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Cover Illustration: *Black Terns by Barry Kent MacKay*

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Egg predation by Great Horned Owls: A significant predator of Black Tern nests in Kawartha Lakes, Ontario

Valerie von Zuben and Joseph J. Nocera

Introduction

The Black Tern (*Chlidonias niger*) is a Special Concern species in Ontario that has undergone an annual population decline of 10.5% across the Great Lakes basin since 1995 (Tozer 2013). Population recovery has been hampered by low breeding productivity, for example, nest success (% of nests that hatched ≥1 chick) averaged 37% across nine studies conducted in Ontario, Minnesota, New York, Iowa and Wisconsin (Heath *et al.* 2009). Predation has been found to limit Black Tern productivity in some areas (Mazzochi *et al.* 1997, Maxon *et al.* 2007, Heath and Servello 2008) but the mechanisms are not well documented. Predator identity has been confirmed with evidence in only the situations of Great Blue Herons (*Ardea herodias*) preying on chicks (Chapman and Forbes 1984) and Great Horned Owls (*Bubo virginianus*) preying on adults (Murphy 1997). All remaining accounts of which we are aware are comprised of circumstantial evidence and/or inferences from mobbing behaviour by terns (Cuthbert 1954, Bailey 1977, Dunn 1979, Chapman Mosher 1986, Firstencel 1987, Shealer and Haverland 2000, Heath and Servello 2008). We investigated factors affecting nest success, including predation, in Black Tern colonies in the Kawartha Lakes region of Ontario.

Methods

We investigated five Black Tern colonies in the Kawartha Lakes region: Rice Lake, Pigeon Lake, Emily Creek, Osler Marsh and Buckley Lake from 2013-2015. We conducted nest searches and subsequent monitoring once a week at each site for twelve consecutive weeks, beginning the third week of May. We recorded the location of the nest, clutch size, egg flotation stage (Hays and LeCroy 1971) and a suite of habitat variables. We also sampled

Figure 1. Image of HCO Scout GuardR SG560 and Black Tern pair with nest and eggs at Emily Creek.
Photo: Valerie von Zuben.

prey at 15 locations and monitored 60 artificial nest platforms throughout the season. To determine nest fate and identify predators, we deployed motion-sensitive infrared cameras (Figure 1) at 13 nests in 2014 and 17 nests in 2015. Cameras offer the most accurate method of surveillance (Williams and Wood 2002) and disturbance to the terns was minimal. We mounted cameras on hollow metal poles and inserted the poles into mud and vegetation within 2 meters of nests. Birds acclimatized to cameras within a few minutes. We placed most of our cameras at the two sites with the highest rate of nest failure: Emily Creek and Osler Marsh. The majority of cameras were set up to take still images to conserve card memory, but a sub-set of cameras recorded 10-second video clips. Battery life and card memory usage were monitored weekly. In 2015, plastic bird deterrent spikes were affixed to cameras and mount poles to discourage perching.

Results

Nest success rates we observed were similar to success rates in previous studies in different jurisdictions (Table 1) (Heath *et al.* 2009). In our study, predation was the leading cause of nest failure. We recorded nest fate as depredated for all nests that were found to be empty at an early-to-middle stage of incubation. At nests that

Figure 2. Great Horned Owl consuming Black Tern egg at Osler Marsh. *Photo: Valerie von Zuben.*

were found to be empty at the latest stage of incubation, we confirmed that we could not detect any chicks and recorded fate as unknown. Of the nests that failed to produce a single chick, predation by Great Horned Owl was confirmed on camera at 6 nests in 2014 and 5 nests in 2015 at Emily Creek and Osler Marsh (Table 2). Surprisingly, most confirmed predation by owls was at the egg stage (Figures 2 and 3). Chick predation was assumed based on owl presence at the nest and subsequent absence of chicks during nest monitoring checks. We also found clumps of feathers on two separate occasions indicating owl predation of adult terns. The Great Horned Owls at our sites left no tracks or feathers at nests

Table 1: Nest fate and success rate of 330 Black Tern nests in the Kawartha Lakes region, 2013-2015. Camera monitoring of nests was not conducted in 2013 and predator identity could not be verified that year.

Year	2013	2014	2015
No. Nests Monitored	91	95	144
No. Successful	25	43	41
No. Depredated	**36**	**29**	**54**
No. Abandoned/infertile	11	2	16
No. Flooded	3	2	10
No. Other	0	1	2
No. Unknown Fate	16	18	21
Nest Success %	**27**	**45**	**28**

Table 2: Details of 11 predation events on Black Tern nests by Great Horned Owls in the Kawartha Lakes region, 2014-2015, based on camera recordings.

Site	Year	Day	Time	Egg or Chick	Consumption or Presence*
Emily Creek	2014	July 16	22:43	Chick	Presence
Emily Creek	2015	July 2	00:28	Egg	Consumption
Osler Marsh	2014	June 21	23:39	Chick	Presence
Osler Marsh	2014	June 21	23:49	Chick	Presence
Osler Marsh	2014	July 10	1:46	Egg	Consumption
Osler Marsh	2014	July 10	2:18	Chick	Presence
Osler Marsh	2014	July 10	4:00	Egg	Consumption
Osler Marsh	2015	June 13	2:25	Egg	Presence
Osler Marsh	2015	June 16	3:45	Egg	Consumption
Osler Marsh	2015	June 24	23:14	Egg	Consumption
Osler Marsh	2015	June 25	23:57	Egg	Consumption

*"Consumption" confirms predation event; "Presence" indicates a probable predation event in which eggs or chicks were missing in a subsequent nest check.

Figure 3. Great Horned Owl consuming Black Tern egg at Emily Creek.
Screen capture of video by Valerie von Zuben.

and there was very little evidence of broken eggs or nest disturbance. The majority of nests deemed depredated simply had missing eggs between weekly checks. American Mink (*Neovison vison*) sign was found at depredated nests at Pigeon Lake and an American Crow (*Corvus brachyrhynchos*) was recorded on camera eating two abandoned eggs. Predator identity was not confirmed at any nests at Buckley Lake. Eggs in two different nests were crushed by a Wood Duck (*Aix sponsa*) and a Great Blue Heron crushed eggs at a third nest. Other wetland species recorded on camera, which induced alarm responses by terns and were thus perceived as a threat, with the potential to damage a nest, include Mallard (*Anas platyrhynchos*), Common Gallinule (*Gallinula galeata*), Snapping Turtle (*Chelydra serpentina*) and Midland Painted Turtle (*Chrysemys picta*).

Discussion

Great Horned Owls are generalist predators with a broad dietary niche (Marti and Kochert 1996). Range-wide, their diet is comprised of 90% mammals, 10% birds and trace amounts of amphibians, reptiles and invertebrates (Artuso *et al.* 2014). In North America, the proportion of avian prey in the diet of Great Horned

Owls ranges from 5 to 65% (Tomazzoni *et al.* 2004). Owls in the prairie pothole region of North Dakota rely heavily (65%) on wetland-dependent avian prey, with 2.7% classified as shorebirds (including Black Tern) and the rest comprising mostly ducks and rails (Murphy 1997). Great Horned Owls were responsible for 68% of documented mortality of Piping Plover (*Charadrius melodus*) and Least Tern (*Sternula antillarum*) chicks in South Dakota (Kruse *et al.* 2001), the majority of Gull-billed Tern (*Gelochelidon nilotica*) predation in coastal Virginia (Eyler *et al.* 1999) and direct and indirect mortality of Common Terns (*Sterna hirundo*) in the Monomoy Refuge of Massachusetts (Nisbet 1975, Nisbet and Welton 1984). Tomazzoni *et al.* (2004) also emphasized the importance of wetlands to foraging Great Horned Owls in Brazil, with the majority of prey items coming from wetland habitat.

Our study is the first to visually confirm and document consumption of bird eggs by Great Horned Owl. To the best of our knowledge, the only literature that alludes to this phenomenon describes mostly circumstantial evidence of owl predation on eggs of Least Tern (McMillian 1998) and Swallow-tailed Kite (*Elanoides forficatus*) (Coulson *et al.* 2008). Nisbet and Welton (1984) suggest that direct predation of eggs or nestlings by owls is less important to bird nest success than indirect mortality such as nocturnal nest abandonment as a result of owl presence. In their study of Common Terns (*Sterna hirundo*), Great Horned Owl presence led to egg and chick loss from exposure, ant attack, hatch failure, egg breakage and predation by additional predators. Heath (2004) found nocturnal nest desertion to be a common occurrence in Black Tern colonies in Maine.

Great Horned Owls generally prefer fragmented habitats of open second growth forests, swamps and agricultural areas (Artuso *et al.* 2014), which are abundant in the Kawartha Lakes region and much of southern Ontario. Given that Great Horned Owls are distributed continent-wide, this predator could pose a large overall threat to Black Tern productivity across their range. Effective and ethical solutions remain elusive; Smith *et al.* (2010) found that predator removal (by culling or translocation) can produce significant increases in breeding bird populations but Catlin *et al.* (2011) had mixed success removing owls from areas near Piping Plover nest sites. The ethical and practical issues of lethal forms of predator control have to be evaluated in conjunction with alternative non-lethal solutions. Predator exclusion using nest cages and fencing are widely used and effective management tools but are invasive, expensive, and labour intensive (Smith *et al.* 2011). Heath and Servello (2008) found that predator exclosures were readily accepted by adult Black Terns, which protected chicks until fledging at 70% of nests. With any predator management strategy, it is essential to have evidence-based confirmation of predator identity before evaluating options. It is also important to test the efficacy of the chosen strategy before prescribing it widely. The protection of remaining breeding colonies is one of the key priorities for Black Tern population recovery (Matteson *et al.* 2012) but to do this, the mechanisms driving productivity at the local level need to be better identified. We will continue to study predation dynamics at our Kawartha Lakes colonies with a focus on developing and evaluating simple, cost effective and minimally invasive techniques to prevent Great Horned Owl predation of eggs and chicks.

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Influence of bottom-up trophic dynamics on Northern Saw-whet Owl irruptions revealed by small-scale banding data in Central Ontario

Samantha Henry, Erica Nol and Walter Wehtje

Introduction

The Northern Saw-whet Owl (*Aegolius acadicus*) is one of the most common of eastern North America's owl species, but also one of the smallest and most elusive, making it a difficult species to study (Beckett and Proudfoot 2011). Despite its nocturnal nature the Northern Saw-whet Owl can be lured into mist nets and banded every fall during its southerly movements away from breeding ranges. Large-scale analysis of Northern Saw-whet Owl movement has indicated that there are significant differences in the proportions of adult and juveniles migrating between years (Beckett and Proudfoot 2011) and that these differences relate to regional differences in the yearly fluctuations of prey (Confer *et al.* 2014). Years where there are high proportions of juveniles are termed irruption years.

Most avian predators are thought to show high breeding success in relation to higher prey populations in the breeding range, and this may be the cause of Northern Saw-whet Owl irruptions (Côté *et al.* 2007). Some evidence suggests that Northern Saw-whet Owls return to the same breeding ranges annually, and also display migration route fidelity (Beckett and Proudfoot 2011). By contrast, Northern Saw-whet Owls are thought by others to be nomadic, tracking their prey across the landscape and choosing breeding habitat based on high local prey availability (Bowman *et al.* 2010). Both hypotheses support the notion that owl irruptions are caused by particularly high breeding success within the breeding range rather than synchronous movements of particularly successful cohorts.

Northern Saw-whet Owl
Photo: Tianna Burke

Northern Saw-whet Owl
Photo: Laura Koloski

Small mammals of the boreal forest appear to show population fluctuations that follow a 4-year cycle (Cheveau *et al.* 2004). While food supply plays an important role in the reproduction of small mammals, Korpimäki *et al.* (2004) argued that predation is the main cause of mortality among these populations, creating fluctuations from year-to-year. By contrast, Falls *et al.* (2007) studied fluctuations of deer mice (*Peromyscus maniculatus*) over a 36-year period and concluded population fluctuations were highly influenced by forest seed crop in the autumn and that overwinter deaths were greatly reduced in years with high seed production. These two contrasting views correspond, respectively, to top down (predator mediated) and bottom-up (primary production mediated) trophic interactions (Powers 1992).

A meta-analysis of 102 field experiments (Shurin *et al.* 2002) indicates that top-down forces are stronger in aquatic ecosystems than in terrestrial ecosystems. The hypothesis of nomadism (Bowman *et al.* 2010) in Northern Saw-whet Owls would support a top-down system, where owls may have an effect on the fluctuations of small mammal populations by depleting a local population and moving to find areas with higher abundance of prey. In contrast, a bottom-up system would be implicated if Northern Saw-whet Owl populations fluctuated as a function of primary production (coniferous seed production), through the influence of the food abundance on yearly small-mammal population fluctuations via enhanced reproduction and survival.

The southern region of the Canadian boreal forest is breeding habitat for Northern Saw-whet Owls that migrate through the Peterborough, Ontario, region (Badzinski 2007). Data from boreal forest seed production may therefore provide insight into broad-scale primary production and whether Northern Saw-whet Owl populations are regulated by top-down or bottom-up processes. Capture and banding at the James McLean Oliver Ecological Centre of Trent University provides 15 years of data on the age structure of migrating Northern Saw-whet Owls. We test the hypothesis that small scale fluctuations in the proportion of hatching year owls coming through a single banding station can be explained by qualitative measures of forest seed production from the presumed breeding grounds of the banded owls. Support for our hypothesis would indicate that bottom-up processes help to explain Northern Saw-whet Owl demography.

Coniferous seeds are the preferred forage of Northern Saw-whet Owl prey such as red-backed voles (*Myodes gapperi*), deer mice (*Peromyscus* spp.) and other small rodents (Lobo 2014). If bottom-up interactions are taking place, a year with high seed production in the autumn will produce more fallen nuts and seeds for small mammals on the forest floor, allowing for higher survival rates over winter and higher reproductive success in the spring, ultimately leading to a more successful breeding and fledging season for Northern Saw-whet Owls. We predict that high boreal seed production two summers before our fall captures (i.e., not the current summer) would result in high seed availability in the winter immediately preceding the March to May owl breeding season and would lead to higher proportions of hatching year owls in our subsequent fall banding. We also predict that the proportion of second-year birds captured in any one year would be positively related to the seed production indices from two years previously.

Methods

Banding Data

Northern Saw-whet Owls have been banded near Nogies Creek, Ontario (44.57º N, 78.5º W), at the James McLean Oliver Ecological Centre, Trent University, since 1999. Three standard passerine mist nets (36 mm mesh), 12 meters in length and 2.5 meters high, were set up yearly for the month of October (plus or minus the last few days of September and the first few days of November), in a forested portion of the property. The nets were arranged in a triangular pattern with a speaker between the nets playing repetitive Northern Saw-whet Owl calls as an audio lure. During inclement weather (high winds, below 0ºC or raining) or when predators were present (e.g., Barred Owls, *Strix varia*) the nets were not opened and the audio lure remained off. When conditions were acceptable the nets were opened and the audio lure was turned on for a minimum of 4 hours each night starting about 19:30 hrs. Nets were then checked every 20 minutes for owls. Each owl caught was removed from the net and banded with an aluminum uniquely numbered Canadian Wildlife Service band (size 4). The date, time of capture, age, sex, wing chord length and weight of each owl were recorded. Owls were sexed using a discriminant function (Paxton and Watts 2008) and then aged by observing primary and secondary molt patterns. Primary and secondary feathers were observed under a UV light to assess flight feather molt. Hatch-year (HY) owls have uniform wear and rachis vascularization of the primary and secondary flight feathers. Under UV light the ventral surface of all flight feathers and underwing coverts of HY owls appears pink. Under normal lighting these flight feathers in HY owls appear uniform dark brown (Pyle 1997, Project Owlnet 2015). Second-year (SY) owls have a new-old-new pattern in their primaries and secondaries. Under UV light SY flight feathers appear in a pattern of pink-beige-pink. After-second-year birds (ASY) exhibit three generations of primaries and secondaries which appear dark brown, lighter brown and dark brown under normal light and with alternating patterns of pink and beige under UV light (Pyle 1997, Project Owlnet 2015). Owls aged as after-hatch-year (AHY) were not distinguished as SY or ASY, but determined to be older than hatch-year based on the molt pattern of their flight feathers. The owls were released after banding. All procedures used to capture and band owls were done under Animal Care permits from Trent University.

Banding data from all years (1999-2014) were entered into spreadsheets. The data were divided into year-class (HY-birds capable of flight and hatched

Northern Saw-whet Owl. *Photo: Tianna Burke*

the present year and SY-hatched the year before banding) and sex. Proportions of HY, SY, ASY and AHY birds were calculated out of the total number of owls banded.

Primary Production Indices

To obtain an index of forest primary productivity, data were compiled from the Winter Finch Forecasts produced by naturalist Ron Pittaway for each year since 1999/2000 (Jean Iron 2015, NeilyWorld 2015). His forecasts are compiled from a number of sources including staff from the Ministry of Natural Resources and Forestry in Ontario, biologists, birders and naturalists from across North America. For the purpose of this research, we considered the area of central Ontario and western Quebec as potential breeding areas. In most cases the cone crop predictions were the same for both provinces. Where the predictions differed slightly, we then used the score from the Ontario region, because of its larger geographic extent north of our banding station. We focused on the qualitative seed production descriptors provided in these reports rather than the winter finch numbers. Lobo (2014) determined from feeding experiments that red-backed voles, deer mice and other common rodents prefer conifer seeds with an overall preference of lodgepole pine (*Pinus contorta*), eastern white pine (*P. strobus*), and occasionally white spruce (*Picea glauca*) seeds. Therefore, focus was placed on mention of native conifer species in the reports (eastern white pine, red pine (*P. resinosa*), white spruce and black spruce (*P. mariana*). We used the reports to produce a quantitative scale from 1 to 5 using descriptive words and phrases about coniferous cone crops in central Ontario and western Quebec. Years where "very poor", "failure" and "very low" were used were ranked as a 1 on the scale. Years where "poor", "few" (and occasionally with "spotty") were used were ranked as a 2. Years where "moderate", "fair" (and occasionally also with "spotty") were used were ranked as a 3. Years where "very good" and "above-average" were used were ranked as a 4 and where "heavy", "bumper", "excellent" were used were ranked as a 5.

Statistical Analysis

The proportion of hatch-year owls was regressed against the seed crop (scale 1-5) from the previous fall reports, whereas the proportion of second year owls was regressed against seed crop from two years prior to banding. These temporal lags were used because seed crops relevant to small mammal production in an owl breeding year are produced a year before the fall that owls are banded at the field station. We first analyzed the relationship between owl age distributions and seed crop by including the covariate: number of fall banding days. As inclusion of this variable did not improve fit, we removed it for subsequent analyses. The proportion of SY owls from the year 2003 was eliminated from our analysis because it appeared that banders in that year, were unable to reliably differentiate between HY and older age classes. The proportion of AHY in that year fell outside of a 95% confidence interval (μ=0.22, SD = 0.16, n = 15, CI: 0.14 to 0.30) of the total sample. Owls aged as third year or after-third-year were combined into the after-second-year category because these older age classes are not reliably determined (ProjectOwlnet 2015). We assessed significance using an α= 0.05. We conducted all analyses using Program R (CRAN Project 2015).

Results

The number of Northern Saw-whet Owls captured at the James McLean Oliver Ecological Centre banding station showed substantial annual variation (Figure 1). The proportion of hatch-year birds and second-year birds banded each year appeared to track the forest primary production scale used to rank seed crop abundance in the central Ontario region (Figure 2). On average twice as many HY birds were captured as SY birds (Table 1).

Table 1. Comparison of proportions of hatch-year (HY), second-year (SY), after-hatch-year (AHY), after-second-year (ASY) and unknown (U) age Northern Saw-whet Owls banded at the James McLean Ecological Centre from 2000 to 2014.

Year	HY	SY	AHY	ASY	U
2000	0.19	0.33	0.10	0.32	0.06
2001	0.44	0.12	0.09	0.32	0.03
2002	0.48	0.29	0.02	0.13	0.09
2003	0.56	0.03	0.25	0.12	0.04
2004	0.59	0.02	0.00	0.31	0.08
2005	0.36	0.19	0.04	0.41	0.00
2006	0.46	0.25	0.02	0.27	0.00
2007	0.57	0.23	0.04	0.16	0.01
2008	0.25	0.44	0.06	0.26	0.00
2009	0.47	0.11	0.00	0.42	0.00
2010	0.50	0.25	0.03	0.23	0.00
2011	0.40	0.35	0.00	0.26	0.00
2012	0.48	0.18	0.02	0.32	0.00
2013	0.19	0.57	0.00	0.25	0.00
2014	0.77	0.08	0.01	0.14	0.01

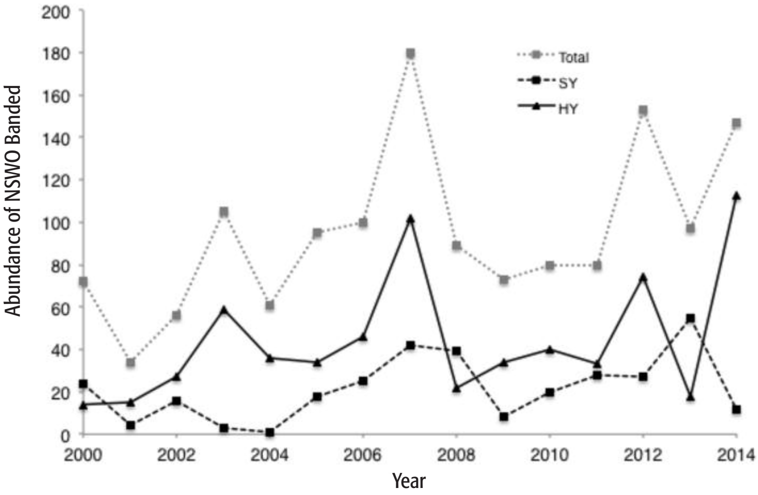

Figure 1. Abundance of hatch-year (HY), second-year (SY), and total abundance of Northern Saw-whet Owls banded at the James McLean Oliver Ecological Centre during autumn migration from 2000 to 2014.

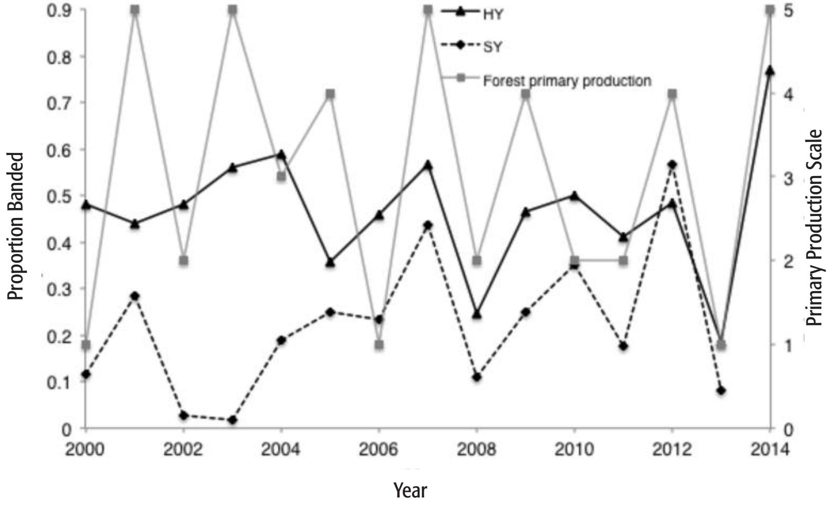

Figure 2. Proportion of hatch-year (HY) and second-year (SY) Northern Saw-whet Owls banded at the James McLean Ecological Centre during autumn migration from 2000 to 2014 compared to an index of primary productivity in Central Ontario forests based on winter coniferous seed crops from 1999 to 2013. A lag of 1-year for HY and a lag of 2-years for SY is incorporated.

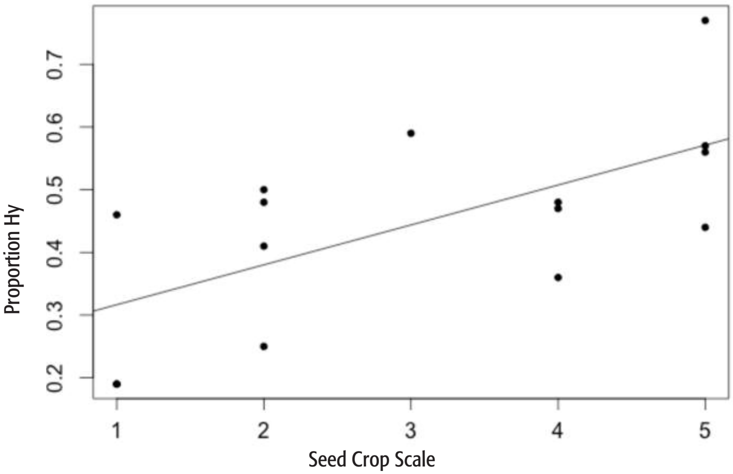

Figure 3. Linear relationship between proportion of Northern Saw-whet Owls banded at the James McLean Ecological Centre during autumn migration that were hatch-year birds, with a lag of one year between seed mast and banding accounted for, and an index of forest primary productivity in Central Ontario based on winter coniferous seed crops.

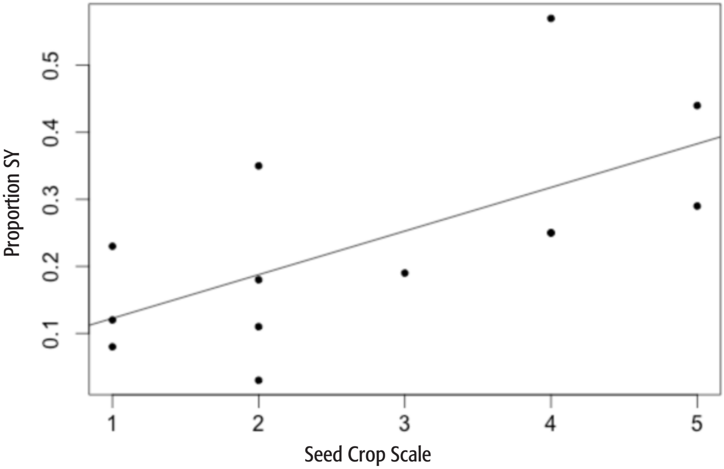

Figure 4. Linear relationship between proportion of Northern Saw-whet Owls banded at the James McLean Ecological Centre during autumn migration that were second-year birds, with a lag of two-years between seed mast and banding accounted for, and an index of forest primary productivity in Central Ontario based on winter coniferous seed crops.

There was a significant positive relationship between forest seed crop abundance in the winter before breeding and the number of HY owls banded in the following fall (F=5.11, df=1,13, $P< 0.05$, $R^2 = 0.23$) (Figure 3). A positive linear relationship was also observed between forest seed crop and the number of SY birds banded two years later, (F=7.70, df=1,11, $P< 0.05$, $R^2= 0.36$) (Figure 4).

Northern Saw-whet Owl
Photo: Tianna Burke

Discussion

The proportion of hatch-year Northern Saw-whet Owls banded at the James McLean Oliver Ecological Centre varied greatly between 2000 and 2014, with higher proportions occurring every 3-5 years. These irruption years are similar to patterns seen in red-backed vole abundance, the main breeding ground prey species of Northern Saw-whet Owls (Swengel and Swengel 1995, Evans 1997, Duncan *et al.* 2009). Similar fluctuations were also seen within primary production indices from central Ontario. However, fluctuations in Northern Saw-whet Owl populations have never been compared to the primary production occurring within the breeding range relating back to red-backed vole abundance (Cheveau *et al.* 2004, Bowman *et al.* 2010). We found a positive linear relationship between primary production in central Ontario and the number of HY and SY birds banded in autumn. These findings indicate a two step correlation (1) that fluctuations of red-backed vole populations appear to relate to conifer seed crops (Lobo 2014), (2) vole production appears to relate to the number of HY owls banded the breeding year following a vole population high. Previous research has examined the response of accipiters to fluctuations in mast seed production in forest ecosystems and results indicated that these pulses have bottom-up effects on the entire system (Schmidt and Ostfeld 2003, Schmidt and Ostfeld 2008). Our results suggest a similar relationship for Northern Saw-whet Owls. The outlier year (2003) in the proportions of SY and AHY birds reduced the strength of the relationship between the primary production scale.

Top-down trophic interactions are thought to be the controlling factor when predators and prey exhibit fluctuations or cycles. The well documented trophic interactions between Canada lynx (*Lynx canadensis*) and snowshoe hare (*Lepus americanus*) cycles, where predation by lynx has the ability to lower hare populations during years when hare populations are high is support for a top-down view (Krebs *et al.* 2001). In central Ontario, red-backed vole populations are not considered cyclical; instead they fluctuate irregularly in response to cone crops (Bowman *et al.* 2010). Such pseudo-cyclical patterns in the biomass of seed production by fruiting plants are not uncommon; they are highly dependent on environmental conditions such as temperature, weather and pollination during the growing season (Howe *et al.* 2012).

While most research examining trophic cascades focuses on top-down interactions, it is important to consider the reverse. Research focusing on the Boreal Owl (*Aegolius funereus*), a close relative of the Northern Saw-whet Owl, concluded that owls do not likely cause small mammal population fluctuations, as the owls' behavioural response to scarce prey is immediate, indicating nomadism (Marks and Doremus 2000, Cheveau *et al.* 2004, Bowman *et al.* 2010). Both top-down and bottom-up interactions are likely to play equally important roles in the function of ecosystems (Ritchie and Johnson 2009). Research on trophic cascades shows that primary production has the potential to affect the abundance of populations at all levels, cascading through the ecosystem to higher trophic levels (Power 1992, Dyer and Letourneau 2003, Ritchie and Johnson 2009, Howe *et al.* 2012)

This research contributes to the existing body of research on Northern Saw-whet Owl ecology. The data from a single banding station examined in the present study are an underutilized source of raw ecological information as are the broad-scale primary production indices retrieved from a descriptive online public resource. Using the Winter Finch Forecast presented some challenges, as it was presented descriptively with variation in which species of tree were examined between years and the level of description given. While we were able to develop a useful quantitative scale with these descriptions, it would increase the value of the winter bird forecasts if there were standardized estimates of the annual seed resources, and if the scale was compared to finch movements or small mammal abundance.

Future research could be conducted across a larger geographic scale and longer time frame using the same method with banding data compiled from several stations to determine whether similar relationship can be seen.

Acknowledgments

Many thanks go out to all of the volunteer banders and assistants who have spent so many late nights each fall banding Northern Saw-whet Owls at the Oliver property. Special thanks to Chris Risley for obtaining the necessary permits to band owls each year and to Eric Sager and Sheena Symington for access to the Oliver Property cabin, as well as all of the volunteers that have made it possible.

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Diversity and abundance of landbirds in spring reorientation flights in the Pelee region, Canada

Kenneth G.D. Burrell, Stephen D. Murphy and Bradley C. Fedy

Introduction

The reorientation flight of landbirds during migration (often termed "reverse migration") is a phenomenon that involves birds flying, diurnally, in the opposite direction of normal migration in North America (Lewis 1939, Gunn 1951). Noted primarily in spring, reorientation flights also occur in varying intensity in the fall in the Atlantic maritime provinces of Canada (Richardson 1982, McLaren *et al.* 2000), at Cape May, New Jersey (Weidner *et al.* 1992, Van Doren *et al.* 2015), and in Fennoscandia (Alerstam 1978, Åkesson 1999). Reorientation flights have seldom been studied in the Great Lakes region and have only been documented there in the spring (Lewis 1939, Gunn 1951). Lewis (1939) made perhaps the earliest observations about reorientation flights. He made the observation that species which were common during spring reorientation flights in the Pelee region seem to become increasingly uncommon or absent in days following intense reorientation flights. Gunn (1951) conducted an observational study and reported that reorientation flights occurred between one and four hours after sunrise, were most intense in May and were mainly comprised of blackbirds (Icteridae), wood warblers (Parulidae) and pipits (Motacillidae).

This paper describes the species composition and abundances associated with reorientation flights in the Pelee region of southwestern Ontario. We conducted daily visual observations to identify and count landbird species engaged in spring reorientation flights and estimate their abundance at Point Pelee National Park and Fish Point Provincial Nature Reserve on Pelee Island (Figure 1). Our study had three main objectives. First, we wanted to document the composition and abundance of species that participated in spring reorientation flights and determine their relative abundances. Second, because of population declines

Figure 1. The Pelee region, showing the locations of both study sites (Fish Point Provincial Nature Reserve and Point Pelee National Park).

noted among Neotropical species (Sauer *et al.* 2014), we wanted to know if there were significant differences in composition and abundance of Neotropical-wintering versus temperate-wintering migrant species. Finally, we wanted to compare differences in composition and abundance of species between the mainland and island study sites.

Methods

Data Collection

We developed a standardized fixed point survey, similar to that employed by the Cape May Bird Observatory's 'Morning Flight' program (New Jersey Audubon 2014), and to the Thunder Cape Bird Observatory's migration monitoring protocol (Wojnowski *et al.* 2010). Daily observations were conducted by two trained observers between 26 April and 20 May, 2010-2012 at the southern tip of Fish Point Provincial Nature Reserve (41.4° N, 82.4° W) on Pelee Island and in 2012 at the southern tip of Point Pelee National Park (41.5° N, 82.3° W). The timing of observations (late April to May) corresponded with peak spring abundances of migrating landbirds.

Surveys were conducted during the first three hours following local sunrise at both locations. Birds flying in a persistent southerly direction out of sight over Lake Erie were recorded as participating in reorientation flights. Identification and counting occurred while birds were in flight. Using binoculars, we identified birds to species whenever possible; otherwise birds were assigned an identification as close to species level as possible (e.g., blackbird species). Where necessary and possible, some birds were photographed to aid in identification; however, identification was greatly aided by call notes, as well as by birds landing before continuing south. Only landbirds were counted, as these species have been shown to commonly participate in reorientation flights (Lewis 1939, Gunn 1951). One family (swallows) was excluded, as foraging extends over large areas (Kerlinger 1995, Faaborg 2002), making it difficult to differentiate between foraging birds and those engaging in reorientation flights and to accurately record numbers.

Data Analysis

Species were identified as Neotropical-wintering or temperate-wintering migrants based on Sibley (2000) and Dunn and Alderfer (2011). We compared abundance and species composition between the two study sites and among years at Fish Point. Differences in daily counts were tested for significance using a Wilcoxon rank sum test (Crawley 2013).

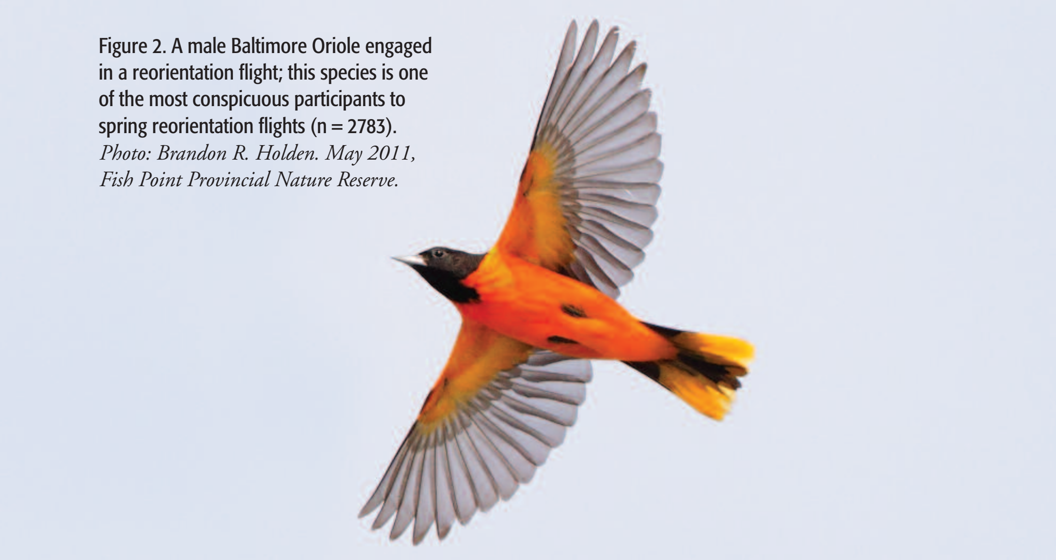

Figure 2. A male Baltimore Oriole engaged in a reorientation flight; this species is one of the most conspicuous participants to spring reorientation flights (n = 2783). *Photo: Brandon R. Holden. May 2011, Fish Point Provincial Nature Reserve.*

Figure 3. Red-headed Woodpeckers were observed infrequently during spring reorientation flights (n = 44). *Photo: Brandon R. Holden. May 2011, Fish Point Provincial Nature Reserve.*

Results

The number of days of observation in 2010, 2011 and 2012 at Fish Point was 24, 24, 25 respectively, and 24 in 2012 at Point Pelee. Eighty species, totalling 61,677 individuals, were recorded participating in spring reorientation flights. Of these individuals, 38,337 were identified to species and 23,340 were identified to family level only. During our three hour early morning observation periods, very few birds were observed flying to the north, presumably because most northbound spring migrants engage in nocturnal migration, whereas reorienting birds fly south diurnally.

Blackbirds (9 species) and wood warblers (27 species) were the most common participants (n = 42,686 and 10,842, respectively) (Table 1; Figure 2), accounting for 87% of all reorienting migrants. Woodpeckers (Figure 3) and pipits were comparatively scarce, with just 58 and 136 individuals noted (0.09 and 0.22% of all observed migrants, respectively). The remaining species and numbers are listed in Table 1. Thrushes (*Catharus* spp.) were absent in all surveys, while tyrant flycatchers (Figure 4), vireos and sparrows were observed in relatively low numbers. These results were surprising based on the number of observations of the species at these locations (K. Burrell pers. obs.).

Neotropical wintering migrants species (n = 42) represented just over half of all species (n = 80) participating. However, individuals of temperate-wintering migrant species outnumbered individuals of Neotropical species almost 4:1, largely as a result of the high number of blackbirds. There was a difference in individuals of the two groups between study sites; at Fish Point, Neotropical wintering migrant species comprised approximately 12.6% (2011 and 2012) and 9% (2010) of the tally of birds observed reorienting per year, compared to only 7.2% of the total at Point Pelee in 2012. Certain Neotropical wintering species also engaged in high abundance during reorientation flights, including Nashville (n = 831) and Yellow warblers (n = 581), as well as Indigo Bunting (n = 788), all of which are common breeding species in Ontario (Table 1; Cadman *et al.* 2007).

The number of reorienting birds varied across study sites and years (Table 1). The highest annual total was recorded at Fish Point in 2011 (n = 20,828) and the lowest annual total count was in 2012 at Fish Point (n = 10,768). The mean daily count did not vary significantly between the two study sites in 2012; at Fish Point it was 675 and at Point Pelee it was 517 (Wilcoxon rank sum test, P=0.790). While there was not a substantial amount of variation between study sites, there was considerable variation among the mean daily count among the three study years at Fish Point, where the mean daily count was 736 in 2010, 906 in 2011, and 431 in 2012. There was a significant difference in pairs of study years at Fish Point, with 2010 and 2012, and 2011 and 2012 being significantly different (Wilcoxon rank sum test, P=0.001); 2010 and 2011 were not significantly different, P=0.776).

Figure 4. Eastern Kingbirds were noted to participate in spring reorientation flights (n = 282).
Photo: Brandon R. Holden, May 2011, Fish Point Provincial Nature Reserve.

Figure 5. Scarlet Tanagers were observed to participate in spring reorientation flights less commonly than previously thought (n = 111). *Photo: Brandon R. Holden. May 2012. Point Pelee National Park.*

Table 1. Total number of observed reorientation migrants throughout the study (2010-2012). Species are in taxonomic order following American Ornithologist Union (1998). Totals are delineated by species, study site (Fish Point, Pelee Island, ON; and Point Pelee National Park, ON) and year; [1] denotes a species at risk; [2] denotes a vagrant bird species; and * denotes a Neotropical migrant.

Bird families with more than one representative have been identified by their family name and subtotals provided, e.g. Columbidae. Bird families with only a single representative are separated with a blank space below their names, e.g. Ruby-throated Hummingbird.

Common name	Latin name	2010 Fish Point Total	2011 Fish Point Total	2012 Fish Point Total	2012 Point Pelee Total	Total Individuals
Rock Pigeon	*Columba livia*	0	0	0	1	1
Mourning Dove	*Zenaida macroura*	7	9	4	26	46
Columbidae						47
Ruby-throated Hummingbird*	*Archilochus colubris*	61	35	20	16	132
Red-headed Woodpecker[1]	*Melanerpes erythrocephalus*	17	11	7	9	44
Red-bellied Woodpecker	*Melanerpes carolinus*	3	0	6	0	9
Northern Flicker	*Colaptes auratus*	2	1	0	2	5
Picidae						58
Eastern Wood-Pewee*	*Contopus virens*	1	1	2	0	4
Least Flycatcher*	*Empidonax minimus*	0	1	0	0	1
Eastern Phoebe	*Sayornis phoebe*	2	0	0	1	3
Great Crested Flycatcher*	*Myiarchus crinitus*	0	4	4	0	8
Eastern Kingbird*	*Tyrannus tyrannus*	107	156	13	6	282
Flycatcher spp.	*Tyrannidae* spp.	2	0	0	0	2

Common name	Latin name	2010 Fish Point Total	2011 Fish Point Total	2012 Fish Point Total	2012 Point Pelee Total	Total Individuals
Tyrannidae						300
Yellow-throated Vireo*	*Vireo flavifrons*	1	5	1	0	7
Blue-headed Vireo	*Vireo solitarius*	0	8	0	0	8
Warbling Vireo*	*Vireo gilvus*	20	21	24	3	68
Philadelphia Vireo*	*Vireo philadelphicus*	0	9	2	0	11
Red-eyed Vireo*	*Vireo olivaceus*	2	16	0	0	18
Vireo spp.	*Vireo* spp.	22	28	0	4	54
Vireonidae						166
Blue Jay	*Cyanocitta cristata*	349	220	101	439	1109
American Crow	*Corvus brachyrhynchos*	2	0	0	0	2
Crow spp.	*Corvus* spp.	0	0	0	2	2
Corvidae						1113
Horned Lark	*Eremophila alpestris*	0	4	1	0	5
Blue-gray Gnatcatcher	*Polioptila caerulea*	31	8	10	36	85
Ruby-crowned Kinglet	*Regulus calendula*	0	5	0	0	5
Eastern Bluebird	*Sialis sialis*	0	3	2	0	5
American Robin	*Turdus migratorius*	147	151	52	215	565
Turdidae						570
Gray Catbird	*Dumetella carolinensis*	0	0	1	0	1
European Starling	*Sturnus vulgaris*	502	362	238	581	1683
American Pipit	*Anthus rubescens*	83	11	16	26	136
Cedar Waxwing	*Bombycilla cedrorum*	33	116	128	482	759
Ovenbird*	*Seiurus aurocapillus*	0	2	0	0	2
Northern Waterthrush*	*Parkesia noveboracensis*	0	0	1	0	1
Golden-winged Warbler[1]*	*Vermivora chrysoptera*	0	0	1	0	1
Blue-winged Warbler*	*Vermivora cyanoptera*	0	1	4	1	6
Black-and-white Warbler*	*Mniotilta varia*	0	25	0	0	25
Prothonotary Warbler[1]*	*Protonotaria citrea*	1	1	1	1	4

Common name	Latin name	2010 Fish Point Total	2011 Fish Point Total	2012 Fish Point Total	2012 Point Pelee Total	Total Individuals
Tennessee Warbler*	*Oreothlypis peregrina*	1	11	6	0	18
Orange-crowned Warbler*	*Oreothlypis celata*	0	2	1	0	3
Nashville Warbler*	*Oreothlypis ruficapilla*	58	626	119	28	831
Hooded Warbler[1]*	*Setophaga citrina*	0	1	0	0	1
American Redstart*	*Setophaga ruticilla*	0	53	3	0	56
Kirtland's Warbler[1 2]*	*Setophaga kirtlandii*	0	1	0	0	1
Cape May Warbler*	*Setophaga tigrina*	3	11	6	0	20
Northern Parula*	*Setophaga americana*	0	28	0	0	28
Magnolia Warbler*	*Setophaga magnolia*	0	286	1	2	289
Bay-breasted Warbler*	*Setophaga castanea*	0	32	0	0	32
Blackburnian Warbler*	*Setophaga fusca*	3	68	3	2	76
Yellow Warbler*	*Setophaga petechia*	153	129	166	133	581
Chestnut-sided Warbler*	*Setophaga pensylvanica*	2	136	1	0	139
Blackpoll Warbler*	*Setophaga striata*	0	8	0	0	8
Black-throated Blue Warbler*	*Setophaga caerulescens*	0	33	0	0	33
Palm Warbler	*Setophaga palmarum*	11	268	56	16	351
Pine Warbler	*Setophaga pinus*	0	1	3	1	5
Yellow-rumped Warbler	*Setophaga coronata*	236	404	1618	19	2277
Black-throated Green Warbler*	*Setophaga virens*	11	44	11	0	66
Canada Warbler[1]*	*Cardellina canadensis*	0	6	0	0	6
Wilson's Warbler*	*Cardellina pusilla*	0	7	0	0	7
Warbler spp.	*Parulidae* spp.	148	4277	1378	172	5975
Parulidae						10842
Chipping Sparrow	*Spizella passerina*	40	3	19	1	63
Clay-colored Sparrow	*Spizella pallida*	0	1	0	0	1
Field Sparrow	*Spizella pusilla*	1	2	1	0	4
Lark Sparrow[2]	*Chondestes grammacus*	1	0	0	0	1
Savannah Sparrow	*Passerculus sandwichensis*	0	5	0	0	5
Sparrow spp.	*Emberizidae* spp.	47	12	91	2	152
Emberizidae						226
Summer Tanager[2]*	*Piranga rubra*	1	2	0	0	3
Scarlet Tanager*	*Piranga olivacea*	10	101	0	0	111
Northern Cardinal	*Cardinalis cardinalis*	0	0	1	8	9

Common name	Latin name	2010 Fish Point Total	2011 Fish Point Total	2012 Fish Point Total	2012 Point Pelee Total	Total Individuals
Rose-breasted Grosbeak*	*Pheuticus ludovicianus*	1	24	13	5	43
Blue Grosbeak[2]*	*Passerina caerulea*	0	0	0	1	1
Indigo Bunting*	*Passerina cyanea*	255	188	228	117	788
Dickcissel[2]*	*Spiza americana*	1	4	1	0	6
Cardinalidae						961
Bobolink[1]*	*Dolichonyx oryzivorus*	42	126	33	40	241
Red-winged Blackbird	*Agelaius phoeniceus*	2553	2498	3584	6398	15033
Eastern Meadowlark[1]	*Sturnella magna*	1	1	0	0	2
Yellow-headed Blackbird[2]	*Xanthocephalus xanthocephalus*	0	0	0	1	1
Rusty Blackbird[1]	*Euphagus carolinus*	2	3	0	8	13
Common Grackle	*Quiscalus quiscula*	949	1400	1574	2288	6211
Brown-headed Cowbird	*Molothrus ater*	388	831	287	143	1649
Orchard Oriole*	*Icterus spurious*	58	24	116	68	266
Baltimore Oriole*	*Icterus galbula*	1014	634	644	491	2783
Meadowlark spp.	*Sturnella* spp.	0	0	0	1	1
Blackbird spp.	*Icteridae* spp.	9718	6553	0	215	16486
Icteridae						42686
House Finch	*Haemorhous mexicanus*	0	12	5	0	17
Purple Finch	*Haemorhous purpureus*	0	1	0	0	1
Pine Siskin	*Spinus pinus*	0	21	0	0	21
American Goldfinch	*Spinus tristis*	442	188	160	401	1191
Fringillidae						1230
House Sparrow	*Passer domesticus*	2	2	0	0	4
Small Bird spp.	*Passeriformes* spp.	122	546	0	0	668
Neotropical (N=42 species)		1614	2614	1359	888	6475
Temperate (N=38 species)		16055	18214	9409	11524	55202
Total		**17669**	**20828**	**10768**	**12412**	**61677**

Discussion

While species richness was high, several species and families were conspicuously absent from reorientation flights. *Catharus* thrushes were completely absent, despite being relatively abundant migrants at Fish Point and Point Pelee during all study years (K. Burrell, pers. obs.). Weidner *et al.* (1992) also found that *Catharus* thrushes rarely participated in diurnal reorientation flights, accounting for 0.01% of all identified Neotropical migrants (among a sample size of 24,378). *Catharus* thrushes are largely nocturnal migrants (Mack and Yong 2000, Lowther *et al.* 2001, Rimmer *et al.* 2001), and our results confirm they essentially do not participate in diurnal reorientation flights.

Several other species were also observed in lower numbers than expected based on the senior author's previous experience with spring migration and reorientation flights in the Pelee region (K. Burrell, pers. obs.). Fewer than expected Rose-breasted Grosbeaks (*Pheucticus ludovicianus*; *n* = 43), Scarlet Tanagers (*Piranga olivacea*; *n* = 111) (Figure 5), vireos (*n* = 166), sparrows (*n* = 226), and tyrant flycatchers (*n* = 300) were noted. Similar to *Catharus* thrushes, these species and families are all noted to be primarily nocturnal migrants (Lanyon 1997, Middleton 1998, Mowbray 1999, Cimprich *et al.* 2000, Wyatt and Francis 2002) and common in Ontario (Cadman *et al.* 2007). It is possible that larger landbird species which flock, such as blackbirds, may be better adapted for diurnal migration and in particular diurnal spring reorientation flights than other birds. Birds that flock are generally better adapted for identifying predators and alerting other birds to their presence (Thompson *et al.* 1974, Lazarus 1979, Cresswell 1994).

Involvement in spring reorientation flights through the Pelee region of families and species from different wintering areas varied. Although we observed more individuals of temperate-wintering species than Neotropical-wintering species, number of species was similar between the two groups (Table 1). Wood warblers and cardinals and allies were the most abundant Neotropical-wintering migrants during spring reorientation flights, while blackbirds were the most abundant temperate-wintering migrants. Based on their flight ecology, nocturnal migrants, such as wood warblers, are expected to be less prone to engage in diurnal flight events in comparison to diurnal migrants, such as blackbirds (Van Doren *et al.* 2015). Our results confirmed this, as we found that the highest number of reorienting birds was blackbirds. However, wood warblers still accounted for 17.5% of all observed migrants (*n* = 10,842); supporting the results of Wiedner *et al.* (1992) that wood warblers engage frequently in this migration phenomenon, despite the general tendency of nocturnal migrants to be less prone to engaging in reorientation.

Distinct differences were noted between Fish Point and Point Pelee during surveys in 2012. Temperate-wintering migrants outnumbered Neotropical-wintering migrants by a substantial margin at Point Pelee, while the opposite was true at Fish Point. Additionally, as Point Pelee has a larger amount of immediately available vegetative cover in comparison to Fish Point and Pelee Island, our results suggest that increased vegetative land cover may result in increased number of birds in the study site, thus increasing density among migrants and increasing the likelihood for increases in the number of migrants to be counted. In particular, the larger amount of wetlands at Point Pelee may help account for the relatively high abundance of blackbirds. Water crossing is also a difference that is likely to affect responses between study sites. Point Pelee is on the Ontario mainland 45km from the US mainland while Fish Point is on Pelee Island, 21km and 24km from the US and Canadian mainland shorelines, respectively.

While spring reorientation flights are a regularly observed phenomenon, the implications and repercussions of these flights are not clearly understood. It is possible that birds engaging in this form of flight do so to take advantage of propitious weather to the south because of inclement weather. Impacts associated with migration delays may have negative impacts on the life-cycles of birds most readily seen through delays reaching suitable territories and/or engaging in breeding opportunities. Monitoring programs (e.g., the Canadian Migration Monitoring Network) and short-term studies such as ours allow researchers and conservationists the ability to monitor migratory bird populations unobtrusively. The study of spring reorientation flights warrants more research to determine their relationship with weather events, potential differences in life-cycle impacts of migration delays among long- and short-distance migrant groups and to determine how far reorienting birds travel in the opposing direction before resuming normal migration orientation.

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Foraging by a Summer Tanager during a reorientation flight

Brandon R. Holden and Kenneth G.D. Burrell

Spring reorientation flights (see Burrell *et al.* 2015, *this issue*) of landbirds are a rarely studied phenomenon in North America. The region of Point Pelee National Park, near Leamington, Ontario, has regular reorientation flights involving dozens of species and thousands of individuals, predominantly in May (Lewis 1939, Gunn 1951, Burrell 2012, 2013). These flights have raised questions about the physiological demands placed on the individuals involved as the elevated energy requirements of migration on passerines is well documented (Richardson 1978, Van Doren *et al.* 2015). This note documents a Summer Tanager (*Piranga rubra*) interrupting its spring reorientation flight to forage. No other observations of birds doing this have been noted by the authors during previous surveys of spring reorientation in the Great Lakes region.

On 12 May 2014, Holden was observing a reorientation flight at the tip of Point Pelee National Park. During mid-morning, he recorded two observations of Summer Tanager; a first-alternate male at 0924 EDT and an alternate female at 1009 EDT (cf. Humphrey and Parkes 1959). While the male flew steadily southwards over the waters of Lake Erie, the female interrupted her passage to forage, a behaviour not noted during previous observations of spring reorientation flights (K. Burrell pers.obs.). As she approached the tip of Point Pelee from the north at an estimated height of 50m, she made an erratic flight, followed by a rapid descent to the southernmost trees on Point Pelee. Holden observed that she had captured a wasp and she spent the following three minutes consuming the prey item. Upon consumption, she rapidly ascended from her perch and continued her flight southwards over the waters of Lake Erie. The sequence was captured with a Canon DSLR and 600mm lens (Figures 1, 2, and 3). An additional forty minutes of observation yielded no further observations of Summer Tanager foraging.

The Summer Tanager is one of the quintessential ‘reverse migrants’ in Ontario; observations of reorientation flights at Point Pelee and nearby Pelee Island have documented the species relatively frequently (Burrell 2013). With no confirmed nesting of Summer Tanager for the province (Reid 2007), observations

of the species most likely pertain to overshooting migrants beyond their traditional breeding grounds (Robinson 2012). The individual documented here was presumably migrating south, flying from Point Pelee National Park south over the waters of Lake Erie. While it would be difficult to fully understand the energy expenditure placed on a single individual during a spring reorientation flight, this observation would indicate that the phenomenon is not engrossing to the point of stopping basic foraging instincts. Given the amount of time undertaken by the authors documenting spring reorientation flights in the Pelee region, this observation was specifically noteworthy given the fact that no previous observations of this nature have been documented (i.e. individuals engaged in spring reorientation flights abruptly stopping their flight and consuming prey, before resuming flight southwards). As such, we hope this observation can provide but a small piece in helping to understand reorientation flights in the future and greater insight into the documentation and understanding of foraging behaviour and energetic needs of reorienting passerines.

Figure 1. The female Summer Tanager seconds after her capture of a wasp sp. at 1009 EDT on 12 May 2014.

Figure 2. Consumption of the wasp sp. on one of Canada's southernmost mainland trees at 1010 EDT on 12 May 2014. The consumption of bees and wasps by Summer Tanager is characteristic of the species (Robinson 2012).

Figure 3. Following the consumption of the wasp sp., the female Summer Tanager rapidly ascended and continued her reorientation flight at 1013 EDT on 12 May 2014.

Photos: Brandon R. Holden

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In Memoriam
Allan J. Baker

Oliver Haddrath, Cathy Dutton
and Mark K. Peck

Allan John Baker passed away unexpectedly on 20 November 2014. He had worked for over 42 years at the Royal Ontario Museum (ROM) as a Curator in the Department of Ornithology and was Senior Curator at the time of his death. He also served as Head and Vice President of the Department of Natural History from 2004 through 2014.

Allan was born in Westport on the South Island, New Zealand, in July 1943. It was during his childhood spent on a farm near the coast that his interest in natural history, and particularly birds, was kindled. Some evenings he could hear kiwis calling in the darkness and he was also a keen observer of the nearby shorebird colonies. Both the kiwis and the shorebirds would later factor highly into his life's work.

After he earned his undergraduate degree, he went to teacher's college where he met his wife Sue. He began work as a high school teacher in 1965, but returned to the University of Canterbury to earn his MSc, followed by his PhD, on the systematics and evolution of oystercatchers in 1972. Upon receiving his doctorate, he was hired as an Assistant Curator in the Department of Ornithology at the ROM. He, Sue and their very young son, Daniel, packed up and moved to Toronto. Their second son, Ben, was born in Canada a few years later.

Allan's early research and publications focused on oystercatchers, but he soon diversified, expanding his research program to studying evolutionary changes in introduced species throughout the world. While he brought an international scope to the programs carried out in the ornithology department, he was also interested in questions dealing with species in his adopted land. Among some of his studies, he helped clarify the evolutionary relationships between the different subspecies of Canada Geese (*Branta canadensis*). He was always innovative, embracing new tools and techniques that could help shed light on the evolutionary history of birds. In the 1970s, the tools available for the study of museum specimens were limited and largely relied upon direct measurements of birds, or examining variation in size and structure.

Allan Baker holding a moa leg bone in New Zealand, 1994. *Photo by Oliver Haddrath.*

By the 1980s, new research methods were becoming available and he was quick to use these approaches. Examining cultural inheritance of bird song, and employing new molecular tools that looked beyond the phenotype to the genetic makeup (genotype) of the bird were among these methods.

Allan initiated the ROM Ornithology frozen tissue collections, changing the emphasis from collecting whole birds to collecting a blood sample and releasing the birds back into the wild. He recognized that many of the evolutionary questions he was asking could be answered with the wealth of information provided in DNA. This collection would also prove to be an important resource in his future conservation efforts. He was also actively involved in many aspects of museum curation. He initiated the database cataloguing of the various Ornithology collections, secured grants to establish a world-class molecular genetics laboratory at ROM, and was co-lead on the development and installation of the ROM Evolution Gallery.

As well as being a Curator at the ROM, he was also cross-appointed as a Professor at the University of Toronto, teaching courses from introductory biology to advanced graduate classes. Over his teaching career, he helped to shape the minds of multiple generations of young ornithologists, naturalists and evolutionary biologists. He did this not only in the classroom, but also in his own laboratory, where he supervised and mentored over 30 graduate students. There was also a constant stream of international students coming to learn the latest techniques and applying them to their own research projects.

With an expanding lab and cutting edge technology, it was not long before Allan's expertise was being sought to help with external projects. His conservation genetics research continued in the early 1990s with the genetic examination of the Yellow-eyed Penguin (*Megadyptes antipodes*), the world's rarest penguin species, whose populations were suffering predation from introduced mammals in New Zealand. Allan used his molecular skills and knowledge to assess the population dynamics of these birds and to understand their dispersal, allowing for a more informed management strategy. In a similar way, he helped with kiwi conservation by using DNA sequencing to show the three recognized species of kiwi were in fact, five species, a key piece of information that impacted species management, recovery plans and captive breeding programs.

Allan also worked on a number of other collaborative conservation projects both within Canada and internationally. Over the last twenty years, he has had a special interest in the conservation of shorebirds, in particular the *rufa* subspecies of the Red Knot (*Calidris canutus*) in North America that has undergone a dramatic population decline that began in the 1990s. He and his students used molecular resources to answer questions surrounding the genetic diversity and evolutionary history of the Red Knot. In addition, he co-founded the Global Flyway Network, a collaboration of scientists and ornithological enthusiasts who provide an early warning service for identifying migratory shorebirds at risk. He also helped organize and coordinate international teams of shorebird researchers from Argentina to the Canadian Arctic. This research on Red Knots helped to have it designated as a species at risk in Canada and the United States.

Alongside his conservation work, Allan carried out research addressing the fundamentals of bird diversity. He was involved with helping to build the avian tree of life, sequencing DNA from different bird species to help resolve avian relationships. This also involved trying to work out when these different bird lineages originated, which touches on one of the controversies of the bird world: how old are modern birds and what events shaped their modern radiation? He also co-chaired the All Birds Barcoding Initiative (ABBI) Steering Committee, whose aim is to identify all of the more than 10,000 species of birds in the world using a unique DNA sequence from the COI gene.

He received several distinguished awards during his career, including the Doris Huestis Speirs Award for Outstanding Contributions to Canadian Ornithology, presented in 2006 by the Society of Canadian Ornithologists, and the William Brewster Memorial award in 2007, presented by the American Ornithologists' Union for his outstanding and influential work in avian molecular evolution. He was made a fellow of the American Ornithologists' Union in 1988, and served as an editor or member of the editorial Board for such publications as *Systematic Biology*, *BMC Evolutionary Biology*, and *The Auk*. He was co-convenor for Symposium 22 "The Avian Tree of Life" at the XXV International Ornithological Congress.

While Allan enjoyed working in the museum on the questions surrounding birds, he loved to get out into the field and study them directly and in doing so visited many countries around the world. It was often on these trips that his true mischievous sense of humour would come out and field trips always resulted in many fun and entertaining stories.

Allan had a passion for life, his work and birds. He will be missed by those whose life he has influenced, and there have been a great many. His legacy will live on with the continuation of the initiatives he began, the ROM Ornithology collections, and in the spirit of scientific curiosity he has inspired in his students.

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Distinguished Ornithologist
D.V. "Chip" Weseloh

Chris Risley

D.V. (Chip) Weseloh receiving the Distinguished Ornithologist Award at the OFO 2015 Annual Convention at Leamington on 4 October. Presenting the award is Dave Moore, Environment Canada (right). *Photo: Jean Iron*

This year's recipient of the Distinguished Ornithologist Award is D.V. "Chip" Weseloh. Chip is well known to many Ontario birders but some highlights of his background will be important to those who may not know him or know why he was given this award. His contributions include: outstanding scientific research, long-term service to Ontario Field Ornithologists (OFO), his ability to communicate science, and his passion for birds, especially colonial waterbirds.

Chip is an emeritus wildlife biologist who worked for the Canadian Wildlife Service (CWS), part of Environment Canada, in Burlington and Downsview for over 35 years. Prior to his CWS position, he completed graduate studies on colonial waterbirds, worked as a bird tour leader, a museum curator in Alberta and an environmental consultant.

Chip grew up in a small town in south-central Minnesota where his initial interest in birds developed during duck hunting trips with his father and younger brother. Driving country roads, scouting feeding areas and figuring out where the ducks would be the next morning, spurred his interests in birds and their behaviour.

During his undergraduate years at Gustavus Adolphus College in St. Peter, Minnesota, Chip's ecology professor happened to mention that repeated defecation from Great Blue Herons (*Ardea herodias*) over the edge of their arboreal nests, over time, changed the herbaceous vegetation growing beneath their nests. He undertook a class project on this topic and then continued the research for his MSc. degree from Michigan Technological University (Weseloh and Brown 1972). Intrigued by the roosting and feeding flights he had seen of the herons during that research, Chip went on to complete a PhD. at the University of Calgary on the local movements and urban ecology of Ring-billed Gulls (*Larus delawarensis*) (Weseloh 1976). He became hooked on colonial waterbirds and when asked why, he notes, "Usually when you find one or two of them nesting, you find hundreds. They're easy to find, easy to count, easy to catch and easy to work with…and they're fun!"

Starting employment with the CWS in 1978, Chip was the lead field biologist with the Great Lakes Herring Gull Annual Egg Monitoring Project where his duties involved collecting Herring Gull (*Larus argentatus*) eggs for contaminant analysis and monitoring reproductive success along with super normal clutches and skeletal deformities at select colonies in each of the Great Lakes. He also periodically investigated contaminant levels in other colonial waterbirds: Common Terns (*Sterna hirundo*), Caspian Terns (*Hyropogne caspia*), Black Terns (*Childonias niger*), Double-crested Cormorants (*Phalacrocorax auritus*), Great Black-backed Gulls (*Larus marinus*) and Black-crowned Night-Herons (*Nycticorax nycticorax*). This was all part of the Great Lakes Wildlife Toxic Chemical Surveillance Program. He maintained that position throughout his 35 years with CWS; the project is now the longest continuous annual wildlife toxicology sampling program in the world.

In 1998, with the retirement of Dr. Hans Blokpoel from CWS, Chip inherited the responsibility for the conservation of Great Lakes colonial waterbirds along with his usual role of monitoring contaminant levels and population effects in Herring Gulls and other waterbirds.

With this new responsibility, his field research expanded to include the decadal censuses of colonial waterbirds on all of the Canadian Great Lakes (a three year undertaking every ten years), annual monitoring of the expanding population of the Double-crested Cormorants on the four Canadian Great Lakes, and satellite tagging and tracking of Herring and Great Black-backed Gulls on the upper Great Lakes and Lake Ontario. He also began monitoring numbers of Little Gulls (*Larus minutus*) at Oshawa Second Marsh (their most predictable and populous gathering site in North America) and developing the Little Gull Viewing Weekend (assisted by Tyler Hoar and

Counting Caspian Tern nests on Mohawk Island, Lake Erie, 2007. *Photo: Tania Havelka, CWS.*

Banding Great Blue Herons on Howland Rocks, North Channel, Lake Huron, 9 June 2008. *CWS, file photo*

Richard Joos). He was also able to start extensive colour-marking of Great Egrets (*Ardea alba*) at their colonies and recruit citizen scientists to assist in reporting re-sightings, as well as censusing their roosting sites during spring and fall (more than 70 sites have been identified so far).

Chip, with his co-workers, have published over 200 peer-reviewed journal articles, government reports, technical reports, book chapters and progress reports. Likewise, he has given dozens of presentations. His list of co-authors on these publications and presentations is impressive and speaks to Chip's ability to collaborate effectively with a wide variety of scientists and citizen scientists, both within Ontario and Canada as well as internationally.

For his efforts, he received the Queen's Golden Jubilee Medal in 2003 for contributions to ornithological science and bird conservation. The value of his research was recognized in 2012 by his co-workers when they formally proposed to Geographic Naming Canada that a set of rocks (and the gull, night-heron, cormorant and egret colonies on them) in the rapids just above Niagara Falls be officially named “Weseloh Rocks”. In 2014, his research was also recognized when he received the Lifetime Achievement Award from the International Association of Great Lakes Research.

Chip first became interested in birding as a hobby while attending graduate school at the University of Calgary. His supervisor, who was also president of the local naturalist club, required all his students to take part in club activities and lead field trips. Chip obliged and immersed himself in birds other than waterbirds. His interest drew him into the birding world in short order.

In the late 1970s, he and his wife, Linda, were two of the founding executive of OFO and he remembers the heady planning meetings of the day: “Those were exciting meetings. Figuring out who was going to do what, what we were going to call ourselves, how we were going to get started with a big bang and what our logo was to be….” He not only served as President in those early days (1986-87) but also, due to his interest in writing, he and Linda were the first editors of the new journal, *Ontario Birds*, from 1982 to 1984.

Chip and Linda live in Toronto but their favorite birding haunts are on the eastern edge of the city, so naturally they became active in the Pickering Field Naturalists and Chip served as its President from 1980 to 1982. Nationally and internationally, he is active in the Waterbird Society, acting as its President during 2010-2011 and, before that, organizing its meeting in Niagara Falls in 2001. He has also been a board member of the Long Point Bird Observatory and the Ontario Bird Banding Association. He spends his summers, with his family, on Garden Island, a 26 ha island in Kingston harbour.

A Mute Swan nest on Nottawasaga Island, Collingwood, 1 May 2008. *CWS, file photo*

Chip is always interested in field work and is known to remark, “A bad day in the field is better than a good day in the office.” One of his ongoing projects has been to band and wing-tag young Great

Egrets at their nests and then track their post-fledging movements. His use of volunteer birders to report sightings is an excellent example of a "citizen science" research project that the public has bought into enthusiastically. He maintains a network of volunteers across the province and continent for reporting tagged egrets. He also enjoys watching and documenting egrets and other birds (e.g. American Crows, *Corvus brachyrhynchos*), going to roost, a time when most birders are winding down from their day, and has taken many birders for a dusk watch that is never forgotten.

Chip has been an enthusiastic mentor for numerous young scientists, technicians, students and volunteers. Always one to encourage and support others, Chip has this advice for those looking for a career in biology or conservation: "I can't overestimate the value of volunteerism. In this day and age, it seems like the competition for bird jobs is very high and there are fewer and fewer of them. Do whatever you have to do to get your foot in the door. Make yourself indispensable to whomever you can do volunteer work for. Several of the people I've hired over the years at CWS started out as volunteers for us."

Chip is a recognized scientist, a keen birder and an active supporter and contributor to OFO and *Ontario Birds*, who enjoys sharing his knowledge. He is well deserving of the OFO Distinguished Ornithologist Award.

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Ontario Field Ornithologists is an organization dedicated to the study of birdlife in Ontario. It formed in 1982 to unify the ever-growing numbers of field ornithologists (birders/birdwatchers) across the province, and to provide a forum for the exchange of ideas and information among its members. The Ontario Field Ornithologists officially oversees the activities of the Ontario Bird Records Committee (OBRC); publishes a newsletter (*OFO News*) and a journal (*Ontario Birds*); operates a bird sightings listserv (ONTBIRDS), coordinated by Mark Cranford; hosts field trips throughout Ontario; and holds an Annual Convention and Banquet in the autumn. Current information on all of its activities is on the OFO website (www.ofo.ca), coordinated by Doug Woods. Comments or questions can be directed to OFO by e-mail (ofo@ofo.ca).

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