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How the Canada Jay lost its name and why it matters

Dan Strickland

Introduction

In 1957, with the publication of its fifth "Check-list of the Birds of North America", the American Ornithologists' Union (AOU) did away with "Canada Jay", the name it had used for *Perisoreus canadensis* until 1910, and for the nominate subspecies, *P. c. canadensis*, during the subsequent 47 years. English names were discontinued for all subspecies in Check-list 5 (AOU 1957) and, in the case of *P. canadensis*, a new English species name was declared, namely "Gray Jay". The taxonomic and nomenclatural decisions of the AOU are held in such respect that North American journal editors, ornithologists and birders almost always accept them and assume that they are invariably made for compelling biological reasons. Gray Jay researchers such as Ryan Norris of the University of Guelph and I are good examples because, although we have studied the ecology and behaviour of Gray Jays for a combined total of over 60 years, and have always called them by that name, we never once questioned why the original name, "Canada Jay", was deemed inappropriate.

This would still be the case were it not for the Royal Canadian Geographical Society's (RCGS) well-publicized 2015-16 campaign to choose a national bird for Canada (Anon. 2015). While both of us supported the Gray Jay nomination, we felt the name, with its American spelling of "gray" instead of the Canadian "grey" was inappropriate for a Canadian national symbol. We noted that the RCGS had presented *P. canadensis* in their campaign as "Gray Jay/Whiskeyjack", thus acknowledging the country-wide use of the colloquial name derived from the Cree *Wisakedjak* that entered English as "Whisker-jack" as early as 1740 (Gosselin 2017). However, we lamented that they had not also included "Canada Jay", the original official name. After all, it, too, clearly had unassailable historical legitimacy and was obviously appropriate as the name for a Canadian national bird. We also thought, if the RCGS had

A colour-banded population of *P. canadensis* has been under continuous study in Ontario's Algonquin Provincial Park since the 1960s. *Photo by Dan Strickland*

chosen to present *P. canadensis* under its original official English name, it would have received much more support than it actually did (it finished third in the "popular vote" behind the Common Loon (*Gavia immer*) and the Snowy Owl (*Bubo scandiacus*)). Thus, when, at the end of the campaign, the RCGS nevertheless chose the Gray Jay as its choice to be Canada's national bird (Walker 2016), we took it as self-evident there would have been more public acceptance if the choice had been announced as the "Canada Jay".

It was in this context that we found ourselves increasingly asked by the public and media why the AOU had abandoned the historic name, "Canada Jay", back in 1957. Personal circumstances allowed me to attempt finding an answer to this question and I report my findings here.

Methods

Consultation

I first contacted several of the present members of the AOU's Nomenclature and Classification Committee (NACC) to determine whether any of them knew the thinking behind the imposition of "Gray Jay". I then consulted relevant popular and academic literature from the

1940s and 1950s, the official history of the AOU (Sterling and Ainley 2016) and another, unofficial history of American ornithology (Barrow 1998). Finally, in April and August of 2016, I examined the AOU's archives housed in the Smithsonian Institution in Washington, D.C.

Analysis

After finding serious contemporary criticism of the AOU's pre-1957 vernacular naming system, I converted Check-list 4 (AOU 1931) to a spreadsheet format to facilitate a more quantitative evaluation of its problems. In particular, I asked to what extent the vernacular naming system mirrored the Latin system which permits, even for someone with no ornithological knowledge, the certain identification of a bird at both the species level (binomial name structure, e.g., *Larus argentatus*) and the subspecies level (trinomial name structure in which the binomial species name is embedded, e.g. *Larus argentatus smithsonicus*). I more loosely defined an English "binomial" as consisting of a single-word category name (e.g., Sparrow, Quail-dove) modified by a specific "qualifier" that usually consisted of one word (e.g., "Fox" [Sparrow]) but which might also be a two-word geographic reference (e.g., "Key West" [Quail-dove]). English "trinomials" (i.e., subspecies) correspondingly consisted of a binomial modified by a subspecific qualifier that could also consist of one or more words (e.g., Warner Mountains [Fox Sparrow]).

Results

General

None of the present members of the NACC that I consulted had any knowledge of the choice of "Gray Jay" in 1957, and the official and unofficial ornithological histories I consulted were disappointingly silent about the deficiencies of the English nomenclatural system used before 1957. Most of the insights offered in this paper came from a few key published articles from the 1940s, the AOU's own published Check-lists and Supplements and unpublished archival material from the 1940s and 1950s. The latter (excerpts cited here in italics within quotation marks) was contained in Smithsonian Institution Archives Record RU7150, Boxes 3 to 7, 38, 39, 43 to 49 and 58. I have retained photocopies of all the original archival material cited here and they are available upon request.

History of the names "Canada Jay" and "Gray Jay"

"Canada Jay" was used as the species' English name for *P. canadensis* at least as early as Swainson and Richardson (1831) and Audubon (1840-44). It was also so used by the AOU (Table 1) in its Check-lists 1 and 2 (AOU 1886, 1895) but "demoted" to meaning merely the nominate subspecies, *P. c. canadensis* in Check-lists 3 and 4 (AOU 1910, 1931) before its failure to reappear in the Check-list 5 (AOU 1957).

"Gray Jay" was first used by Robert Ridgway (1899) of the Smithsonian Institution as the English name for a new subspecies (*Perisoreus obscurus griseus*) of the "Oregon Jay", *Perisoreus obscurus* which, at the time, was deemed to be a different

Mated pairs of *P. canadensis* occupy large permanent territories in Canada's boreal and subalpine forests. *Photo by Dan Strickland*

species, separate from *P. canadensis*. As with "Canada Jay", the specific name "Oregon Jay" was downgraded in the 1910 and 1931 Check-lists to mean merely the nominate subspecies (i.e., *P. o. obscurus*). The names "Gray Jay" and "Oregon Jay" continued to be the English designations for the two subspecies of *P. obscurus* up until 1944 when the AOU lumped *P. obscurus* with *P. canadensis*. This lumping had no effect on the AOU's meaning of "Canada Jay" which designated a subspecies of *P. canadensis* before the lump and designated exactly the same after the lump. For the next 13 years, right up until publication of Check-list 5, the Canada Jay, the Gray Jay, the Oregon Jay and several other named taxa coexisted as mere subspecies of *P. canadensis*.

The AOU's conventions of vernacular nomenclature 1910-1957

The AOU's failure to provide overall English species names for the two *Perisoreus* species in its 1910 and 1931 Check-lists was in no way unique. For all monotypic species (i.e., species with no subspecies; 389 of 798 species on the 1931 list; 49% of the total), the AOU provided both Latin binomials and English names but for the 409 polytypic species (i.e., species with at least two subspecies; 51% of the total) such as *P. canadensis*, it gave neither. Instead, it presented Latin trinomials and English vernacular names for each of the 1020 subspecies comprising the polytypic species.

P. canadensis is quick to take advantage of novel sources of food that can supplement its winter food stores. *Photo by Gord Belyea*

Table 1. History of AOU's nomenclatural treatment of "Canada Jay" and "Gray Jay"

Check-lists 1 and 2 (AOU 1886, 1895)	Check-lists 3 and 4 (AOU 1910, 1931)
Perisoreus canadensis **Canada Jay**	(No species-level scientific name) (No species-level common name)
(NO NOMINATE SUBSPECIES) (NO NOMINATE SUBSPECIES)	*Perisoreus canadensis canadensis* **Canada Jay**
Perisoreus canadensis capitalis Rocky Mountain Jay	*Perisoreus canadensis capitalis* Rocky Mountain Jay
Perisoreus canadensis fumifrons Alaskan Jay	*Perisoreus canadensis fumifrons* Alaska Jay
Perisoreus canadensis nigricapillus Labrador Jay	*Perisoreus canadensis nigricapillus* Labrador Jay (not on the 1931 list)
Perisoreus obscurus **Oregon Jay**	(No species-level scientific name) (No species-level common name)
	Perisoreus obscurus obscurus Oregon Jay
	Perisoreus obscurus griseus **Gray Jay**

The ultimate Canadian bird? A female incubating in a late winter snowstorm. Her three eggs hatched a few days later. *Photo by Dan Strickland*

1931 List modified by Supplements 19, 20, 24 and 27 (AOU 1944, 1945, 1949, 1952)	Proposed for Check-list 5 1947-48	Check-list 5 (AOU 1957)
(No species-level scientific name) (No species-level common name)	***Perisoreus canadensis*** **Gray Jay** →	***Perisoreus canadensis*** **Gray Jay**
Perisoreus canadensis canadensis **Canada Jay** ⇢	*Perisoreus canadensis canadensis* Canada Gray Jay	*Perisoreus canadensis canadensis*
Perisoreus canadensis capitalis Rocky Mountain Jay	*Perisoreus canadensis capitalis* Rocky Mountain Gray Jay	*Perisoreus canadensis capitalis*
P. c. fumifrons → *pacificus* (1952)[1] Alaska Jay	*Perisoreus canadensis fumifrons* Alaska Gray Jay	*Perisoreus canadensis pacificus*
Perisoreus canadensis nigricapillus Labrador Jay (restored to list 1944)	*Perisoreus canadensis nigricapillus* Labrador Gray Jay	*Perisoreus canadensis nigricapillus*
Perisoreus canadensis albescens Alberta Jay (1944)	*Perisoreus canadensis albescens* Alberta Gray Jay	*Perisoreus canadensis albescens*
Perisoreus canadensis obscurus Oregon Jay (1944)	*Perisoreus canadensis obscurus* Oregon Gray Jay	*Perisoreus canadensis obscurus*
Perisoreus canadensis griseus **Gray Jay** (1944)	*Perisoreus canadensis griseus* Ridgway's (Cascades) Gray Jay[5]	*Perisoreus canadensis griseus*
Perisoreus canadensis bicolor Idaho Jay (1944)	*Perisoreus canadensis bicolor* Idaho Gray Jay	*Perisoreus canadensis bicolor*
Perisoreus canadensis barbouri Anticosti Jay (1944)	*Perisoreus canadensis barbouri* Anticosti Gray Jay	*Perisoreus canadensis barbouri*
P. c. pacificus → *arcus* (1952)[2,3] Pacific Canada Jay (1945)	*Perisoreus canadensis pacificus* Pacific Gray Jay	*Perisoreus canadensis arcus*
Perisoreus canadensis sanfordi Newfoundland Gray Jay (1949)[4]		*Perisoreus canadensis sanfordi*

[1] *P. c. fumifrons* became *P. c. pacificus* with the 27th Supplement (AOU 1952) because of a naming priority issue.

[2] *P. c. pacificus* named in the 20th Supplement (AOU 1945) was renamed *P. c. arcus* in the 27th Supplement (AOU 1952) because *P. c. pacificus* was preoccupied (see above).

[3] Note that when *P. c. pacificus* was proposed in 1945, it received the English subspecies name Pacific Canada Jay, clearly implying that the presumptive English species name was "Canada Jay" (see text).

[4] When *P. c. sanfordi* was proposed in the 14th Supplement (AOU 1949) it was given the English name "Newfoundland Gray Jay", thus signalling the AOU's otherwise unannounced intention to elevate "Gray Jay" to the status of overall English species name (see text).

[5] To avoid having a subspecies with the English name "Gray Gray Jay", it was first proposed that *P. c. griseus* be renamed "Ridgway's Gray Jay". This was later changed to "Cascades Gray Jay".

This vernacular naming system had several serious drawbacks including:

1. It was impossible to determine, from the English name alone, whether the name referred to a species or to a subspecies. Latin species names are invariably binomials and subspecies names are trinomials but the English names on Check-list 4, whether of species or subspecies, could be trinomials, binomials, or even "uninomials". For example, 26 English uninomials (e.g., Ovenbird, Bobolink) on the 1931 list referred to monotypic species and 12 were the names of subspecies (e.g., Osprey, Whimbrel). Similarly, 338 binomials were the names of species (all monotypic, e.g., Western Meadowlark, Canada Warbler) and 659 (66%) referred to subspecies (e.g., Eastern Meadowlark, Nashville Warbler). Of 374 trinomials 349 (93%) referred to subspecies (e.g. Gray–crowned Rosy Finch, American Three-toed Woodpecker) but 25 referred to monotypic species (e.g., Cassin's Purple Finch, McKay's Snow Bunting), and it was impossible to realize this from their name structures alone.

2. A further deficiency of the English trinomials on the 1931 list was that the binomials they contained did not always refer to the same species. Of 100 different binomials contained within English trinomials, nine referred to two different species. For example, the California Clapper Rail and the Yuma Clapper Rail were races of *Rallus obsoletus*, while four other "Clapper Rails" on the 1931 Check-list were races of *Rallus longirostris.*

3. The failure of Check-list 4 to give overall species names for the 409 polytypic species it contained was trivial for Latin names since the provided trinomial subspecies names always included the binomial species names as their first two elements (genus and species). On the vernacular side, however, there were only 91 polytypic species (22% of the total) whose subspecies all had English trinomial names containing a possible overall English name for the species (e.g., the three then-recognized races of *Canachites canadensis*; Hudsonian Spruce Grouse, Canada Spruce Grouse, and Alaska Spruce Grouse). A further 19 species (5%) had at least some subspecies with similarly helpful English names (e.g., the races of *Branta canadensis* on the 1931 list were: Common Canada Goose, White-cheeked Canada Goose and Lesser Canada Goose, as well as the uninformative Hutchin's Goose and Cackling Goose).

This left 299 species (73% of polytypic species and 37% of the entire 1931 list) that had neither an overall English species name or even a single subspecies with a trinomial name containing a binomial that could be construed as a species name. It was, therefore, literally impossible to refer to any of these species with an AOU-sanctioned overall English name for the 47 years from 1910 to 1957. *P. canadensis* was one of those species.

I found two approaches to writing about *P. canadensis* that were taken by authors of the day. Bent (1946) followed the AOU's lead and made no mention of the species at all, writing separately instead about several of its subspecies,

including the Canada Jay (*P. c. canadensis*) and the Gray Jay (*P. c. griseus*). In contrast, Roger Tory Peterson broke from AOU orthodoxy by using "Canada Jay" in both his eastern and western field guides (Peterson 1941, 1947) to mean both the nominate subspecies, *P. canadensis canadensis*, and the overall species, *P. canadensis*. He similarly used "Oregon Jay" in his western guide to mean both the overall species, *P. obscurus*, and its nominate subspecies (Peterson 1941).

Pressure on the AOU to reform its naming systems

Complaints about the AOU's vernacular naming system and appeals for its overhaul came from several quarters in the 1940s. In their popular bird identification field guides, both Peterson (1941, 1947) and Pough (1946) addressed the confusion surrounding vernacular nomenclature and both corresponded with Alexander Wetmore, chairman of the AOU's NACC, urging reforms. In appendices on "Subspecies", Peterson used the "Steller's Jay" in his western guide (Peterson 1941) and later the "Canada Jay" in his eastern guide (Peterson 1947) as examples to illustrate his frustration with the lack of overall English species names for polytypic species and the impossibility of knowing from their vernacular names to which species many subspecies belonged. He also lauded the introduction of a rational naming system by Alden H. Miller in "The Distribution of the Birds of California" (Grinnell and Miller 1944). Miller's approach was to imitate the scientific naming system by using English trinomials for all subspecies and having the species name nested within the trinomial. Thus, for *P. canadensis*, Miller restored the original overall species name, "Canada Jay" and for the two alleged races occurring in California (referred to by the AOU as the "Oregon Jay" [*P. c. obscurus*] and the "Gray Jay" [*P. c. griseus*]), he used "Southwestern Canada Jay" and "Gray Canada Jay", respectively.

"Canada Jay" was the AOU's official name for *Perisoreus canadensis* on its first two Check-lists (1886 and 1895). *Photo by Dan Strickland*

Further important pressure for reform came from a *Wilson Bulletin* paper whose lead author was Eugene Eisenmann, president of New York's influential Linnaean Society (Eisenmann and Poor 1946). In it, the authors set out the problems of the existing vernacular nomenclatural system and proposed that two main principles should guide its reform, namely:

"*1. Every species should have a name, applicable only to that species, which can be used in a comprehensive manner for all races of the species…"* and

"2. Every subspecies name should be formed by prefixing to the species name a word or words indicating the race."

They also stated that "*it is certainly desirable to retain many established names regardless of whether or not they are appropriate…*" but urged the observance of additional naming principles when a new name had to be found. One of these was that "*a species name should not be formed from the name of a geographical or political subdivision*", the reason being that this could lead to geographically awkward subspecies names.

The AOU's response to the calls for reform

The AOU, in general, was apparently sympathetic to the reformers' wishes. In a 1939 memorandum entitled "*Recommendations of the A.O.U. to its Committee on Classification and Nomenclature of North American Birds*", the AOU specifically recommended that "*editions of the Checklist should appear every 10 years*" and that (in the next edition) "*there be a scientific name, a vernacular name, and a statement of range for each species as a whole, …*". They also added the suggestion that "*vernacular names for subspecies are unnecessary.*"

Notwithstanding this clear direction, the minutes of a subsequent Check-list Committee meeting held in Boston on 10 September 1940 recorded that: "*A suggestion by A.H. Miller in a letter regarding abandoning subspecific vernacular names was unanimously voted down. All present felt it was necessary and desirable to continue common names for subspecies.*" The same minutes also noted "*The suggestion that each subspecific vernacular name include the vernacular name of the species (ex. Louisiana Carolina Paroquet) was voted down.*"

Wetmore eventually yielded to the pressure by agreeing to support a radical overhaul of vernacular names following the principles advocated by Eisenmann and Poor (1946) in anticipation of the next (5th) AOU Check-list. His archived correspondence records his appreciation for the leading role played by W.L. McAtee of Chicago in preparing two exhaustive lists of proposed new vernacular species and subspecies names. The first, covering non-passerines, was presented at meetings of the Check-list Committee held in Toronto in September 1947 and the second, covering passerines, was circulated by mail in June 1948 in anticipation of a fall meeting in Omaha later that year. Wetmore graciously acknowledged that the proposed names he was then circulating closely followed the principles (that he had previously resisted) advocated by Eisenmann and Poor (1946) and, before them, by Grinnell and Miller (1944). Still, even then, Wetmore had serious misgivings about the new scheme. In the preface to the 1947 list, he remarked: "*Whether this demand* (i.e., for overall species names and for subspecies names that contain those species names) *is genuine and necessary, or whether it is based on the idea of a few vocal individuals has been difficult for your Chairman to determine.*" A few lines later, he wrote, "*The list as presented shows some of the benefits as well as the various horrors of such a plan.*"

The new overall vernacular species name (Gray Jay) and reformed subspecies names for *P. canadensis* that were proposed in 1948 for inclusion in Check-list 5 are shown in Table 1. These proposed names (and those of all other species on

The confiding Whiskyjack is beloved by Canadians from coast to coast. *Photo by Gord Belyea.*

the 1947 and 1948 lists) were initially circulated to Check-list Committee members for their comments. Proposed draft accounts as they would appear in Check-list 5 were then drawn up and circulated to at least 40 North American ornithologists including four based in Canada (I. McTaggart Cowan and J.A. Munro in British Columbia, W. Earl Godfrey at the National Museum in Ottawa and L.L. Snyder at the Royal Ontario Museum). The only comment returned to Wetmore expressing reticence concerning the choice of "Gray Jay" as the overall species name for *P. canadensis* was a hand-written marginal notation on Snyder's copy saying: *"'Whiskeyjack' is used universally in the north (& will continue to be). Its use with names of political areas (such as Idaho) would avoid awkward term and avoid a new coinage."*

Snyder did not express an opinion about "Canada Jay" but his comment indicates he recognized a need to avoid geographic awkwardness. While I found no other discussion of the subject, I believe the AOU's decision to choose "Gray Jay" as the overall species name rather than restoring "Canada Jay" is indeed most plausibly attributed to that concern. Since the new vernacular scheme required that the overall species name be included in all vernacular subspecies names, the choice of "Canada Jay" as the species name would have resulted in geographically awkward subspecies names such as "Alaska Canada Jay", "Oregon Canada Jay", and "Idaho Canada Jay". Even "Labrador Canada Jay" would have been less than ideal since, in the late 1940s, Labrador's borders and status were still contested and Newfoundland had not yet joined Canada. Previous proponents of a rationalized vernacular nomenclatural

system had cautioned against names that gave rise to geographical absurdities such as "California Florida Jay" (Eisenmann and Poor 1946) or "Florida Carolina Wren" (Peterson 1947) and I suggest that this concern also motivated the AOU's rejection of "Canada Jay" and preference for "Gray Jay" instead.

I further suggest, incidentally, that "Canada Goose" was not likewise rejected as a restored overall vernacular species name for *Branta canadensis* because none of its English subspecies names (listed above) contained geographic qualifiers that would have led to similar difficulties. "Canada Warbler" (the only other vernacular name on the 1931 Check-list that included "Canada") was not affected by the proposed nomenclatural reforms since it already referred to a (monotypic) species, *Wilsonia canadensis*, not to a subspecies.

The dénouement

Minutes of the 7 September 1947 Committee meeting in Toronto record that those present were specifically enjoined to keep the new scheme and the list of names secret since "to publicize the matter now would lead to much useless and burdensome correspondence". As far as I am aware, the AOU made no public announcement of the impending changes in nomenclature, let alone on the specific case of *P. canadensis*, before the actual publication of the Check-list's fifth edition in 1957, a year in which its journal, the *Auk*, even published a note that still used "Canada Jay" (Lawrence 1957). Nevertheless, clues were available well before 1957 that nomenclatural changes were afoot. In 1945, the AOU announced the alleged existence of a new subspecies *P. c. pacificus* (later *P. c. arcus*; see footnote #2 in Table 1) for which it gave the English name "Pacific Canada Jay" (AOU 1945). Four years later, however, the AOU accepted another subspecies, *P. c. sanfordi*, this time with the English name of "Newfoundland Gray Jay" (AOU 1949), hinting at a switch in allegiance from "Canada Jay" to "Gray Jay" as an implied overall vernacular species name. Reference by the AOU to an east-coast race as a "Gray Jay" should have raised eyebrows since, at the time, that name still officially designated only *P. c. griseus*, a race of the far west (Cascades and B.C. coastal mountains). An even stronger clue that a new order was imminent came with the publication of "Birds of Washington State" (Jewett *et al.* 1953). The authors (two of whom, Jewett and Aldrich, were among the 40 receiving advance copies of the draft Check-list 5) explicitly gave "Gray Jay" as an overall species name for *P. canadensis* (something that, according to the AOU, had ceased to exist after Check-list 3 replaced Check-list 2). They also gave "Oregon Gray Jay" for *P. c. obscurus*, and "Cascade Gray Jay" for *P. c. griseus*.

To my knowledge, this was the first and only time that any of the new vernacular names for the subspecies *P. canadensis* proposed in 1948 (Table 1) were ever published. The original plan to present the entire freshly overhauled vernacular naming system in the Check-list's fifth edition came to a dead-stop at a September 1954 meeting of the renamed "Committee on Classification and Nomenclature of North American Birds" held in Madison, WI. Discussion of the

"*controversial*" subject of common names stretched over two days, during which more and more of the committee expressed waning enthusiasm for retaining common names for subspecies.

The minutes, possibly betraying a certain 11th hour exasperation, end with: *"Amadon expressed as his opinion, that those who believe common names will be missed by amateurs are laboring under a delusion. Van Tyne believed that we should assume leadership rather than merely go along with the desires of what may be a minority. Both Lincoln and Miller commented on the time spent in past meetings in our efforts to decide on suitable names while Wetmore referred to the confusion that will be caused by designating some species by a name that was formerly confined to a subspecies. To bring the question to a head Miller moved for the deletion of sub-specific common names. This was seconded by Friedmann, and carried with one dissenting vote."*

Recall that in 1940, the same (Alden H.) Miller had urged exactly the same thing (abandonment of subspecific vernacular names) but was turned down unanimously by the then committee (of which three members, including Wetmore, were still members in 1954). In the space of 14 years, the committee had gone from strongly favouring a system in which only subspecies had common names to the exact opposite (only species were to have common names).

This complete reversal of naming philosophy had an important implication. I argue that the motivation for elevating "Gray Jay" from obscurity instead of restoring "Canada Jay" to its original status as the long-standing overall species name was to avoid geographical awkwardness in the reformed English subspecies names. But this justification for choosing "Gray Jay" instead of restoring the original "Canada Jay" as the overall species name evaporated with the decision not to have vernacular subspecies names. There could be no awkwardness in subspecies names after the 1954 decision because there were simply not going to be any subspecies names.

The committee also recognized this and the minutes of their annual meeting a year later (24 October 1955, Cambridge, MA) included the following agenda item and comment: "*Common names to be used in the Fifth Edition. Decision to abandon subspecific vernacular names, makes it possible to retain as specific names a number that have been long in use.*"

I found no further discussion of possible abandonments of the new names proposed in 1947-48 but I did discover 18 cases where the names actually published in 1957 (Check-list 5) were not the proposed names, but reversions to the real or implied names on Check-list 4 (AOU 1931). Examples of ultimately rejected proposed names include "Chestnut-backed Bluebird", "Pileolated Warbler", "Grass Wren" and "Chestnut-crowned Warbler". They reverted to, respectively, "Western Bluebird", "Wilson's Warbler", "Short-billed Marsh Wren" and "Nashville Warbler". There is no reason apparent to me why the proposed "Gray Jay" could not have similarly reverted to the original "Canada Jay".

Discussion

One early hypothesis to explain the AOU's 1957 imposition of "Gray Jay" was that it resulted from the lumping of *P. canadensis* and *P. obscurus*. This was superficially plausible because the two species were widely believed to have the English names, "Canada Jay", and "Oregon Jay" and the AOU later adopted a guideline (AOU 1983), suggesting that, when two taxa with different English names are lumped, a new name should be found for the merged taxon. But the hypothesis is false because, as summarized in Table 1, the two species, *P. canadensis* and *P. obscurus*, did *not* have English names during the period (1910-1957) when they were lumped (1944). As for "Canada Jay", "Oregon Jay", and "Gray Jay", those names referred, not to species, but to subspecies. Contrary to widespread perception, therefore, the Canada Jay and the Oregon Jay (both just subspecies) were not lumped in 1944 and the name "Gray Jay" did not come into existence at that time. All three names designated subspecies before the 1944 lumping of their "parent" species and they continued as such for another 13 years afterwards. Indeed, the only real nomenclatural effect of the 1944 event was that the scientific names of the Oregon Jay and the Gray Jay changed, respectively, from *P. obscurus obscurus* to *P. canadensis obscurus* and from *P. obscurus griseus* to *P. canadensis griseus*.

There is no doubt, however, that in 1957, the AOU chose the name "Gray Jay" to designate the overall species, *P. canadensis,* and the question is why it did not follow the more obvious course of restoring the much older and well established "Canada Jay" instead. The AOU archival material and the contemporary literature I have examined indicate that the decision not to restore "Canada Jay" resulted from an honest attempt to reform the previously chaotic vernacular naming system and in particular to avoid geographic awkwardness in the common names of subspecies. But this possible reason for abandoning "Canada Jay" and imposing "Gray Jay" in its place abruptly disappeared when, in 1954, the AOU gave up on the whole idea of vernacular subspecies names.

I would argue further that, even if the AOU had decided to retain vernacular subspecies names in Check-list 5 (AOU 1957), there would still be grounds to challenge its decision to abandon "Canada Jay". The original stricture of Eisenmann and Poor (1946) to avoid geographic qualifiers in species names was specifically intended to apply to *new* species names and not to result in the abandonment of traditional, well-established names. Moreover, there are two ways, not just one, to avoid awkwardness when geographic subspecific and specific qualifiers clash in the bosom of single trinomial (e.g., "Alaska Canada Jay"). The way chosen in the AOU's still-born proposals of 1947 and 1948 was to abandon the older specific qualifier ("Canada") and keep the often much younger subspecific qualifiers (e.g., "Idaho, Oregon, Newfoundland", etc.). But the AOU could just as easily have chosen to keep "Canada" and abandon the subspecific qualifiers, as Miller did in his pioneering attempts to reform the AOU's nomenclatural system (Grinnell and Miller 1944). Faced with the two California

perisoreus subspecies, Gray Jay and Oregon Jay, Miller "trinomialized" their names as the "Cascade Canada Jay" and the "Southwestern Canada Jay", in the latter case avoiding the geographic awkwardness of what otherwise would have been the "Oregon Canada Jay".

Overall, I conclude that there was no valid taxonomic or nomenclatural reason for the AOU to impose "Gray Jay" as the overall English species name in 1957 or to refrain from restoring the original and historically far more authentic "Canada Jay". Further, while the history of the Canada Jay/Gray Jay name change may be of particular interest to ornithologists, I suggest it should matter to the wider community as well. At the present time, just before Canada's 150th birthday, the federal government may be considering whether to endorse the Royal Canadian Geographical Society's choice of *P. canadensis* as our national bird. Of course, as a sovereign nation, Canada does not need to seek approval from any outside body for its decisions on what to call its national symbols. It has even less reason to ask for permission to restore the original official English name—and least of all from the unelected foreign-dominated body that, through error, caused the name to be "lost" in the first place. But, given the traditional automatic acceptance of the AOU's taxonomic and nomenclatural decisions, the federal government might well assume that "Canada Jay" was abandoned in 1957 for sound biological reasons that it dare not contravene.

On the contrary, since the facts related here show otherwise, if the Canadian Government should now see fit to endorse the Royal Canadian Geographical Society's choice of *P. canadensis* as Canada's national bird, it will be innocent of any biological or nomenclatural heresy and perfectly within its rights should it, at the same time, declare the name of our new national symbol to be, once again, "Canada Jay".

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Egg carrying by a Trumpeter Swan

Harry G. Lumsden

Flying Trumpeter Swan carrying an egg from her nest in Milliken District Park. *Photo by Kim Stevenson*

On 5 June 2015, Kim Stevenson photographed a leucistic female Trumpeter Swan (*Cygnus buccinator*) (Tag H11) carrying an egg with some nest material at Milliken District Park (43° 82' N 079° 27' W), Toronto. The swan gripped the egg with her lower mandible, apparently through a hole in the shell (*right)*. She was also seen carrying the egg while flying (*above*) from her nest to the far end of the pond, where she dumped the presumably damaged egg and then swam back to the nest, accompanied by her mate (Tag L42). Six days later she completed incubation of her remaining eggs and hatched four cygnets.

This seems to be the first report of any swan carrying a complete egg. Bollinger and King (2002) reported "direct evidence of hatching (i.e., newly hatched cygnets and/or the female tossing eggshell fragments over the side of the nest)." At Aurora, Ontario, where nesting Trumpeter Swans have been intensively observed over many years, no observations of removal of hatched shells from the nest have been made (H. Lumsden,

Female Trumpeter swan gripping an egg with her lower mandible apparently through a hole in the shell. Note attached nesting material. *Photo by Kim Stevenson*

pers. obs.). Shells remain crushed flat beneath the newly hatched cygnets, as is the case in the wild with other swans, geese and most ducks. Perrins (1969) reported that when an incubating Mute Swan (*Cygnus olor*) broke an egg in defence of her nest, she ate the contents and carried three pieces of the shell, one at a time, about 4 m to the river's edge and dropped them. In contrast, there are many accounts of ducks carrying eggs, e.g., Hindman (2015) saw a male Wood Duck (*Aix sponsa*) carrying an egg. Between his literature search and Johngard and Kear (1968), records of 14 additional species of ducks carrying eggs were listed. Removal of shells of hatched eggs with deposition at a distance from the nest is a common behaviour of birds (e.g., shorebirds; Sandercock 1996), presumably due to heightened risk of predator attraction or other risks to the remaining eggs.

The restored population of Trumpeter Swans in Ontario originated from the Rocky Mountain-Greater Yellowstone breeding population (Lumsden and Drever 2002). Oyler-McCance *et al.* (2007) documented a low level of genetic variability in this population. This may account for the relatively poor reproductive performance of Rocky Mountain origin pairs in Ontario whose proportion of eggs hatched was 57% (N = 262), and whose cygnet survival to fledging was 64% (N = 96). In a 1994 incubator study of egg hatching rates from these pairs, Hamilton (1996) found that 34% of the embryos died during the first 14 days of incubation and 29% died in late incubation. She also found that 14% of the eggs were infertile. Eighty-eight unhatched eggs were collected from the nests of captive pairs of Trumpeter Swans used in the Ontario restoration program (Lumsden and Drever 2002). They were refrigerated and later examined by the late R. Hampson (Veterinary College, University of Guelph) and H. Lumsden. Of these eggs, 32% of the embryos were diagnosed as having died in the early stages of incubation (similar to Hamilton's results). These results indicate that incubating female Ontario Trumpeter Swans may frequently have to cope with nonviable eggs.

Study of Mute Swan eggs in very early stages of incubation showed that developing embryos envelop the yolk with a network of blood vessels, whereas this does not occur in infertile eggs (H. Lumsden, pers. obs.). Eggs possess physical and biological defence systems to protect the live embryo from invasion by microorganisms (Kovacs-Nolan *et al.* 2005). However, on the death of the embryo, the haemoglobin in these eggs decomposes rapidly and gas exchange through the porous shell may allow invasion by bacteria. Diagnosis of early embryonic death is a dark grey stain in the egg contents caused by sulphur amino acid decomposition (V. Thomas, pers. comm.). Pressure builds within the shell. A puncture will cause the egg to explode, spattering the nest contents (R. Hampson and H. Lumsden, pers. obs.). Should such contents smear the remaining eggs in the nest, shell pores would be plugged and gas exchange impaired, potentially causing death of those embryos. In contrast to eggs with decomposing embryos, infertile Trumpeter Swan eggs have endured incubation

of 33 days without obvious bacterial infection (H. Lumsden, pers. obs.) and when opened two days after the other eggs hatched, a yellowish liquid of a thick consistency was found with little or no pressure within the shell. Cracked eggs may also decompose with results similar to eggs with dead embryos. Removal of cracked eggs from a nest under incubation has been documented for many species, and nearly all bird species reject broken eggs (Kemal and Rothstein 1988). Predators search for unhatched eggs and disturb hatched shells in the nest. Presumably they look for egg membranes and perhaps the droppings passed by the embryo before emerging from the shell.

It is possible that the female swan H11 was carrying a decomposing egg, the shell of which had ruptured. This may explain the adhering nest material. Given the advanced state of incubation of the nest at the time of the observation (i.e., within six days of hatch), it appears likely that the egg was one with a dead embryo. The egg was abandoned at the far end of the pond and was not examined, thus its condition was not confirmed.

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Wetland drawdown and the nutritional value of *Lemna minor* to a wild Trumpeter Swan brood

Harry G. Lumsden, Vernon G. Thomas and Beren W. Robinson

Introduction

In wetlands, drought followed by flooding stimulates primary productivity and rapid population growth of invertebrates (Neckles *et al.* 1990). Kadlec (1962) found that drawdown released nutrients that also enhanced the population growth of fast-growing common duckweed (*Lemna minor*) (hereafter *Lemna* or duckweed) which is an important habitat for macroinvertebrates (Harper and Bolen 1996). Lumsden *et al.* (2015) reported that drawdown of a managed pond in Ontario in 2009 produced an abundance of gastropods in 2010 on which a brood of Trumpeter Swans (*Cygnus buccinator*) fed. This surge in abundance was followed by a snail population collapse (Lumsden *et al.* 2015). A similar release of nutrients in these managed ponds from drawdowns in 2010 and 2011 stimulated a strong productive pulse of duckweed that was colonized by snails. In each year, a brood of Trumpeter Swans fed on duckweed and associated invertebrates throughout the summer months, but it is not clear if the swans were attracted by the nutritional value of the duckweed alone or to the combined/enhanced nutritional value (e.g., calcium) added by the snails which colonized it. This paper reports on the nutritional value of the *Lemna* with and without snails and the foraging behaviour of a brood of Trumpeter Swans which shifted in response to changes in pond conditions related to *Lemna* growth following drawdown.

Methods

Three ponds in Aurora, Ontario (44º 00' N 079 º 28' W), were used in this study (Figure 1). The House pond (0.4 ha, 0.6 m deep) and its use by Trumpeter Swans is described in Lumsden *et al.* (2015). The Garden pond (0.14 ha, 0.6 m deep) was drawn down to dryness in early August 2010 and re-flooded in late September 2010. The North pond (0.2 ha, 1.0 m deep) was drawn down in mid-August 2011 and re-flooded in late September 2011.Water levels were kept stable in the Garden and North ponds in the

Parents feeding and stirring up food items for small cygnets. *Photo by Harry Lumsden.*

autumn of 2012. Various natural foods used by the swans were collected from the ponds and shorelines, stored frozen and then freeze-dried and analysed for their percentage content of protein, calcium, phosphorus and magnesium by Laboratory Services at the University of Guelph. The Garden pond supported a vigorous stand of bur-reed (*Sparganium americanum*), cattail (*Typha* spp.), rice cutgrass (*Leersia oryzoides*) and arrowhead (*Sagittaria latifolia*) among which the *Lemna minor* was present on the water surface. A bottomless bucket (537.3 cm^3) (Lumsden *et al.* 2015) was used to take standardized samples of *Lemna* from each pond in 2011 and 2012. Samples were collected by placing the bottomless bucket over the *Lemna* and scooping it from the water surface within the bucket using a 1.2 mm screen mesh sieve. No benthic samples were collected from the Garden pond. The North pond had no emergent vegetation and its surface was not sampled. However, in 2012, one set of benthic samples was taken at 10 points spaced

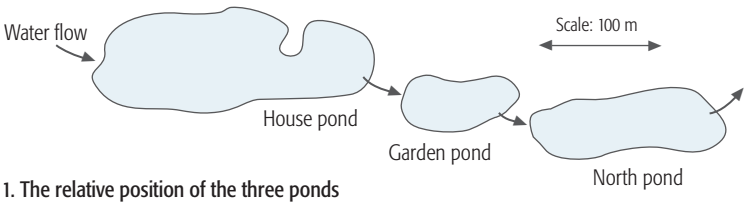

Figure 1. The relative position of the three ponds at the Aurora, Ontario, study site.

8 m apart, 0.5 m from shore, along the east shore; a second set of benthic samples was taken at 10 points similarly spaced 8 m apart, about 3 m from the east shore. Benthic samples were collected by pushing the above mentioned bottomless bucket into the benthos, then excavating the loose mud into a container (Lumsden *et al.* 2015). All invertebrates in each *Lemna* and benthic sample were counted, preserved and identified by Dr. G. Mackie (Department of Integrative Biology, University of Guelph).

Results

Lemna and snail abundance and nutrient levels, 2011

In 2011, *Lemna* covered close to 100% of the water surface of the Garden pond among the macrophytes and was colonized abundantly by snails (*Physella gyrina*). Two samples of *Lemna* (combined wet mass 227 g) taken on 1 July 2011 contained 33 live snails (0.12 snails/g *Lemna*). Four samples of *Lemna* taken on 24 and 26 July 2011 (combined wet mass 472 g) contained 531 live snails (1.13 snails/g *Lemna*). On 11 August 2011, one sample of 113 g of *Lemna* contained 256 live snails (2.27 snails/g *Lemna*).

Nutritional analysis of the dried *Lemna* (including colonizing small snails) sampled on 1 July 2011 showed that the protein content was 21.0%, calcium 1.90%, phosphorus 0.41% and magnesium 0.45% (Table 1). In samples from 24 July-11 August combined (including large snails), the values were protein 29.1%, calcium 5.95%, phosphorus 0.47% and magnesium 0.40% (Table 1).

Lemna and snail abundance and nutrient levels, 2012

In 2012, two years after the drawdown of the Garden pond, a second year of abundant *Lemna* production occurred. During this period, there was no water flowing through the ponds from an adjacent creek because a drain pipe was blocked, allowing nutrient rich water to remain in the ponds. Samples collected on 12 July 2012 in the Garden pond produced an average of 982 g *Lemna*/m^2 and 203 live snails/m^2 (0.2 snails/g *Lemna*). Samples from the North pond taken on 12 July 2012 produced an average of 447 g *Lemna* /m^2, but no live snails and only one dead snail.

In the Garden pond, the analysis of the *Lemna* sample with snails on 12 July showed: protein 27.8%, calcium 4.02%, phosphorus 0.52% and magnesium 0.36%. The nutrient value of the *Lemna* alone in the North (snail-free) pond on 12 July 2012 was: protein 24.4%, calcium 1.90%, phosphorus 0.43% and magnesium 0.34%. Live snails, alone, collected from the House and Garden ponds contained: protein 10.3%, calcium 18.15%, phosphorus 0.21% and magnesium 0.09% (Table 1).

Lemna and snail abundance and nutrient levels, 2013

In 2012, the ponds were not drawn down and in 2013, water flow through the ponds from an adjacent creek was resumed and there was no pulse of *Lemna* production. In the Garden pond, the adults swans fed on cattail (protein 9.1%, calcium 1.84%, phosphorus 0.69% and magnesium 0.17%) and burreed (protein 12.9%, calcium 1.93%,

Table 1. Nutrient analysis of *Lemna minor* plus snails, *Lemna* alone and snails alone at the Aurora, Ontario, study site in 2011 and 2012.

		Lemna + Snails		*Lemna* alone	Snails alone
	%	%	%	%	%
Protein	21.0	29.1	27.8	24.4	10.3
Calcium	1.90	5.95	4.02	1.90	18.15
Phosphorous	0.41	0.47	0.52	0.43	0.21
Magnesium	0.45	0.40	0.36	0.34	0.09
Sample site	Garden Pond	Garden Pond	Garden Pond	North Pond	House Pond and Garden Pond (combined)
Sample period	1 July 2011	24 July 2011 11 August 2011 (combined)	12 July 2012	12 July 2012	12 July 2012
Notes	Small snails	Large snails	Small and large snails	(no snails)	(no *Lemna*)

phosphorus 0.67%, magnesium 0.6%) (Table 2) for two days only. They sometimes ate *Spirogyra* (protein 23.30%, calcium 2.09%, phosporus 0.35%, and magnesium 0.30%) in the House pond. However, in 2013 they subsisted largely on whole corn provided in a hopper. The cygnets followed their parents and ate *Sagittaria* leaves and chewed on the ends of the stems of cattail and bur-reed uprooted by their parents. On 16 June 2013, the cygnets accepted a meal of commercial poultry ration (PuriNature Growena, Cargill Ltd.) which contained: protein 15%, calcium 0.85%, and phosphorus 0.70%. These values for protein are higher, for calcium much lower and for phosphorus about the same as in the cattail and bur-reed samples.

On 7 August 2013, samples collected from one transect in the North pond showed 3 live snails and 44 dead snails (82 dead snails/m^2) and samples from the other transect had 2 live snails and 107 dead snails (199 dead snails/m^2). The live snails on both transects were confined to the northern-most four sampling sites of the two transects, which thus contained 14 live snails/m^2 and 9 live snails/m^2, respectively. Cygnets were seen to grub briefly only in this circumscribed area. A grass sample was collected on 15 September 2013 from the lawn near the House pond because both cygnets and adults were observed grazing on lawn grass (cygnets more so); the sample had: protein (29.9%), calcium (1.22%), phosphorus (0.40%) and magnesium (0.22%) (Table 2).

Table 2. Nutrient analysis of local algae and macrophytes in the House and Garden ponds, and lawn grasses and commercial poultry ration at the Aurora, Ontario, study site in 2013.

	Spirogyra	Cattail	Bur-reed Stems	Lawn Grasses	Poultry ration
	%	%	%	%	%
Protein	23.3	9.1	13.1	29.9	15.0
Calcium	2.09	1.84	1.93	1.22	0.85
Phosphorus	0.35	0.69	0.67	0.40	0.70
Magnesium	0.30	0.17	0.26	0.22	–
Sample period	2 July 2013	2 to 12 July 2013	15 September 2013	15 September 2013	

Discussion

A pulse in *Lemna* production in two ponds in 2011 and 2012 after drawdowns in 2010 and 2011, respectively, demonstrates that this plant can rapidly respond to nutrients released from the organic sediments after they were exposed to the air. The *Lemna* response was ephemeral and did not re-occur in 2013 when flow-through of creek water resumed, presumably lowering the nutrient concentrations. The Trumpeter Swans responded to the superabundance of *Lemna* in both 2011 and 2012 by feeding almost exclusively in *Lemna*-rich ponds. When the ponds were not dominated by *Lemna* in 2013, the brood consumed other natural foods plus grain and commercial chow. The rapid colonization of snails onto *Lemna* indicates that the snails can use the plant as a substrate for feeding. Their presence suggests that any foraging on *Lemna* by swans would potentially involve the ingestion of significant quantities of snails. This raises the question of whether *Lemna* alone can be of any nutritional value to swans (especially the rapidly growing cygnets) or only when in combination with significant abundances of snails? The chemical analysis results indicate that *Lemna* is a rich source of nutrients, especially protein, even in the absence of adhering snails. In this regard, it compares well with the protein content of domestic poultry rations. The high nutritional value of the protein and its component amino acids in duckweeds (*Lemnaceae*) has been reported by Rusoff *et al.* (1980). The levels of the protein in the *Lemna* samples available to the cygnets in this study correspond well with those given in Rusoff *et al.* (1980) and Men *et al.* (2001), who suggested using duckweed as a protein additive to domestic duck grower rations.

While live snails alone offered relatively little protein (10.3%) to the diet of cygnets compared to that of *Lemna* alone (range 21%-29%), the higher nutritional quality of the animal protein with its essential amino acids may be important to developing cygnets (Sedinger 1984). Moreover, the potential

contribution of calcium by snails (range 4.02%-5.95%) would also be considerable, and was much higher than in any other food item assayed in this study, making snails an attractive calcium source and offering an enhanced diet in combination with *Lemna*. The number of snails living among the *Lemna* increased between 1 July 2011 (370/m^2) and 24 July-11 August (2470/m^2). Dead snail shells presumably could also supply dietary calcium but the cygnets apparently did not consume them as they did not grub in areas where benthic sampling revealed abundant snail shells but few live snails.

Young cygnets do not independently choose feeding locations that satisfy their nutritional needs because they are physically unable to do extended searches on their own. They depend upon the guidance of their parents to lead them into nutrient-rich areas. Parents do this, but not necessarily solely for the cygnet's benefit, as the breeding female must also replenish protein and calcium reserves depleted during egg laying and incubation periods (Thomas 1983). Later, both parents need calcium and protein following their moult, hence, they must feed in nutrient-rich areas at the same time as developing cygnets. Thus, the nutritional needs and appetitive behaviour of parents aligns with the nutritional needs of the cygnets.

The Aurora Trumpeter Swans had access to the ponds at all times, and the adults were able to assess the collapse of the snail population in the House pond in 2011 (Lumsden *et al.* 2015) and the abundance of *Lemna* and snails in the Garden pond. They led their brood to the Garden pond as soon as the cygnets could travel (within 1-2 days), where they found a highly nutritious diet of *Lemna* colonized by snails. The cygnets development through the summer corresponded with a steady increase in the quantity and quality of food available provided by the high abundance of *Lemna* and increasing abundance and size of snails. The *Lemna* lacking snails in the North pond was still higher in its protein and calcium content than the poultry ration (which the cygnets only briefly accepted in 2011). As in 2010 (Lumsden *et al.* 2015), these broods demonstrated a strong appetite for the most nutritious food available. We hypothesize that they sought calcium.

Selection of foraging habitat based on nutrition alone is unlikely in most animals because they often face a tradeoff between finding nutritious food and avoiding predators (Lima and Dill 1990). The Aurora swans exhibited habitat choices consistent with assessing predation risk against nutritional benefit. In 2012, the brood moved to the North pond after only one day in the *Lemna*-rich Garden pond (despite the high nutritional value available there) following the loss of a cygnet, probably due to predation by a Snapping Turtle (Lumsden 2013). The protein level of *Lemna* was slightly lower in the North pond compared to the Garden pond (24.4% vs. 27.8%), but the potential dietary calcium level in the North pond was much lower (1.9% vs. 4.02%) presumably because of the absence of snails in the *Lemna*. Thus, predation risk apparently

over-rode a nutritionally-based feeding choice in the choices made by the swans. Nevertheless, our analysis of nutritional value and foraging habitat use indicates that swans have the capacity to evaluate and consume abundant resources, such as *Lemna* or *Lemna* plus snails, based on their greater nutritional value compared with other foods locally available.

Summary

Sequential drawdowns of two ponds in 2010 and 2011 released nutrients from the substrate which stimulated a strong summer pulse of *Lemna minor* production in the refilled pond in the first year after drawdown. This production was ephemeral and did not reoccur in 2013. The *Lemna* and associated invertebrates, primarily snails, were fed on all summer each year by a brood of wild Trumpeter Swans. The colonization of *Lemna* by snails significantly increased the calcium content of the food, and may in part explain its attractiveness to the swan family with its rapidly growing cygnets.

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The aspirations and disappointments of Charles Fothergill in Upper Canada, Ontario's pioneer ornithologist/naturalist, from 1817 to 1840

John W. Sabean

Introduction

Charles Fothergill (1782-1840, Figure 1) was the first naturalist actively engaged in ornithological studies in southern Ontario, but due to a combination of misfortune and mismanagement, his efforts did not lead immediately to an advancement in natural history. It was not until a hundred years after his death that his extraordinary achievements came to light. Recently, I wrote a series of articles for the newsletter of the Pickering Township Historical Society about Charles Fothergill's years in Pickering Township where he lived from 1831 to 1837. I then followed those up with another article on the "Nature Notes of Charles Fothergill between 1831 and 1837", specifically those notes that pertain to Pickering Township. Subsequently, I published all of the articles in a special edition of the newsletter (Sabean 2015). The sightings that Fothergill recorded for Pickering—27 bird species, 7 mammals, and one reptile—constitute the first historical "list" of natural history for the city (then township).

For the general background of those articles, as everyone must now do, I relied heavily on James L. Baillie, Jr.'s article, "Charles Fothergill, 1782-1840", published in an issue of the *Canadian Historical Review* (Baillie 1944). Baillie wrote nearly three quarters of a century ago. What prompted his effort was the "discovery" (in several descendants' homes) of 16 manuscripts between 1931 and 1944. More than 40 years later Paul Romney made Fothergill the subject of his doctoral dissertation, a distillation of which was published in the *Dictionary of Canadian Biography* (Romney 1988). Even that is more than a quarter century ago. While I was particularly interested in Fothergill's contributions to the history of Pickering Township, I was also interested to see if Baillie's and Romney's assessments of Fothergill might change with new information or a different approach.

Writing in a more popular article in the same year as Romney, Elaine Theberge noted that Fothergill's status as

Fothergill's descriptions of the birds, mammals, fishes, reptiles and amphibians were meticulous and included a number of species he was the first to describe.

Figure 1. Charles Fothergill (1834) by Grove Sheldon Gilbert. *With permission of the Royal Ontario Museum. © ROM*

Canada's pioneer naturalist was beginning to have its due (Theberge 1988). While Romney's interests were chiefly political, Theberge was more concerned with arguing that the reappearance of the Fothergill manuscripts proved him to be primarily a naturalist: "Although prominent as a legislator, newspaper publisher and artist, it is in the field of natural history that Charles Fothergill deserves to be best remembered." Another more recent, but brief, account of Fothergill's contribution to Ontario ornithology may be found in D.F. Brunton's article in *Ornithology in Ontario*: "The early years of ornithology in Ontario: southern Ontario from Champlain to McIlwraith 1600 to 1886" (Brunton 1994). Brunton suggested that "Fothergill's tragic life in Canada underlines the limited support that existed in the early nineteenth century for intellectual pursuits… His time was one of political unrest and rebellion, as well as difficult economic conditions for most citizens… and the community of the day was simply not prepared to listen." While what follows is not a detailed biography of Fothergill, it does cover the main factors of his life in an attempt to understand what went wrong to nearly assign him to oblivion rather than to celebrate his great accomplishments.

England

Charles Fothergill was born in York, England, on 23 May 1782. His father, John Fothergill, was a maker of brushes and combs. Charles was trained in his father's trade, but did not choose to follow a commercial avocation; rather he opted to find his niche in scientific and artistic pursuits. In 1811, Fothergill married Charlotte Nevins, the daughter of a Quaker woollen manufacturer. Two sons, Charles and George, were born to them before they immigrated to Upper Canada.

If one's pedigree counts for anything, Fothergill was well situated. He came from a well-known Yorkshire family noted for their interests in ornithology, science and art. His uncle, James Forbes, F.R.S., for example, was an artist who

He came to Canada with one plan in mind—to research, compile and illustrate the natural history of the British Empire.

travelled to Asia, Africa, America and Europe depicting the people and places he encountered, including the natural history. Fothergill assisted in the preparation of his *Oriental Memoirs* (Forbes 1813) and acknowledged his debt to his uncle in art and natural history in dedicating to him a book he himself published in 1813 under the title *Essay on the Philosophy, Study, and Use of Natural History* (Fothergill 1813).

A great uncle, Dr. John Fothergill, a naturalist and philanthropist, had assisted George Edwards with the publication in England of his works on birds including many new world species being illustrated for the first time, and also sponsored William Bartram in his botanical investigations in the Carolinas, Georgia, and Florida between 1773 and 1778. Another uncle, William Fothergill, recounted to Charles the birdlife of the ancestral home of the family in Yorkshire, while a first cousin, Alexander Fothergill, drew from life nearly all the birds and other wildlife of the same area. Alexander's brother, another Dr. John Fothergill, was an artist and compiled a list of birds in *The History of Richmondshire* (Whitaker 1823). Charles's brother, Dr. Samuel Fothergill, was a physician, and his sister Eliza Fothergill was a talented portrait and landscape artist.

British Research

Given these stimuli, it was not surprising to find Fothergill wandering about the British Isles in pursuit of its natural history. He spent a year in Wales, another in Ireland, and still another in the Shetlands and Orkneys, two years in Scotland and two years on the Isle of Man. As early as age 13, he had begun an intensive study of Yorkshire birds, and at 17 (1799) he had published *Ornithologia Britannica*, a folio of eleven pages, listing 301 species of British birds (Fothergill 1799). Four years later, he published a two-volume work at London entitled *The Wanderer: or a Collection of Original Tales and Essays Founded upon Facts* (Fothergill 1803). Before leaving for the New World, he also published in 1813 an *Essay on the Philosophy, Study and Use of Natural History* (Fothergill 1813). Seeking a greater challenge, he conceived the idea of compiling a comprehensive natural history of the British Empire, and for that he had to travel to the New World.

Aspirations

On 6 March 1817, 200 years ago, Charles Fothergill arrived in York, Upper Canada, having emigrated from Yorkshire, England to Montreal the previous year. He came to Canada with one plan in mind—to research, compile and illustrate the natural history of the British Empire. The project carried the tentative title *Memoirs and Illustrations of the Natural History of the British Empire*. It was to run

to several volumes and include his own illustrations. This might appear to have been a daunting task, but if anyone was prepared to attain this end, it was he.

After visiting York, Upper Canada, Fothergill eventually settled his family at Smith's Creek (later Port Hope) in the spring of 1817, where he opened a general store and became the settlement's first postmaster. Meanwhile, he applied to Lieutenant-Governor Sir Francis Gore for 1200 acres of land on the south shore of Rice Lake. In this vicinity, he proposed to create a colony of gentlemen.

In 1818, Fothergill was appointed a Magistrate in the Court of Requests, and the next year became a member of the district land board. By 1821, he was also operating a brewery and distillery in Port Hope and a sawmill in South Monaghan. Later he would become one of the principal founders of the Port Hope Harbour and Wharf Company, founded in March 1829.

In 1821, Fothergill was appointed King's Printer, necessitating a move to York where he took up his duties as of 1 January 1822. In this capacity, he published the official *Upper Canada Gazette,* but he also availed himself of the opportunity to find other outlets for his energy. He published a newsletter, the *Weekly Register*, which would include the first nature column to appear in a Canadian newspaper.

From 1825 to 1830, Fothergill represented Durham County in the Legislative Assembly where he played an active role. Among the bills he initiated in the House, were an Act to establish agricultural societies in the province, an Act for the preservation of salmon within Upper Canada and a proposal to create a federal government for all the British provinces in North America. According to Paul Romney's assessment: "Fothergill's importance in the years 1824-30 was considerable. He was the foremost exponent of 'conservative reform' views in the province, and his image of gentility and respectability was useful to the emergent reform movement at a time when many people still equated 'party' activity with disloyalty" (Romney 1988).

The Pickering Years

Charles Fothergill's wife, Charlotte Nevins, died in 1822. Shortly after her death, he wrote pensively to his sister Elizabeth in England expressing a desire to reunite with the Quaker heritage of his family. Though his family had been Quakers (Friends) for many years, Charles had been banished in England from the society for his interest in breeding race horses. It may be that his wish to reconnect with the Friends' Society was what led him to the Richardson family of Pickering Township, a Quaker family that had emigrated from Ireland about 1820. At some time, he met Eliza Richardson, eldest daughter of Joshua and Catherine Richardson and on 20 March 1825, they were married in Port Hope. For the next six years, the family made their home in Port Hope.

Late in the year 1830, Fothergill purchased for £1200, a 50-acre lot in Pickering Township (Lot 14, Concession 1) from York businessman Alexander Wood and sometime in the following year he moved his family to this land. The land was described as having a gristmill and sawmill and with a blacksmith shop on

its border. Even before the sale was registered in the Land Registry Office, Fothergill was already petitioning Peter Robinson, Commissioner of Crown Lands, for permission to obtain the adjoining Lot 15, a Clergy Reserve. In order for Fothergill to repair the mills and get them up and running again, he needed to dam up the creek that ran through the property and supplied the motive power for the mills. The dam, however, would have backed up the creek onto Lot 15. Before he invested in re-establishing the mills, he needed to gain control of the land he would be flooding.

Fothergill had in mind more than the working of the mills on his newly acquired property. Once he secured Lot 15, comprising 187 acres, he proceeded to purchase the 200 acres of Lot 16 as well, and these 387 acres would form "the principal part of the Town plot of Monadelphia". Monadelphia was the name he gave to a proposed town he planned to create. First he restored the mills, then he built a distillery and barns. Further plans included dwelling houses, a tavern, churches and a printing office and probably much more. From the time Fothergill first arrived in Upper Canada, he had been interested in assisting British immigrants. When his "colony of gentlemen" did not materialize in South Monaghan, perhaps Monadelphia, on a grander scale, was meant to accomplish the same ends.

Intellectual Pursuits

Fothergill had high intellectual ideals and pursued many of them during his years in Upper Canada. As an artist, he entered some of his paintings into a public exhibition. Along with Paul Kane and Richard Bonnycastle, he was one of the exhibitors in the first exhibition of art in what is now Ontario, which took place in July 1834 at the Legislative Building on Front Street West in York. It was sponsored by the Society of Artists and Amateurs. For the show, he pulled out some of his older watercolours that he had painted in Yorkshire and Scotland. None of his Rice Lake or Port Hope paintings were entered in this exhibition, not even his very first effort in the New World—a watercolour painting of a Red-breasted Nuthatch (*Sitta canadensis*) (Figure 2) completed while he was still aboard ship in the St. Lawrence River.

As a public-spirited citizen, Fothergill proposed both a literary society and a museum for the Town of York. In 1831, with the aid of Dr. William Rees, a surgeon and meteorologist from York, and William (Tiger) Dunlop, army officer, surgeon and official with the Canada Company, Fothergill proposed to establish the Literary and Philosophical Society of Upper Canada, which, among other things, would promote the study of natural history. They applied to Chief Justice John Beverley Robinson and Archdeacon John Strachan to assume the leadership.

In 1836, Fothergill, again with associates Rees and Dunlop, proposed the establishment of a Lyceum of Natural History and the Fine Arts. For this they received the patronage of Sir John Colborne. Sir Francis Bond Head promised "a piece of ground on the Military Reserve behind the Garrison, and near Farr's Brewery, containing a little more than two acres" (Fothergill undated. TFRBL MS. Coll 140:24). Plans for the Lyceum were ambitious. It was to comprise a museum

Figure 2. Fothergill's first effort in the New World—a watercolour of a Red-breasted Nuthatch (*Sitta canadensis*) completed while aboard ship in the St. Lawrence River. *Fothergill (undated) T FRBL MS Coll 140:20, folio 247.*

of natural and civil history, an art gallery, a botanical garden and a zoological garden. Henry Scadding cited a prospectus that described a picture gallery "for subjects connected with Science and Portraits of individuals" and did not omit "Indian antiquities, arms, dresses, utensils and whatever might illustrate and make permanent all that we can know of the Aborigines of this great Continent, a people who are rapidly passing away and becoming as though they had never been." (Scadding 1966). The building that would house the museum and art gallery was to be patterned after the Parthenon of Athens.

Fothergill's last venture was the establishment of a printing office in which he published the newspapers the *Palladium of British America*, and *Upper Canada Mercantile Advertiser*, with his eldest son, Charles, as co-proprietor. He also issued a *Toronto Almanac* and the *Royal Calendar of Upper Canada* for 1839. Despite all this other activity, Fothergill did not forget what he had come to Upper Canada to achieve, and in 1833, Fothergill wrote a letter to British bookseller, John Murray, seeking a publisher for his intended opus: *Memoirs and Illustrations of the Natural History of the British Empire*.

A Naturalist Above All

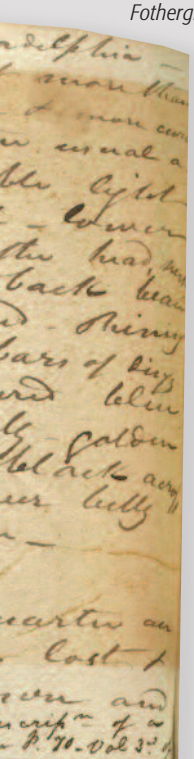
No matter what else occupied him during the 24 years he lived in Upper Canada, he remained, above all, a naturalist. He prepared "An Essay Descriptive of the Quadrupeds of British North America", in which he described 117 mammals (Fothergill, undated). He was one of the first to document the depletion of salmon in the rivers and streams of Upper Canada and in 1835 he had a paper he prepared on the migration of salmon read at the Literary and Historical Society of Quebec (Fothergill 1835). In that paper, he noted the diminishing of salmon due to the building of dams, the increase of human population, and illegal fishing. He wrote that Magistrates "who have attempted to enforce the protection… have generally suffered some way… in their persons or property. The writer of this essay had a very valuable mill burnt down in the night, [and] other mischief done for sending a notorious salmon poacher to gaol for killing salmon contrary to Law" (as quoted in Anonymous 1855).

In order to record, study and illustrate the fauna of North America, Fothergill collected and had stuffed, specimens of as many species as he could find. In his journals, he often spoke of shooting birds and mammals for the purpose of identification. These he would have preserved and added to a growing collection. Beyond that, he would purchase stuffed specimens from

Figure 3. A handwritten account by Charles Fothergill on the Golden backed or Little Pivoine [Northern Parula *Setophaga americana*] *Thomas Fisher Rare Book Library MS 140:25.*

Charles Fothergill: Description of Northern Parula, Female and Male

The account below is an example of a species description that I (JWS) transcribed from a handwritten account (Figure 3) by Charles Fothergill. The first line in the account (below) is the name he gave to the species he was describing. Then, in square brackets, is the present nomenclature–the English and the Latin genus and species names. The third line provides the source from which the account has been taken. The number 25 refers to Volume 25 of the Charles Fothergill papers in the Thomas Fisher Rare Book Library (TFRBL) entitled "Memoirs and illustrations of natural history in various parts of the British Empire" (Fothergill, undated, TFRBL MS 140:25). The number 20 signifies Volume 20 in the same collection: "Canadian researches chiefly in natural history" (Fothergill, undated, TFRBL MS 140:20). I have also noted R.D. Black's references by page and number from his 1934 article (Black 1934). Note that words and phrases contained between asterisks (*) are interlinear additions or corrections made by Fothergill in the manuscript, usually indicated there by a caret (^)



Golden backed or Little Pivoine / Golden, or Bronzed Backed, or Least Pivoine [Northern Parula. *Setophaga americana*] 25: 295; 20: 70 (Black 154:86)

[25: 295] "Shot May 4, 1833 at Monadelphia. Length apparently not more than 4 1/2 Inches. Bill small & more curved and sharp pointed than usual among the Warblers – Upper mandible light brown, lower yellow – Irides hazel – Lower eyelid white – Upper plumage on the head, neck, rump &c, lead coloured blue – The back beautifully marked with a gold coloured shining olive – On the wing two short bars of dingy white, smaller coverts lead coloured blue – Chin, throat, neck, breast and belly golden yellow – with a broken bar of black across the breast about the vent & lower belly white – Legs & feet light brown.

The above written about a quarter an hour after the specimen was lost & just as I was going to sit down and describe it accurately. I believe the above was a female. For a further descrip[tio]n of a perfect male see p. 70, Vol. 3rd of Cana[dia]n Researches."

[20: 70] "The following is a description of a perfect male killed at Monadelphia May 12, 1837 ….

Length 4 1/4 [-] 4 1/2 In. Breadth 6 1/2 [-] 6 3/4 inches. Bill to corners rather more than 3/8ths, very sharp pointed, somewhat curved and beset at base with very fine horn like bristles. Upper mandible dark blue, *nearly black*, lower orange yellow. Irides hazel. Eyelids white. From the bill to the eye black. Head, cheeks, sides & back of the neck, scapulars, less[er] wing coverts, lower back, rump and upper tail coverts a fine and glossy blue or very blue lead colour much more inclining to a perfect blue than the most cerulean lead colour. Center of the back behind the shoulders tapering to a point on the lower back a bright and shining golden *olivaceous* bronze colour – not easily described or imitated. Quills black finely margined on their outer edge with blue and on the inner with white. Their coverts the same tipped with white. The first row of the second coverts are also white which together form two short bars of white across the extended wing. Chin and throat virgin golden yellow – below this across the front of (th)e neck a narrow bar of black *or dusky spots* edged with gold. Upper breast gold or yellow with a few large spots of bright ferruginous. Lower breast, belly, vent & under tail coverts white. Sides lead colour. Tail a little forked, bluish black finely edged on their outer margins with blue. Two outer feathers marked with a large spot of pure white near the end of inner web. Legs & feet *light* reddish brown. Soles yellow."

a number of different sources. The collection was housed at first at his home in Pickering Township. In his *Statistical Account of Upper Canada,* Thomas Rolph (1836) recorded a visit he made to Fothergill in Pickering.

> *The Township of Pickering,* he said*, is well settled & contains some fine land and well watered. Mr Fothergill has an extensive & most valuable museum of natural curiosities, at his residence in the township, which he has collected with great industry & the most refined taste. He is a person of superior acquirements & ardently devoted to the pursuit of natural philosophy* (Scadding 1966).

Fothergill's Museum

When Fothergill began to urge the creation of a provincial natural history museum at Toronto, he moved his collection into the city. According to James L. Baillie, Jr., the first home was in Chewett's building at the southwest corner of King and York Streets, then it was moved to the Market Square building (St. Lawrence Hall) and finally it was housed in a building at the corner of York and Boulton Streets. Fothergill also kept detailed records of his wildlife encounters, filling several ledger-size volumes with descriptions of birds, mammals and other wildlife that he either shot or observed. Baillie, the first to write comprehensively about Fothergill in relation to his natural history pursuits, concluded:

> *The present writer has made no attempt to ascertain the number of British animals discussed in the Fothergill records, but his Canadian descriptions and notes concern approximately 186 birds, 105 mammals (not including domestic ones), 27 fishes, 15 reptiles, and 2 amphibians. The descriptions were, in nearly all cases, given in great detail, and were prepared with such care that one experiences little difficulty in identifying the animals concerned. There is no question that Fothergill was the pioneer naturalist of southern Ontario and the care with which he made his notes stamps him as one of the most important of the early naturalists of Canada* (Baillie 1944).

Fothergill died in Toronto on 22 May 1840. He was buried in the burying ground of the Cathedral Church of St. James. During his years in Upper Canada, he was at one time or another, among others, a storeowner, a postmaster, a mill owner, a brewer, King's printer, a newspaper publisher, a legislator, a magistrate, a member of the land board, as well as a naturalist and an artist.

So why is Charles Fothergill not better known for his role in the affairs of Upper Canada? And why has he not been generally recognized as the Audubon of Canada, or at least, as Baillie put it: "one of the most important of the early naturalists of Canada" (Baillie 1944)?

Disappointments

It must be said that in many ways Fothergill was a man ahead of his times, a visionary, a deep thinker. But that, among other things, was also his undoing. Paul Romney, in his article for the *Dictionary of Canadian Biography*, refers to "unbroken sequences of failures that were largely of his own making." "His

self-destructive risk-taking is probably traceable to an obsessional neurosis akin to that of a compulsive gambler" (Romney 1988).

Even before he came to Canada, Fothergill had already gained a reputation as a poor money manager. He appeared to be constantly in debt. That trend continued in the New World. His store in Port Hope failed and the property was seized for debt. Later, he was dismissed from the post office for his criticism of the post-office administration.

Fothergill was strongly opinionated and that often brought him into a clash with the ruling authorities. Thus, for example, he was removed as King's Printer on January 1826 after voting against the administration and incurring the wrath of the Family Compact. While the decision was political, he had not endeared himself to the administration by constantly asking for cash advances and not using the money wisely.

As a legislator, he was not always able to convince his fellow members of the benefits of his proposals. So while he had an act for the preservation of salmon passed in the House, it was vetoed by the Executive. His proposal to create a federal government was rejected by the majority of the House as "visionary". Had he succeeded at the time, we would this year be celebrating nearly 190 years of a united Canada instead of 150 years. But his proposal to create agricultural societies not only passed in the House, it had some success subsequently.

Of his scheme to create a model community in Pickering, whether Fothergill was ill prepared to complete his project, or whether events conspired against him, he was unable to see his vision established despite a great outlay of money. He lacked the good will of his neighbours, including some of the earliest settlers in Pickering Township, who might have assisted him in achieving his goal if he had not quarrelled with them. In 1834, one of his mills burned down, the responsibility for which he blamed an alleged salmon poacher, John Sparks, whom he had previously prosecuted. In the same year, both his milldams were carried away by floods—for which he blamed his sons for neglecting their responsibilities. In any case, he could not enlarge his mill complex because the land he had purchased was not sufficient for the operation—for which he blamed the seller of the property for misrepresenting what was intended in the sale.

When, in 1831, Fothergill requested Robinson and Strachan take up the leadership of his proposed Literary and Philosophical Society of Upper Canada, they turned him down only to accept a few months later a similar proposal from James Cull, newly arrived in Upper Canada and virtually unknown. On Friday, 5 September 1832, Strachan gave the inaugural lecture to the society. The society, however, failed to attract a large following and soon disbanded.

Lyceum of Natural History

As for the plans for the creation of a Lyceum of Natural History and the Fine Arts in the mid-1830s, although Fothergill did secure the support of Sir John Colborne and Sir Francis Bond Head, the project eventually had to be abandoned. There was an effort to raise money by subscription, but it fell short of the goal.

Henry Scadding was probably right when he said in 1873 that the project "was probably too bold in its conception and too advanced to be justly appreciated and earnestly taken up by a sufficient number of the contemporary public forty years ago" (Scadding 1966). At the time Fothergill's efforts were most needed, he was lying desperately ill at home for seven months, so ill that doctors despaired of his life. No doubt his health had been undermined by the troubles he faced in Pickering and by his inability to find remunerative work.

This was not the first time sickness plagued Fothergill. In 1822, the year he began his term as King's Printer, a time that should have been one of the happiest of his life, he suffered a prolonged illness. At the same time an infant son (his and Charlotte's third son) died from meningitis, and Charlotte, herself, succumbed after a long bout with tuberculosis.

The failure of the Lyceum was especially cruel for Fothergill as he was desperate to find employment and had written a letter to Sir Francis Bond Head in 1836 pleading to be appointed to one of several offices then vacant: Commissioner of Crown Lands, Surveyor General, or Inspector General, or failing those appointments to be put in charge of the Lyceum (his preferred position).

The Final Challenge

By the time Fothergill took on his final challenge, the publication of the *Palladium of British America*, he was probably too worn out by illness, constant poverty, and failure to secure a remunerative position. Samuel Thompson, who in 1838 managed Fothergill's newspaper, summed up the dilemma perfectly:

> *Mr Fothergill was a man of talent, a scholar and a gentleman, but so entirely given up to the study of natural history and the practice of taxidermy that his newspaper received but scant attention… His family sometimes suffered from the want of common necessaries, while the money which should have fed them went to pay for some rare bird or strange fish* (Thompson 1969).

When he died in 1840, his debts, his land claims and his failures all had to be sorted out by his widow and children. So destitute was Fothergill's widow that a Quaker neighbour wrote a letter to Fothergill's sister in England to make her aware of Eliza's predicament and suggest she desperately needed financial help.

Assessment

There can be no doubt that, as Baillie stated, "As a naturalist and an illustrator of animals, he ranked with the best of his period." At the same time, again as asserted by Baillie, "Fothergill exerted no great influence on the development of natural history studies in Ontario" (Baillie 1944). Although he accumulated much data for his proposed *Memoirs and Illustrations of the Natural History of the British Empire,* all of his notes and illustrations remained in manuscript form not to be discovered until the 1930s. Added to that, shortly after after he died in 1840, the building that housed his museum burned down and his collection was totally destroyed by the fire. All of Fothergill's stubbornly accumulated artefacts, and all of his notes

...what remains of his achievement stands as a remarkable record of the wildlife of southern Ontario in the early decades of the nineteenth century.

and written records were lost, some permanently, some for nearly 100 years. His descriptions of the birds, mammals, fishes, reptiles and amphibians of Upper Canada were meticulous and included a number of species he was the first to describe. Had his work been available to subsequent scholars and scientists over the next century, the development of ornithology and other scientific disciplines would have been greatly advanced. As it is, however, what remains of his achievement stands as a remarkable record of the wildlife of southern Ontario in the early decades of the nineteenth century.

Faunal Descriptions

Ten years before Baillie published his seminal article on Charles Fothergill, Delamere Black did an analysis (not without error) of one of Fothergill's manuscripts ("Canadian Researches Chiefly in Natural History" (Fothergill undated. TFRBL MS Coll. 140:20) in which he wished "to convey some idea of the quality and keenness of [Fothergill's] observations" (Black 1934). Black recorded 117 birds, 23 mammals, 7 fish, 7 reptiles, 1 amphibian and 3 plants. My own researches were just as limiting as Black's, but in a different way. I had access to a second, and somewhat more extensive, manuscript containing Fothergill's faunal descriptions, viz., "Memoirs and illustrations of natural history in various parts of the British Empire" (Fothergill undated. TFRBL MS Coll. 140:25). From these two manuscripts, I extracted only his faunal descriptions for Pickering Township. There, between 1831 and 1837, Fothergill observed, shot and stuffed as many of the specimens as he could—often with the help of his son George, who appears to have been handy with a gun. The preserved specimens were added to his growing museum. While I asked Ross James, Barry Kent MacKay and Glenn Coady for help in determining the bird species described, for the most part I was able, without question, to make my own determination. I have to conclude with Black that of Fothergill's wildlife records: "The minuteness and accuracy of Fothergill's descriptions are amazing and such that there could be no doubt as to the identity of the species in the great majority of cases" (Black 1934).

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Coniferous forest habitat in the Kenauk Nature Reserve. *Photo by Juliana Balluffi-Fry*

Using bird survey data to associate habitat type and bird species richness in a forest of southern Quebec

Juliana Balluffi-Fry and Kyle Elliott

Introduction

The effects of habitat on biodiversity have been studied extensively. Species richness is a basic measure of diversity and can be a proxy for ecosystem health (Mitchell 2006). Birds are plentiful, diverse and identifiable to the trained ear, making them a useful umbrella or indicator taxa for biodiversity studies.

Habitat largely determines breeding bird distribution as it dictates two fundamental needs: an acceptable nesting site and an ample food supply (Vickery and Arlettaz 2012). According to previous studies of bird species richness, a habitat's structural diversity, or the number and varieties of nesting and feeding niches, is positively correlated to its avian species richness (Cody 1985).

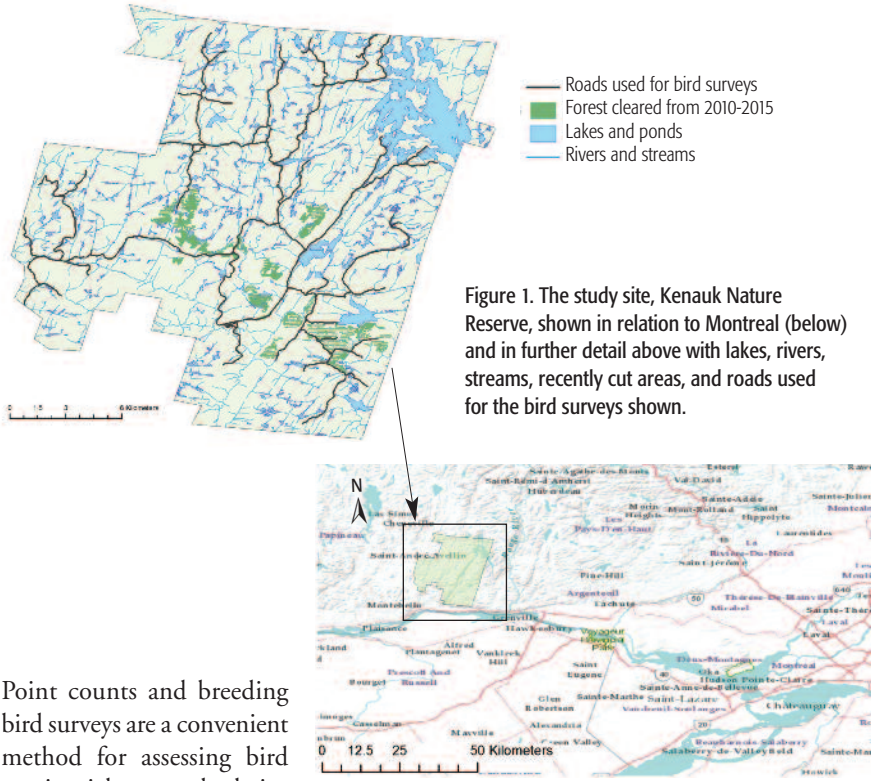


Figure 1. The study site, Kenauk Nature Reserve, shown in relation to Montreal (below) and in further detail above with lakes, rivers, streams, recently cut areas, and roads used for the bird surveys shown.

Point counts and breeding bird surveys are a convenient method for assessing bird species richness and relative abundance. A common way to collect such data is by recruiting experienced volunteer birders (Sauer *et al.* 2001), as did the managers of this paper's study site. The study site of this paper is a private game reserve located in Montebello, Quebec, whose recent owners have collaborated with Nature Conservancy of Canada (NCC) to catalogue the biodiversity of their reserve. They have done so in part by using volunteer birders to conduct bird surveys and create an inventory of all bird species present.

This paper is the culmination of a 2015 attempt to inventory the diurnal avian diversity in the Kenauk Nature Reserve and its association with habitat type. It is an example of one of the many achievable uses for bird inventory data collected by volunteers and the possible ecological effects of certain land management practices.

Materials and Methods

Study area

The Kenauk Nature Reserve study site of this paper is a 260 km² private game reserve located in Montebello, Quebec, halfway between Montreal, Quebec, and Ottawa, Ontario, just north of the Ottawa River (Figure 1). The reserve sits on the border between the sugar maple-basswood (*Acer saccharum-Tilia Americana)* and the sugar maple-yellow birch (*Acer saccharum-Betula alleghaniensis*) forest zones (Belanger *et al.* 1992).

Bird survey data were collected from all drivable roads inside the Kenauk Nature Reserve. *Photo by Juliana Balluffi-Fry*

The property has a history of strip-cut forest harvesting. Most regrowth is natural regeneration, however, there are plots that have been seeded with coniferous species. This has caused the property to be a heterogeneous patchwork of both coniferous and naturally occurring forest stands varying in age. Along with a wide range of forests, the land also includes wetlands, lakes, ponds, rivers, streams and some recently cleared areas. The road system in the Kenauk Nature Reserve (Figure 1) is a tertiary one, meaning all of the roads are narrow and unpaved (McCarthy 2012).

Bird data

Avian species richness data were collected from the faunal surveys by NCC volunteers. The goal of NCC's surveys was to complete an overall bird species inventory for conservation planning purposes

NCC volunteers at Kenauk. *Photo by Mike Dembeck*

and to determine whether any endangered, threatened or special concern bird species inhabited the property. Sampling occurred in the summer of 2015 on 6, 7, 19, 20, 21 June. The morning and evening birding sessions were conducted between 5:00 and 11:00 and 16:00 and 22:00, respectively. Some volunteers chose to bird between the hours of 11:00 and 16:00; we used these point counts as well, since we needed to account for the variable of "time of day". Volunteers worked in pairs, with each of the volunteers having at least 10 years of point count experience.

Bird survey data were collected from all drivable roads inside the property. The literature suggests that tertiary road systems such as Kenauk's do not affect bird populations enough to change point count accuracy (McCarthy 2012). Since the original purpose of the bird surveys was to observe the most avian species possible, volunteers did not use the typical stationary point count method. Instead, their collection was much more like that of surveys consisting of driving and birding specific lengths of roads with stops for further observation.

Volunteers used the detailed maps of the property's 30 divisions to mark their routes' starting and ending locations and times. They proceeded slowly down the roads in their vehicles and recorded any bird heard while driving. The birders would stop and conduct a point count every 0.3 kilometers along the drive or until there was a noticeable habitat change (for example, a roadside marsh or pond). The point count stops would last for a maximum of 5 minutes, unless extra time was needed to identify certain challenging bird calls.

These methods provided flexibility for experienced observers to increase the number of point counts across the many habitat changes while maximizing habitat covered by following roads. Increasingly, observer flexibility has become recognized as an important component of biodiversity inventories, as observers can maximize time in regions of high abundance, such as by following calls to locate flocks (Rompre *et al.* 2007, Bart *et al.* 2012). Accurate community-level data can be obtained from more flexible study designs as well as purely random point counts and line transects (Rompre *et al.* 2007, Bart *et al.* 2012).

The end result was one survey record per birding route, which listed all detected species and their observed abundance tallies. Birds encountered while driving were included in the analysis. We extracted the total avian species richness, passerine richness (number of passerine species observed) and *at risk* richness (number of species listed by COSEWIC as Threatened or Special Concern) for each birding route.

Habitat data

We drove all of the NCC birding routes by following their paths marked in detail on property maps, and measured their lengths to the nearest 0.1 km (100m) using an odometer. We classified each route's habitat composition using eight categories: deciduous (>90%), coniferous (>90%), deciduous-dominated mixed forest (50-89%), conifer-dominated mixed forest (50-89%), wetlands (peatlands, marshes, swamps), permanent waterbody (lakes, ponds, rivers), rocky outcropping and recently cleared, which we defined as non-wetland openings with vegetation no greater than shrub level. As we drove, we categorized the road-side habitat and recorded the location of each habitat change, i.e., its distance in kilometers from the starting location. This gave us the distribution of habitats along the roadsides of each birding route. For each bird survey route, we calculated the total length (km) of each habitat present and then divided by the

total length of the route to get percentages for each. We then arcsine-transformed the habitat percentages. Time of day was not controlled for on each birding survey, therefore we added this variable by using the median time between each birding route's start and stop times.

Statistical analysis

Each data point in our model is one bird survey route since the volunteers only provided the species and total numbers of each species observed per each birding route. This caused each data point to vary in length (km), duration (i.e., how long it took them to conduct the survey from start to finish), time of day, observer (the observer chosen to represent the route was the most experienced birder) and habitat proportions. A generalized linear mixed model was run using these data with observer as a random effect (Bolker *et al.* 2008). The fixed effects for each data point were duration, length, time of day and the percentages of each of the eight habitat categories listed. We ran the model three times for the three different response variables: total richness, passerine richness and *at risk* richness.

We analyzed the data using the R package lme4 (Bates 2010). To achieve normality, we log-transformed total and passerine richness and fit a Poisson distribution in the lme4 package for *at risk* richness. To determine which fixed variables significantly affected total richness and songbird richness, we ran the model using the function lmer (glmer for *at risk* richness to accommodate a Poisson distribution) and obtained effect sizes (t-values).

We eliminated all insignificant effects using a significance level of $P<0.05$, which was executed within the lmer function using the criterion $|t|<2$, and re-ran the model until all effects were significant.

To prove our total species richness was justified and to conduct a meaningful comparison across the varying habitat proportions, we created a sample-based rarefaction curve using the number of new species heard in each driven route over the total amount of time birding (Gotelli and Colwell 2001). We extrapolated how many bird species could potentially occur at Kenauk, to further determine how conclusive the data were, using the *Chao1* index. The *Chao1* index is given by the following expression (Chao 1984):

$$S_{est} = S_{obs} + \left(\frac{(f_1)^2}{2f_2}\right)$$

Where: f_1 is the number of singletons (species observed once), and f_2 is the number of doubletons (species observed twice) and S_{obs} equals the total number of species observed regardless of abundance (Gotelli 2008).

Results

Observed species

A total of 99 species was observed on the property including 68 passerines, 13 waterfowl, and 18 others (Appendix 1). Of the 99 species, eight were listed as *at risk* by COSEWIC (2015). These included the Eastern Whip-poor-will, Olive-sided Flycatcher, Eastern Wood-Pewee, Barn Swallow, Wood Thrush, Canada Warbler, Bobolink and Eastern Meadowlark (see Appendix 1 for scientific names).

Habitats

The total number of birding routes (data points) used in this study was 48. Of the 48 total routes, not all were unique; there was much overlap and eight had the exact same start and ending locations. The average length of the routes was 3.17 km. The average amounts of each habitat present per birding route were as follows: deciduous-dominated mixed forest (34.8%), deciduous forest (28.1%), wetlands (11.7%), permanent waterbody (9.9%), coniferous forest (6.7%), rocky outcropping (3.8%), coniferous-dominated mixed forest (2.8%) and lastly reccently cleared (2.2%).

Sampling effort

The plot of our species accumulation-effort curve almost asymptotes by the end of the study's sampling period (73.46 hours) with an accumulated total of 99 species (Figure 2). Hence, a very large increase in sample effort would be needed to reach a higher total species richness.

This is important because as Gotelli and Colwell (2001) state: "Raw species richness counts… can be validly compared only when taxon accumulation curves have reached a clear asymptote." Therefore, our total species list is a strong representation of the Kenauk diurnal bird diversity.

If we substitute our findings into the *Chao1* equation:

$$S_{est} = 99 + \left(\frac{(14)^2}{2(7)}\right)$$

$$S_{est} = 113$$

the results concur that theoretically there should be 113 species inside the Kenauk forest. Gotelli (2008) explains that this equation equates to "a conservative estimate", so a minimum of 14 species went undetected by our point counts.

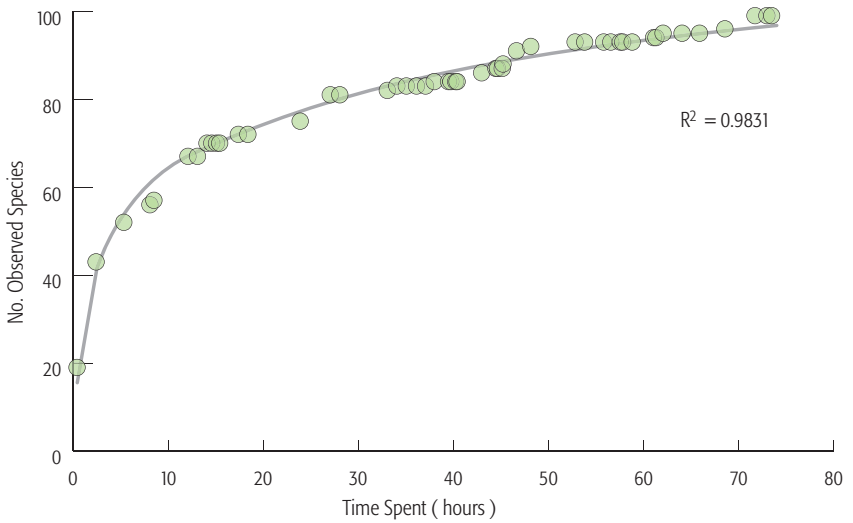


Figure 2. Total number of species detected by sampling effort (hours), fitted to a logarithmic line.

Top: **Sugar maple habitat with dense understory.**
Left: **A tertiary road through coniferous habitat.**
Above: **An open shrub dominated wetland.**
Photos by Juliana Balluffi-Fry

The percent of recently cleared area was positively correlated with the number of *at risk* species detected. *Photo by Juliana Balluffi-Fry*

Effects of habitat

Two habitat types were associated with at least one type of richness: coniferous forest and recently cleared (Table 1 and Figure 3).

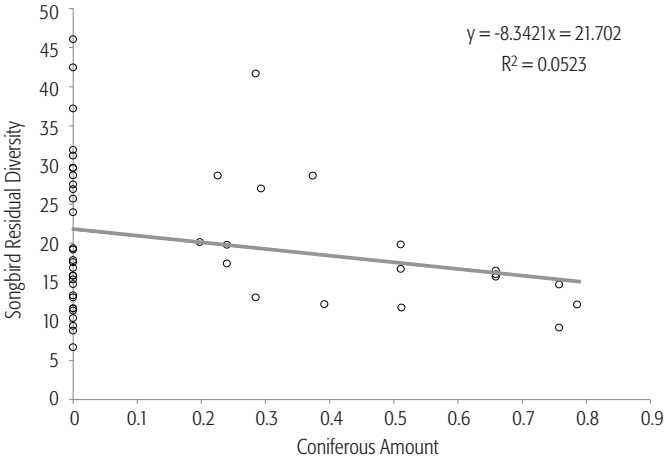
The total species richness was significantly affected by the duration and length of the point count route, with route length having a greater effect than duration; total richness was negatively affected by the amount of coniferous forest (Table 1). No other fixed effects were significant.

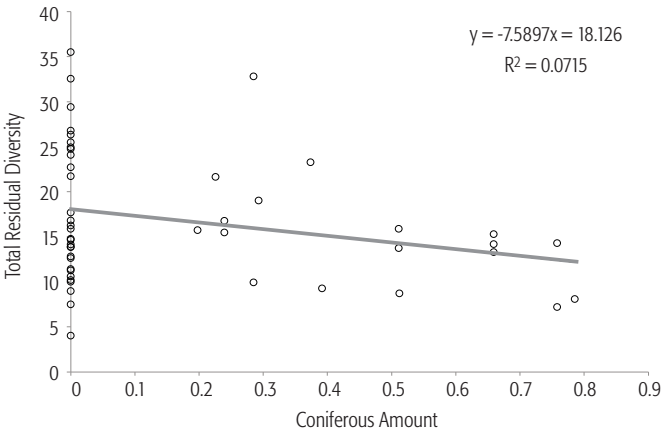
Passerine richness was significantly affected by time of day in addition to duration of point count and amount of coniferous forest. Passerine richness declined with time of day. *At risk* richness also declined with time of day, but was not related to either length or coniferous factors. However, the habitat parameter "percent recently cleared area" was positively correlated with this type of diversity. Regardless, the amount of variation associated with habitat was relatively low (R^2 = 0.01-0.07) (Figure 3).

Table 1. The relationships between each type of species richness and its fixed effects. Only the fixed effects that proved significant to at least one richness type are shown. Significant relationships are represented by the estimated regression slope ± standard error from the generalized mixed model. Deciduous, deciduous-dominated mixed, coniferous-dominated mixed, wetlands, permanent waterbodies, rocky outcroppings were not included in the table as they showed no significant relationship to any type of species richness.

	Time of Day	Duration	Birding Route Length	Coniferous	Recently Cleared
Total Species Richness	Not Significant	0.0023 ± 0.00040	0.045 ± 0.016	-0.32 ± 0.11	Not Significant
Passerine Richness	-0.41 ± 0.16	0.0017 ± 0.00046	0.042 ± 0.018	-0.36 ± 0.13	Not Significant
At Risk Richness	-2.8 ± 0.93	*	Not Significant	Not Significant	1.3 ± 0.51

* Duration was excluded for *at risk* richness because the model would not converge.





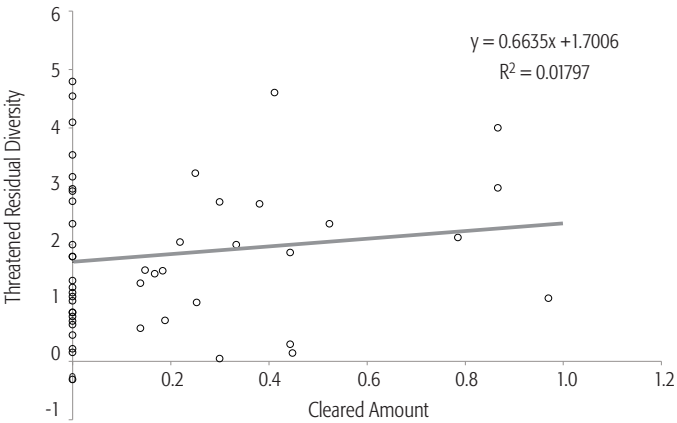


Figure 3. The residual plots using the same significant habitats as in Table 1. These residual plots show the relationships between the habitats of interest and species richness after accounting for all other significant variables. All slopes are significantly different from zero (Table 1).

Discussion

Species observed

Our total observed species list reveals that this forest holds a diverse diurnal bird fauna. The 99 species found, representing 90% of 114 species estimated to occur in mid-June, is a minimum estimate of richness, but it covers many avian orders and families. The Kenauk property is considered a diverse landscape, because it has many types of habitats in large areas. The landscape diversity theory states that the more heterogeneous a landscape is, the more species it will have (Dolman 2012). In our study, richness was not strongly associated with any particular habitat feature (relationships with habitat composition were weak), implying that the high species richness at Kenauk is associated with the mosaic of habitats present on the property.

The majority of the observed species were passerines, which is predictable because Passeriformes is the most species rich of the avian orders and contains many species often found in forests (Sibley 2003). There were also 13 species of waterfowl due to the many lakes, marshes and ponds. Few nocturnal species (e.g., owls, nightjars) were detected because of method bias (i.e., birding occurred between 05:00 and 22:00) (Sibley 2003). Eight (8.8%) of the species observed were either Threatened or of Special Concern (COSEWIC 2015).

Total and passerine richness

We found that there was a significant negative correlation between bird species richness and percent of coniferous forest. A widely accepted and supported theory in ecology is that habitat diversity is reflected in wildlife species diversity (Tews *et al.* 2004). This theory holds that less diverse habitats hold fewer niches, such as nesting sites and food sources (Cody 1985). This property was an ideal study site to investigate these effects because it holds areas which were once seeded with coniferous species and therefore, are now homogenous in tree species and height. Our findings support the theory because we found that the bird survey routes with the more homogenous and less-diverse coniferous seeded stands showed lower total and passerine species richness. We believe this is because the coniferous stands tend to have less diverse understories which would equate fewer food and nesting site options (Ramovs and Roberts 2003, Barbier *et al.* 2008). It is also suggested that tree height diversity as well tree species diversity of a forest stand is positively correlated with avian richness (MacArthur and MacArthur 1961, Karr and Rothland 1972).

At risk species richness

The number of observed *at risk* species increased with percent cleared area. Most of the Threatened species listed do in fact prefer nesting or foraging in fields, clearings or forest edges. Two recorded *at risk* grassland species, Eastern Meadowlark (Sibley 2003, Guzy and Ribic 2007) and Bobolink (Sibley 2003, Diemer and Nocera 2014), breed and nest almost exclusively in agricultural or abandoned fields. Likewise, aerial insectivores use open areas to forage, e.g., Barn Swallows prefer to nest in man-made structures surrounded by open habitat (Brown and Bomberger Brown 1999). The Olive-sided Flycatcher chooses meadows, forest

openings and edges over dense undisturbed woods (Altman and Sallabank 2012) and the Eastern Whip-poor-will prefers sparser woodlands, such as areas with strip cuts or selected harvests (Cink 2002). All of these species were observed in Kenauk Nature Reserve.

Future monitoring and research

Homogeneous coniferous forest stands decreased overall bird diversity while many of the *at risk* species at Kenauk were found in edge and field habitats. Both of these findings can be helpful for the management of the property by knowing the direct effects that plantations and strip cuts have on bird species and potentially on other taxa. More research must be done in this area to better understand the effects of plantations and forest cuts on biodiversity. Moreover, this property in particular must continue bird surveys if the owners wish to confirm and elaborate our results, as well as observe rarer species since species with low detection probability are more likely to be observed when point counts last longer (Dettmers *et al.* 1999).

Population estimates of species of interest could be made if more point counts were done each year. Experienced volunteers would have to work evenly across the territory, with more survey points revisited for many years (Thompson *et al.* 2002). We suggest that static point count sites should be chosen representatively across the property's varying habitats for long term comparison studies along with NCC's informal inventories. If the sites are revisited multiple times each year, with standardized methods of point counts, variables such as duration and extent of habitat, could be eliminated and the effects of habitat on the bird diversity of this forest would be more apparent.

Overall, biodiversity is a critical indicator of ecosystem health and important field of ecological study. Therefore, land and forestry managers should ideally monitor these forms of diversity to understand the effects of management (Hartley 2002). As this paper shows, it is in fact possible to use general survey data to explore deeper topics.

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APPENDIX 1. Species (American Ornithologists' Union 2016) recorded on Kenauk Nature Reserve point counts collected between the 6th-21st of June 2015. All species with the COSEWIC status as Threatened ("T") or Special Concern ("SC") are in bold.

Species per Route	No. Occupied Routes	Avg No Ind per Route
Canada Goose (*Branta canadensis*)	5	6.8
Wood Duck (*Aix sponsa*)	8	2.9
American Black Duck (*Anas rubripes*)	2	1.5
Mallard (*Anas platyrhynchos*)	1	1
Ring-necked Duck (*Aythya collaris*)	3	3.7
Common Goldeneye (*Bucephala clangula*)	1	5
Hooded Merganser (*Lophodytes cucullatus*)	4	2
Common Merganser (*Mergus merganser*)	1	1
Ruffed Grouse (*Bonasa umbellus*)	12	1.8
Common Loon (*Gavia immer*)	2	1.5
American Bittern (*Botaurus lentiginosus*)	4	1.3
Great Blue Heron (*Ardea herodias*)	9	4.3
Green Heron (*Butorides virescens*)	1	1
Turkey Vulture (*Cathartes aura*)	11	1.8
Red-shouldered Hawk (*Buteo lineatus*)	3	1
Broad-winged Hawk (*Buteo platypterus*)	1	1
Red-tailed Hawk (*Buteo jamaicensis*)	2	1
American Woodcock (*Scolopax minor*)	1	1
Mourning Dove (*Zenaida macroura*)	5	1.6
Black-billed Cuckoo (*Coccyzus erythropthalmus*)	7	1.7
Great Horned Owl (*Bubo virginianus*)	2	1
Barred Owl (*Strix varia*)	1	1
Eastern Whip-poor-will (*Antrostomus vociferus*) T	**1**	**8**
Ruby-throated Hummingbird (*Archilochus colubris*)	7	1.6
Belted Kingfisher (*Megaceryle alcyon*)	4	1
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	15	1.9
Downy Woodpecker (*Picoides pubescens*)	4	1
Hairy Woodpecker (*Leuconotopicus villosus*)	6	1.2
Northern Flicker (*Colaptes auratus*)	17	1.9
Pileated Woodpecker (*Hylatomus pileatus*)	6	1.5
Olive-sided Flycatcher (*Contopus cooperi*) T	**7**	**1.1**
Eastern Wood-Pewee (*Contopus virens*) SC	**13**	**1.5**
Alder Flycatcher (*Empidonax alnorum*)	16	1.6
Least Flycatcher (*Empidonax minimus*)	9	2
Eastern Phoebe (*Sayornis phoebe*)	8	1.5
Great Crested Flycatcher (*Myiarchus crinitus*)	19	2
Eastern Kingbird (*Tyrannus tyrannus*)	9	1.4
Yellow-throated Vireo (*Setophaga dominica*)	1	1
Blue-headed Vireo (*Vireo solitarius*)	4	1.8
Warbling Vireo (*Vireo gilvus*)	6	1.2
Red-eyed Vireo (*Vireo olivaceus*)	39	4
Blue Jay (*Cyanocitta cristata*)	23	3.0
American Crow (*Corvus brachyrhynchos*)	7	2.3

Species per Route	No. Occupied Routes	Avg No Ind per Route
Common Raven (*Corvus corax*)	11	1.6
Tree Swallow (*Tachycineta bicolor*)	3	2.7
Barn Swallow (*Hirundo rustica*) T	**3**	**3.3**
Black-capped Chickadee (*Poecile atricapillus*)	14	1.7
Red-breasted Nuthatch (*Sitta canadensis*)	7	2
White-breasted Nuthatch (*Sitta carolinensis*)	7	1.4
Winter Wren (*Troglodytes hiemalis*)	6	1.5
Sedge Wren (*Cistothorus platensis*)	1	1
Marsh Wren (*Cistothorus palustris*)	1	1
Golden-crowned Kinglet (*Regulus satrapa*)	1	1
Veery (*Catharus fuscescens*)	33	3.2
Swainson's Thrush (*Catharus ustulatus*)	1	1
Hermit Thrush (*Catharus guttatus*)	12	1.6
Wood Thrush (*Hylocichla mustelina*) T	**7**	**1.7**
American Robin (*Turdus migratorius*)	27	2.6
Gray Catbird (*Dumetella carolinensis*)	3	2.3
Brown Thrasher (*Toxostoma rufum*)	1	1
Cedar Waxwing (*Bombycilla cedrorum*)	16	3.5
Ovenbird (*Seiurus aurocapilla*)	36	4.0
Northern Waterthrush (*Parkesia noveboracensis*)	7	1.6
Black-and-white Warbler (*Mniotilta varia*)	15	2.3
Nashville Warbler (*Leiothlypis ruficapilla*)	12	1.4
Mourning Warbler (*Geothlypis philadelphia*)	1	2
Common Yellowthroat (*Geothlypis trichas*)	33	3.1

Species per Route	No. Occupied Routes	Avg No Ind per Route
American Redstart (*Setophaga ruticilla*)	12	2.3
Cape May Warbler (*Setophaga tigrina*)	2	1
Northern Parula (*Setophaga americana*)	4	1.8
Magnolia Warbler (*Setophaga magnolia*)	7	3.3
Bay-breasted Warbler (*Setophaga castanea*)	1	2
Blackburnian Warbler (*Setophaga fusca*)	5	1.2
Yellow Warbler (*Setophaga petechia*)	15	1.7
Chestnut-sided Warbler (*Setophaga pensylvanica*)	29	2.6
Black-throated Blue Warbler (*Setophaga caerulescens*)	14	2
Palm Warbler (*Setophaga palmarum*)	1	2
Pine Warbler (*Setophaga pinus*)	3	1.3
Yellow-rumped Warbler (*Setophaga coronata*)	9	1.6
Black-throated Green Warbler (*Setophaga virens*)	15	2.3
Canada Warbler (*Cardellina canadensis*) T	**13**	**1.9**
Chipping Sparrow (*Spizella passerina*)	8	2.4
Song Sparrow (*Melospiza melodia*)	12	2.7
Swamp Sparrow (*Melospiza georgiana*)	12	1.4
White-throated Sparrow (*Zonotrichia albicollis*)	25	2.0
Dark-eyed Junco (*Junco hyemalis*)	2	1.5
Scarlet Tanager (*Piranga olivacea*)	9	2
Northern Cardinal (*Cardinalis cardinalis*)	1	2
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	20	3.0
Indigo Bunting (*Passerina cyanea*)	11	1.4
Bobolink (*Dolichonyx oryzivorus*) T	**2**	**3.5**
Red-winged Blackbird (*Agelaius phoeniceus*)	16	2.8
Eastern Meadowlark (*Sturnella magna*) T	**1**	**1**
Common Grackle (*Quiscalus quiscula*)	15	3.9
Brown-headed Cowbird (*Molothrus ater*)	1	1
Baltimore Oriole(*Icterus galbula*)	3	1
Purple Finch (*Haemorhous purpureus*)	4	1.8
American Goldfinch (*Carduelis tristis*)	13	1.5
European Starling (*Sturnus vulgaris*)	2	1.5

Corrections

Ontario Birds, Volume 34 Number 3, December 2016:

The cover incorrrectly identified this Volume as 33.

Coady, G. Consumption of amphibian prey by a Piping Plover:

On page 243 under Observation, change date 25 July 1998 to 25 July 2016.

ONTARIO BIRDS

The aim of *Ontario Birds* is to provide a vehicle for documentation of the birds of Ontario. We encourage the submission of full length articles and short notes on the status, distribution, identification, and behaviour of birds in Ontario, as well as location guides to significant Ontario birdwatching areas, and similar material of interest on Ontario birds.

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