigne Natural Park and at the Carp Hills, and found interesting new species records at both locations in 2021.

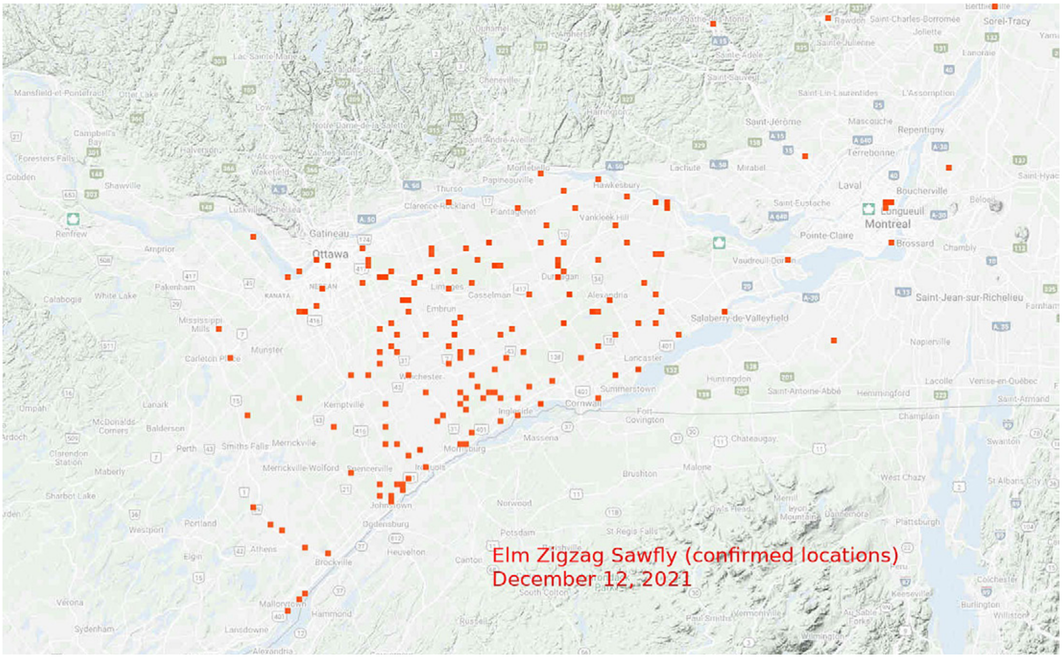
Our group (led by Henry Robertson) explored alvar-like habitat across the Ottawa River (e.g., Aylmer Quebec) and in Ontario (e.g., Dunrobin Shore) to help establish biodiversity baseline data, and provide community outreach regarding stewardship of these threatened habitats.

Numerous site visits with biodiversity surveys and community outreach occurred in 2021, at locations such as Orleans (Lalande Conservation Park), Kanata (near Kizell Pond Natural Reserve), southeast rural Ottawa (Tewin area), Rockcliffe Park (Kichi Sibi Trails), Gananoque Lake (Ontario Nature Bioblitz), and many more.

Our group participated in advocacy work, with a focus on the well-known large bogs of eastern Ontario: Mer Bleue and Alfred Bog. Club president Jakob Mueller outlined how a proposed road expansion threatened the Mer Bleue bog: https://ofnc.ca/conservation-2/proposed-new-road-threatens-mer-bleue-wetland.

Jakob was also interviewed (not yet published) by NBC News regarding environmental issues related to bogs and human activities associated with bogs (peat extraction, etc.). Alfred Bog was cited as an example of a partially conserved bog, which is subject to mining and conversion of habitat to agriculture at its privately-owned edges.

Our committee also released a statement, advocating for postponement of an immediate decision regarding including the proposed Tewin development (rural southeast Ottawa) into Ottawa’s urban



boundary, to allow for adequate biodiversity surveying of the location (https://ofnc.ca/conservation-2/ofnc-urges-deferring-the-inclusion-of-tewin-in-ottawas-urban-boundary-expansion).

OWEN CLARKIN, Chair

Education and Publicity Committee

Coronavirus disease 2019 created a series of cancellations that again severely limited the work of the Education and Publicity Committee. No in-person meetings were held but a few Zoom meetings helped keep us focussed. Fortunately, the Committee welcomed three new members: Sheilagh Stacey, Joceline Beaulieu, and Robyn Molnar.

The Ottawa-Carleton District School Board's Science Fair was also held online. Fenja Brodo, Lloyd Mayeda, and I judged the four applicants for the OFNC nature prizes. All four were deemed excellent and were awarded $100 and a certificate of recognition.

Dean Beeby continues as our Twitter administrator. He gave a presentation to the Board to encourage members to submit newsworthy items to add to the account. Jakob Meuller added a YouTube page for the OFNC—look for it at: https://www.youtube.com/channel/UCHryjAyoDoz7qnanrVaTJ_w or search YouTube for "OFNC Video".

Sandy Garland continues to keep our Friends of the Fletcher Wildlife Garden (FWG) Facebook page up to date. Thanks to Nina Stavlund, our OFNC Facebook page is well-run and active.

Lorraine Elworthy, Annie Bélair, Sandy Garland, and Gord Robertson keep our webpages informative and well maintained.

Gord Robertson has made three new wildlife quests for the Richmond Conservation Area, Pinhey Dunes and Forest, and Andrew Hayden Park. More are planned for next year. Find them at https://ofnc.ca/quests.

This summer "News Flashes" have been posted around the FWG to highlight recent wildlife occurrences. For example, occurrences such as a juvenile Wood Duck perched on a branch overlooking the Amphibian Pond, the invasion by LDD (Gypsy) Moths, the arrival of Plum Pocket fungus and Butternut Canker, and the emergence of cicadas were posted, among others.

Groups of Beavers and Cubs came to the FWG on 26 and 27 September. Eighteen children showed up from both groups. They were divided into two sections and shown the Backyard Garden and Amphibian Pond. Masks were worn by all. Fenja Brodo, Robyn Molnar, and Lloyd Mayeda led the tours.

With the addition of three new storyboards (now at 13) some members of the committee (Sheilagh Stacey, Sarah Wray, Fenja Bordo, and myself) have created new stories for the various seasons. Thanks to Dr. Jean-Michel Weber and Diane Lepage for checking the French translations. Find copies at https://ofnc.ca/stories.

There were no applicants for the Youth Summit this year that was to be online. Macoun Club members were contacted but none responded. Greater outreach is necessary for this event to be successful.

GORDON ROBERTSON, Ph.D., Chair

Events Committee

The Events process continued to be unusual in 2021, due to the persistence of the COVID-19 pandemic. Monthly meetings were held virtually on Zoom for the duration of the year, and several other virtual events were held as well. For the second year in a row, in-person field trips were not held during the normally busy spring season due to the pandemic's "third wave" and the resulting restrictions of public health measures. Restrictions eased as vaccination rates increased, allowing a resumption of in-person field trips in August.

In total, the committee coordinated 40 events, including field trips, workshops, presentations for monthly meetings, and digital events. Topics included birding (nine), mycology (nine), botany (six), herpetology (three), entomology (three), and conservation (two), with the remainder being general interest (eight).

As always, the committee extends its sincere gratitude to all individuals who led, presented, or assisted with events.

JAKOB MUELLER, Chair

Finance Committee

This report covers financial matters during fiscal year 2020–2021, which extended from 1 October 2020 through 30 September 2021.

The impact of the COVID-19 pandemic lessened compared to the previous year. In particular, the Fletcher Wildlife Garden plant sale resumed, with orders taken online. It was very successful, netting about $6600. Compared with many other small charities, we are fortunate. We have a sizeable reserve that enables us to continue our activities even though revenues are down, and to purchase things such as a Zoom licence to help us cope with the pandemic.

The primary task of the Finance Committee is to prepare a draft budget for consideration by the Board of Directors. The committee receives suggestions, and estimates of committee revenues and expenses, from directors and committee chairs. Our process is that the Finance Committee presents a draft budget for discussion at the September meeting of the Board of Directors. After amendment, it is adopted at the October meeting.

The budget for FY2020–2021 was approved at the Board of Directors meeting of October 2020. The draft budget for FY2021–2022 was presented to the Board's September 2021 meeting and after revision, was approved at the October 2021 Board meeting. The budget forecasts revenues of $164 900 and expenses of $185 350, for a deficit of $20 450. A copy of the budget, as approved, is included as an appendix to the minutes of the October 2021 Board of Directors meeting. These minutes are posted on the OFNC website (https://ofnc.ca/wp-content/uploads/2021/11/OFNC-BoD-Meeting-October-18-2021-Minutes.pdf).

The committee developed a policy titled "Applying for a Grant". It provides a procedure for committees to follow when applying for grants from third parties. The policy was adopted by the Board of Directors on 15 March 2021.

The Board asked the committee to consider whether the OFNC should amend its investment policy to include a statement on ethical investing. The committee's recommendation, which was accepted by the Board, was to leave the choice of securities to the Investment Manager, who can take into account ethical investing considerations.

The committee reviewed the Club's insurance coverage, specifically whether additional types of risks should be added. The additional types discussed were Accident Compensation Coverage, Publisher's Errors & Omissions Liability, and Cyber insurance. The committee does not consider that any of these would add significant protection, and they are expensive. The Club will continue with its existing coverage (General Liability - Bodily or Mental Injury & Property Damage, and Nonprofit Organizations Directors' & Officers' Liability).

The question arises from time to time whether our spending is appropriate. Members have two concerns. On the one hand, will we exhaust our investment fund prematurely? Our current budgeted deficits are in the range of $20 000 to $25 000. We are currently earning interest of 2.5% to 3% on our investments. If we continue in this manner, our investment fund will be maintained for almost three decades. Even if our earned interest rate drops to 1% it would be two decades. Based on this, the Board feels that our deficits are reasonable.

The other concern is that we are not spending enough. The Board of Directors reviews proposals for spending, during the budget process and on an *ad hoc* basis during the year. Proposals are evaluated based on the Club's objectives, for example natural history education, and our policies, for example a focus on eastern Ontario and the Ottawa Valley. The Board is responsive to proposals, but also prudent.

KEN YOUNG, Chair

Fletcher Wildlife Garden Committee

The Fletcher Wildlife Garden was able to accommodate the many challenges that COVID-19 brought due to the dedication of its volunteers and their ability to adjust and adapt. Throughout the year, the safety of our volunteers and our many visitors was the most important factor that affected how we did things. The FWG is a tenant of Agriculture and Agri-Food Canada (AAFC), and so many of the changes that occurred this year were implemented following discussions with them.

An unexpected consequence of the COVID-19 restrictions was the very large increase in the number of visitors to the FWG. This in turn resulted in the inability to accommodate all the extra vehicles looking for parking spaces on the property. Following a review by AAFC, several traditional parking places were eliminated because they hindered emergency vehicle access; parking in front of the Resource Centre (Building 138) was limited to Fletcher volunteers; additional parking spaces were created as part of the baseball diamond parking lot; cement curbs were added to better indicate where parking was not allowed; additional signage was added to more clearly indicate where parking was or was not allowed. Agriculture and Agri-Food Canada also increased enforcement of the parking regulations on the property using warnings and fines. To accommodate FWG volunteers, monthly parking passes have been issued to a limited number of volunteers. To increase security at the Resource Centre, photo id/door unlock swipe cards have been issued to a limited number of FWG and OFNC members.

The increased number of visitors also has led to an increased number of dogs off-leash on the property. Ottawa city by-law now includes the Fletcher as part of its jurisdiction. Cases of dogs off-leash are to be reported to the city via its 3-1-1 complaint phone number. Increased signage has been put up, and city by-law officers have made unannounced visits to the Garden. Dogs off-leash continue to be a problem.

Coronavirus disease 2019 restrictions postponed the opening of our volunteer season and did restrict activities such as indoor coffee breaks. The size of volunteer work parties was kept small, and social distancing was emphasized to increase volunteer safety. The Resource Centre was closed to the public all year.

Our annual plant sale did happen but with a pre-order, pre-pay, curbside pick-up format. A small group of dedicated volunteers was able to meet regularly to carry out the planting, growing, and potting of plants for the sale. E-mail messages and e-transfer of money were used to carry out the sale in a safe way. When the two-week pick-up period was over, this year's profit had exceeded all previous plant sales!

A "big year" was declared at the start of 2021 as a challenge to the many birders that regularly visit the Fletcher, and to get an answer to the question "How many different kinds of birds visit the Fletcher each year?" As of November, 65 different bird species have been identified and reported. Most of the reports of sightings were posted on the Friends of the Fletcher Wildlife Garden Facebook group page, accompanied by spectacular photographs.

There were many challenges this year. The many compliments and the expressions of thanks by our visitors are true indicators of how valued the FWG is to the Ottawa community and beyond.

TED FARNWORTH, Chair

Macoun Club Committee

The Macoun Field Club, which is for kids aged eight to 18, is in its 73rd year. The Club normally runs during the school year, offering a weekly program of indoor meetings alternating with outdoor field trips. During this second year of disruption by the COVID-19 pandemic, the meetings had to be abandoned, but for eight of the 12 months outdoor activities were permissible under public health regulations.

On 1 September 2020, the OFNC Board of Directors voted to permit the resumption of field trips after a six-month suspension. The Macoun Club was ready to go with immediate demand from families, a well-informed leadership, and an effective COVID-19 protocol. In the year that followed, Committee members led 22 field trips and two overnight camping trips. Half of our trips were to the Macoun Club Nature Study Area in Ottawa's western Greenbelt, and half into Lanark County. The camping trips were conducted in remote locations. An account of each activity was promptly posted on the Macoun Club's home page on the OFNC website.

Early in the autumn of 2020, Ontario's limit on the size of outdoor gatherings was reduced from 100 to 25 people, which was still sufficient for our groups. Soon after New Year's Day, 2021, however, not even two people were permitted to be together unless they were from the same household. During four of the next five months (the provincial stay-at-home orders of January/February and April/May) field trips were therefore not possible. Trips resumed in June and continued into August.

Pandemic conditions significantly altered the character of our field trips. This Club, which is centred on the child, became more of a family-oriented organization. Instead of dropping their children off for the day, parents, grandparents, and even aunts and uncles came out with us. One result was that adults outnumbered the children and physically dominated the groups. Another was that the children interacted with each other far less than previously, not getting to know each other, even by name.

Interaction was further stifled by adherence to public health guidance. Unless people were in a common family or social "bubble", they had to maintain a 2-m distance from each other. Best friends could not walk or eat or play together. Without the buzz of excitement that arises from the discovery of a snake or salamander, children could not communicate their healthy attitudes and advanced knowledge about reptiles and amphibians to their more fearful fellow members. Similarly, leaders could not just pull out a hand lens and bring the sub-visible world of insects, lichens, and mosses into view for the children. We left our hand lenses at home.

Despite the impairment of its normal functioning, the Macoun Club remained much in demand, and not only from its existing membership. New families found us through our website and phoned or e-mailed, “desperate” to get their children outdoors. Some of these children turned out to have no interest at all in nature; we were thanked for providing “video-game detox” and exercise. But others now number among our most devoted members.

We do not know when indoor meetings may resume, but experience now tells us that they are the backbone of the Macoun Club. Meetings are typically better attended than field trips, and provide greater cohesiveness and continuity. Yet during the pandemic, field trips proved to be far more important to the lives of the members. Only one young person ever suggested online meetings, whereas families were enquiring about field trips every week.

Demand for field trips finally slackened in the summer of 2021, when the relaxation of public health restrictions opened up old opportunities. Families admitted that they were choosing to do other things, which had been denied them for a year.

Still, with no more promotional effort than a single-line entry on our schedule page: “Field Trip, call Rob”, we had taken 38 children out into the safety of the natural world, and 32 adults, many of them repeatedly. (Club membership in the last pre-pandemic year had been 19.) The burden of doing this every possible weekend fell disproportionately on one or two members of the Macoun Club Committee. It was felt, though, that the stresses on kids and families under pandemic restrictions were so great that these Macoun Club volunteers held to their commitment to “Connect the Child with the Wild”.

ROBERT E. LEE, Chair

Membership Committee

Club participation includes (1) “Membership” which consists of those who pay Club fees, are “Honorary” members, or participate in the “Macoun Club”, (2) “T&L (*Trail & Landscape*) Subscribers”, and (3) an aggregate called “Other” which represents individuals and organizations that receive complimentary copies of T&L. The groups are reported separately.

The distribution of Club membership on 30 September 2021 and on 30 September 2020 is shown below. There was a notable increase in Membership of 76 for 2021, much of which occurred in the last six months of the fiscal year. This increase is consistent with the volatility in membership that the Club experiences from year to year.

Members within 50 km of Ottawa comprised 766 of the total membership of 871.

	2021	2020
Individual	415	377
Family	340	309
Student	19	16
Honorary	24	23
Life	38	39
Macoun Club	23	20
USA	11	10
International	1	1
Total	871	795

The number of “T&L Subscribers” and “Other” on 30 September 2021 and on 30 September 2020 is shown below. The numbers do not vary greatly on a year-to-year basis.

	2021	2020
T&L Subscriber	2	3
Other	25	23
Total	27	26

HENRY STEGER, Chair

Publications Committee

The Publications Committee manages publication of CFN, T&L, and Special Publications. The committee also advises OFNC with respect to issues relating to research, including managing the research grants program. We published four issues of T&L (54[4] and 55[1–3]), and we sold advertising space in T&L to two clients, which generated $255 of revenue. We published four issues of CFN (134[2–4] and 135[1]).

Daniel Brunton and David Seburn, both longstanding committee members, stepped down this year. Due to the impacts of the COVID-19 pandemic, the committee conducted its meetings virtually; this meeting mode worked well for the committee because some committee members reside outside of the National Capital Region in Prince Edward Island, Alberta, and British Columbia.

This was the seventh year of the OFNC Research Grants program. Research grants support field-based research activities that reflect and promote the Club’s objectives within eastern Ontario and/or western Quebec, focussed particularly upon the Club’s study area. A total of $15 000 is available each year to fund research. The application deadline was 15 January 2020. A subcommittee comprising Jeff Saarela (chair), Paul Catling, and Carolyn Callaghan reviewed all proposals and submitted funding recommendations to the OFNC Board of Directors. The list of recipients of 2021 Research Grants was published in T&L 55(3): 119–120 (https://ofnc.ca/publications/trail-landscape/tlpdfs).

JEFFERY M. SAARELA, Chair

Safe Wings Ottawa Committee

Numbers

From 1 October 2020 to 30 November 2021, Safe Wings volunteers:

- Documented more than 3278 window collisions (final number not yet available), similar to 2019–2020.
- Provided care to 1338 injured birds representing 125 species, compared to 1336 birds of 127 species the previous year. Of these, 655 (49%) were victims of window collisions.
- Answered more than 5000 phone calls, similar to the previous year, and recruited more volunteers to help answer the high volume of calls.
- Added three new species to our list of collision victims (Great Horned Owl, Red Crossbill, Hoary Redpoll), bringing our cumulative total to 148.

Year in review

The pandemic continued to affect Safe Wings operations and activities. The increase in calls about injured birds at homes again outnumbered calls from commercial and institutional buildings, and meetings as well as outreach activities were limited to online events.

Our annual bird display, cancelled in 2019, was held on 23 August 2020, as a virtual event at the Jack Purcell Community Centre. Only fully vaccinated and masked volunteers were allowed to participate. They created a spiral layout of all 4015 specimens collected in 2019 and 2020, then photographed and filmed the layout. The event was organized in collaboration with Fatal Light Awareness Program (FLAP) Canada and other bird collision groups, and included a short film.

The Advocacy Subcommittee created last year to better oversee and organize outreach continued to meet monthly to promote bird-safe measures for new and existing buildings. These efforts are ongoing and have led to input on the new hospital campus, the new library, and various other buildings, as well as encouraging the City of Ottawa to incorporate bird-safe design into energy-efficiency measures promoted and subsidized by the draft Better Buildings Strategy.

After several years of collecting data and trying to convince the owners of a business park to apply collision mitigation measures at their buildings, we filed an application on 7 May requesting that the Ontario Ministry of the Environment investigate the properties under the *Environmental Bill of Rights* (EBR) for offences under the *Environmental Protection Act* (EPA) and the *Endangered Species Act* (ESA). A decision under the EBR is required within 60 days; however, as of 30 September, the ministry had not rendered a decision.

We also filed an application on 25 September requesting an investigation of a different property under the federal *Species at Risk Act* (SARA).

Maurine Mikhail initiated the creation of a federal government working group dealing with the issue of bird–building collisions. Representative from various government departments are working together to add bird-safe glazing and lighting to the National Master Specifications (used for federal procurement and as the basis for provincial building codes).

Deb Doherty initiated the creation of a campus collision group at the University of Ottawa. She guided students as they assessed buildings for collision risk, monitored for birds, and reported on their findings. They applied for and received a grant to retrofit a raised walkway between Morisset Library and the Jock Turcot Centre. Vanessa Hum designed and painted a mural with the help of other students. While retrofit measures are normally applied to the exterior surface of glass in order to maximize effectiveness, in this case an exception was made to allow interior application. The university understandably would not allow students to work at height, and light conditions at the specific location of the walkway ensure the mural is highly visible from outside.

Deb also led a partnership with the Canadian Wildlife Federation Wild Outside youth program to paint a bird-safe mural at the Ottawa Public Library's Centrepoint Branch (101 Centrepointe Drive). This mural was also designed by Vanessa Hum.

Willow English presented a talk, Windows of Opportunity: Making Our Homes Safer for Birds, for the City of Ottawa's Wildlife Speakers Series on 31 March.

We began collaborating with the Club des ornithologues de l'Outaouais (COO) as they work towards earning Bird-Friendly City certification from Nature Canada for Gatineau.

The City of Ottawa and National Capital Commission (NCC) both finalized and adopted bird-safe building design guidelines. City planners now expect projects requiring Site Plan Approval to adhere to the municipal guidelines. The NCC requires all new buildings, major retrofits, and additions to be bird-safe. It has also begun assessing all the properties in its real estate portfolio for collision risk, and is beginning to retrofit some buildings.

We continue to pressure OC Transpo to make current and future Light Rapid Transit (LRT) stations and other transit structures safe for birds. Stage 1 LRT stations have proved to be lethal to birds, as predicted by Safe Wings. The City promised to make Stage 2 LRT stations bird-safe, although they are not following current guidelines.

The Ottawa Valley Wild Bird Care Centre moved to a new, temporary location in the spring. To help with the transition, the Safe Wings rehab team took on a lot of additional patients and kept them in care longer. Since then, we have tried to limit patients as much as possible to window collisions, raptors, and after-hours critical cases.

ANOUK HOEDEMAN, Chair

The Canadian Field-Naturalist

The Ottawa Field-Naturalists' Club Awards for 2021, presented February 2022

Eleanor Zurbrigg, Irwin Brodo, Christine Hanrahan, Karen Mclachlan Hamilton, and Lynn Ovenden

The 2021 Club awards were presented virtually on 11 February 2022. Awards are given to members or non-members who have distinguished themselves by accomplishments in the field of natural history and conservation or by extraordinary activity within the Club. Six awards were conferred for 2021, for: (1) outreach and engagement in support of bird conservation, (2) initiating a research grant program and modernizing two Club publications, (3) contributions to five conservation organizations, (4) turtle conservation efforts, (5) researching Red Spruce distribution, and (6) long-time service to the Club on financial matters.

Member of the Year: Deborah Doherty

In recognition of the member judged to have contributed the most to the Club in the previous year.

Safe Wings Ottawa, an initiative of the Ottawa Field-Naturalists' Club (OFNC), is committed to reducing the number of birds being killed by window strikes. In Ottawa, the number of bird fatalities by windows is staggering—approximately 250 000 annually. Deborah Doherty contributed a great deal to Safe Wings this past year in engaging new volunteers and new connections within the community to support and contribute to bird conservation.

Deborah, with her background in leadership and training, has been a wonderful asset to Safe Wings since becoming a member in 2016. Her strong communication skills as well as her natural ability to easily engage people, enabled her to undertake many valuable functions and allowed her to make new connections with people and communities. She has inspired the next generation of leaders to make Ottawa safer for birds.

Throughout the pandemic, she found creative ways to connect with the general public via videos and virtual events, like the virtual Jane's walk. When possible, she helped train patrollers, provided 10 virtual orientations to volunteers, and tours for groups such as WILD Outside youth's program. Deborah's partnership with WILD Outside resulted in the installation of the mural seen at the Ottawa Public Library's Centrepointe Branch.

Because it is Deborah Doherty's achievements in 2021 that are being recognized with this award, here are some of her accomplishments that year. Apart from her usual Safe Wings activities, she managed to guide new volunteers through the testing of new software for Safe Wings activities, deliver a strategic planning session, and co-write a Naturehood funding grant from Nature Canada allowing Safe Wings to be part of an after-school program with racialized communities this winter.

One of her more noteworthy achievements was the ability to connect with a new demographic—students. She mentored three groups of University of Ottawa students through an ambitious, multi-phase project to develop a more bird-safe campus. The first group researched historical bird collisions, patrolled during migration for new injuries/fatalities, conducted building assessments to determine what buildings are threats, and liaised with the Office of Sustainability. She helped another group develop a design contest which resulted in a Bird Safe mural installed on an overhead corridor. The last group gained funding and facilities management experience as they worked on a proposal to apply bird-friendly film on the Social Sciences building using an Indigenous art motif. She guided this group through writing project proposal presentations, coordinating team meetings, and organizing meetings with at least two different university departments. All of these communications were bilingual … a mighty task for a unilingual person.

If Deborah had a wish, it would be to see community engagement and citizen science promoted through collaborative efforts of the newly formed Ottawa Bird Team (a Nature Canada Bird-Friendly Cities initiative). She believes that working together effects policy change and the Ottawa Bird Strategy recommendations will happen. This summer, try strolling around the University of Ottawa campus, or along the Rideau River. You may see Deborah or other volunteers making a difference, one building at a time.

This past year Deborah Doherty has contributed to the success of Safe Wings Ottawa thanks to her outreach and engagement efforts and is the reason for the OFNC selecting her as Member of the Year for 2021.

(Prepared by Karen McLachlan Hamilton)

George McGee Service Award: Jeffery M. Saarela

In recognition of a member who has contributed significantly to the smooth running of the Club over several years.

Jeff Saarela is being recognized for his leadership on the OFNC research grant program and publications modernization.

Jeff joined the Board of Directors in 2011–2012 as a member-at-large. At the January 2015 Board meeting, he proposed a new initiative: the research grants program. He quickly formed a subcommittee to develop guidelines for the research grants, put out a call for proposals in April 2015, and the first round of research grants were awarded in June 2015—quite a feat! Jeff has taken part in the research grants process every year since, and the program has proven to be a great success. Research grants support field-based research activities in all fields of natural history and has generated significant original Ottawa Valley natural environment research. It is valued by other researchers and by OFNC's members through the documentation of the findings of these studies in *Trail & Landscape* (T&L).

Jeff Saarela found his way to the Publications Committee soon after joining the Board, and he accepted the responsibilities of Committee chair in 2015. A lot has been accomplished under his guidance.

The Publications Committee brought innovative updates to the 'look and feel' of the OFNC's two publications: *The Canadian Field-Naturalist* (CFN) and T&L. New types of content were introduced to CFN including: Great Canadian Field-Naturalists (https://doi.org/10.22621/cfn.v131i3.2071) and Thematic Collections (https://doi.org/10.22621/cfn.v131i1.1962 or https://doi.org/10.22621/cfn.v131i2.1989). A Thematic Collection is a compilation of previously published contributions in CFN and T&L on a central theme with electronic hyperlinks to each manuscript.

Jeff led the initiative to increase institutional subscription fees in 2017 based on a survey of fees for journals similar to the CFN. Simpler page charges were instituted in October 2019. He managed a major editorial transition for CFN (Editor-in-Chief, Assistant Editor, Book Review Editor, online journal manager) and T&L (Editor).

Jeff efficiently supervised the final transition of CFN to its fully digital submission, reviewing, editing, and publication form while maintaining its important traditional hard copy identity. Many issues were addressed. Jeff ensured the incorporation of DOIs (digital object identifiers) for CFN articles and integration with CrossRef. A DOI is a permanent electronic link to an article's online location, and CrossRef summary tracks the number of times a DOI is followed. All older content in CFN (1920–2012) is freely available at the Biodiversity Heritage Library (BHL: https://www.biodiversitylibrary.org/bibliography/39970#/). To further disseminate journal content, Jeff undertook to have CFN, and later T&L, full-text content included in a prominent environmental journal database.

Jeff was also instrumental in updating and modernizing the complex issue of copyright for all things published in CFN and has been consulted regarding other copyright problems based on his expert knowledge of copyright outside CFN.

Jeff smoothed the way for the T&L team to transform our regional publication into the appealing and effective, all-colour format that has been so well received by readers and contributors alike. He helped connect T&L editor Annie Bélair to the librarian at the Canadian Museum of Nature to get T&L scanned and uploaded to the Biodiversity Heritage Library website, the same place older content of CFN is archived and freely available (https://www.biodiversitylibrary.org/bibliography/115961#/).

Jeff is noted for his professionalism and for getting things done. The OFNC is pleased to present Jeff Saarela with the George McGee Service Award for 2021.

(Prepared by Eleanor Zurbrigg, based on material from Dan Brunton, Dwayne Lepitzki, and Annie Bélair)

Conservation Award—Member: Janet Mason

In recognition of an outstanding contribution by a member in the cause of natural history conservation in the Ottawa Valley.

Janet Mason is being recognized for outstanding contributions to the conservation work of several community organizations in the Ottawa area. She currently leads the Mississippi Valley Conservation Authority (vice-chair), the Friends of the Carp Hills (chair and co-founder), and the Friends of the Carp River (chair). She has led the Ottawa Stewardship Council since founding it 20 years ago. She has served on the boards of the Mississippi-Madawaska Land Trust and the Macnamara Field Naturalists Club. How generous!

After graduating from Queens University as an electrical engineer, Janet worked for 30 years in the defence and technology industries with leadership positions. Since retiring, she has volunteered with several community organizations involved in environmental stewardship. She writes newsletters, blog posts, grant applications, and study reports. She gives public talks and engages persuasively with municipal politicians, scientists, and business leaders alike. Colleagues have attributed her success in conservation to incredibly hard work, tremendous communication skills, persistence, and the ability to solve problems with insight and analysis.

Janet and others incorporated the Friends of the Carp Hills in 2013 to preserve areas of the Carp Hills where there is little human activity and to offer other specific areas for public recreation. The Friends envisage a collaborative forum for stewardship of the highland (which is mostly privately owned) to strike a balance between protection, conservation, and the desire to experience its natural beauty. They build trails and hold organized walks, lectures, and public meetings on conservation issues. They try to protect species at risk in the area, especially Blanding's Turtle, Whip-poor-will, and Common Nighthawk. The City of Ottawa and Ducks Unlimited partner with them on assessments, management plans, and conservation measures. The Carp Barrens Trail Study (2019–2020), led by consulting ecologist Holly Bickerton, is a good example of this collaboration. Following the impact assessment of trail use, the Friends worked with the City of Ottawa to reduce disturbance in this popular recreational destination.

The Friends of the Carp River is another organization that Janet chairs. Since 1997, the organization raised funds and planted 50 000 trees and shrubs to restore shorelines along the river. In recent years, they worked with the Mississippi Valley Conservation Authority on a major wetland restoration project in West Kanata along 2 km of the Carp River. This is the Carp River Conservation Area, a floodplain previously channelled and farmed, and now restored with meanders, a pond, wet meadows, and a loop trail with bridges for recreational use. The site is animated by an educational program with curriculum for use by schools, a mobile app called Eco-Trekr, a downloadable brochure, interpretive signs, an osprey nest tower, a viewing platform, and citizen science projects on iNaturalist. The Mississippi Valley Conservation Authority, Ottawa Stewardship Council, and Friends of Carp River all participate in this project.

Like all members of OFNC, Janet Mason loves to explore local natural areas herself. She also has an extraordinary ability to collaborate with others to get things done. She has described herself as "an advocate for neighbourhood involvement in the stewardship of local natural areas for the mutual benefit of their human and wildlife communities". People throughout western Ottawa have joined in conservation projects that she leads. We are grateful to Janet for her generous work in conservation.

(Prepared by Lynn Ovenden)

Conservation Award—Non-Member: Tammy MacKenzie

This award recognizes an outstanding contribution by a non-member in the cause of natural history conservation in the Ottawa Valley.

Tammy MacKenzie is being recognized for her exceptional efforts in turtle conservation in Lanark County.

All of Ontario's eight species of turtle are listed as species at risk by the Federal Government. Five of these eight species occur within the Ottawa Valley. Turtles face numerous threats, chief among them is loss of habitat and road fatalities. Slow-moving turtles are no match for speeding cars. Add to this predation on eggs and young turtles and it is easy to see why our native species are facing serious problems.

Wanting to help these vulnerable creatures, Tammy MacKenzie founded OUR Turtles (Observing, Understanding, Rescuing Turtles), a volunteer organization based in Perth. She has since become a remarkable champion for turtle conservation and education of the public about turtles.

Tammy organizes all of the volunteers, coordinates checks on nests during hatching season in late summer, and advocates for turtles whenever and wherever she can.

Volunteers are trained to help injured turtles on roads, watch for nesting turtles, and install nest protectors on roadside nests that are in safe locations (e.g., behind guard rails).

She worked with the roads department in Lanark County to help create a roadside nest protection strategy that will be safe for turtles as well as motorists. She worked with the Perth Men's Shed to get nest protectors built, which are then also sold by OUR Turtles to the public.

She has developed outreach materials which she takes to various events and locations to help spread the word about turtle conservation and to get more people interested in volunteering to help protect turtles and their nests. In 2021, she held turtle conservation and education events in Perth at Watershed Discovery Days and at Starbucks. She has been interviewed or profiled in various media including an appearance on Lake 88.1 radio station to promote turtle conservation. Spreading the word about turtle conservation and ways in which the public can help is an important part of her work.

In 2021 alone, OUR Turtles installed over 30 nest protectors on turtle nests along roadsides to protect the eggs from predation by Raccoons and other nest predators. While doing so, Tammy discovered a previously unknown nesting location for Northern Map Turtle in an unusual location. During nesting season, it seems like Tammy is everywhere: driving roads to find nesting turtles, delivering nest protectors to those who want to purchase one, and coordinating the Facebook group for OUR Turtles which is used to organize all of their volunteers.

Tammy MacKenzie does all of this work as a volunteer. She is incredibly passionate about helping turtles and tireless in her efforts. Her dedication to turtle conservation makes her a very worthy recipient of the OFNC Conservation Award (Non-member) for 2021.

(Prepared by Christine Hanrahan and David Seburn)

Anne Hanes Natural History Award: Owen J. Clarkin

The Anne Hanes Natural History Award recognizes outstanding contributions of an amateur naturalist to our understanding and knowledge of the natural history of the Ottawa Valley.

Red Spruce is a distinctive tree, native to eastern North America. In the Ottawa district, recent records were few, and those that were known were found primarily in small plantations or single trees in scattered locations east of the City of Ottawa. However, Red Spruce was apparently more common in Ontario in the past, but was largely logged out, according to research by Owen Clarkin.

From his knowledge of the species and its habitat requirements, Owen was convinced there were more Red Spruce populations than previously recorded in the district. Having driven past likely looking forests, he decided to conduct a detailed search of potential sites, using Google Streetview to do a preliminary check of roadsides in selected locations prior to checking them in the field. In addition, he spent countless hours driving through other areas searching for the species.

From 2019 through 2020 and 2021, Owen conducted a number of surveys in locations such as Garlandside Road and Lavigne Natural Park, both north of Limoges; the Plantagenet area, Rockland, a section of forest near Anderson Road and Highway 417, areas he calls "the Ottawa–Hawkesbury Red Spruce belt", i.e., acidic clay on sandy substrate. During 2021 he also conducted Red Spruce surveys in Lennox and Addington County.

Many new populations of Red Spruce were found and recorded, both single trees and stands of three or more. Numerous photos were taken, and all records added to iNaturalist. Owen has added 1000 observations of Red Spruce to iNaturalist (https://www.inaturalist.org/lifelists/owenclarkin).

These records are complemented by Trees Canadensis (https://treescanadensis.ca/), a website where he shares identification features, illustrative photos and distribution maps, not only for Red Spruce, but also for 12 other native trees. Owen and Janet Mason began the website in 2016 to record and disseminate their experiences with and appreciation for native trees of eastern Ontario and western Quebec. The website also includes accounts of Owen's search for extant populations of Red Spruce and, just last year, the spread of Eastern Elm Sawfly westward from Quebec into eastern Ontario.

While Owen is a chemist by vocation, he has been an avid naturalist since his youth. Through his efforts, Owen Clarkin has added to our knowledge of the distribution of Red Spruce in the area, previously poorly documented. These activities and accomplishments make Owen a very fitting recipient of the Anne Hanes Natural History Award.

(Prepared by Christine Hanrahan, Lynn Ovenden, and Eleanor Zurbrigg)

Honorary Member: Kenneth Young

This award is presented in recognition of outstanding contributions by a member or non-member to Canadian natural history or to the successful operation of the Club. Usually, people awarded an honorary membership have made extensive contributions over many years.

The OFNC is very pleased to welcome Ken Young as our newest Honorary Member in recognition of his many years of extraordinary service and leadership in the Club. Ken joined the OFNC in 1985 and was a member of the Board for 15 of those 36 years.

Ken enjoys problem solving and tackling new challenges, talents he has put to good use as a Board member. If a problem comes up that Ken thinks he could help solve, he never hesitates to offer his assistance. Examples abound.

In 2013, the Club was the beneficiary of a million-dollar bequest from the late Violetta Czasak. Someone was needed to manage the myriad of decisions that had to be made regarding the gift, and Ken, as Club Treasurer at the time (2012–2016), volunteered to take on this enormous job. And what a job it turned out to be! Among other things, it involved his becoming executor of Ms. Czasak's entire estate. He dealt with the estate and the bequest extremely well and was given the 2015 President's Prize for his efforts.

Ken used his skills to manage other business matters for our Club. He served on the Finance Committee as Chair in the 1990s and again from 2018 to the present, and as Treasurer for five years. He has always been the "go-to" person for any question involving the business end of running the Club, including making sure that the Club's insurance is appropriate and up to date. He takes on various problems, does the often time-consuming but essential research, and comes up with recommendations for action.

This is particularly true regarding Ken Young's involvement with Club publications. He created and then ran the subscription management system for CFN for several years and has been the Author Charges Manager for the journal from 2014 until the present. In fact, Ken has been the Publication Committee's key contact for all financial matters related to publications, including keeping an eye on the status of the Manning Fund and helping the Committee understand how far into the future the fund will carry us at the existing 'spend rate'. The financial reports Ken has regularly and consistently provided for the Committee are always detailed, insightful, informative, and highly relevant. While wearing his financial hat, he's been a consistent champion for the journal, showing a keen understanding of its deep history as core Club activity, and its important role in the Canadian natural sciences.

Ken also was an engaged member of the Fletcher Wildlife Garden Committee in the 1990s and was on the Conservation Committee for many years, including serving as its Chair, expressing his views and offering sage advice on many issues.

More recently, with the COVID pandemic making online meetings and activities a necessity, Ken has taken on the job of handling the Zoom account, which has enabled our club to function virtually and to keep members connected.

This Honorary Membership is a fitting way for the OFNC to acknowledge Ken Young's many years of service.

(Prepared by Irwin and Fenja Brodo)

1880. 1881.

OTTAWA

Field Naturalists' Club

TRANSACTIONS NO. 2.

OTTAWA, CANADA.

PRINTED BY C. W. MITCHELL, "FREE PRESS" OFFICE, 6 TO 10 ELGIN STREET.

1881.

In 1880, the Ottawa Field-Naturalists' Club (OFNC) began printing the papers that had been read before the Club at their monthly "soirees" and the committee reports with the creation of the annual *Transactions of the Ottawa Field-Naturalists' Club*. This cover graced Transactions No. 1 (1879–1880) through 7 (1885–1886). The monthly *Ottawa Naturalist* replaced the Transactions for 1887–1888 (Volume 1) through 1918 (Volume 32), becoming *The Canadian Field-Naturalist* in 1919. See Cook (1986) and Brunton (1986, 2004) for details about the origins and history of the OFNC and its publications.

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Volume 136, Number 1 • 2022

(continued inside back cover)

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Table of Contents (*concluded*)

Tributes

Book Reviews

News and Comment

Mailing date of the previous issue 135(4): 25 May 2022