



MIGRATION MONITORING AT CABOT HEAD

FALL 2016

by

Stéphane Menu, Ph.D.
Station Scientist
Cabot Head Research Station
Bruce Peninsula - Ontario
stefmenu@gmail.com

*prepared
for*

BRUCE PENINSULA BIRD OBSERVATORY

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Preface

Cabot Head is a promontory of the northeast headland of the upper Bruce Peninsula in south-central Ontario, at the northern end of the Niagara Escarpment, in the mixedwood plains ecozone. Cabot Head Research Station (CHRS) is situated on a small spit of land (at 45°15'N, 81°18'W), bordered north by Georgian Bay and south by the western side of Wingfield Basin near the community of Dyer's Bay. In 2001, Cabot Head was designated as an Important Bird Area (IBA) by Birdlife International for its significant concentrations of migratory bird species (Cheskey and Wilson, 2001) and Red-necked Grebe in particular. Situated in a provincial nature reserve, Cabot Head Research Station is managed conjointly by Ontario Parks and Bruce Peninsula Bird Observatory (BPBO).

The Breeding Bird Survey (BBS) is the principle method for monitoring bird populations in the United States and the southern part of Canada. However, breeding ranges of many species in northern Canada are inaccessible to roadside surveys and are therefore poorly monitored by the BBS method. The Canadian Migration Monitoring Network (CMMN) is a nation-wide network of independent bird monitoring stations, such as BPBO, along with Bird Studies Canada and the Canadian Wildlife Service of Environment Canada. The Network's mission is *To contribute to conservation, knowledge, and public understanding of Canadian migrant birds and bird migration through a collaborative network of independent migration monitoring and research stations.*, (<http://www.bsc-eoc.org/volunteer/cmmn>). There are approximately 25 stations across Canada where data are collected for each bird species during spring and fall migrations, through standardized capture and observation protocols. Since 1998, Bruce Peninsula Bird Observatory has demonstrated that Cabot Head is a significant site for monitoring migrating landbirds and has been part of the CMMN since 2003.

Bruce Peninsula Bird Observatory was incorporated as a charitable non-profit organization in 2001 to initiate and direct ornithological assessments and monitoring at Cabot Head and surrounding areas. Migration monitoring has been the primary focus of bird research at Cabot Head since 1998. This document reports on results of the fall 2016, migration monitoring season at Cabot Head Research Station.

Executive Summary

In this document, the results of migration monitoring at Cabot Head from the fall of 2016 are summarized and analysed. It is the 15th year of consecutive monitoring following a research protocol established in 2002. Keeping a consistent monitoring effort helps ensure that trends can be detected and quantified.

Fall fieldwork began on August 16 and ended on October 31 for a total of 77 consecutive days of coverage. A total of 133 species of birds were detected in the standard count area over the course of the field season. Among them, 78 species (58%) have been seen every fall. The number of species detected this fall was around the 2002-2015 average of 137 ± 9 (range: 127 species in falls 2006 and 2008 – 156 species in fall 2002;). The highest one-day species total was 48, recorded on September 22. One highlight of the season was the observation of Black-crowned Night Herons detected for the first time during the monitoring period.

In total, 1,691 birds of 66 species were banded and 151 birds of 32 species were recaptured (Table 1). Species-specific capture rates in 2016 were similar to average capture rates between 2002-2015 with the exception of Swainson's and Gray-cheeked Thrushes, which were captured in record numbers (see Appendix I for banding fall totals per year and Appendix II for species detected). Notably, a Rusty Blackbird was banded at Cabot Head, the second ever individual of this species ever banded in fall.

Recapture data indicate that stopover rates at Cabot Head are generally low but highly variable depending on species and year. It appears that some species, like thrushes, could extensively use Cabot Head as a stopover habitat, to rest and refuel, principally in years of local high food availability (like chokecherry or cone seeds). Analysis of capture rate per net location indicates a large degree of variation associated with habitat characteristics and species behaviour.

The fall 2016 migration monitoring season was a success thanks to the efforts of the 8 volunteers who contributed their time and enthusiasm to the project.

Table 1: Summary of coverage and species detected and banded.

	August	September	October	Total
Days with coverage	16	30	31	77
Species detected	73	103	91	133
Days with no banding (% of total)	2 (13%)	3 (10%)	8 (26%)	13 (17%)
MN hours realized (% of potential)	85%	87%	67%	79%
Number of birds banded	184	547	960	1691
Number of species banded	34	50	41	66
Average daily number of birds banded	13	20	42	26
Maximum daily banding total (with date)	19 (22 Aug.)	49 (21 Sep.)	90 (23 Oct.)	
Minimum daily banding total (with date)	7 (17, 27, 28 Aug.)	6 (10 Sep.)	8 (30 Oct.)	

MN: Mist net.

1.0 Methods

The migration monitoring program at Cabot Head Research Station follows a field protocol (established by Heagy et al, 2003) as it is essential for the production of population indices that data collection be consistent over the long term. Specifically, 15 mist nets are operated for six hours commencing a half hour before sunrise (or later, depending on weather). Personnel also complete a one hour census along a fixed route, where all bird seen or heard are recorded, usually starting an hour after sunrise. Casual observations are also taken and all of the methods are used to determine a detected total (DT) for each species within the area of the station during the sampling period each day. Supplemental surveys such as visible migration counts and bay watches are completed when circumstances permit. As expected, there is a tremendous variation in diversity and abundance throughout the season (Fig.1).

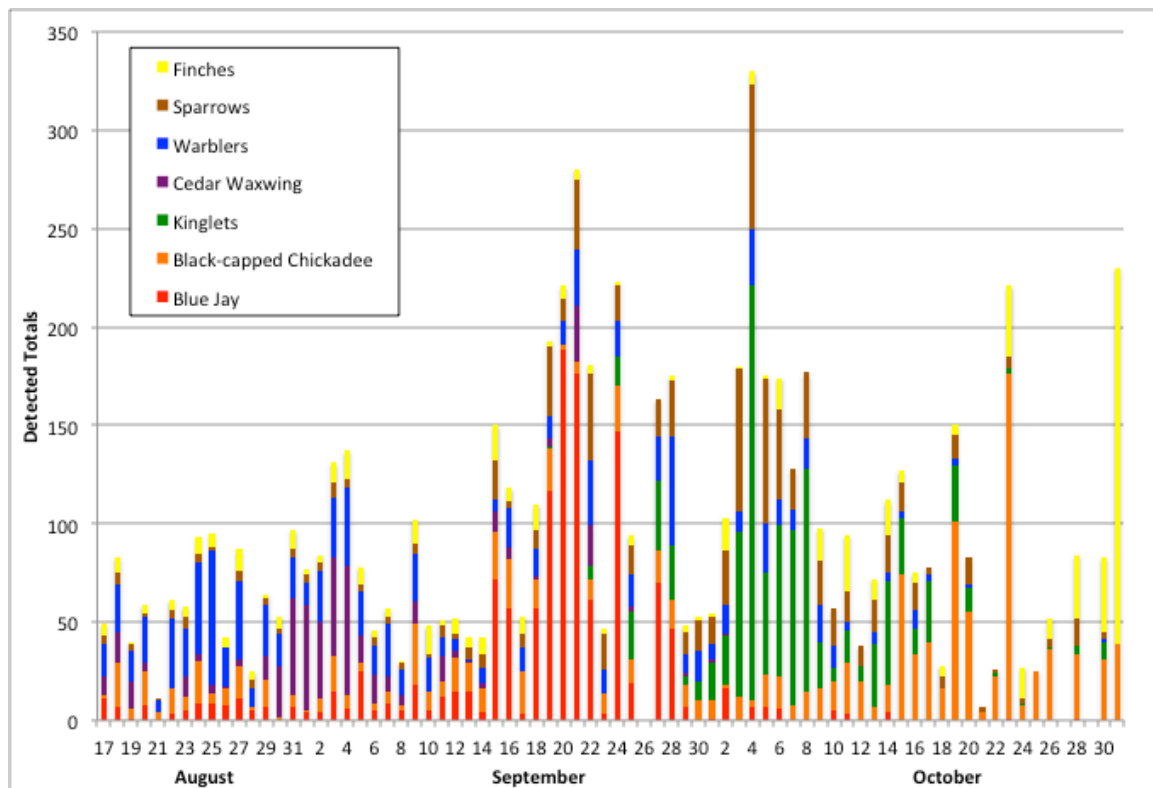


Figure 1. Detected Totals of the most common species throughout the monitoring period at Cabot Head Research Station, fall 2016 (kinglets comprised of both Golden-crowned and Ruby-crowned Kinglets).

2.0 Season Summary

August

Fieldwork for fall migration monitoring began at Cabot Head Research Station on August 16 with fifteen mist nets in operation. August is normally a quiet month of migration in southern Ontario. Banding was possible for every day but two in this period, with only a few net hours lost to bad weather (85% of the potential mist net hours were realized. See Table 1). A total of 73 species, including 19 species of warblers, were detected in August, with an average of 29 species per day (range of 12 species on August 21 to 38 on August 25). Only six species were detected on every single day in August: Double-crested Cormorant, Ring-billed Gull, Black-capped Chickadee, Red-breasted Nuthatch, American Redstart, and Common Yellowthroat. A total of 19 species (including the previous ones) were seen on ten days or more during the 16 days of monitoring in August. On the other end of the scale, 20 species were detected only once during this period (like American Kestrel, Great Crested Flycatcher, Yellow-bellied Flycatcher). A total of 184 birds of 34 species were banded: the second-lowest total for August after 2004 with 159 birds banded. Once again, American Redstart was the most common species caught, with 23% of the monthly banding total, followed by Common Yellowthroat and Black-and-white Warbler (about 8% each).

The 4-day period from August 24 to 27 was the most diverse in August with a total of 55 species detected (75% of the August total), including 14 species of warblers. Out of the 55 species observed, only 17 were seen every day of that 4-day period and another 18 only observed on one day. The first Veery and Swainson's Thrush of the fall season were detected during this period, as well as the first Bay-breasted and Wilson's Warblers, "true migrants", that is, species that don't breed on the Bruce Peninsula. The Eastern Whip-poor-will was heard at dawn during this 4-day period. This species sings again in late summer and early fall. As a crepuscular species, it is not always recorded in the "official" monitoring period. This fall, it was detected (officially and unofficially) from August 19 to September 20.

The American Redstart is usually the most abundant species, both observed and banded in August, because of a large breeding population around the station and a rather early fall migration. However, this fall, the banding total for American Redstart is the

second lowest of the 15 years of fall monitoring, with only 54 birds banded (78% of the redstarts were banded in August this year). Between 2002 and 2015, an average of 94 (± 39) American Redstarts are banded, with a low of 44 in fall 2007 and a high of 171 in 2008. Even though an (unknown but likely) high proportion of redstarts banded both in spring and fall are local birds, a relationship between numbers of birds banded in spring and in subsequent fall does not appear to exist: a high number of redstart banded in spring does not automatically translate into high numbers banded in fall (Fig.2).

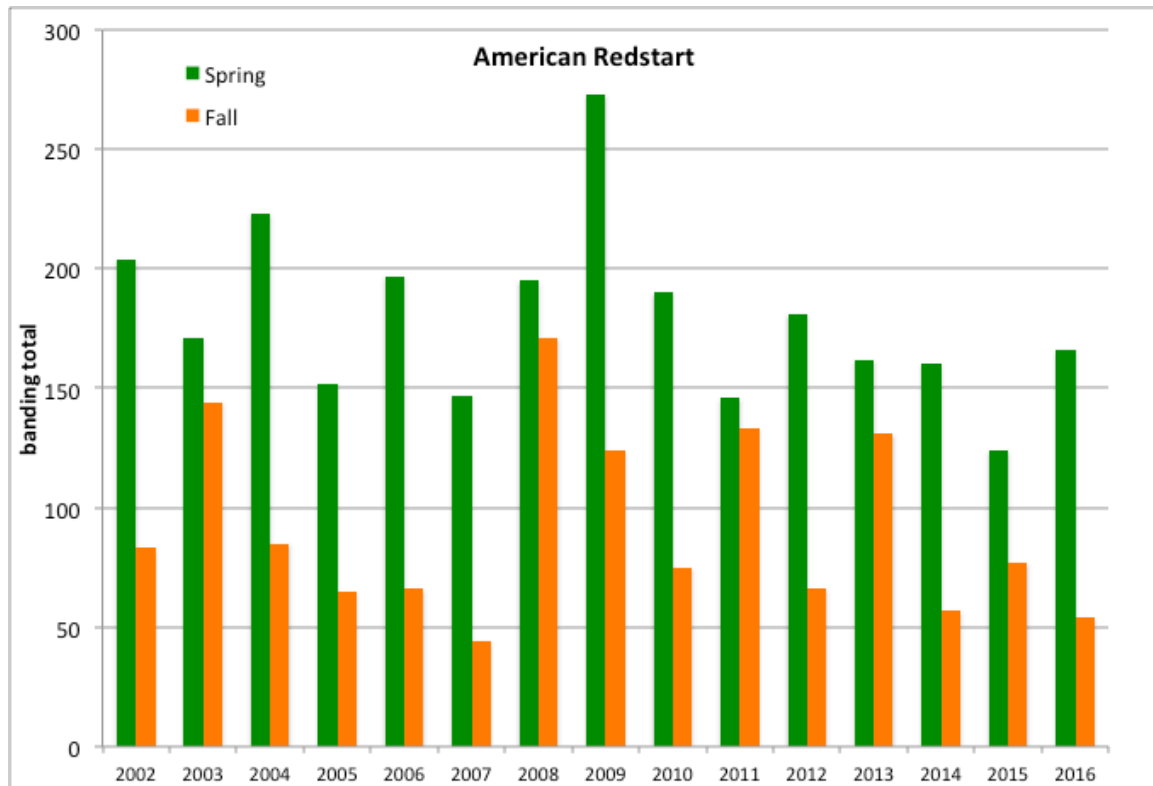


Figure 2. American Redstarts banded in spring and fall at Cabot Head Research Station between 2002 and 2016.

In August, migration monitoring is complicated by the presence of local birds. Even though they could also be migratory species, they may not be migrating at this time. For example, an American Redstart observed in August may not be migratory, but rather a local bird. Most adult songbirds moult their flight feathers in the summer before starting their migration. Of the ten adult American Redstarts captured at Cabot Head this fall, six of them were in active moult, mostly in August from the 17th to the 22nd. However, two adult females were still showing signs of active moult when captured in September 2 and

7. The other four adults with no active moult were captured from August 30 to September 21. Though a very small sample size, the moult timing seems to confirm the presence of local birds in our captures. Nonetheless, most of the captures of American Redstarts occur in August: depending on years, from 57% to 89% of all redstarts have already been banded at the end of August (Fig.3). It is a clear indication that migration happens mostly during August for this species. It is even likely that the onset of migration for this species might be missed when monitoring starts on August 16. For example, in the fall of 2003, monitoring started on August 10: during the first five days, 54 American Redstarts were banded, as many as this year's total.

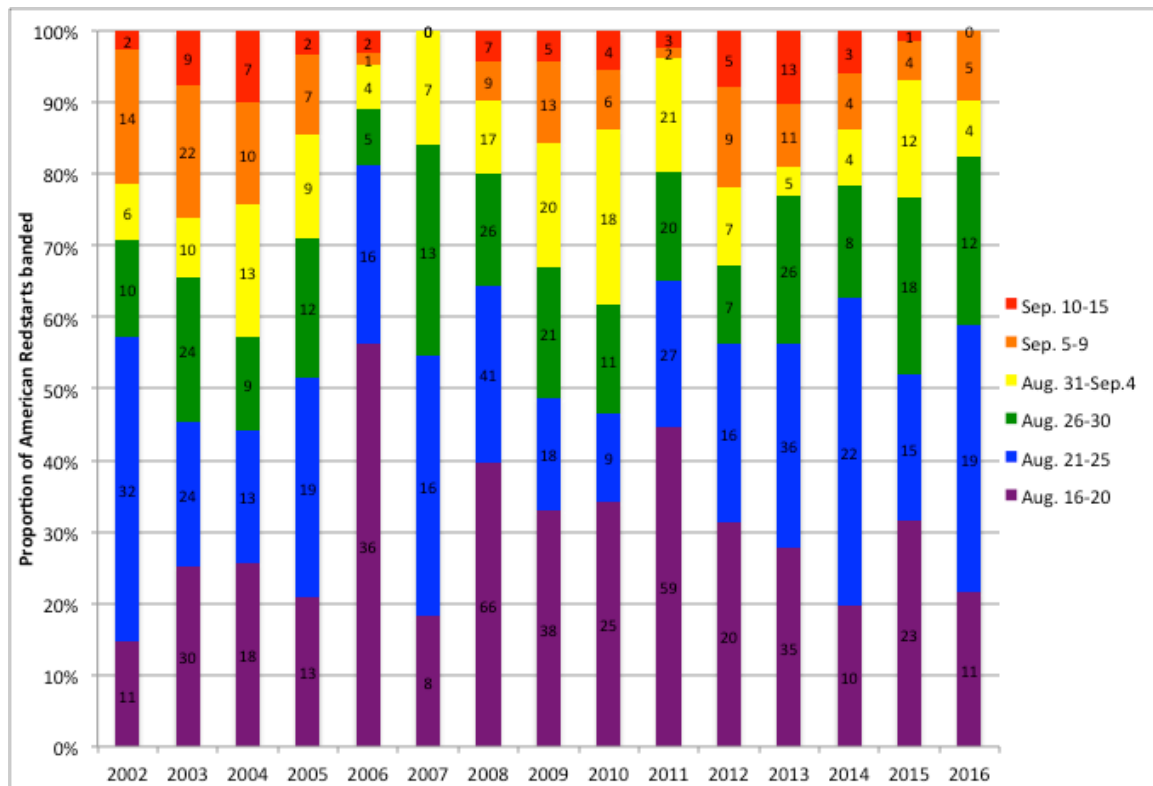


Figure 3. Proportion of American Redstarts banded by 5-day period in the fall at Cabot Head Research Station, 2002-2016. (Numbers in bars are numbers of birds banded)
NB: only 0 to 7% of seasonal total are captured after September 15.

Nevertheless, migration does occur in August, as shown by the appearance of species that do not breed on the Bruce Peninsula. For example, the Greater Yellowlegs was noted first this fall on August 27. The first boreal warblers and “true” migrants were the Wilson’s (detected on August 25), Bay-breasted (on August 28), Blackpoll (on

August 30) and Tennessee Warblers (on August 31).

An unlikely species was observed and banded in August: two adult Eastern White-crowned Sparrows were observed on August 17, with one being captured on that day. The second bird was captured on September 4. Both of them were in the process of moulting their wing and tail feathers. Because this moult happens in the summer grounds, before migration, it means that these individuals have likely spent the summer on the Bruce Peninsula. It is quite surprising for a species that breeds, in Ontario, exclusively in the far north (near, and north of, the tree line adjacent to Hudson's Bay). Neither individual was subsequently recaptured but were seen regularly almost every day until mid-September. The next observations of White-crowned Sparrows were on September 21 with new arrivals, with numbers slowly building afterwards and peaking in early October.

White-crowned Sparrows were detected in August in five other years: in 2004, one individual was observed on August 28 (with the next observation that year on September 18); in 2007, one bird was observed on August 19, one was banded on August 24 (possibly the same one?), with active moult in its wings, and it was recaptured on September 3; in 2011, two individuals were banded with active moult on August 17 and 21; In 2013, one to three individuals were detected from August 14 to 28, with a bird banded on the 27th; in 2015, one individual was banded on August 27 with active moult in its wings. In summary, White-crowned Sparrows on the Bruce Peninsula in the summer are thus not totally unusual, as they have been detected in six summers out of 15 years of monitoring. It is possible that they are birds in poor conditions in spring, which then make them unable to finish their migration to their northern breeding grounds.

This fall, Barn Swallows were seen in extremely low numbers, continuing a worrying trend of declining abundance. All observations were in the single digit, with the highest Detected Totals of only six birds on August 19 (Fig.3). The last Barn Swallows (a total of 3) were seen on August 23, much earlier than usual. Barn swallows are extremely visible, especially so at Cabot Head, since they use the shipwreck in the basin as a breeding and roosting site. When present, they are observed daily, first heard chipping from within the wreck as the sun warms the day, then flying out and around conspicuously. It is thus very unlikely that Barn Swallows or other species of swallows

are missed in the fall. Barn Swallow is the only species of swallow seen every fall, certainly because they breed yearly in the shipwreck. No other species of swallow were observed this fall.

Other birds of summer were rarely or not observed this year: no Common or Caspian Terns were detected this summer, even though they are species, like Barn Swallow, that are very visible and vocal. For context, both Common and Caspian Terns were previously not detected in a total of three fall seasons: in 2009, 2010, and 2012 for Common and in 2012, 2013, and 2015 for Caspian. Eastern Kingbird was detected only twice, on August 25 and 27, with one individual each. This species prefers the marshy margins of the shallow lakes at the base of West and Middle Bluffs: it is thus not rare at Cabot Head and is regularly seen around the station - albeit in small numbers - when moving from and to its favourite habitats. This species has been detected every August since 2002, except in 2012, 2013, and 2014, with usually multiple observations. A few Spotted Sandpipers are observed every summer and up to mid-September (last date on September 24, 2014). In 2016, numbers were very low, with only five observations made in total. On the other hand, a less frequent species, Eastern Bluebirds were detected twice in August, on August 26 and 27. This species has been detected previously in only four years of the past 14 seasons, with two observations in August, three in September, and two in October (latest date on October 18, 2003).

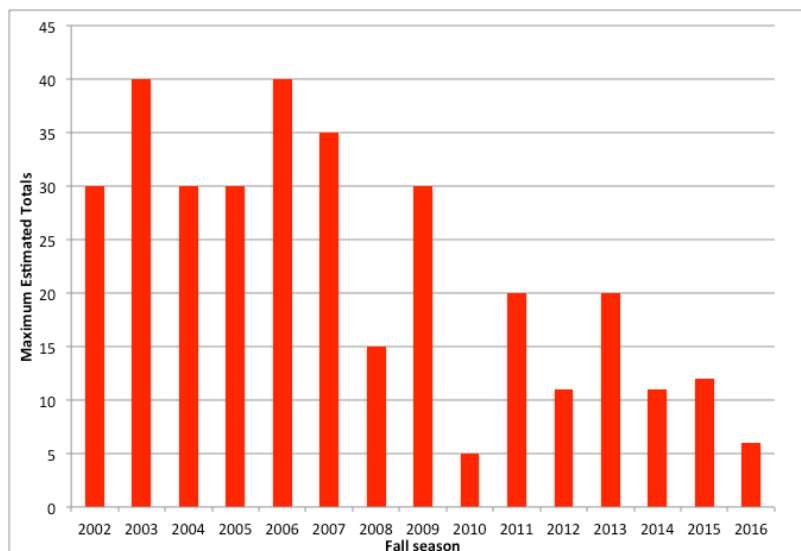


Figure 3. Highest daily Estimated Total for Barn Swallows at Cabot Head Research Station in fall 2002-2016, in relation to year.

September

Weather in September was mostly warm and dry, with only three days of showers or rain during the month. As with birds, it is a time of transition between summer and fall. Only three full days of banding were lost due to either rain and/or high wind, and six other partial days were lost, resulting in 13% loss of possible mist net hours. A total of 103 species were detected during the month. The most frequently detected species were Ring-billed Gull, Common Raven, Black-capped Chickadee, and Red-breasted Nuthatch, with only one day in the month when each species was missed. A total of 19 species (including the previous four) were detected at least on 20 different days, while 45 species were rarely detected (on 5 days or less). A total of 547 birds of 50 species, below the average of 622 (± 189) birds, were banded in September, but very close to the median value of 561 birds. The most common species caught were Swainson's Thrush (with 64 birds banded, accounting for about 12% of the monthly total), followed by Red-eyed Vireo (56 birds banded, i.e. 10% of the monthly total), then Red-breasted Nuthatch and Gray-cheeked Thrush (about 8% each). Through time, BPBO has documented huge variations in number of banded birds and capture rates in September, with a low of 331 birds in 2007 and a high of 1029 in 2005.

September is the most diverse month: 51 species were caught compared to 34 for August and 41 for October and 103 species detected compared to 73 and 91 for August and October, respectively. Many species migrate mainly during this month (i.e., warblers, White-throated Sparrow and Swainson's Thrush), while early migrants are still moving through (American Redstart and Black and White Warbler, for example). The earliest individuals of the late migrants can also be encountered at the end of the month (Kinglets, Hermit Thrush, Sparrows). Banding in September was relatively slow with an average of 20 birds a day (range from 6 to 49 birds). September 21 was the busiest day for the month: In 90 mist net hours, 49 birds of 16 species were banded. Captures were widespread across species but Gray-cheeked Thrush had the highest capture rates, with eight individuals banded. The following day, September 22, was the second busiest day, with 39 birds of 17 species banded, with – again – all nets open for six hours. Most species were captured in small numbers, with Gray-cheeked Thrush once again having 8 individuals banded. Both days were quite warm (with high around 22°C), overcast, with a

light South wind. In all of September, most daily captures for any species were very low, with usually less than five birds. Besides the aforementioned Gray-cheeked Thrush captures, the highest daily captures were nine Red-eyed Vireos (September 7) and 13 Swainson's Thrushes (September 18).

This fall, more Gray-cheeked Thrushes were banded than in any other falls (Fig.4) with 41 birds, compared to an average of 15 (\pm 9) birds (low of 7 in 2012 and 2014; previous high of 21 in 2011). In 2016, captures were concentrated from September 8 to 23, with a high proportion of "busy" days, compared to previous falls: There were two days with four birds captured (September 16 and 18), one with six birds (September 20), and - as mentioned - two days with eight thrushes captured (September 21 and 22). In comparison, in the 14 years from 2002 to 2015, there were only a total of three days with four gray-cheeked thrushes captured, two with five, one with six, and one with seven (the previous highest daily total, on September 23, 2004). Across the years, the earliest capture was on September 2 (in 2005) and the last on October 8 (in 2003). Gray-cheeked Thrushes are northern breeders, from Siberia to Newfoundland, occupying the northern reaches of the boreal forest and into the tundra. It is thought to breed in northern Ontario, although in very small numbers (OBBA 2007).

Swainson's Thrushes were banded in good numbers as well, reaching the second highest total, with 70 birds, compared to an average of 34 (\pm 21) birds (Fig.5). Captures were concentrated in the same few days as Gray-cheeked Thrush, from September 16 to 22, when 63% of the season total was banded. About 96% of all Swainson's Thrushes banded this fall were captured in September, with the first captured on August 27 and the last in October 15. Timing of captures varies quite widely between years (Fig.6) Swainson's Thrush does breed on the Bruce Peninsula, although at a very low density compared to the boreal forest populations: according to the Ontario Breeding Bird Atlas, this species is practically ubiquitous in the conifer-dominated Northern Shield. Birds captured earlier in the season (i.e. August) are thus potentially local birds but afterwards the vast majority of them are more likely to come from north of the Bruce.

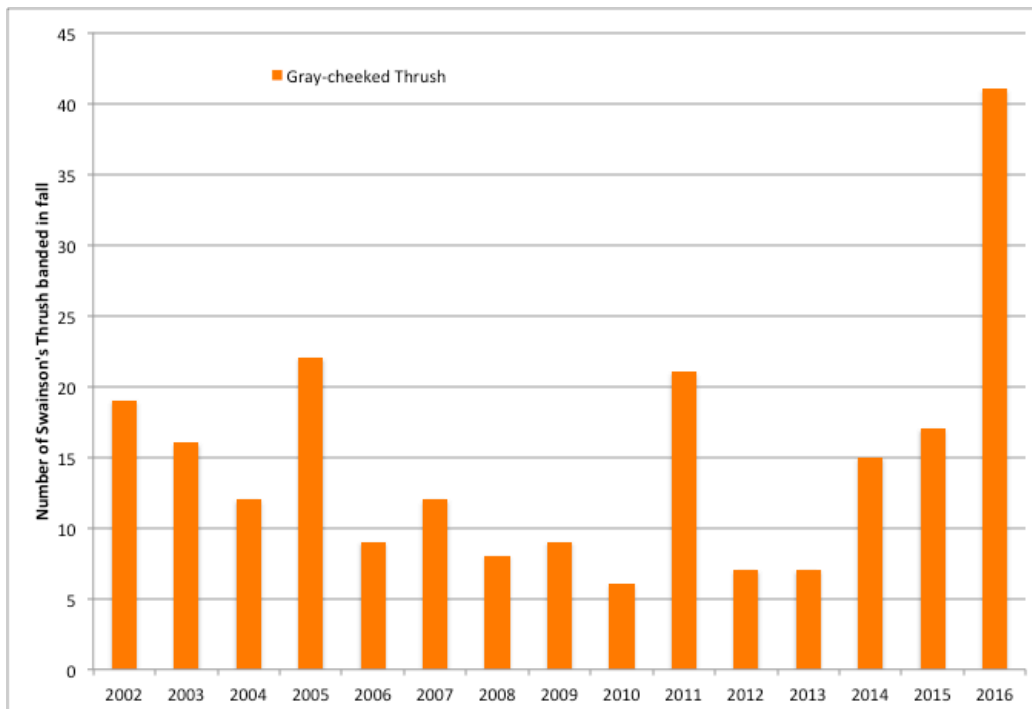


Figure 4. Banding totals of Gray-cheeked Thrush in the fall at Cabot Head Research Station from 2002 to 2016.

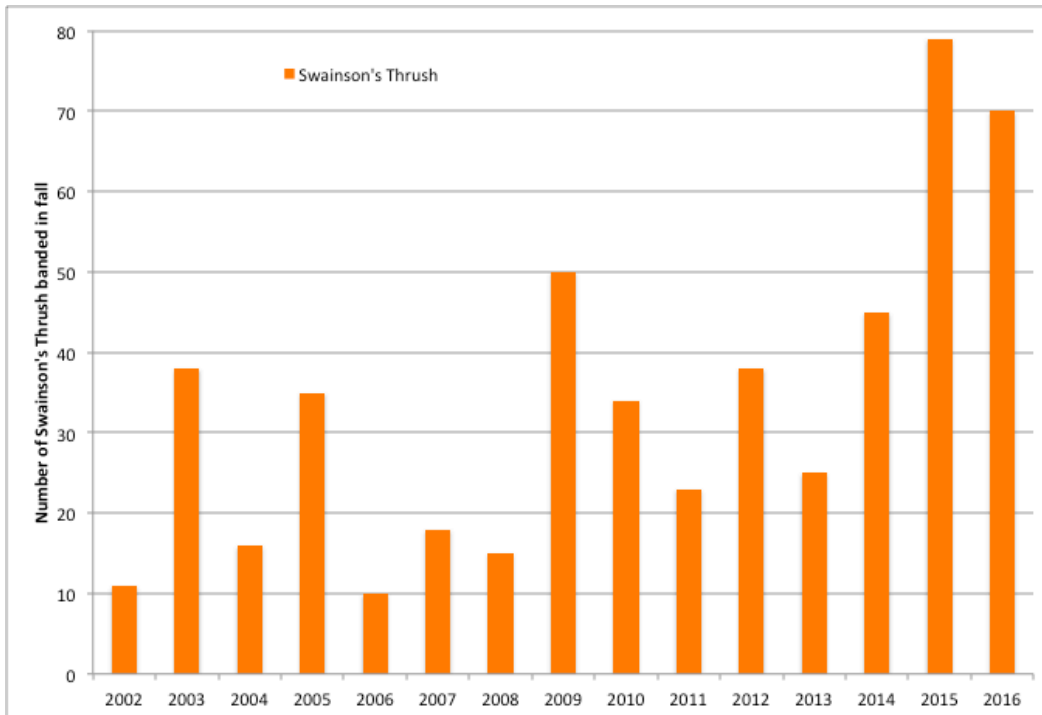


Figure 5. Banding totals of Swainson's Thrush in the fall at Cabot Head Research Station from 2002 to 2016.

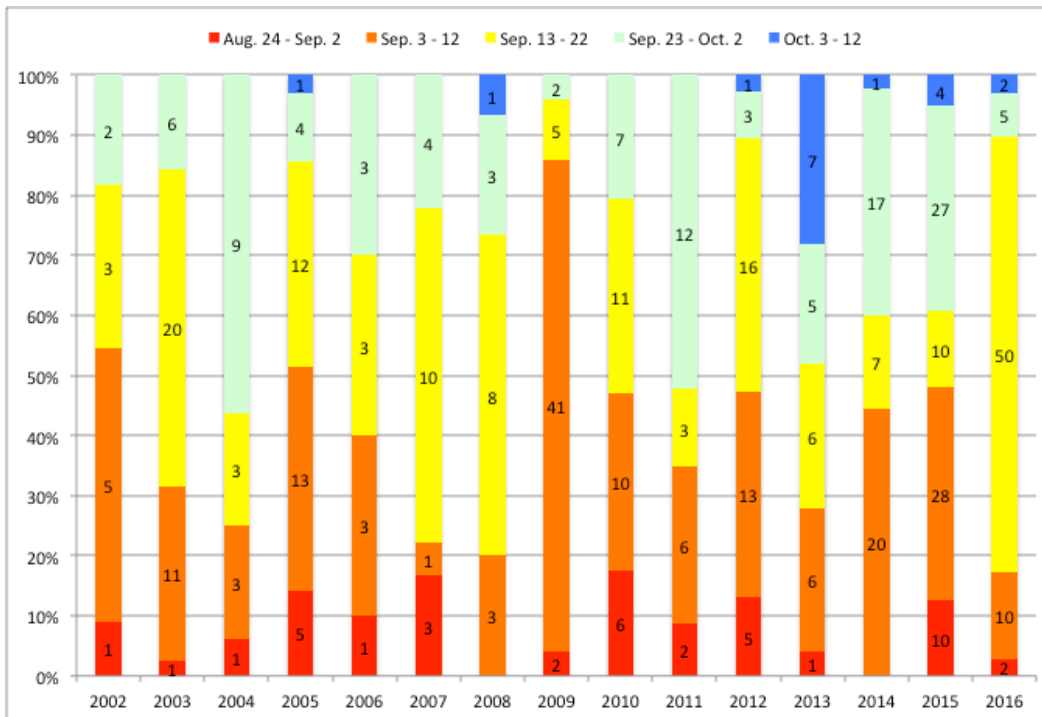


Figure 6. Proportion of Swainson's Thrush banded by 10-day period in the fall at Cabot Head Research Station, 2002-2016. (Numbers in bars are numbers of birds banded).

Diversity reached high points throughout the month, especially early and late in the month. A total of 72 species were detected between September 4 and 9, with a daily high of 43 on the 9th. Likewise, 71 species were detected in the 5-day period between September 18 and 22, with a high of 48 species on the 22nd. A total of 50 species were common at these two periods, or in other words, 22 and 21 species were unique to the early and late periods, respectively. Surprisingly, the diversity of warblers was very similar between the early 16 species and late 14 species: only Yellow and Canada Warblers were not detected in the late period onward. Species unique to the late period included Brown Creeper and American Pipit, as well as both species of kinglets.

Diversity and abundance of warblers peaked in late August and early September (Fig.7 and Table 2): in the 5-day period between August 31 and September 4, a total of 16 warbler species was detected, with American Redstart, Common Yellowthroat, and Black-and-White Warbler, being the most abundant. After 25 days of monitoring, the cumulative number reached 20 species of warblers on September 9. The remaining 52 days of monitoring added three species (Orange-crowned and Cape May Warblers and Northern Parula). Despite a sharp drop in both diversity and abundance between September 10 and 14, the number of species of warblers detected was still high in late September, with a cumulative total of 17 species from September 15 to 24. However, the decline in diversity and abundance is drastic in October, where only a handful of species of warblers were detected, including Myrtle and Orange-crowned Warblers seen in significant number for longer periods during this month. Throughout the season, Myrtle Warbler, Common Yellowthroat, and American Redstart were the species most often detected and in the highest numbers. Some late dates were noted for a few species this fall: a Black-throated Blue Warbler on October 8 (as in 2006 and 2012, with the latest dates on October 12 and 25 in 2008). Only two Northern Parula were detected during the monitoring period, setting each time a record for the latest observation. The first one was captured and banded on October 17 and was recaptured on the 20th. The second was captured and banded on October 30! The last Nashville Warbler was detected on October 17, although this species was observed later in four previous seasons (latest on October 28, 2004).

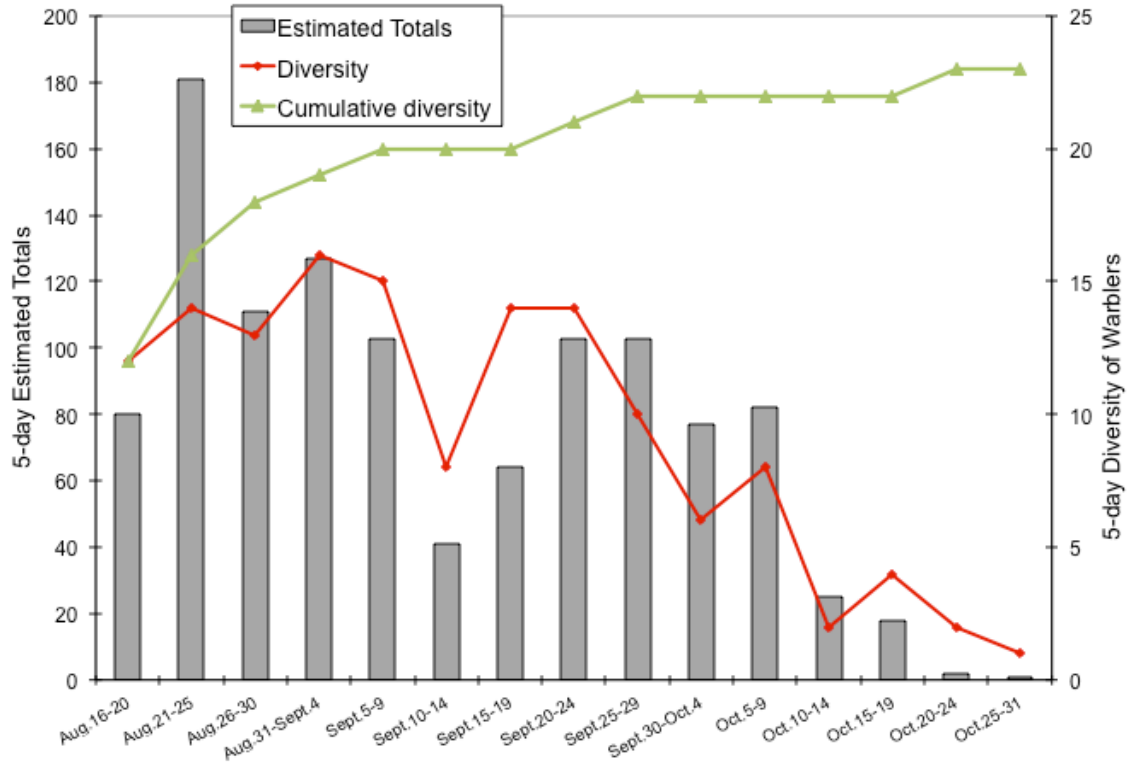


Figure 7. 5-day total numbers of warbler species (right Y-axis) and 5-day Estimated Totals of warblers (all species combined; left Y-axis) at Cabot Head Research Station in fall 2016.

Table 2: Phenology of migration for warbler species, with dates of first and last observation, number of days between first and last observation, number of days with observation, and estimate totals.

	Dates of first and last observations			Number of days		Estimated Total
	August	September	October	between first and last observation	with observation	
Myrtle Warbler ^B	20		20	62	47	299
Common Yellowthroat ^B	17	24		39	39	175
American Redstart ^B	17	21		36	29	234
Nashville Warbler ^B	17		17	62	26	61
Black-and-White Warbler ^B	17	21		36	21	55
Black-throated Green Warbler ^B	21		7	48	20	44
Magnolia Warbler ^B	19	28		41	17	29
Bay-breasted Warbler	27		6	41	16	35
Ovenbird ^B	19	22		35	15	18
Blackpoll Warbler		28		30	14	29
Black-throated Blue Warbler ^B	19		8	51	13	19
Tennessee Warbler	31		6	37	13	20
Orange-crowned Warbler		23	16	24	12	36
Wilson's Warbler	25	29		36	7	10
Canada Warbler ^B	18	16		30	7	7
Western Palm Warbler		9	8	30	7	12
Northern Waterthrush ^B	18	1		15	7	8
Yellow Warbler ^B	22	16		14	7	11
Chestnut-sided Warbler ^B	19	20		34	3	4
Northern Parula ^B	28		29	13	3	3
Mourning Warbler	18-28			11	2	2
Pine Warbler ^B	24-25			2	2	6
Cape May Warbler		26		-	1	1

^B: These species breed on the northern Bruce Peninsula (according to the Ontario Breeding Bird Atlas)

Black-throated Green Warblers were detected and banded in lowest numbers this fall. It appears that this species shows large fluctuations over the years, with highest numbers occurring in the first four years of the 15 years of monitoring. With most of its breeding range in the boreal forest, this species likely experiences large and widespread yearly variations in breeding success.

Many species not monitored by banding migrate mostly in September. The first flocks of Canada Geese were seen in early September, as usual, but the biggest

movement happened later, especially from September 21 to 24, when an estimated 1405 Canada Geese flew through (62% of the season total). The highest Estimated Total was 653 birds on September 22. This species usually peaks in early- to mid-September (Fig.8), although some later movements have been occasionally noted over the years: for example, 490 Canada Geese were counted on September 26, 2003. Double-crested Cormorants were seen daily from the start of monitoring period until early-September. This species roosts in Wingfield Basin making it difficult to differentiate migrants from local residents. Water levels this year were at record high, covering rocks that cormorants (and other birds like gulls) like to use as resting areas. As a consequence, numbers detected were lower, with cormorants crowding the few rocks still emerged as well as the navigation markers. Numbers of Cormorant dropped drastically after early-September with the last individual of the month (and the season) seen on September 18.

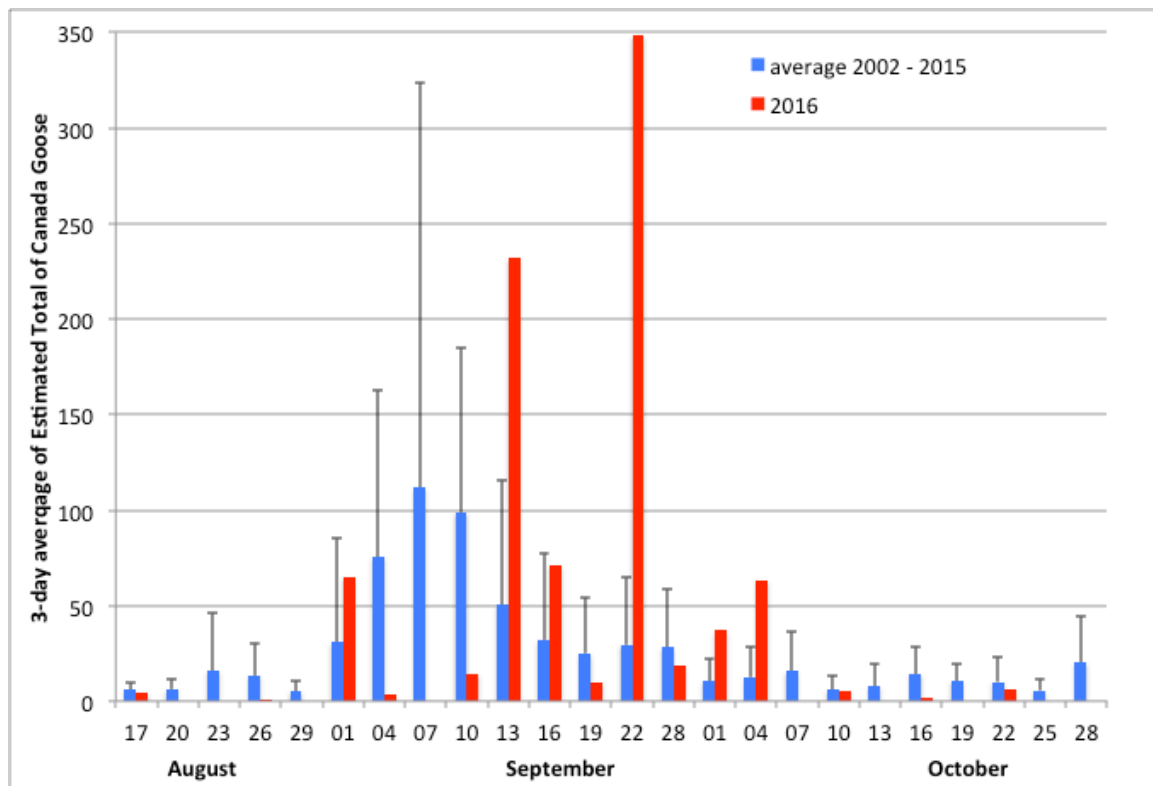


Figure 8. 3-day average of Estimated Totals of Canada Goose for 2016 and the combined years of 2002 to 2015.

An overwhelming majority of Blue Jays and Yellow-shafted Flickers migrate in September: in 2016, 89% and 77% of Estimated Totals, respectively, occurred during this month. Even though the bulk of migration is in September for both species, their phenology could be quite different (Fig.9&10): in years of small numbers, Yellow-shafted movements through Cabot Head are spread throughout September, whereas Blue Jays tend to peak over a few days in mid-month. This fall was quite different for Yellow-shafted Flickers as large numbers were detected, reaching the third-highest total of 325 birds (2002-2015 average of 160 ET \pm 106; low of 72 in 2007 and high of 394 in 2014). Observations peaked from September 19 to 23, when 114 flickers (i.e. 35% of the seasonal total) were seen. Interestingly, this period corresponds to the migration peak of Blue Jays: from September 19 to 24, 692 blue jays were counted, representing 53% of the seasonal total of 1308 birds (third-highest fall total; 2002-2015 average of 1037 ET \pm 585; low of 490 in 2007 and high of 2825 in 2014). Most of the time, between one half and two-thirds of the Blue Jay season total is detected in a seven-day period.

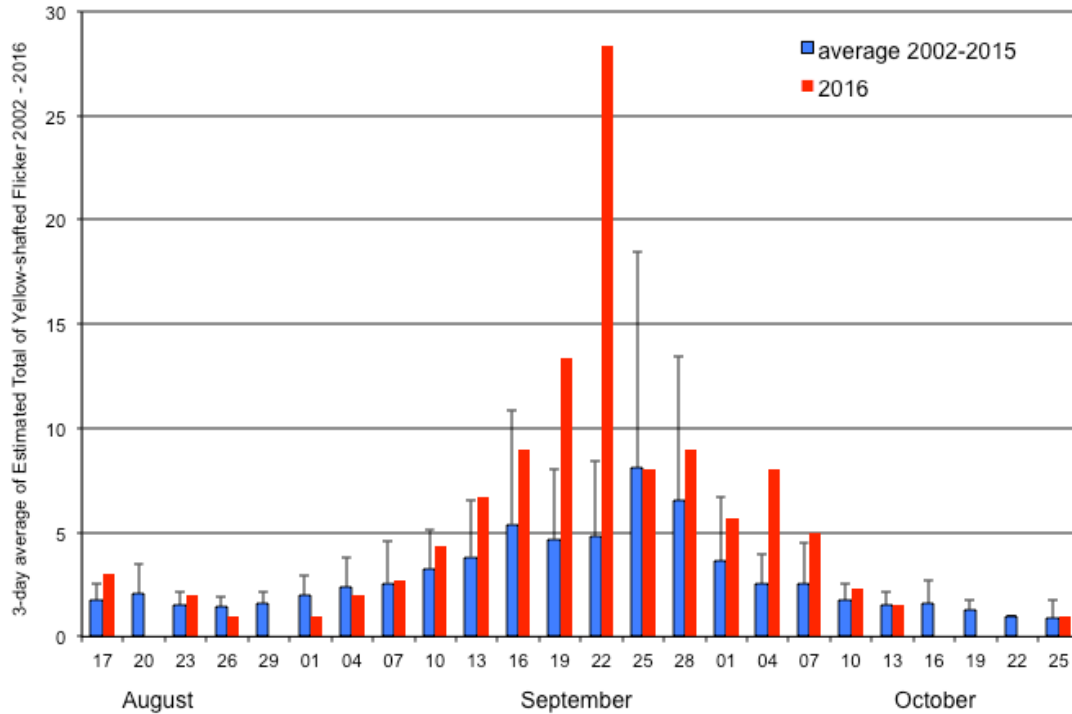


Figure 9. 3-day average of Estimated Totals of Yellow-shafted Flickers for 2016 and the combined years of 2002 to 2014.

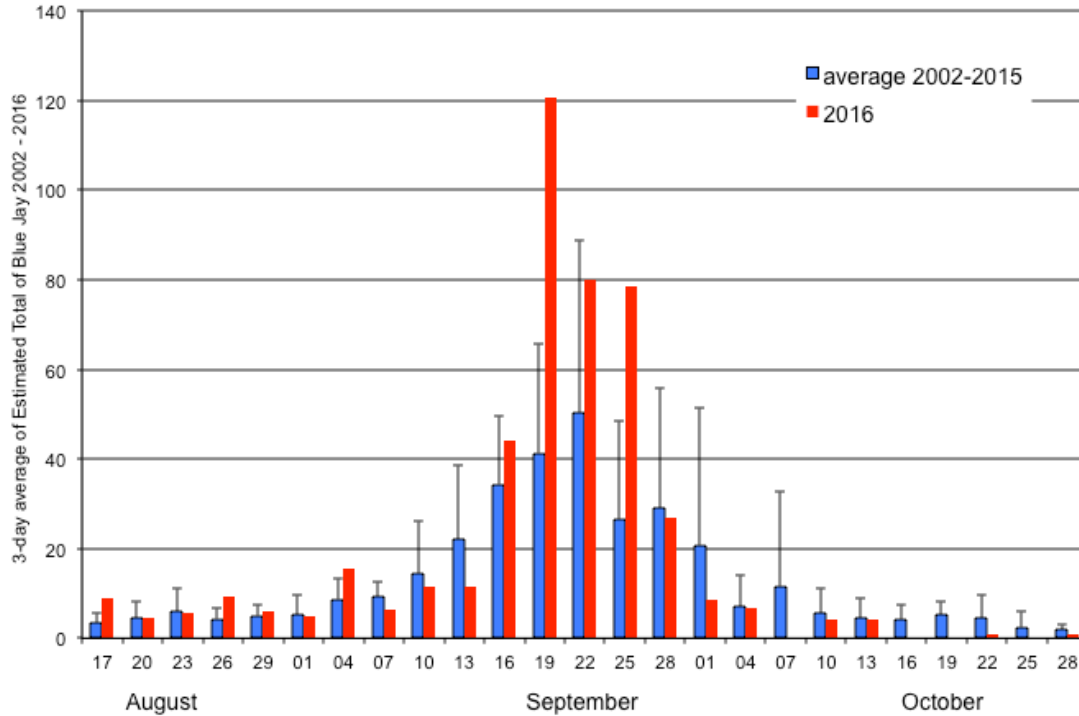


Figure 10. 3-day average of Estimated Totals of Blue Jays for 2016 and the combined years of 2002 to 2016.

Common Loons were seen throughout the entire season with about 73% of all observations made in September. Loons can usually be seen in small rafts on Georgian Bay or flying in a southeast direction, either over water or land. This fall, a total of only 183 Loons was detected, a marked rebound from the previous years (range of 115 in 2011 and 997 in 2003; Fig.11). This species is a strong flyer and moves through the area rapidly, making detection difficult. Another potential problem is that it routinely flies, low or high, over Georgian Bay at any time of the day, which makes accurate monitoring difficult as well. However, detection problems should stay relatively similar between years, so the decline in numbers observed since fall 2008 is most likely real. In the fall of 2016, very few loons were seen resting on the water of Georgian Bay unlike in the first few years of monitoring. In these early years, it was easy to pick up moulted loon feathers off the water while kayaking just offshore from Cabot Head. That was definitively not the case this fall. Even though anecdotal, that would indicate a marked decrease in use of water off Georgian Bay by Common Loons.

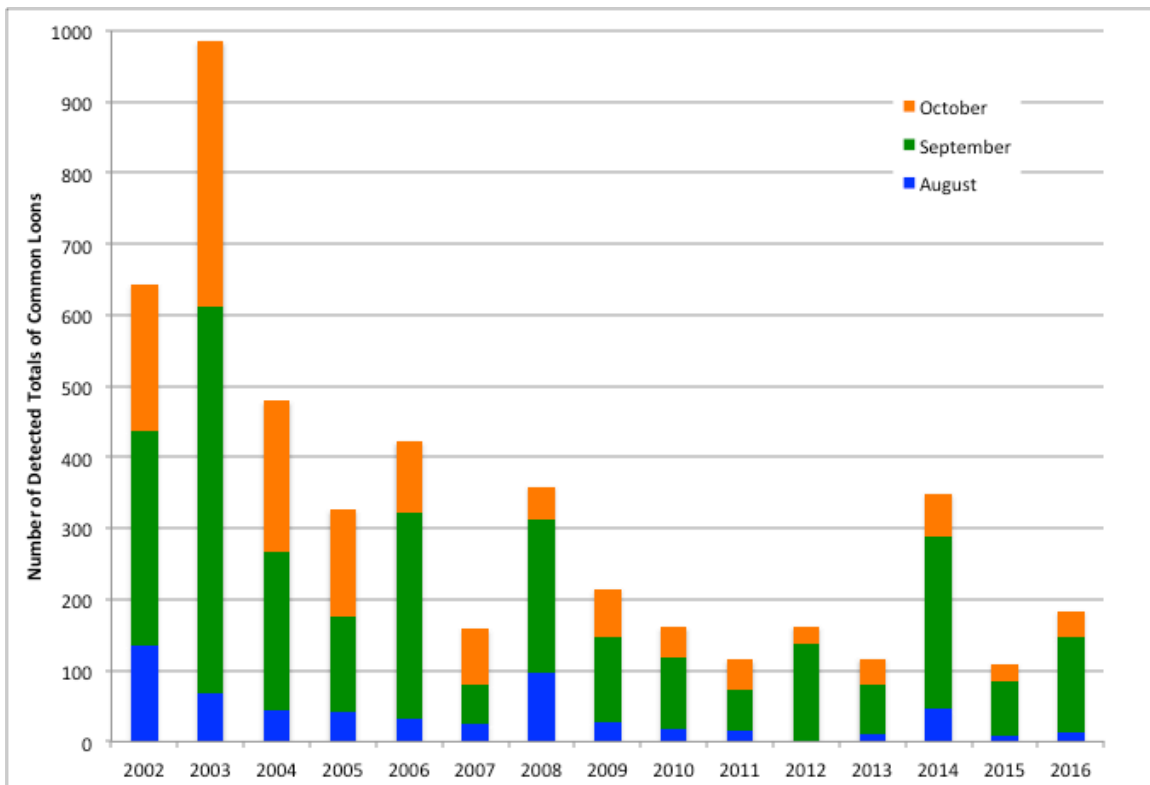


Figure 11. Detected Totals of Common Loons detected at Cabot Head Research Station, in relation to year and time of monitoring.

October

October is usually the busiest – although less diverse - banding period of the fall migration season at Cabot Head Research Station. This was again the case in 2016, as 960 birds of 41 species were banded (almost 57% of the seasonal total), for a daily average of 42 birds captured. Banding was hampered by weather relatively often in October, with eight complete days lost due to rain and/or wind and two other days with only limited monitoring (either a few nets open for the full six hours or most nets open for a short time). As a consequence of the bad weather, only 67% of the potential mist net hours was realized. The most common species caught were Golden-crowned Kinglet, with 291 individuals banded (30% of the monthly total) followed by Black-capped Chickadee and Slate-coloured Junco (with 18% and 9%, respectively of the monthly total). A total of 91 species were detected during the month, including an Eastern Meadowlark observed for the first time at the Cabot Head Research Station in the fall.

Daily numbers of birds banded in October were very variable, ranging from 8 to 130 (highest daily total of the season - Fig.12). As noted previously, quite a number of days were lost or with monitoring greatly reduced due to weather. Captures were thus concentrated in a few days, most notably in the first half of the month and in two days at the end. Golden-crowned Kinglets arrived in good numbers at the end of September and showed a well-marked peak between October 3 and 8 (when 61% of the season total were banded). Their numbers declined rapidly afterwards, with very few detected in the second part of October. The migration phenology of Golden-crowned Kinglets is quite variable between years (Fig.13): for example, in 2012, 78% of all kinglets were detected before October 12, whereas, in 2009, 81% of all kinglets were detected after that date. Their overall numbers were around average in fall 2016 for banding but with the third-lowest Estimated Total (Fig.14). Numbers of Golden-crowned Kinglets are highly variable in fall, with a seven-fold difference between the lowest and the highest banding totals.

Black-capped Chickadee is a well-known irruptive species: some falls, due to high breeding success, large flocks of young birds disperse across wide areas in search of new territories. This fall, at Cabot Head, there was a notable movement of chickadees, mostly in the second half of October (particularly on October 23, with 82 chickadees banded), resulting in 205 birds banded and the fourth highest total. No apparent pattern

emerges from 15 years of banding at Cabot Head (Fig.15). The Red-breasted Nuthatch is another species with large variations in banded numbers and no apparent patterns. This fall, 82 of them were banded (the fourth highest total in fall - Fig.16) throughout the season, with no evident peak. Unlike in spring, the Brown Creeper migration is fully covered during the fall monitoring. In 2016, a total of 75 Brown Creepers were banded, the highest total to date (Fig.17). Abundance and migration phenology are quite variable through time: this year, movements were mostly concentrated in the first week of October: 57% of the season total was banded between October 3 and 8.

Like both Kinglets and Brown Creepers, Slate-coloured Juncos showed a distinct peak this fall in captures between October 3 and 8, where 60% of the season total of 103 birds was banded. As with Golden-crowned Kinglet, there is tremendous variation in regard to migration timing between years (Fig.18): this fall, 69% of all juncos were detected from October 3 to 15. In 2007, the same proportion was detected during the second half of October (from the 19th to 31st), whereas approximately 50% of detections in 2013 was much earlier, from September 21 to October 4.

American Tree Sparrow is a late migrant, appearing in early October in small numbers and becoming more common at the end of October. It is likely that some of its migration is missed at Cabot Head when monitoring ends on October 31, in varying degree across the years. As a consequence, numbers detected and banded are very variable: this year, a total of 18 American Tree Sparrows were banded, much lower than the average of 31 ± 26 (but with a median of 18). The first American Tree Sparrows this fall were detected on October 9. Only three years have later date of first observation: October 13 in 2009 and October 17 both on 2002 and 2008. This species was observed in September in four different fall seasons ranging from the 9th to the 30th. Surprisingly, one bird was detected in August 22, in 2012.

Other species, which migrate mostly in October, were also captured in relatively low numbers this fall. Only 20 White-crowned Sparrow were banded, the second lowest total (19 birds were banded in 2006). A total of 57 White-throated Sparrows were banded, well below the average of 81 ± 47 . Only 25 Hermit Thrushes were banded, the third lowest total. Variations in fall banding total are quite important for these three

species: for example, for Hermit Thrush, there is a 5-fold difference between the low of 16 in 2002 and the high of 87 in 2011.

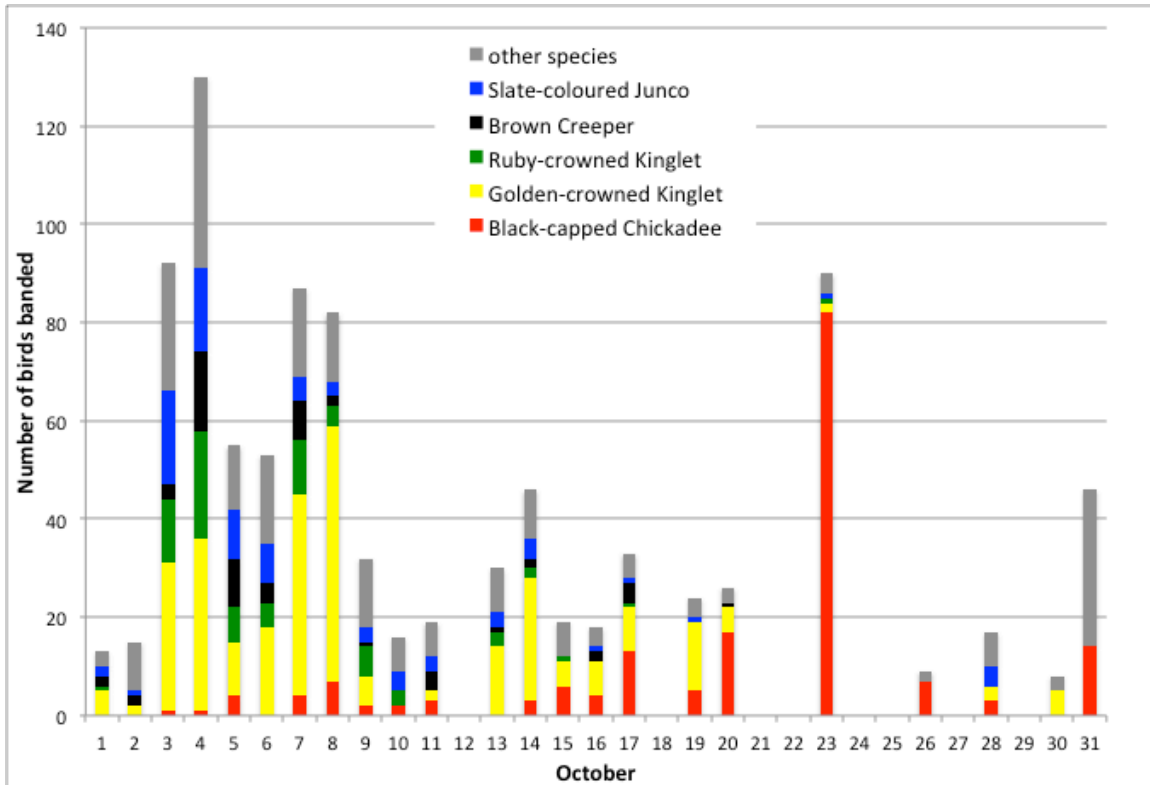


Figure 12. Daily banding total in October by the most common species banded at Cabot Head research Station in 2016.

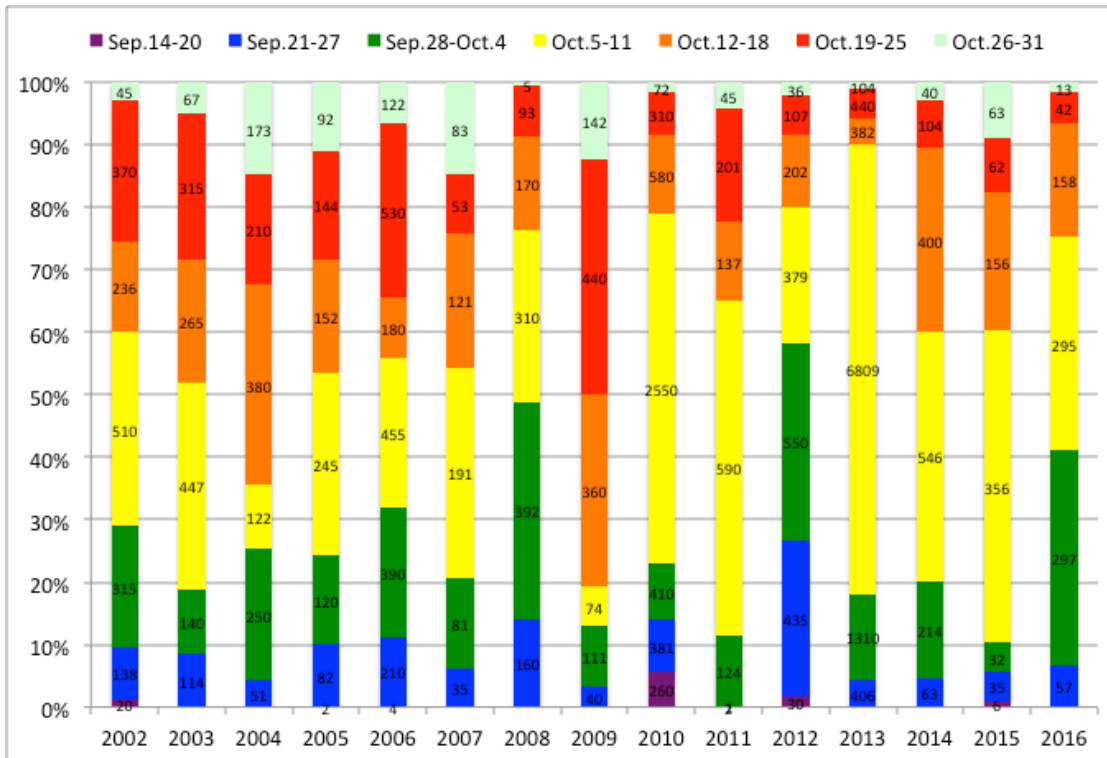


Figure 13. Proportion of Golden-crowned Kinglet banded by 7-day period in the fall at Cabot Head Research Station, 2002-2016. (Numbers in bars are numbers of birds banded).

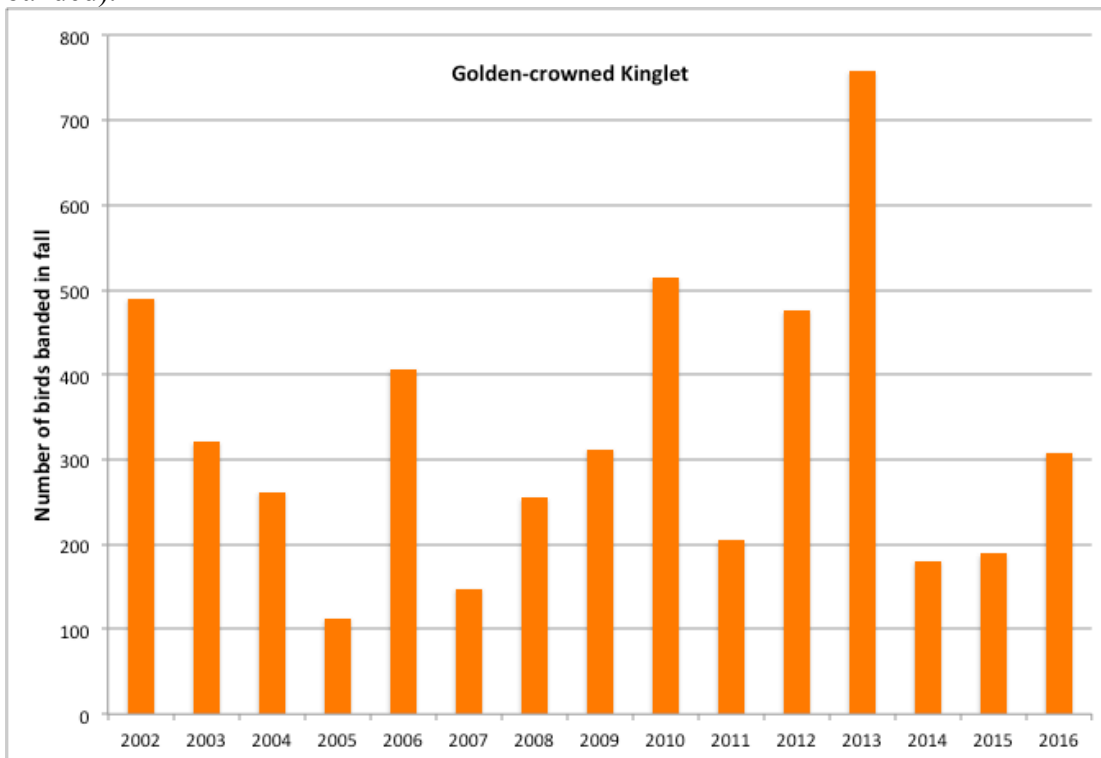


Figure 14. Banding totals for Golden-crowned Kinglets at Cabot Head Research Station, 2002 - 2016.

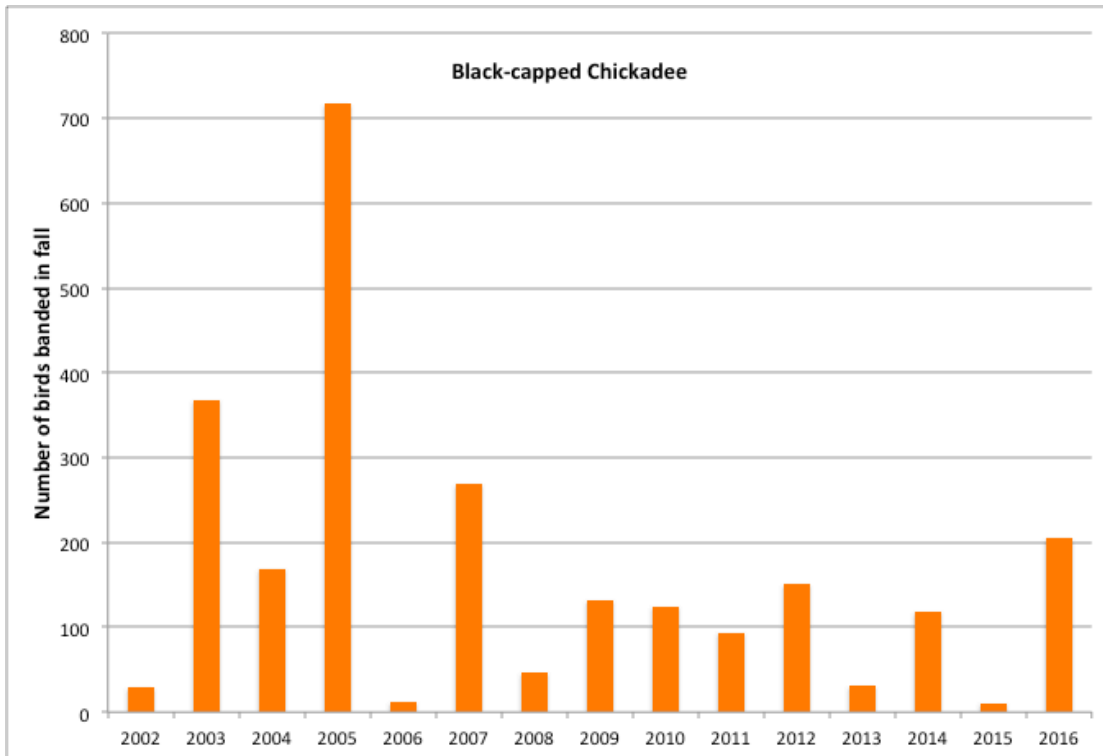


Figure 15. Banding totals for Black-capped Chickadees at Cabot Head Research Station, 2002 - 2016.

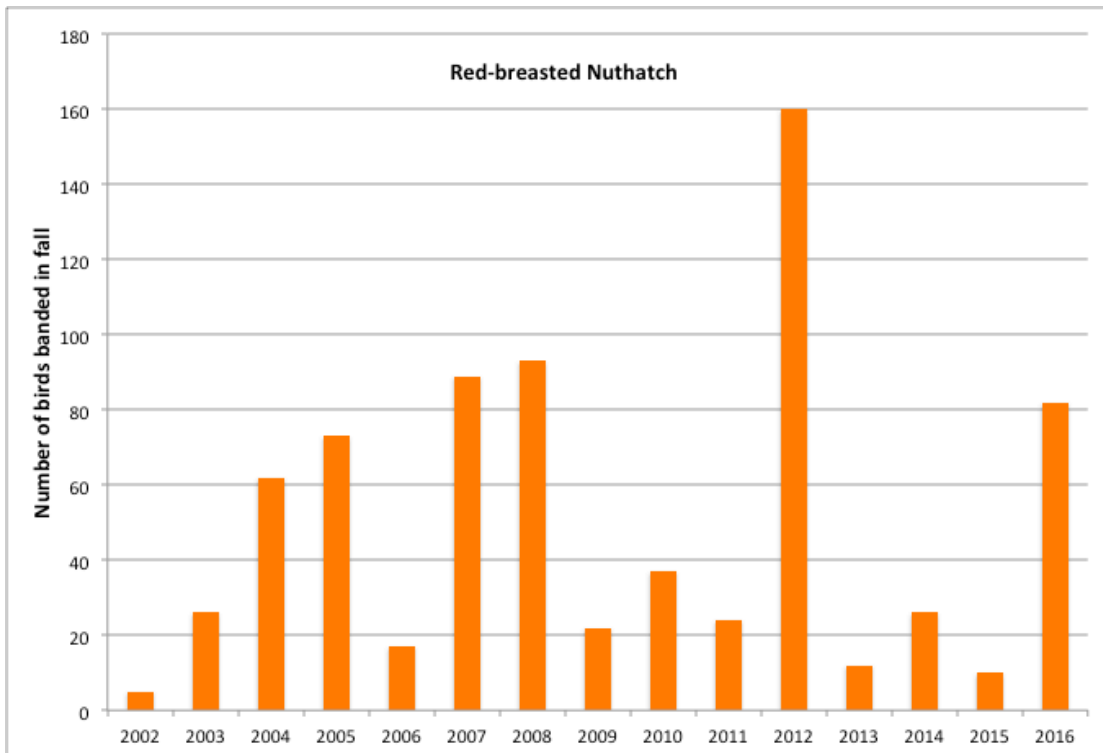


Figure 16. Banding totals for Red-breasted Nuthatches at Cabot Head Research Station, 2002 - 2016.

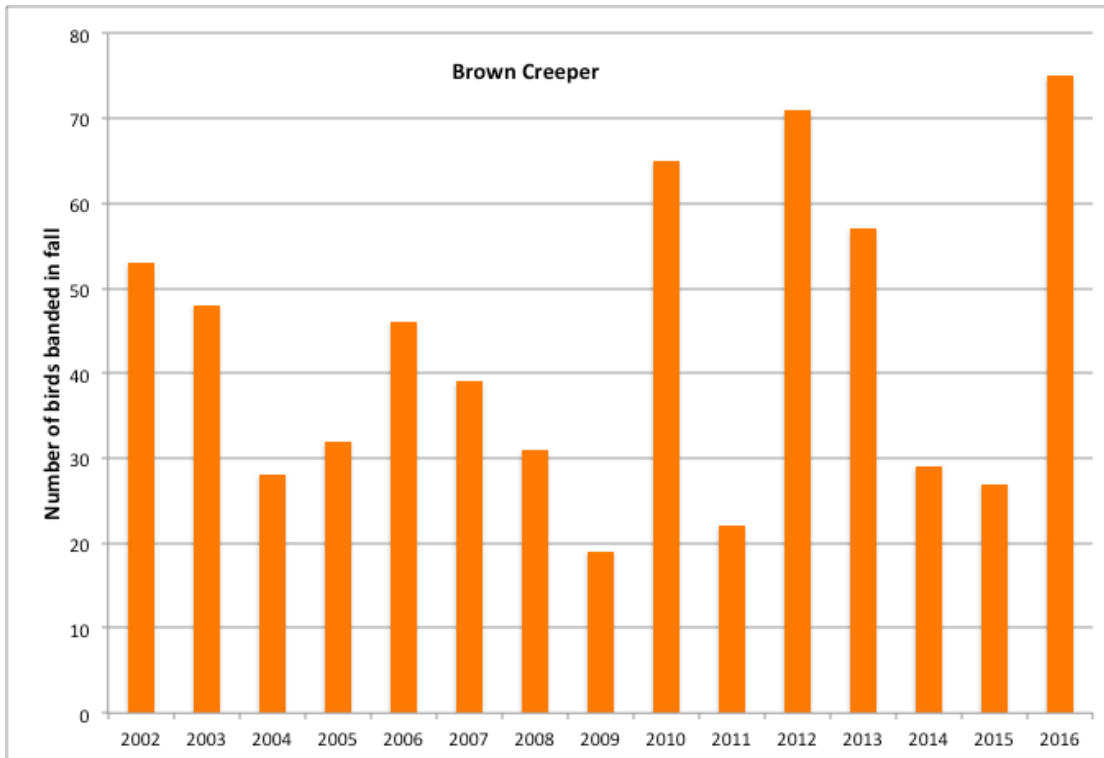


Figure 17. Banding totals for Brown Creepers at Cabot Head Research Station, 2002 - 2016.

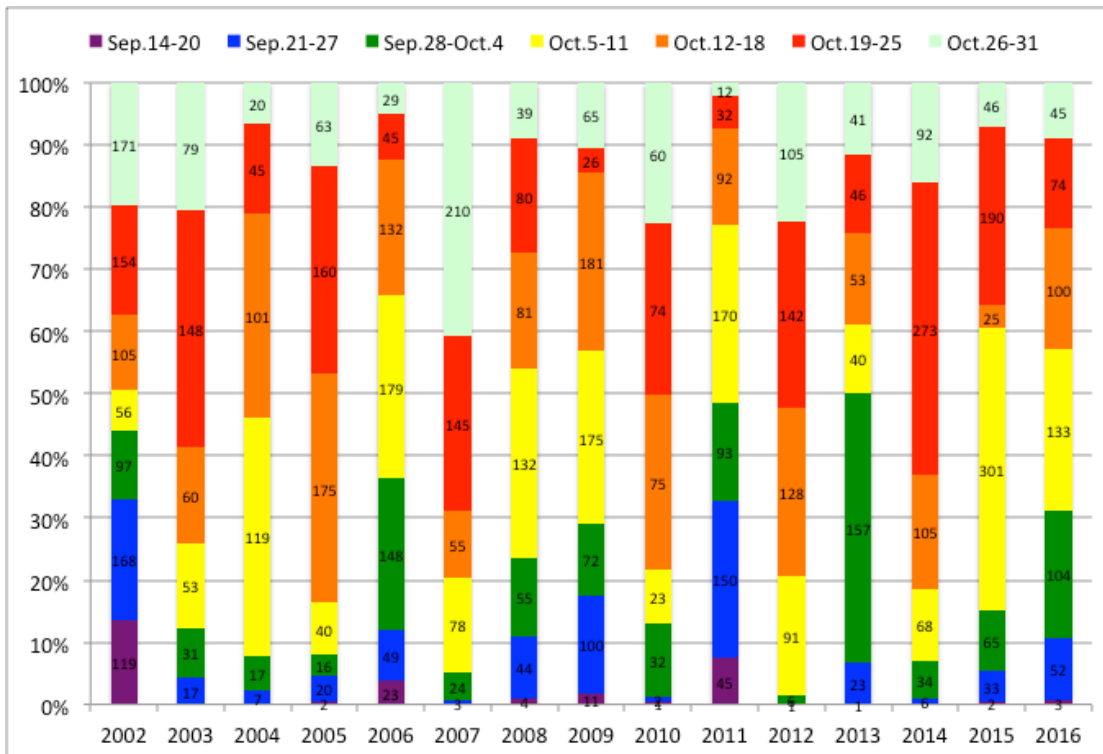


Figure 18. Proportion of Slate-coloured Juncos banded by 7-day period in the fall at Cabot Head Research Station, 2002-2016. (Numbers in bars are numbers of birds banded)

In October, most warblers have usually already gone through the area. With the exception of Orange-crowned and Yellow-rumped Warblers, which are late migrants, it is mostly stragglers that are observed. Nonetheless, an average of 9 (± 1) species of warblers are detected every October, ranging from a low of 5 species (in 2005, 2007, and 2011) to a high of 15 in 2014, for an overall total of 19 species of warblers. Three species (Orange-crowned, Nashville, and Yellow-rumped Warblers) have been observed every October, with Palm Warbler only missed once in 2004 (Fig.19). This fall, nine species of warblers were detected in October. Bay-breasted Warbler was detected twice in early October, on the 3rd and 6th. This species had been seen previously only twice in October, on the 2nd, in 2012 and 2014. Black-throated Green and Black-throated Blue Warblers are present more regularly in October: this fall, they were observed on the 7th for the former and the 8th and 9th for the later.

Orange-crowned Warblers were observed from September 23 to October 16, and 22 individuals were banded (average: 14.9 ± 8.7). The latest detection for this species is October 26, 2015. Myrtle Warblers were detected first on August 20, mostly breeders from the Bruce Peninsula. Numbers increased after mid-September, when the much larger population of the boreal forest starts to migrate south, and peaked in late September-early October. No birds were observed after October 20.

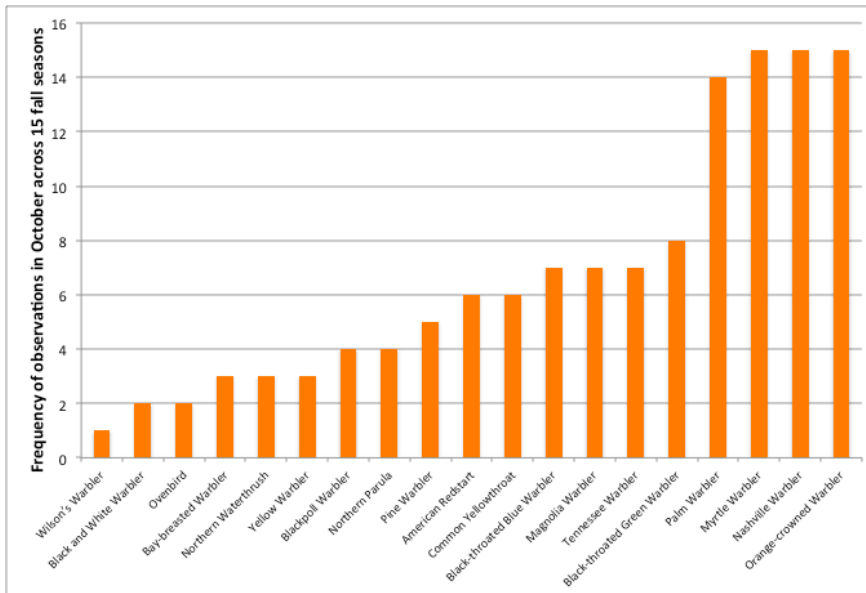


Figure 19. Number of year warbler species were observed in October at Cabot Head Research Station between 2002 and 2016.

3.0 Unusual Records

No new species was added to the area checklist this fall. However, Black-crowned Night-Herons were seen during the “official” monitoring period for the first time, when two were seen during census on August 24.

Some species, rarely banded in the fall (five seasons, including this one, or less), were banded this fall: a Rusty Blackbird was banded on October 1, only the second ever banded in the fall (the first one was in fall 2007); the other was banded in spring of 2008. This species was also seen in record number this fall, with the first (and earliest record) detected on September 15. Afterward, Rusty Blackbirds were seen daily from September 29 to October 11, sometimes in small groups of 12 to 20 birds. This represents the first fall season when such regular observations have occurred. A single adult female White-breasted Nuthatch was banded on October 9. Only five birds of this species have been banded in previous falls (one in 2005, two in 2007, and one in 2012, and one in 2015). One Black-billed Cuckoo was banded on September 4 and another one on September 16. Only eight individuals of this species were banded in previous seasons (two in 2002, five in 2003, and one in 2012). As previously mentioned, two Northern Parula were banded this fall.

A record three Red-bellied Woodpeckers were banded this fall. Only single individuals were captured in four previous falls (in 2003, 2004, 2010, and 2012). A Northern Saw-whet Owl was banded in the early morning of October 8. During daytime banding, this nocturnal species was captured in six other fall seasons. A young female Belted Kingfisher was captured in August 31. Surprisingly, this species of lakes and rivers has been captured in seven other fall seasons (for a total of 11 individuals, all young) but never in the spring. A House Wren was banded on October 2. It is not a common species at Cabot Head: only nine other individuals have been banded in seven previous fall seasons. One young Scarlet Tanager was banded on September 9, the 13th individual ever banded in eight fall seasons.

Noteworthy observations are (by chronological order): On the evening of August 18, about 60 Common Nighthawks were seen foraging and flying in the western horizon. The loose flock scattered more widely after a little while, with some birds drifting closer to the station, others disappearing below the horizon. A small flock of six Great Egret

was seen on August 19, fighting a strong wind. This species has been seen during the monitoring period only with single individuals on three previous occasions in total (May 26 and August 28 of 2005; September 7, 2008). One Great-crested Flycatcher was seen in the Pine Barrens on August 24. This species is rarely observed in the fall, with one to five observations in the seven falls with detection (including 2016), from August 15 (in 2010) to October 18 (in 2007). Even more rarely detected, Eastern Bluebirds were heard twice, on August 26 and 27, this fall, the fifth with detections. Likewise, it is only the fifth fall with observations of Red-shouldered Hawk, with one bird on September 5. One Eastern Wood-Pewee was detected on September 7, a species observed in the falls of 2003 and 2004, and then, every fall from 2009 onward. One Warbling Vireo was observed on September 17, the latest date on record for this species rarely observed in fall (detected in five other fall seasons). One young Red-headed Woodpecker was seen near the station on September 21 and another one on October 6. The Cape May Warbler is observed every fall in small numbers (from one to 23 birds). This year, only one bird was seen, although at the latest date on record, on September 27. One Clay-colored Sparrow was seen the same day, the sixth fall season with sighting. One Brown Thrasher was briefly seen on September 28, the only observation of the fall. Although this species is present at Cabot Head almost every fall, it is usually in small numbers: one to three birds detected in seven seasons of the nine falls with observation. The small size of a Cackling Goose was obvious in a big flock of Canada Geese on October 1. Savannah Sparrow is observed every fall but in fluctuating numbers: from one individual this year (on October 1) to 42 birds in 2014. A late-season migrant, a Northern Shrike (an immature based on plumage) was seen on October 14 (the earliest date on record) and, again, the following day. A different bird, a young one (aged by its brown plumage) was almost caught on October 31. The first Eastern Meadowlark ever observed in fall was seen flying over the Pine Barrens on October 25. Common Redpolls, like other “northern finches”, when observed at Cabot Head, are always at the end of October. This fall, small flocks of five and 16 were seen on October 23 and 24, respectively. Numbers range from one (in 2011 and 2015) to 245 birds in 2012. Another late season migrant, albeit seen every season, is the Snow Bunting. The first observed this year was on October 22 (earliest date on the 14th in 2007), then another one on the 28th and the last ones where in a small flock of eight birds

on the 30th. Like redpolls, numbers vary greatly: one or two birds (in 2011, 2012, and 2015) to 138 (in 2003) and 177 (in 2009).

Except for a few species, the monitoring area at Cabot Head does not offer great habitat for ducks, especially dabbling ducks. This fall, there were a few unusual sightings: one Gadwall (in a small flock of Mallard) on October 7; six American Widgeon on October 9 (It was the third fall with observation for both species); more common (observed in seven other falls), one American Green-winged Teal was seen in Wingfield Basin on October 22; Wood Ducks and Hooded Mergansers use the shallow lakes next to the research area quite extensively. They are thus seen more frequently during monitoring, albeit still in relatively small numbers. Only one Hooded Merganser was seen on Wingfield Basin this fall on the last day (October 31). A large flock of 24 Wood Ducks was seen on September 24, the biggest ever.

Peregrine Falcons are rarely seen at Cabot Head in the fall, even though the species was missed only in 2008: between 2002 and 2015, this species was detected on one to seven occasions, always with a single individual (except on October 3, 2014, with two birds). By contrast, this fall, Peregrine Falcons were seen in 25 days, from August 19 to October 14, with two individuals on five days and three on October 3. Most of the time, adults were seen, notably two seen soaring on September 4, one male and one female (based on size difference) showing moulting flight feathers. The early sightings and the presence of a pair of moulting adults could indicate potential breeding, although no young birds were seen up to mid-September.

Northern Goshawks breed in low density on the northern Bruce Peninsula, and as a forest bird, it is rarely seen at Cabot Head and elsewhere. This fall, observations of one bird were made in August (on the 19th, when a young perched on a dead tree poking out the face of Middle Bluffs and stayed on its perch for about half an hour), in September (8 and 29) and on October 23.

A record number of over 200 Broad-winged Hawks was seen in one large 'kettle' on September 5, pushed and concentrated along the shoreline by a strong south wind. A Common Nighthawk was surprisingly flying in the midst of all these raptors!

A female Surf Scoter stayed on Wingfield Basin for an extended period of time from September 25 to October 20, probably because it was in poor conditions.

On October 30, a large flock of 57 Common Ravens spent some time milling above Middle Bluffs, where, at the same time, four Bald Eagles (two adults, one 4-year-old, and one immature) were perched.

4.0 Banding Data Analysis

With 1691 birds banded of 66 species, the fall 2016 banding total represents an average year, being the seventh-highest total. For the 25 species with more than 15 individuals captured, 11 species have banding totals above average and eight have banding totals below average, with the remaining six species being close to the seasonal average (Fig.20). Among the 66 species banded this fall, nine species have the highest banding total ever this fall, most notably Thrushes (Veery, Gray-cheeked and Swainson's Thrushes), Brown Creeper, Bay-breasted Warbler, and American Goldfinch. Conversely, Black-throated Green Warbler and Song Sparrow had the lowest banding total. Numerous variables could affect the capture rates: population dynamics, weather conditions during migration, food availability and vegetation changes at stopover sites. As a consequence, daily captures are highly variable (Fig.21) and one week (October 3 – 9) concentrates 31% of the season total.

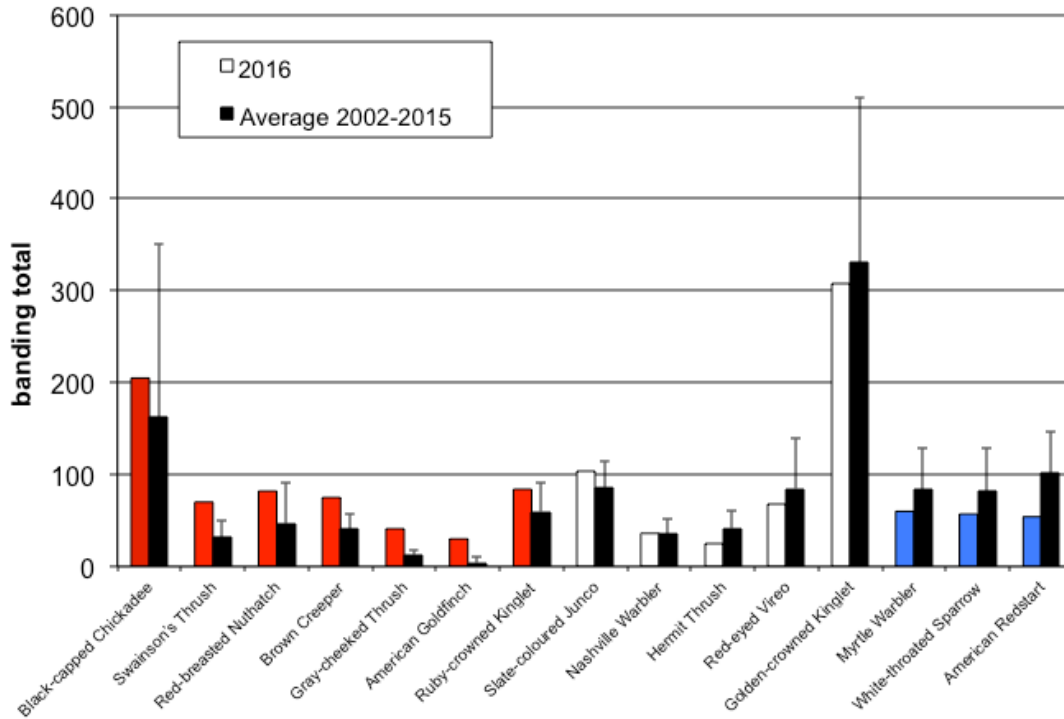


Figure 20. Banding total of the most common captured species (at least 15 individuals) compared to average total of 2002-2010 (highest total in red and lowest in blue). Differences from average in decreasing order from left to right.

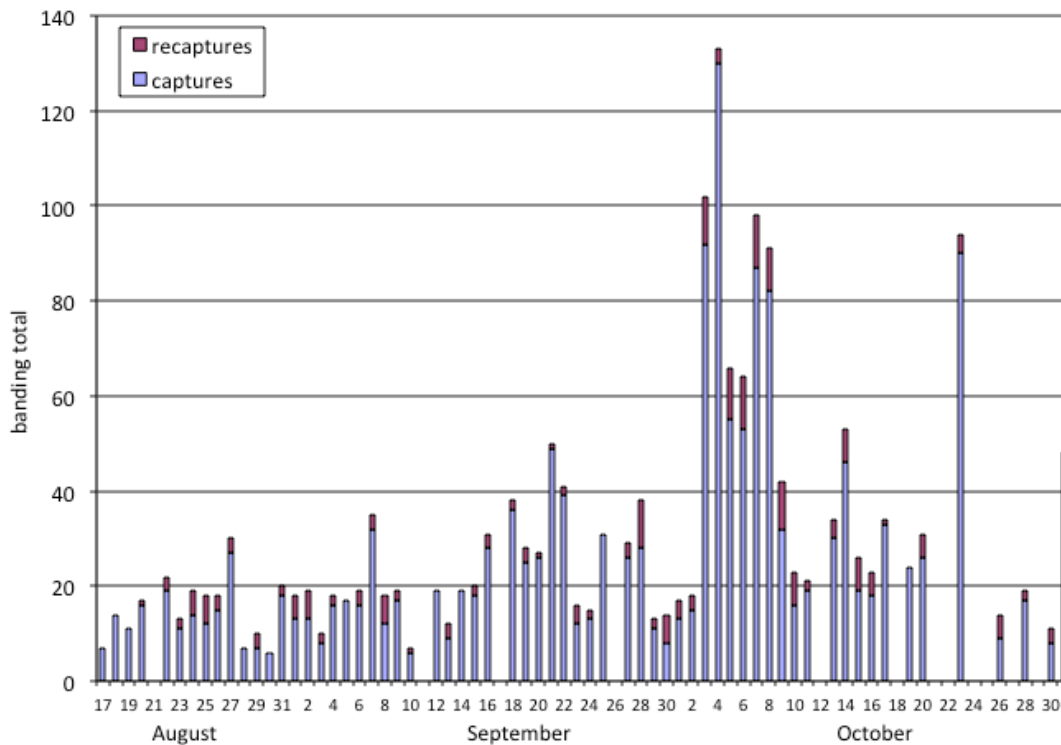


Figure 21. Daily banding and recapture total at Cabot Head Research Station, fall 2016.

Capture rates varied greatly on a monthly, and even weekly, basis (Table 2 & Fig.22.). The capture rate is determined by dividing the number of birds caught in a net, or a group of nets, by the number of hours for which the net or nets were operated. Thus, variation in capture rate reflects variation in those two parameters, which are themselves dependent upon various conditions (weather being the major one). Mist net hours can be lost when weather conditions (i.e. rain or strong wind) or the presence of a predator pose a threat to the birds, forcing us to close nets.

In comparison to previous falls, weekly capture rates this fall were consistently below the 2002-2015 average for seven weeks out of 11, especially so in the first three weeks of monitoring (Fig.22). The weekly banding reflects this same pattern (Fig.23), except for three particular weeks (Weeks 7, 8, & 10) because of large departures from average in the weekly number of mist net hours during these weeks. When all years are combined, weekly mist net hours average around 80% in the first nine weeks of fall monitoring but drop to around 60% for the remaining three weeks. However, variations between years can be substantial (Fig.24). Coverage with 79% of potential mist net hours realized was significantly higher than the 2002 – 2015 average of 73% (low of 54% in 2007 and high of 86% in 2008). Coverage, as usual, varied widely throughout the season. Mist net hours were near the average for about half the season but departed strongly from it for four weeks. Coverage was 100% or very close during two weeks (August 23 - 29 and October 4 - 10) but with opposite results in terms of numbers of birds banded. The week in August saw lower than average birds banded whereas in October, 455 birds were banded, the second highest total for that particular week. On the other hand, only 42% of mist net hours were realized from October 18 to 24, the lowest proportion ever, because banding was possible only during three days during that week. However, 90 birds (mostly Black-capped Chickadee) were banded in a single day during that week. As a consequence, number of birds captured during this week were around average, resulting in a higher than average capture rate.

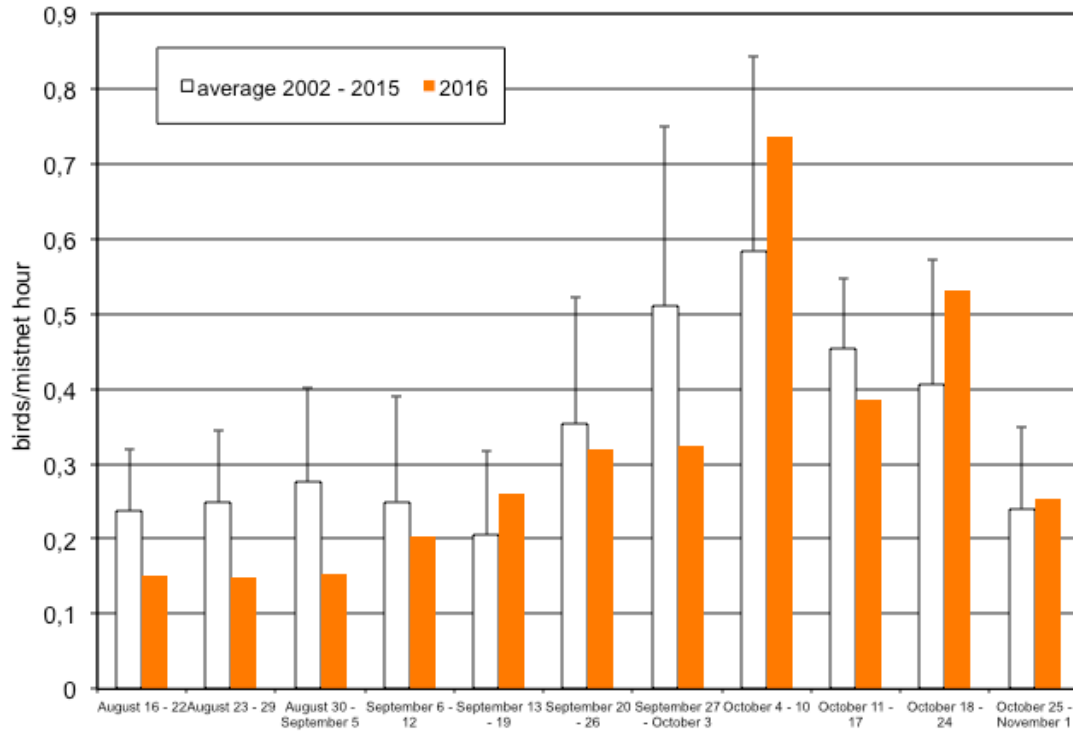


Figure 22. Fall weekly capture rates at Cabot Head Research Station. Error bars show Standard Deviation.

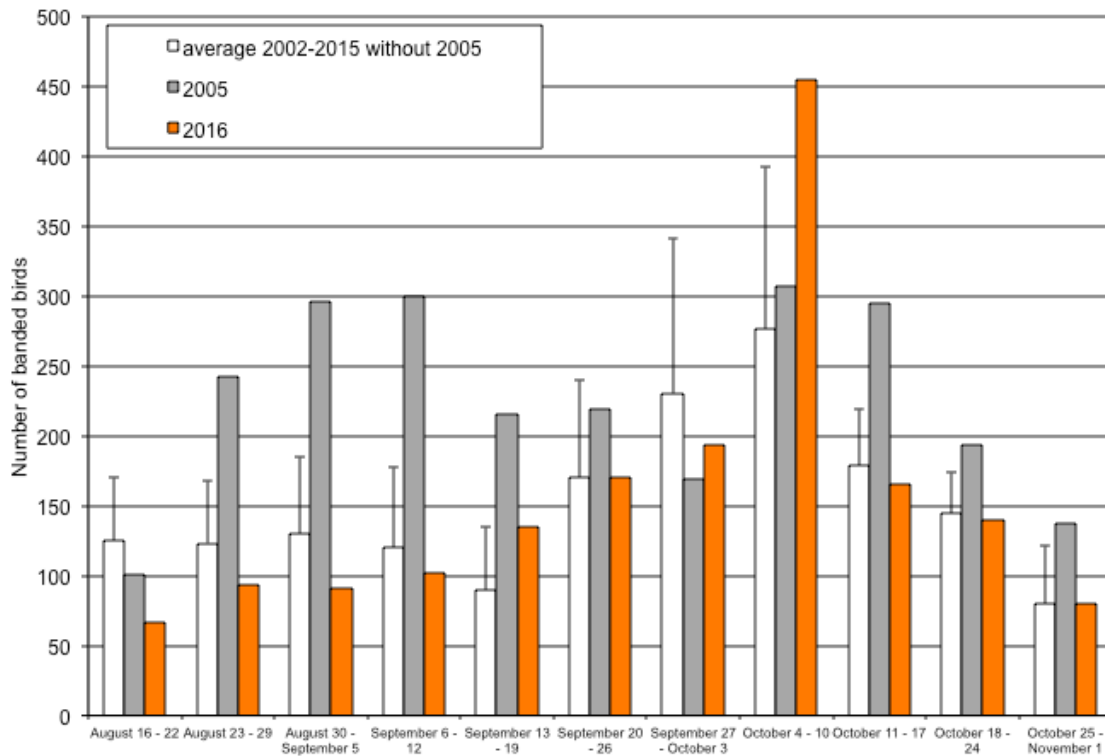


Figure 23. Fall weekly number of banded birds at Cabot Head Research Station. Error bars show Standard Deviation.

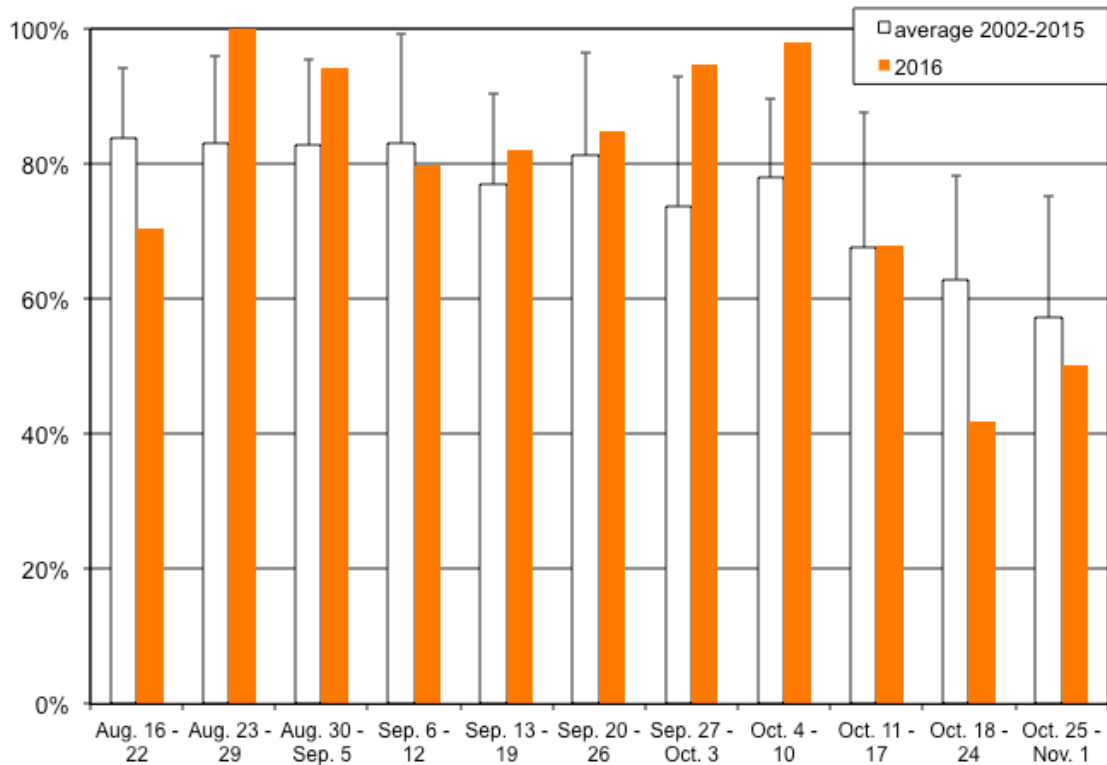


Figure 24. Fall weekly proportion of mist net hours at Cabot Head Research Station. Error bars show Standard Deviation.

4.1 Weather

Weather during the fall migration monitoring in August and September was typical of summer: generally warm and sunny. As summer wanes into fall, the weather became more variable, mostly involving windier days. Fall this year was relatively dry, especially in August and September, as rain occurred only in three days during these two months. There were seven episodes of rain in October, some in the afternoon and/or evening, allowing banding to proceed. Notably, there was a night thunderstorm on October 12 and an intense day of snow mixed with rain on October 27, accompanied with very strong East wind. Banding was precluded completely for 13 days because of rain (for four days, often accompanied by high wind) or wind (for nine days).

With rain, winds are a major factor that influences migration. For example, there was a period of persistent East wind from September 28 to October 2, accompanied with rain in the afternoon of October 1 and 2. It most likely hampered migration as indicated by very few birds captured during this time despite good coverage in term of netting

effort. It is difficult to accurately quantify such a dynamic component of the weather, especially because wind strength and direction are recorded only at the start and end of the count period. To characterize wind strength (on the Beaufort scale) and direction, we considered only the strongest wind during the count period of 7 hours. Undoubtedly, this method would tend to over-represent strong winds. However, strong winds affect migration tremendously. This fall, strong winds (at least 5 on the Beaufort scale) occurred very frequently (48% of the season) and were mostly from South (43% of the strong winds). There were marked differences throughout the season in wind strength and direction: for example, north winds became more common in October (from 13% of the total both in August and September to 32% in October), a month when there were very few periods of light winds (Fig.25). West winds were least common throughout the season, occurring about 17% of the time, but with a strong seasonal pattern.

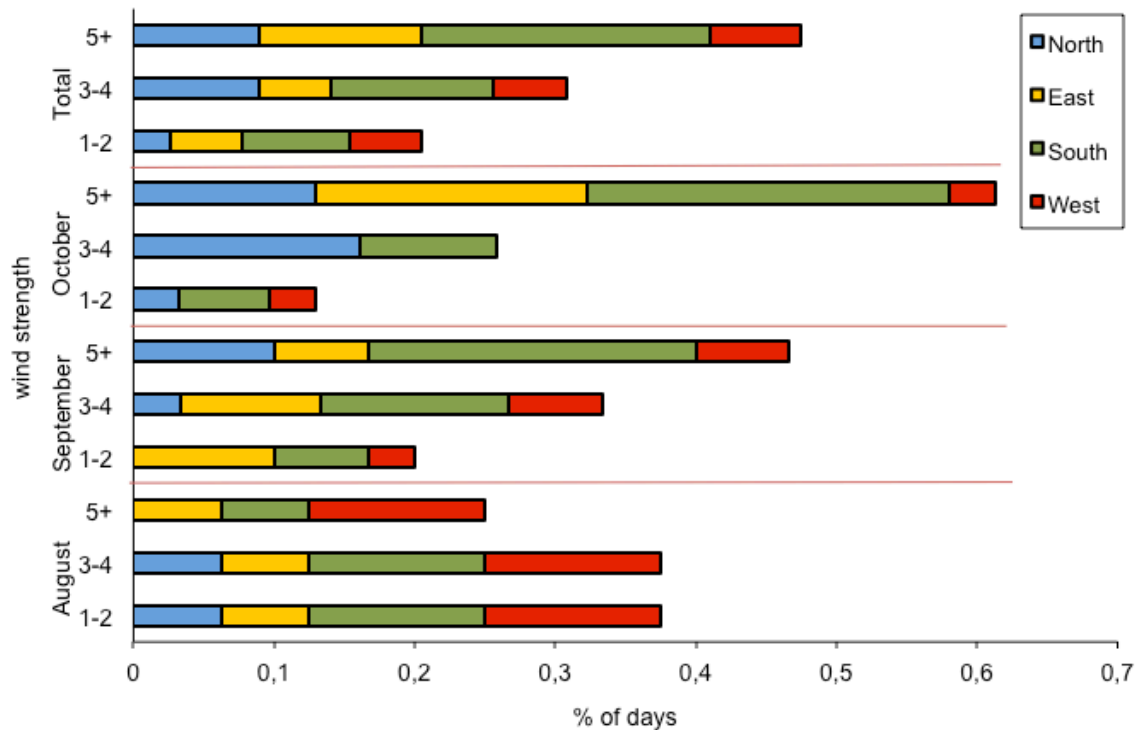


Figure 25. Wind pattern (strength on the Beaufort scale, direction and proportion of time) at Cabot Head Research Station, fall 2016.

4.2 Recaptures

The rate of recapture at Cabot Head was relatively high in fall 2016: A total of 226 recaptures for 150 individuals of 32 species were recaptured from August 20 to October 31 (Table 3). The vast majority (92%) of the 150 recaptured individuals came from birds banded in the fall, representing a recapture rate of 8%. Eleven recaptured birds were from previous seasons at Cabot Head, comprised of three species banded from spring 2010 to spring 2016 (Table 3). Among them, one Black-capped Chickadee was banded in the previous fall as a hatch-year; one Red-eyed Vireo was banded in spring 2015 as an after-second-year, and another two Red-eyed Vireos were banded in the spring 2016 as after-second-year as well. The remaining individuals were American Redstarts, with seven individuals originally banded from spring 2010 to spring 2016. The American Redstart, banded as a second-year male in spring 2010, had previously been also recaptured in fall 2013 and spring 2015, and likely represents a local breeder.

Most of the recaptured birds were recaptured only once (112 out of 150 individuals, 75%) or twice (17%). Five birds (all banded during the fall) were recaptured four times or more. For example, a Common Yellowthroat was recaptured six times, whereas two chickadees were recaptured nine times and another one a record 11 times.

Within-season recapture rates are variable between species but relatively small (Table 3). For species with significant numbers banded (50 individuals or more), recapture rate in fall 2016 varied greatly from 1 and 4% for Ruby- and Golden-crowned Kinglets (respectively) to 15 % both for Red-eyed Vireo and Slate-coloured Junco. There were ten Red-eyed Vireos that were recaptured at least once, out of a total of 58 birds. All but two of them increased their weight between first and last captures. Time between first and last captures varied from one to seven days. There seems to be seasonal variation in body weight for this species (Fig.26), although sample size are small and body weight was not corrected to body size. It is possible that average body weight increases from mid-August to mid-September as migration progresses. Birds captured in late September and October have lower weight, potentially because they are less fit individuals (i.e. “stragglers”) and/or there is less food available at this later date. Recaptured birds tend to have lower weight at first capture than birds not subsequently recaptured, especially later in the season (NB: small sample size makes inferences difficult). The lightest Red-eyed

Vireo captured was 14.4g on September 22 but had even lost weight (to 13.7g) when recaptured two days later. The next two lightest individuals had the same weight (15.5g) at capture, on October 4 and 7. Both birds were recaptured the following day, one with a weight of 16g, the other of 14.7g. The latter, originally banded on October 7, was recaptured a second time on October 13, seven days after the initial capture, and it then weighed 16.6g. The biggest weight increase occurred for two red-eyed vireos both banded on September 2 and recaptured six days later: from 16.3g to 18.4g and from 15.1g to 18.5g.

For species with ten to 50 banded birds, a few species have high rates of recapture: 20% for Hermit Thrush (from a total of 25 birds banded during the fall) and an impressive 43% of the 23 Common Yellowthroats banded this fall. This latter species tends to have a high rate of recapture in the fall, ranging from 14% in 2013 to 47% in 2015. Capture and recapture depend on several factors: presence of a local breeding population, different foraging behaviour between species and individuals, variations in individual quality between- and within-season (for example, birds in bad conditions could require a longer stopover in the area, regardless or not on food availability).

Despite being captured in high numbers, Golden-crowned Kinglets are always recaptured in a quite low percentage: between 5 and 11%. This fall is no exception: only 18 kinglets of the 290 banded were recaptured (i.e. 6%). Usually, kinglets are overwhelmingly recaptured on the following day of banding. This fall, however, only seven birds (39%) were recaptured so quickly. The remaining ones were either recaptured two days (for six of them) or up to 12 days after the original banding. Nonetheless, the low proportion of recaptured birds indicates that the vast majority of Golden-crowned Kinglets move through the area quickly, without lingering to feed or rest.

American Redstarts, on the other hand, are usually recaptured in greater proportion and tend to stay longer at Cabot Head. However, this fall, only four (that is, 7%) American Redstarts banded during the fall were ever recaptured, whereas seven redstarts banded from previous seasons were recaptured. American Redstarts banded in previous seasons and recaptured in fall at Cabot Head are likely local breeders. Their numbers vary between years with no apparent patterns (Fig.27).

Table 3. Total recaptures by species in relation with year and season of banding (only one recapture per individual is included) at Cabot Head Research Station, fall 2016.

Species	2010	2014	2015		2016		Unk.	%
	spring	fall	spring	fall	spring	fall		
Downy Woodpecker						2		17
Hairy Woodpecker						1		20
Yellow-Shafted Flicker						1		13
Red-eyed Vireo			1		2	10		15
Blue Jay						2		40
Black-capped Chickadee				1		18		9
Red-breasted Nuthatch						10	1	12
White-breasted Nuthatch						1		100
Brown Creeper						7		9
Golden-crowned Kinglet						18		6
Ruby-crowned Kinglet						1		1
Veery						1		13
Gray-cheeked Thrush						2		5
Swainson's Thrush						2		3
Hermit Thrush						5		20
American Robin						1		6
Tennessee Warbler						1		8
Orange-crowned Warbler						1		5
Nashville Warbler						2		+
Northern Parula						1		5
Yellow Warbler						1		33
Myrtle Warbler						8		13
Palm Warbler						1		13
Bay-breasted Warbler						2		9
Black and White Warbler						1		4
American Redstart	1	2			4	4		7
Ovenbird						2		13
Northern Waterthrush						1		14
Common Yellowthroat						10		43
American Tree Sparrow						1		6
White-throated Sparrow						5		9
Slate-coloured Junco						15		15
Total	1	2	1	1	6	138	1	8

Unk.: Unknown origin.

%: Proportion of birds banded in fall 2016 recaptured.

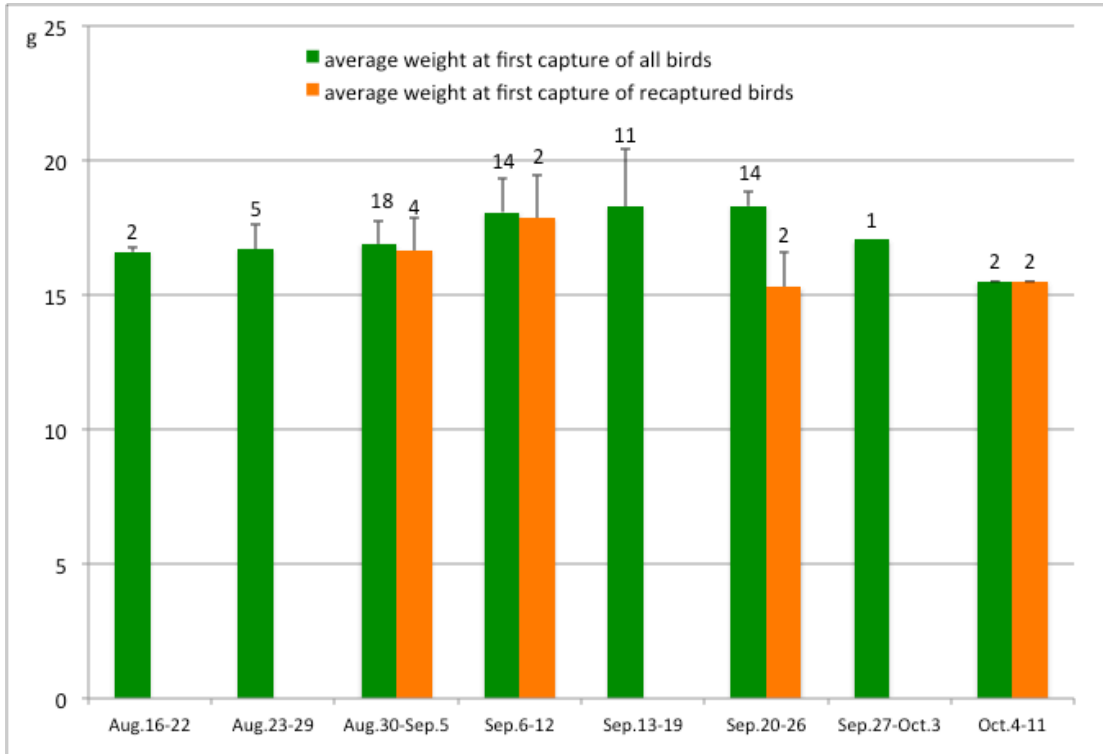


Figure 26. Average weight of Red-eyed Vireos by week by type of captures at Cabot Head Research Station, fall 2016 (numbers are sample size).

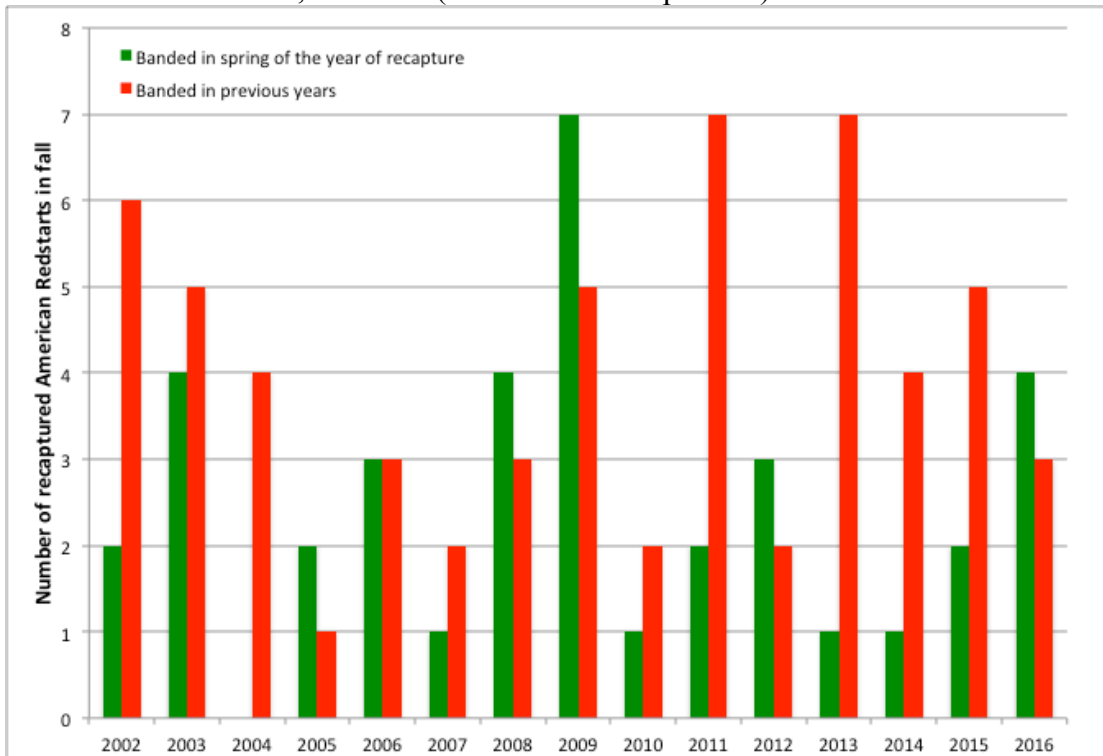


Figure 27. American Redstarts banded and recaptured or not in relation with time of banding at Cabot Head Research Station, fall 2016.

4.3 Net Analysis

Mist net locations at Cabot Head have been permanently set in place in 2002 to ensure standardized capture data. This fall, all nets were open for an average of 75 to 81% of the potential time, except for C13, which was open only 69% of the time: This net is the most exposed of all, being closer to the Georgian Bay shore in an open area; it is thus relatively often affected by winds, especially northeast to northwest.

As usual, there was a significant amount of variation in capture rates for each net: Captures were localized in a few very productive nets, as in previous seasons (Fig.28). Location, and thus difference in habitats, can explain variation in capture rates. However, differences in species behaviour may also account for variation. The five nets with the highest capture rate (in decreasing order, B9, A1, C15, B8, and A3) accounted for 54% of the total capture during 34% of the realized mist net hours. The least productive nets (in decreasing order, C11, C12, A4, A5, and B6) accounted for only 16% of the total capture during basically the same amount of time (33%).

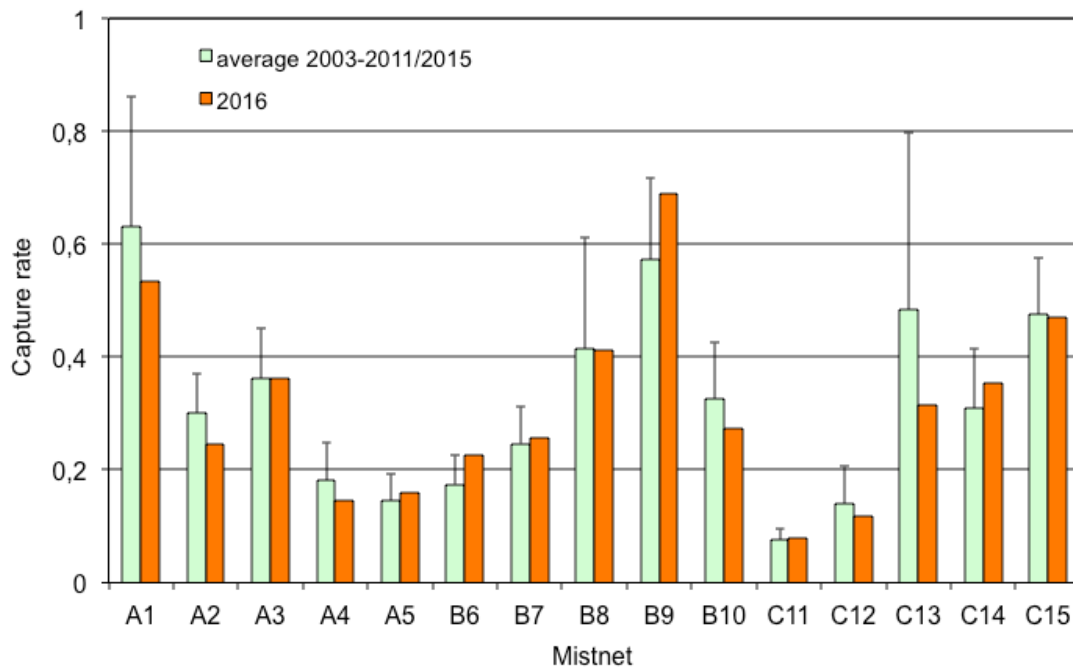


Figure 28. Capture rates per mist net for average 2003-2011/2015 and for 2016 at Cabot Head Research Station (data not available for 2002, 2012, 2013, & 2014).

5.0 Coverage and Protocol

This fall, 23% of the possible mist netting coverage (in hours) was lost due to weather, as high wind and precipitation were significant factors in determining daily net opening and closure (Fig.29). Fortunately, due to the density of habitat at Cabot Head, at least a portion of the nets can usually be operated on windy days. Coverage was relatively good as there was no banding in 13 days (out of 77 days) and the daily average for days with banding was a very high 85 mist net hours (out of a potential of 90). Species coverage at Cabot Head is consistent with coverage elsewhere in the Great Lakes region of the CMMN (Badzinski and Francis, 2000). A census was carried out every day, except during heavy rain.

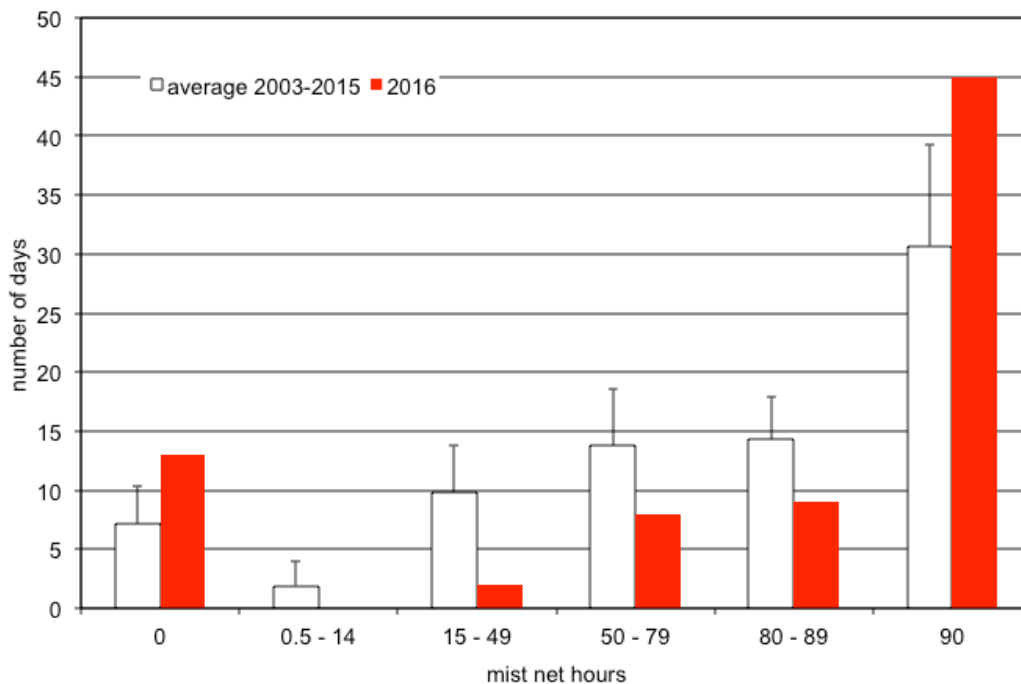


Figure 29. Coverage in mist net hour at Cabot Head Research Station (data not available for 2002), fall 2016.

6.0 Personnel

This fall, 8 volunteers contributed a total of 137 person-days to the fall migration monitoring season (Table 4). This fall, volunteers hailed from Ontario, Québec, Manitoba, Scotland, and, for the first time, from Brazil. Some stayed for just a few days,

while others were long-term, most notably Nathalie and Anna from Ottawa (36 and 29 days, respectively) and Tim from Scotland (30 days). Volunteers are an essential part of the success of the operations at Cabot Head and all help is appreciated.

Table 4. Volunteer effort, fall 2016.

20+ Days	5-10 Days	2-4 Days
Nathalie Paquette (ON)	Valeria Tavares (Brazil)	Rachel Vallender (QC)
Anna Thuong Tran (ON)	Al Woodhouse (ON)	Michael Butler (ON)
Tim Chamberlain (UK)		Janine McManus (MB)
Emily Beacock (ON)		

7.0 Conclusion

Bird migration monitoring was done daily from August 16 to October 31, thanks notably to a dedicated team of volunteers. The continuing monitoring throughout the years keeps providing a more detailed and precise picture of bird migration on the Bruce Peninsula, revealing insights in bird migration. This fall, number of species detected and number of birds banded were around average, although with obvious species difference.

A characteristic of the fall of 2016 was a very dry summer and the preponderance of strong winds and warm weather during the day. Nocturnal weather – not recorded at Cabot Head – is the main driver of migration for songbirds. Within temporal constraints, migration is definitively a very variable phenomenon, fluctuating in abundance and specific timing. Gray-cheeked and Swainson's Thrushes, species that migrate mostly in September, were banded in record numbers, whereas almost all species of warblers were banded in below average numbers.

Continuing migration monitoring at Cabot Head Research Station contributes to the efforts of the Canadian Migration Monitoring Network and ultimately to a better understanding and monitoring of bird populations.

Acknowledgements

As a non-profit, volunteer-based initiative, the Bruce Peninsula Bird Observatory would not be operable without the overwhelming support of its membership, financial supporters and volunteers. BPBO wishes to thank Ontario Parks for their generous on-site management assistance.

The author wishes to thank all the members of the Bruce Peninsula Bird Observatory, as well as Ontario Parks for their support during the field season. A special thank is due to Mike and Sara Jane VanDeLaar as they graciously helped me in so many and various ways. I would also like to commend the 11 volunteers who helped make the field season efficient and enjoyable.

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Appendix I. Fall banding total 2016

Group	Species	2016	Av. \pm stdev	Max.	Year	Min.	Year	#
raptors	Sharp-shinned Hawk	4	$3 \pm 1,3$	5	2011 - 2013	1	2009 - 2012	14
cuckoos	Black-billed Cuckoo	2	$3 \pm 1,7$	5	2003	1	2012	4
owls	Northern Saw-whet Owl	1	$1 \pm 0,4$	2	2011	1	all other years	7
kingfishers	Belted Kingfisher	1	$2 \pm 0,8$	3	2013	1	several years	8
woodpeckers	Red-bellied Woodpecker	3	$1 \pm 0,9$	1	all previous years			5
	Yellow-bellied Sapsucker	2	$2 \pm 0,8$	3	2011 - 2014	1	several years	10
	Downy Woodpecker	12	$10 \pm 7,9$	31	2009	2	2002	15
	Hairy Woodpecker	5	$6 \pm 2,9$	12	2007	2	2005 - 2015	13
	Yellow-Shafted Flicker	8	$4 \pm 2,2$	8	2012	1	2005	14
flycatchers	Yellow-bellied Flycatcher	3	$3 \pm 1,7$	7	2014	1	several years	13
	Trail's Flycatcher	4	$6 \pm 3,8$	16	2007	1	2011	15
	Least Flycatcher	4	$5 \pm 2,0$	9	2010	3	several years	15
vireos	Blue-headed Vireo	7	$6 \pm 3,7$	13	2015	1	2002 - 2007	15
	Philadelphia Vireo	6	$3 \pm 1,8$	5	2012	1	several years	11
	Red-eyed Vireo	68	$84 \pm 52,8$	239	2005	24	2009	15
corvids	Blue Jay	5	$5 \pm 3,7$	16	2014	1	2007	14
paridae	Black-capped Chickadee	205	$165 \pm 182,4$	717	2005	11	2015	15
nuthatches	Red-breasted Nuthatch	82	$49 \pm 43,2$	160	2012	10	2015	15
	White-breasted Nuthatch	1	$1 \pm 0,5$	2	2007	1	2005	4
creepers	Brown Creeper	75	$43 \pm 18,1$	71	2012	19	2009	15
wrens	House Wren	1	$1 \pm 0,5$	2	2003 - 2009	1	several years	8
	Winter Wren	4	$5 \pm 2,3$	8	2007 - 2008 - 2013	1	2003	14
kinglets	Golden-crowned Kinglet	308	$329 \pm 173,0$	758	2013	113	2005	15
	Ruby-crowned Kinglet	84	$61 \pm 30,7$	122	2003	20	2005	15
turdidae	Veery	8	$4 \pm 2,7$	6	2007	1	2010	12
	Gray-cheeked Thrush	41	$15 \pm 9,0$	23	2002	6	2010	15
	Swainson's Thrush	70	$34 \pm 20,7$	79	2015	10	2006	15
	Hermit Thrush	25	$41 \pm 18,9$	87	2011	16	2002	15
	American Robin	16	$18 \pm 8,5$	36	2006	1	2007	15
mimidae	Gray Catbird	2	$5 \pm 3,0$	17	2002	2	2010 - 2014	15
bombycillidae	Cedar Waxwing	11	$36 \pm 35,6$	117	2005	1	2014	14
warblers	Tennessee Warbler	12	$11 \pm 13,0$	44	2005	2	2009	14
	Orange-crowned Warbler	22	$15 \pm 8,6$	28	2014	3	2005	15
	Nashville Warbler	36	$35 \pm 15,4$	78	2005	19	2010	15
	Northern Parula	2	$2 \pm 0,6$	1	2005 - 2008			4
	Yellow Warbler	3	$4 \pm 3,2$	13	2003	1	several years	15
	Chestnut-sided Warbler	3	$2 \pm 1,2$	5	2002	1	several years	13
	Magnolia Warbler	23	$22 \pm 5,0$	34	2005	16	2012 - 2013	15
	Cape May Warbler	1	$2 \pm 1,8$	7	2015	1	several years	11
	Black-thr. Blue Warbler	12	$13 \pm 5,0$	22	2002	2	2014	15

Group	Species	2016	Av. \pm stdev	Max.	Year	Min.	Year	#
warblers	Myrtle Warbler	60	82 \pm 44,5	204	2005	34	2004	15
	Black-thr. Green Warbler	14	58 \pm 35,2	120	2002	15	2007	15
	Palm Warbler	8	8 \pm 5,7	22	2012	1	2004	15
	Bay-breasted Warbler	23	6 \pm 5,5	10	2013	1	2009	13
	Blackpoll Warbler	19	13 \pm 8,4	31	2015	5	2006	15
	Black and White Warbler	24	24 \pm 7,5	37	2013	12	2006 - 2007	15
	American Redstart	54	99 \pm 45,4	198	2003	44	2007	15
	Ovenbird	15	18 \pm 5,6	31	2012	10	2007	15
	Northern Waterthrush	7	7 \pm 3,8	15	2010	1	2005	15
	Mourning Warbler	2	3 \pm 0,9	4	2009 - 2012	1	2002	11
	Common Yellowthroat	23	25 \pm 6,6	39	2010	17	2008	15
	Wilson's Warbler	4	7 \pm 2,9	12	2009	2	2004	15
	Canada Warbler	6	4 \pm 2,0	8	2002	1	2004 - 2006	15
tanagers	Scarlet Tanager	1	2 \pm 0,5	2	several years	1	2002 - 2010	8
sparrows	American Tree Sparrow	18	32 \pm 26,5	94	2015	11	2002	15
	Fox Sparrow	2	3 \pm 1,8	7	2015	1	2003 - 2007 - 2014	14
	Song Sparrow	5	13 \pm 5,1	28	2002	7	2015	15
	Lincoln's Sparrow	8	6 \pm 3,1	13	2010	2	2003	14
	Swamp Sparrow	2	4 \pm 2,4	11	2003	1	2015	15
	White-throated Sparrow	57	80 \pm 45,4	199	2005	39	2007	15
	E. White-crown. Sparrow	20	50 \pm 29,3	126	2007	11	2013	15
	Slate-coloured Junco	103	87 \pm 27,2	141	2015	47	2002	15
icteridae	Rusty Blackbird	1		1	2007			2
finches	Purple Finch	1	5 \pm 4,8	17	2011	1	2012	14
	Pine Siskin	2	27 \pm 51,8	170	2011	2	2014	10
	American Goldfinch	30	7 \pm 9,9	19	2014	1	2008 - 2010 - 2011	10
Total of banded birds		1691	1758 \pm 314	2477	2005	1418	2007	13
Number of species banded		66						

Record for fall 2016: highest number highlighted in red; lowest number highlighted in yellow; tie in orange.

Black-thr. Blue Warbler: Black-throated Blue Warbler

Black-thr. Green Warbler: Black-throated Green Warbler

E. White-crown. Sparrow: Eastern White-crowned Sparrow

Av. \pm stdev.: Average \pm standard deviation

Max. : Maximum; Min.: Minimum

: number of fall seasons with banding

Appendix II. Detected Totals of species observed in fall from 2002 to 2016 at Cabot Head Research Station

group	Species	Season total	Average	Max. daily ET	Min. daily ET	Days with obs.	First obs.	Last obs.
waterbirds	Common Loon	183	4	26	1	49	18 Au.	21 Oc.
	Horned Grebe	10	3	4	2	4	22 Se.	30 Oc.
	Red-necked Grebe	32	5	12	1	7	18 Au.	14 Oc.
	Double-crested Cormorant	216	8	26	1	26	17 Au.	18 Se.
	Great Blue Heron	30	2	6	1	15	17 Au.	3 Oc.
	Great Egret	6				1	19 Au.	
	Black-crowned Night-Heron	2				1	24 Au.	
raptors	Turkey Vulture	99	4	11	1	28	19 Au.	4 Oc.
waterfowl	Cackling Goose	1				1	1 Oc.	
	Canada Goose	2281	74	653	1	31	17 Au.	22 Oc.
	Wood Duck	25	13	24	1	2	19 Se.	7 Oc.
	Mallard	67	4	18	1	19	23 Au.	17 Oc.
	American Black Duck	14	2	6	1	6	22 Se.	17 Oc.
	Gadwall	1				1	7 Oc.	
	Green-winged Teal	1				1	22 Oc.	
	American Wigeon	6				1	9 Oc.	
	Ring-necked Duck	5	1	2	1	4	8 Oc.	13 Oc.
	Surf Scoter	5	1	1	1	5	25 Se.	20 Oc.
	White-winged Scoter	44	6	22	1	7	24 Se.	23 Oc.
	Long-tailed Duck	5	1	2	1	4	15 Oc.	30 Oc.
	Common Goldeneye	1				1	25 Oc.	
	Hooded Merganser	1				1	31 Oc.	
	Common Merganser	156	4	22	1	39	17 Au.	23 Oc.
	Red-breasted Merganser	33	3	7	1	13	27 Se.	30 Oc.
raptors	Bald Eagle	97	2	5	1	57	17 Au.	31 Oc.
	Northern Harrier	7	1	1	1	7	4 Se.	11 Oc.
	Sharp-shinned Hawk	50	2	9	1	29	19 Au.	16 Oc.
	Northern Goshawk	4	1	1	1	4	19 Au.	23 Oc.
	Red-shouldered Hawk	1				1	5 Se.	
	Broad-winged Hawk	332	47	283	1	7	19 Au.	19 Se.
	Red-tailed Hawk	41	2	5	1	21	19 Au.	31 Oc.
	American Kestrel	3	1	1	1	3	31 Au.	20 Oc.
	Merlin	62	1	4	1	43	17 Au.	31 Oc.
	Peregrine Falcon	32	1	3	1	25	19 Au.	12 Oc.
grouse	Ruffed Grouse	30	1	3	1	22	15 Se.	31 Oc.

group	Species	Season total	Average	Max. daily ET	Min. daily ET	Days with obs.	First obs.	Last obs.
shorebirds	Sandhill Crane	15	2	5	1	8	3 Se.	5 Oc.
	Killdeer	1				1	6 Se.	
	Greater Yellowlegs	5	1	1	1	5	27 Au.	17 Oc.
shorebirds	Spotted Sandpiper	5	1	1	1	5	20 Au.	8 Se.
gulls	Ring-billed Gull	369	6	33	1	64	17 Au.	31 Oc.
	Herring Gull	70	2	6	1	37	17 Au.	31 Oc.
columbidae	Mourning Dove	2	1	1	1	2	22 au.	24 Au.
cuckoos	Black-billed Cuckoo	3	1	1	1	3	25 Au.	16 Se.
owls	Northern Saw-whet Owl	1				1	8 Oc.	
caprimulgidae	Eastern Whip-poor-will	8	1	2	1	6	19 Au.	20 Se.
	Common Nighthawk	1	1	1	1	2	18 Au.	5 Se.
hummingbirds	Ruby-throated Hummingbird	76	3	6	1	27	17 Au.	15 Se.
kingfishers	Belted Kingfisher	40	1	2	1	33	17 Au.	4 Oc.
woodpeckers	Red-headed Woodpecker	2	1	1	1	2	21 Se.	6 Oc.
	Red-bellied Woodpecker	4	1	1	1	4	21 Se.	19 Oc.
	Yellow-bellied Sapsucker	4	2	2	2	2	3 Oc.	4 Oc.
	Downy Woodpecker	109	2	6	1	60	17 Au.	31 Oc.
	Hairy Woodpecker	31	1	3	1	22	3 Se.	31 Oc.
	Northern Flicker	325	7	41	1	49	17 Au.	30 Oc.
	Pileated Woodpecker	25	2	3	1	16	3 Se.	28 Oc.
flycatchers	Eastern Wood-Pewee	1				1	7 Se.	
	Yellow-bellied Flycatcher	4	1	1	1	4	31 Au.	18 Se.
	Traill's Flycatcher	4	1	1	1	4	18 Au.	6 Se.
	Least Flycatcher	6	1	2	1	5	19 Au.	28 Au.
	Eastern Phoebe	10	1	1	1	10	25 Au.	6 Oc.
	Great Crested Flycatcher	1				1	24 Au.	
	Eastern Kingbird	2	1	1	1	2	25 Au.	27 Au.
shrikes	Northern Shrike	3	1	1	1	3	14 Oc.	31 Oc.
vireos	Blue-headed Vireo	8	1	2	1	7	21 Se.	19 Oc.
	Warbling Vireo	1				1	17 Se.	
	Philadelphia Vireo	8	2	2	1	5	5 Se.	17 Se.
	Red-eyed Vireo	212	5	16	1	45	17 Au.	13 Oc.
corvids	Blue Jay	1308	26	188	1	51	17 Au.	28 Oc.
	American Crow	202	4	18	1	46	17 Au.	20 Oc.
	Common Raven	252	4	57	1	66	17 Au.	31 Oc.
larks	Horned Lark	48	10	23	1	5	4 Oc.	23 Oc.
swallows	Barn Swallow	13	3	6	1	5	17 Au.	26 Au.
paridae	Black-capped Chickadee	1383	19	175	1	73	17 Au.	31 Oc.

group	Species	Season total	Average	Max. daily ET	Min. daily ET	Days with obs.	First obs.	Last obs.
nuthatches	Red-breasted Nuthatch	519	8	50	1	65	17 Au.	28 Oc.
	White-breasted Nuthatch	10	1	2	1	8	22 Se.	19 Oc.
creepers	Brown Creeper	92	4	17	1	22	19 Se.	20 Oc.
wrens	House Wren	1				1	2 Oc.	
	Winter Wren	10	1	1	1	10	21 Se.	15 Oc.
kinglets	Golden-crowned Kinglet	862	27	155	1	32	22 Se.	30 Oc.
	Ruby-crowned Kinglet	208	8	56	1	27	19 Se.	28 Oc.
turridae	Eastern Bluebird	2	1	1	1	2	26 Au.	27 Au.
	Veery	13	1	2	1	10	26 Au.	19 Se.
	Gray-cheeked Thrush	37	3	8	1	12	9 Se.	23 Se.
	Swainson's Thrush	70	3	16	1	24	27 Au.	15 Oc.
	Hermit Thrush	34	2	5	1	17	9 Se.	28 Oc.
	American Robin	242	5	40	1	45	17 Au.	31 Oc.
mimidae	Gray Catbird	17	1	3	1	14	14 Se.	13 Oc.
	Brown Thrasher	1				1	28 Se.	
pipits	American Pipit	94	5	29	1	18	10 Se.	11 Oc.
bombycillidae	Cedar Waxwing	510	15	66	1	35	17 Au.	2 Oc.
warblers	Tennessee Warbler	20	2	3	1	13	31 Au.	6 Oc.
	Orange-crowned Warbler	36	3	8	1	12	23 Se.	16 Oc.
	Nashville Warbler	61	2	11	1	26	17 Au.	17 Oc.
	Northern Parula	3	1	1	1	3	17 Oc.	30 Oc.
	Yellow Warbler	11	2	2	1	7	22 Au.	16 Se.
	Chestnut-sided Warbler	4	1	2	1	3	19 Au.	21 Se.
	Magnolia Warbler	29	2	5	1	17	19 Au.	28 Se.
	Cape May Warbler	1	1	1	1	1	27 Se.	
	Black-throated Blue Warbler	19	1	3	1	13	19 Au.	8 Oc.
	Myrtle Warbler	299	6	30	1	47	20 Au.	20 Oc.
	Black-throat. Green Warbler	44	2	11	1	20	21 Au.	7 Oc.
	Pine Warbler	6	3	5	1	2	24 Au.	25 Au.
	Black-and-white Warbler	55	3	7	1	21	17 Au.	21 Se.
	Bay-breasted Warbler	35	2	4	1	16	27 Au.	6 Oc.
	Blackpoll Warbler	29	2	6	1	14	30 Au.	28 Se.
	Western Palm Warbler	12	2	3	1	7	9 Se.	8 Oc.
	American Redstart	234	8	26	1	29	17 Au.	21 Se.
	Ovenbird	18	1	2	1	15	19 Au.	22 Se.
	Northern Waterthrush	8	1	2	1	7	18 Au.	1 Se.
	Mourning Warbler	2	1	1	1	2	18 Au.	28 Au.
	Common Yellowthroat	175	4	10	1	39	17 Au.	24 Se.

group	Species	Season total	Average	Max. daily ET	Min. daily ET	Days with obs.	First obs.	Last obs.
warblers	Wilson's Warbler	10	1	3	1	7	25 Au.	29 Se.
	Canada Warbler	7	1	1	1	7	18 Au.	16 Se.
tanagers	Scarlet Tanager	1				1	9 Se.	
sparrows	American Tree Sparrow	37	3	9	1	14	9 Oc.	30 Oc.
	Clay-colored Sparrow	1				1	27 Se.	
	Savannah Sparrow	1				1	2 Oc.	
	Fox Sparrow	5	2	3	1	3	9 Oc.	11 Oc.
	Song Sparrow	106	2	8	1	44	17 Au.	20 Oc.
	Lincoln's Sparrow	13	3	6	1	5	19 Se.	9 Oc.
	Swamp Sparrow	2	1	1	1	2	24 Se.	11 Oc.
	White-throated Sparrow	209	7	27	1	30	2 Se.	14 Oc.
	White-crowned Sparrow	317	6	32	1	55	17 Au.	20 Oc.
	Dark-eyed Junco	282	7	33	1	39	18 Au.	30 Oc.
	Snow Bunting	10	3	8	1	3	22 Oc.	30 Oc.
icteridae	Red-winged Blackbird	3				1	2 Se.	
	Eastern Meadowlark	1				1	25 Oc.	
	Rusty Blackbird	91	7	20	1	14	15 Se.	13 Oc.
finches	Purple Finch	27	3	8	1	10	3 Se.	31 Oc.
	White-winged Crossbill	10	2	5	1	5	31 Au.	30 Oc.
	Common Redpoll	21	11	16	5	2	23 Oc.	24 Oc.
	Pine Siskin	131	7	31	1	18	23 Au.	31 Oc.
	American Goldfinch	538	11	188	1	51	17 Au.	31 Oc.
	Evening Grosbeak	2	2	2	2	1	2 Oc.	2 Oc.

Average: Daily average.

Au.: August; Se.: September; Oc.: October