Birds of the Prince Edward Point National Wildlife Area



A Report and Analysis of Migration Monitoring at Prince Edward Point Bird Observatory 2001-2013

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Table of contents

Exe	cutive s	ummary	12
1.0	Intro	oduction	13
1.	.1 G	oals and objectives	14
1.	.2 N	lethods	14
1.	.3 N	ligration monitoring period	16
2.0	Gen	eral overview of bird migration at Prince Edward Point	18
2.	.1 S	pecies richness and abundance	18
2.	2 S	pring vs. fall migration patterns	20
	2.2.1	Abundance	20
	2.2.2	Age ratio	20
2.	.3 Ir	fluence of weather on migration	21
3.0	Ban	ding	29
3.	.1 B	obolink	41
3.	.2 0	wl banding	45
4.0	Rec	overies of banded birds	50
4.	.1 0	wls	50
	4.1.1	Owls banded at PEPtBO and recaptured elsewhere	50
	4.1.2	Owls banded elsewhere and recaptured at PEPtBO	54
4.	.2 0	ther species	55
	4.2.1	Birds banded at PEPtBO and recaptured elsewhere	55
	4.2.2	Birds banded elsewhere and recaptured at PEPtBO	57
5.0	Cate	chment areas of migrant birds passing through Prince Edward Point	70
6.0	Prio	rity species for migration monitoring at Prince Edward Point	76
6.	.1 P	riority A	78
	6.1.1	Yellow-bellied Flycatcher	78
	6.1.2	Gray-cheeked Thrush	78
	6.1.3	Swainson's Thrush	78

6.1.4	Magnolia Warbler	79
6.1.5	Blackpoll Warbler	80
6.1.6	Northern Waterthrush	80
6.1.7	Wilson's Warbler	81
6.2 P	riority B	
6.2.1	Ruby-crowned Kinglet	
6.2.2	Yellow-rumped (Myrtle) Warbler	
6.2.3	Western Palm Warbler	
6.2.4	White-crowned Sparrow	
6.2.5	Slate-coloured Junco	
6.3 P	riority C	102
6.3.1	Least Flycatcher	102
6.3.2	Blue-headed Vireo	102
6.3.3	Philadelphia Vireo	103
6.3.4	Red-eyed Vireo	103
6.3.5	Nashville Warbler	104
6.3.6	Chestnut-sided Warbler	104
6.3.7	Black-throated Green Warbler	105
6.3.8	Black- and-white Warbler	106
6.3.9	Ovenbird	106
6.3.10	Canada Warbler	107
6.3.11	White-throated Sparrow	107
6.4 P	riority D	123
6.4.1	Brown Creeper	123
6.4.2	Hermit Thrush	123
7.0 Spec	cies phenology	127
7.1 W	Vaterbirds	128
7.1.1	Brant	128
7.1.2	Canada Goose	128
7.1.3	Mallard	
7.1.4	Greater Scaup	
7.1.5	White-winged Scoter	129
7.1.6	Long-tailed Duck	129

7.1.7 Red-breasted Merganser	30
7.1.8 Double-crested Cormorant	30
7.1.9 Bonaparte's Gull	31
7.1.10 Ring-billed Gull	31
7.2 Raptors	42
7.2.1 Turkey Vulture	42
7.3 Corvids	47
7.3.1 Blue Jay	47
7.4 Swallows 15	50
7.5 Black-capped Chickadee	54
7.6 Kinglets	56
7.6.1 Golden-crowned Kinglet	56
7.6.2 Ruby-crowned Kinglet	56
7.7 American Robin	59
7.8 European Starling	51
7.9 Cedar Waxwing	53
7.10 Warblers	55
7.10.1 Magnolia Warbler	55
7.10.2 Yellow Warbler	55
7.10.3 Myrtle Warbler	56
7.11 Sparrows17	72
7.11.1 Song Sparrow17	72
7.11.2 White-throated Sparrow	72
7.11.3 Slate-coloured Junco	73
7.12 Blackbirds	78
7.12.1 Red-winged Blackbird	78
7.12.2 Common Grackle	78
7.12.3 Brown-headed Cowbird	78
7.13 Finches	33
7.13.1 American Goldfinch	83
8.0 Migration strategy in the Great Lakes area	35

9.0	Recommendations for future monitoring of migrant birds	
9.1	Understanding which species cross large water bodies	
9.2	Focal species	
9.3	Aiming for statistical significance/reducing bias	
9.4	Understanding stopover ecology habitat variables at Prince Edward Point	188
9.5	Internships	
9.6	Publish interesting results	
10.0	Acknowledgements	190
11.0	Appendix	191
12.0	Literature cited	229

Table of figures

Figure 1.1. Location of Prince Edward Point (star) and percentage of water and land in a 70-km radius from it
Figure 2.1. Seasonal number of species and cumulative number of new species seen at Prince Edward Point, 2001-2013 (Sp.: Spring; F.:the fall)
Figure 2.2. Abundance of species in relation to occasions of sightings at Prince Edward Point, 2001-2013
Figure 2.3. Number of species observed in relation to season and number of years they have been observed at Prince Edward Point, 2001-2013. (Top: observed in only one season; bottom: observed in both seasons)
Figure 2.4. Average Estimated Totals by season of the ten most abundant species and selected groups of birds at Prince Edward Point, 2001-2013. The "raptors" category includes Turkey Vulture, Bald Eagle, Sharp-shinned Hawk, Broad-winged, Red-tailed and Red-shouldered Hawks, American Kestrel, and Merlin. The "sparrows" category includes Song Sparrow, American Tree Sparrow, Chipping Sparrow, White-crowned Sparrow, White-throated Sparrow and Slate-coloured Junco. The "warblers" category includes Bay-breasted, Blackburnian, Black-and-white, Black-throated Blue, Black-throated Green, Canada, Cape May, Magnolia, Mourning, Nashville, Orange-crowned, Palm, Pine, Tennessee, Wilson's, and Yellow Warblers, Common Yellowthroat, Northern Waterthrush, and Ovenbird. The "blackbird" category includes Common Grackle, Red-winged Blackbird, Brown-headed Cowbird, and unidentified Blackbirds
Figure 2.5. Percentage of Estimated Total by season for the 99 species observed every season of every year at Prince Edward Point, 2001-2013 continued on next page
Figure 3.1. Number of banded birds captured in standard banding by season and year at Prince Edward Point, 2002 – 2013
Figure 3.2. Number of species captured in standard banding by season and year at Prince Edward Point,

2002 - 2013
Figure 3.3. Spring (top) and fall (bottom) numbers of birds banded by type of capture at Prince Edward Point, 2001-2013
Figure 3.4. Cumulative banding totals in relation to season of banding at Prince Edward Point, 2001-2013
Figure 3.5. Spring numbers of birds, with the 3 most commonly caught species, captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013
Figure 3.6. Fall numbers of birds, with the 3 most commonly caught species, captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013
Figure 3.7. Spring weekly numbers of birds captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013
Fig. 3.8. Fall weekly numbers of birds captured in Mist Nets (top) and Ground and J-traps (bottom; high years are: 2001, 2007, 2009, & 2012; low years: all the other years) at Prince Edward Point, 2001-2013 40
Figure 3.9. Fall ET and banding total of Bobolink by year at Prince Edward Point (2001-2013). NB: The y-axis is at a different scale between years. No broadcast calls were played from August 23 to 31 in 2013.
Figure 3.10. Fall ET and banding total of Bobolink by year at Prince Edward Point (2001-2013). NB: The y-axis is at a different scale between years. No broadcast calls were played from August 23 to 31 in 2013.
Figure 3.11. Number of Northern Saw-whet Owls captured in standard and non standard banding by year at Prince Edward Point, 2002 – 2013
Figure 3.12. Hourly number of Northern Saw-whet Owls captured in standard (before midnight) and non standard (after midnight) banding at Prince Edward Point, 2002 – 2013
Figure 3.13. Fall weekly numbers of Northern Saw-whet Owls captured during standard (top) and non standard (bottom) banding at Prince Edward Point, 2001-2013
Figure 3.14. Numbers of Northern Saw-whet Owls by age classes captured during standard (top) and non standard (bottom) banding at Prince Edward Point, 2001-2013
Figure 4.1. Locations of owls banded at Prince Edward Point and recovered elsewhere, 2001-2013 60
Figure 4.2. Locations of Northern Saw-whet Owls banded at Prince Edward Point and recovered elsewhere multiple times, 2001-2013
Figure 4.3. Locations of Northern Saw-whet Owls banded elsewhere and recovered at Prince Edward Point, 2001-2013
Figure 4.4. Time between banding and recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)
Figure 4.5. Season of recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)
Figure 4.6. Distance between banding and recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)
Figure 4.7. Location of Northern Saw-whet Owl monitoring stations across North America, as inventoried by Project Owlnet (www.projectowlnet.org)
Figure 4.8. Locations of species other than owls banded at Prince Edward Point and recovered elsewhere,

2001-2013
Figure 4.9. Locations of species other than owls banded and recovered at Prince Edward Point, 2001-2013 elsewhere
Figure 4.10. Season of recapture for species other than owls banded at PEPtBO and recaptured elsewhere (data 2001-2013)
Figure 4.11. Time between banding and recapture for species other than owls banded at PEPtBO and recaptured elsewhere (data 2001-2013)
Figure 4.12. Distance between banding and recapture for species other than owls banded at PEPtBO and recaptured elsewhere (data 2001-2013)
Figure 4.13. Time between banding and recapture for species other than owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)
Figure 5.1. Catchment areas of Swainson's Thrush captured in spring (left; sample size $n=21$) and of Hermit Thrush captured in the fall (right; $n=13$) at Prince Edward Point Bird Observatory (red dot) 73
Figure 5.2. Catchment areas of Traill's Flycatcher captured in the fall (left; n=12) and of Wilson's Warbler captured in spring (right; n=14) at Prince Edward Point Bird Observatory (red dot)
Figure 5.3. Catchment areas of Magnolia Warbler captured in spring (left; n=16) and inthe fall (right; n=12) at Prince Edward Point Bird Observatory (red dot)
Figure 5.4. Catchment areas of Palm Warbler captured in spring (left; n=16) and inthe fall (right; n=4) at Prince Edward Point Bird Observatory (red dot)
Figure 5.5. Catchment areas of Northern Waterthrush captured in spring (left; n=11) and of Lincoln's Sparrow in fall (right; n=3) at Prince Edward Point Bird Observatory (red dot)
Figure 5.6. Catchment areas of Ruby-crowned Kinglets captured in spring (left) and of Myrtle Warblers captured in spring (right) in Bird Observatories other than PEPtBO (red dots) around the Great Lakes 75
Figure 6.1. Spring (top) and fall (bottom) phenology of Yellow-bellied Flycatcher at Prince Edward Point (2001-2013)
Figure 6.2. Spring (top) and fall (bottom) phenology of Gray-cheeked Thrush at Prince Edward Point (2001-2013)
Figure 6.3. Spring (top) and fall (bottom) phenology of Swainson's Thrush at Prince Edward Point (2001-2013)
Figure 6.4. Spring (top) and fall (bottom) phenology of Magnolia Warbler at Prince Edward Point (2001-2013)
Figure 6.5. Spring (top) and fall (bottom) phenology in relation to age and sex for Magnolia Warbler at Prince Edward Point (average 2001-2013)
Figure 6.6. Spring (top) and fall (bottom) phenology of Blackpoll Warbler at Prince Edward Point (2001-2013)
Figure 6.7. Spring (top) and fall (bottom) phenology of Northern Waterthrush at Prince Edward Point (2001-2013)
Figure 6.8. Spring (top) and fall (bottom) phenology of Wilson's Warbler at Prince Edward Point (2001-2013)
Figure 6.9. Spring phenology in relation to age and sex for Wilson's Warbler at Prince Edward Point (average 2001-2013)

Figure 6.10. Spring (top) and fall (bottom) phenology of Ruby-crowned Kinglet at Prince Edward Point (2001-2013)
Figure 6.11. Spring (top) and fall (bottom) phenology in relation to age and sex for Ruby-crowned Kinglet at Prince Edward Point (average 2001-2013)
Figure 6.12. Spring (top) and fall (bottom) phenology of Myrtle Warbler at Prince Edward Point (2001-2013)
Figure 6.13. Spring (top) and fall (bottom) phenology of Western Palm Warbler at Prince Edward Point (2001-2013)
Figure 6.14. Spring (top) and fall (bottom) phenology of Eastern White-crowned Sparrow at Prince Edward Point (2001-2013)
Figure 6.15. Spring (top) and fall (bottom) phenology of Slate-coloured Junco at Prince Edward Point (2001-2013)
Figure 6.16. Spring phenology in relation to age and sex for Slate-coloured Junco at Prince Edward Point (average 2001-2013)
Figure 6.17. Spring (top) and fall (bottom) phenology of Least Flycatcher at Prince Edward Point (2001-2013)
Figure 6.18. Spring (top) and fall (bottom) phenology of Blue-headed Vireo at Prince Edward Point (2001-2013)
Figure 6.19. Spring (top) and fall (bottom) phenology of Philadelphia Vireo at Prince Edward Point (2001-2013)
Figure 6.20. Spring (top) and fall (bottom) phenology of Red-eyed Vireo at Prince Edward Point (2001-2013)
Figure 6.21. Spring (top) and fall (bottom) phenology of Nashville Warbler at Prince Edward Point (2001-2013)
Figure 6.22. Spring phenology in relation to age and sex for Nashville Warbler at Prince Edward Point (average 2001-2013)
Figure 6.23. Spring (top) and fall (bottom) phenology of Chestnut-sided Warbler at Prince Edward Point (2001-2013)
Figure 6.24. Spring phenology in relation to age and sex for Chestnut-sided Warbler at Prince Edward Point (average 2001-2013)
Figure 6.25. Spring (top) and fall (bottom) phenology of Black-throated Green Warbler at Prince Edward Point (2001-2013)
Figure 6.26. Spring phenology in relation to age and sex for Black-throated Green Warbler at Prince Edward Point (average 2001-2013)
Figure 6.27. Spring (top) and fall (bottom) phenology of Black-and-white Warbler at Prince Edward Point (2001-2013)
Figure 6.28. Spring (top) and fall (bottom) phenology of Ovenbird at Prince Edward Point (2001-2013)
Figure 6.29. Spring (top) and fall (bottom) phenology of Canada Warbler at Prince Edward Point (2001-2013)
Figure 6.30. Spring (top) and fall (bottom) phenology of White-throated Sparrow at Prince Edward Point

(2001-2013)
Figure 6.31. Spring (top) and fall (bottom) phenology of Brown Creeper at Prince Edward Point (2001-2013)
Figure 6.32. Spring (top) and fall (bottom) phenology of Hermit Thrush at Prince Edward Point (2001-2013)
Figure 7.1. Spring (top) and fall (bottom) phenology for Brant at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.2. Spring (top) and fall (bottom) phenology for Canada Goose at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.3. Spring (top) and fall (bottom) phenology for Mallard at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.4. Spring (top) and fall (bottom) phenology for Greater Scaup at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.5. Spring (top) and fall (bottom) phenology for White-winged Scoter at Prince Edward Point (3- day average of 2001-2013 and lowest and highest ET years)
Figure 7.6. Spring (top) and fall (bottom) phenology for Long-tailed Duck at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.7. Spring (top) and fall (bottom) phenology for Red-breasted Merganser at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.8. Spring (top) and fall (bottom) phenology for Double-crested Cormorant at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.9. Spring (top) and fall (bottom) phenology for Bonaparte's Gull at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.10. Spring (top) and fall (bottom) phenology for Ring-billed Gull at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.11. Soaring (top) and flapping (bottom)the fall phenology for Raptors at Prince Edward Point (3- day average of 2001-2013 and lowest and highest ET years). Soaring raptors include: Cooper's and Sharp- shinned Hawks, Red-tailed and Broad-winged Hawks, and Northern Harrier. Flapping raptors include: Osprey, Merlin, and American Kestrel
Figure 7.12. Spring (top) and fall (bottom) phenology for Bald and Golden Eagles at Prince Edward Point (3-day average of 2001-2013)
Figure 7.13. Spring (top) and fall (bottom) phenology for Turkey Vulture at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.14. Number of days in spring (green) and fall (orange) with observation of Common Raven at Prince Edward Point from 2001 to 2013
Figure 7.15. Spring (top) and fall (bottom) phenology for Blue Jay at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.16. Spring (top) and fall (bottom) phenology for Tree Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.17. Spring (top) and fall (bottom) phenology for Cliff Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

Figure 7.18. Spring (top) and fall (bottom) phenology for Barn Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.19. Spring (green) and the fall (orange) seasonal ET for Black-capped Chickadee at Prince Edward Point, 2001-2013
Figure 7.20. Fall phenology for Black-capped Chickadee at Prince Edward Point (3-day average of 2001-2013 and the 3 highest ET years)
Figure 7.21. Spring (top) and fall (bottom) phenology for Golden-crowned Kinglet at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.22. Spring (top) and fall (bottom) phenology for Ruby-crowned Kinglet at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.23. Spring (top) and fall (bottom) phenology for American Robin at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.24. Spring (top) and fall (bottom) phenology for European Starling at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.25. Spring (top) and fall (bottom) phenology for Cedar Waxwing at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.26. Number of species of warblers observed in relation to season and number of years they have been observed at Prince Edward Point, 2001-2013
Figure 7.27. Abundance of species of warblers in relation to occasions of sightings at Prince Edward Point, 2001-2013
Figure 7.28. Spring (top) and fall (bottom) phenology for warblers at Prince Edward Point (3-day average of 2001-2013 and warblers with highest overall ET)
Figure 7.29. Spring (top) and fall (bottom) phenology for Magnolia Warbler at Prince Edward Point (3- day average of 2001-2013 and lowest and highest ET years)
Figure 7.30. Spring (top) and fall (bottom) phenology for Yellow Warbler at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.31. Spring (top) and fall (bottom) phenology for Myrtle Warbler at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.32. Spring (top) and fall (bottom) phenology for Sparrows at Prince Edward Point (3-day average of 2001-2013)
Figure 7.33. Spring (top) and fall (bottom) phenology for Song Sparrow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.34. Spring (top) and fall (bottom) phenology for White-throated Sparrow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.35. Spring (top) and fall (bottom) phenology for Slate-coloured Junco at Prince Edward Point (3- day average of 2001-2013 and lowest and highest ET years)
Figure 7.36. Spring (top) and fall (bottom) phenology for Red-winged Blackbird at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.37. Spring (top) and fall (bottom) phenology for Common Grackle at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)
Figure 7.38. Spring (top) and fall (bottom) phenology for Brown-headed Cowbird at Prince Edward Point

(3-day average of 2001-2013 and lowest and highest ET years)	
Figure 7.39. Spring (top) and fall (bottom) phenology for American Goldfinch at Prince Edv	vard Point (3-
day average of 2001-2013 and lowest and highest ET years)	

Table of tables

Table 1.1. Standard migration monitoring period at Prince Edward Point, 2001-2013 16
Table 3.1. The 10 most abundant banded species in spring by year at Prince Edward Point, $2001 - 201335$
Table 3.2. The 10 most abundant banded species in the fall by year at Prince Edward Point, $2001 - 201336$
Table 3.3. Bobolink fall migration monitoring at Prince Edward Point, 2008-201342
Table 3.4. Owls banded during Northern Saw-whet Owl banding at Prince Edward Point, 2001-2013 46
Table 4.1. Species other than owls banded at Prince Edward Point and recovered elsewhere: Distance between banding and recapture locations and time between banding and recapture 59
Table 11.1. Spring Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013
Table 11.2.Fall Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013
Table 11.3. Spring standard banding totals of birds captured at Prince Edward Point Bird Observatory 2001-2013, highest totals in yellow
Table 11.4. Fall standard banding totals of birds captured at Prince Edward Point Bird Observatory 2001-2013, highest totals in yellow
Table 11.5. Spring non-standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013
Table 11.6. Fall non-standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013

Acronyms used in the manuscript

Acronym	Meaning
DT	Detected total
ET	Estimated total
HY	Hatch year
SY	Second year
AHY	After hatch year
COSEWIC	Committee on the status of endangered wildlife in Canada
CMMN	Canadian migration monitoring network
BBS	Breeding bird survey
BSC	Bird Studies Canada

Executive summary

This report presents an analysis of 13 years of operation of the Prince Edward Point Bird Observatory's bird migration monitoring program at Prince Edward Point, at the southeastern tip of Prince Edward County, Ontario. Since 2001, bird migration has been monitored through banding, census, and observation both in spring and fall. From 2001 to 2013, a total of 6.7 million birds of 273 species have been detected, with considerable variation in specific species abundance and frequency. Slightly more birds, in abundance, are detected in fall than in spring, potentially because fall populations are reinforced by young and the fall monitoring period is longer. In 13 years, a total of 151,046 birds of 166 species have been banded, with more birds banded in fall (75,044 individuals during standard banding) than in spring (58,106 individuals during standard banding). In fall, 84% of birds captured are Hatch-Year birds, a high percentage, and similar to results from other bird observatories in the Great Lakes area.

Banding of Northern Saw-whet Owls revealed a strong fall migration of this species at Prince Edward Point, with fluctuating numbers and age-ratio, reflecting population cycles.

With recoveries of banded birds and stable-isotope analysis of feathers, maps of movements and summer origins were created, revealing, for the first time for birds captured at Prince Edward Point, the extent of migratory connectivity, i.e. the links between the different locations a bird uses during its life. Understanding migratory connectivity is crucial to understand population dynamics, as 'carry-over' effects between seasons and locations potentially influence all stages of life. For example, winter habitat quality determined both timing of spring migration and physical condition at departure, which in turn influenced arrival time and physical conditions in the breeding season (Marra et al. 1998).

Long-term monitoring has a great deal of potential in determining population trends, especially for species difficult to census on their breeding and/or wintering grounds. Here, we briefly present analysis of population trends for some common birds monitored at Prince Edward Point. Daily monitoring at Prince Edward Point during migration also brings unexpected discoveries, like the presence of a White-crowned Sparrow, a northern breeder, in August or spring "overshoots" of southern species (for example, Worm-eating Warbler or Fish Crow). Similarly, a growing presence of Common Ravens and Bald Eagles at Prince Edward Point was noted, reflecting the general increase of their population in the province as a whole.

The Prince Edward Point Bird Observatory, through its bird migration monitoring program, has established a sound long-term data set, from which interesting results have emerged. It will continue to serve in the future, as unforeseen conservation challenges emerge, as new statistical methods are developed, and as new questions in ornithological research arise.

1.0 Introduction

Migration is among the most impressive and complex phenomena of the animal world. It has long puzzled and awed humans by the numbers of animals involved, distances travelled, and feats of navigation. Despite numerous studies and innovative technological developments (like radar, satellite telemetry, geolocators, and stable-isotope analyses – see for example Bart 2005, Hobson 2005, and Millikin 2005), many aspects of migration are still relatively poorly known and understood.

As argued by Gauthreaux (1996), the first phase of the study of animal behaviour is that of observation and description. It provides the foundation on which hypotheses can be built and further studies implemented. Long-term descriptive studies also provide data sets that can be used as baselines for monitoring purposes. While diverse methods can be used to study migrating birds (see a review in Gauthreaux 1996); direct observations and banding following well-established protocols are two of the most widely implemented.

Precise monitoring of populations is essential to the understanding and management of natural resources. 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. Migration monitoring at observatories across the country can be an effective means of tracking populations of species that nest in remote northern areas of Canada, species for which habitat is rarely sampled by roadside surveys and species that are otherwise difficult to detect during the breeding season (Badzinski and Francis 2000). The Canadian Migration Monitoring Network (CMMN) is a nation-wide Bird Studies Canada initiative enacted to assess changes in populations during migration, especially for priority species that are not adequately monitored by other programs such as the BBS and Christmas Bird Count. The network includes over 20 stations across Canada where data are collected during spring andthe fall migrations, typically through standardized capture and observation protocols. Prince Edward Point Bird Observatory (PEPtBO) has demonstrated through data collection since 1995 that Prince Edward Point is a valuable site for monitoring migrating landbirds. Since becoming a member of CMMN in 1999, PEPtBO contributes to this monitoring effort.

Prince Edward Point is located along the north shore of Lake Ontario within southern Ontario (Fig. 1.1). It is at the southeast corner of Prince Edward County at the end of a narrow, long peninsula. It is within the National Wildlife Area (NWA) managed by the Canadian Wildlife Service (CWS), known as the Prince Edward Point National Wildlife Area. It is a narrow point of land that extends approximately 10 km into the lake. Shoals and areas of deeper water are located off the tip. The Point is comprised of shallow soil over limestone bedrock. Much of the habitat consists of old field (savannah) and shrub thickets, with small deciduous and coniferous forests being present. The Point is part of the Prince Edward County South Shore Important Bird Area (IBA), which includes approximately 26 square kilometers of land and 65 square kilometers of water along 30 kilometers of shoreline. It has been designated as a globally significant IBA because of high concentrations of its waterfowl populations (especially Long-tailed Ducks, White-winged Scoters and Greater Scaups). The IBA is also an important flyway for raptors in the fall migration. Large numbers of landbirds pass through in both spring andthe fall and a number of Species at Risk breed in the area.

Birds, most notably raptors and songbirds, migrate across a broad front, unless geographical features such as peninsulas concentrate them. Peninsulas are especially good places to concentrate migrants. Peninsulas

may funnel migrants crossing over land toward water or beckon to those crossing large water bodies, offering first refuge and rest as they reach the other side. Rain, headwinds, or fog can cause "fallouts" of birds reluctant to cross large bodies of water or those which are too exhausted to fly any farther after reaching land. Prince Edward County itself protrudes about 40 kilometers into Lake Ontario and could be considered an odd-shaped peninsula.

The main activity of PEPtBO is to initiate and direct bird research and monitoring at Prince Edward Point and its surroundings in a conservation-minded frame. Migration monitoring has been the primary focus of bird research at Prince Edward Point since 1995, occurring in both spring and fall seasons from 2001 onward.

1.1 Goals and objectives

The main goal of the migration monitoring program at Prince Edward Point is to contribute to the efforts of the Canadian Migration Monitoring Network to monitor changes in the populations of migratory birds, especially species that are not being adequately monitored by other programs. The primary objective of migration monitoring at Prince Edward Point is to generate Standard Migration Counts that represent a consistent sample of birds migrating through Prince Edward Point each day during the spring and fall migration. The Standard Migration Counts can be used after several years to calculate long-term population trends for the target species being monitored. More general objectives of the bird migration research at Prince Edward Point are to learn more about the composition, magnitude, timing, and demographics of bird migration at Prince Edward Point and Great Lakes Basin, and to foster the public's understanding and appreciation of birds and bird migration and other aspects of the natural history of Prince Edward County.

1.2 Methods

The migration monitoring program at Prince Edward Point follows a field protocol (Okines 2009) as it is essential for the production of population indices that data collection is consistent over the long term. Standardized capture and observation methods are designed to monitor landbirds, which have been identified as a priority for migration monitoring by CMMN (Francis and Dobbyn 1997). At Prince Edward Point, three different methods (banding, census, and casual observations) are used to monitor migration in a defined Count Area during a specific period and to produce daily Standard Migration Counts. Standard banding is done using 19 mist nets, six ground traps, and one J-trap operated for six hours commencing at sunrise, weather permitting. In the fall, an additional nine hawk nets are operated, as well as 10 owl nets at night. Personnel also complete a census that takes half an hour along a fixed route, where all birds observed are recorded. Casual observations are made throughout the count period and supplemental surveys such as visible migration counts and lake watches are completed when circumstances permit.

To generate daily Standard Migration Counts, two complementary methods, Standard Observations and Standard Captures, are used at Prince Edward Point. Standard Observations are composed of a standard census (i.e. a fixed-route, half-hour survey), and incidental observations. The census must be completed regardless of weather conditions (except for violent weather when birds are poorly detected). One skilled person using binoculars follows a specific route starting after all mist nets are open and records every bird observed. Those conducting the census must pay close attention to bird movements over the course of the census in order to avoid counting the same individual birds more than once. Incidental observations refer to observations made during the standard count period that do not fall under the category of the census or other survey methods (e.g. visible migration counts). The purpose of these observations is to document

birds that were not captured or banded, and to assist with determining the estimated total for each species each day.

The goal of the Standard Capture program is to capture, mark, and collect data on a representative sample of the target species present in the Count Area on any particular day. Ideally, all nets in the standard array are used for a set period every day, a full set of data are collected for each bird captured, and each bird is banded with a standard numbered band issued by the Canadian Bird Banding Office. However, the welfare of the birds takes priority over maintaining the complete standard protocol. For example, during periods of high volume of captures, less data could be collected to speed up the banding process and reduce stress on birds.

Captured birds are taken to the banding lab to be processed and banded. In general, all unbanded birds that are captured are banded with a standard numbered band issued by the Bird Banding Office. The minimum data recorded for every banded bird are: band number, species, age, aging method, sex, sexing method, bander, location, date, time of capture, and net number. Additional data that are routinely collected include: wing chord, weight, time weighed, fat score, skull ossification score, cloacal protuberance score, and brood patch development score. Previously banded birds are processed in the same way as unbanded birds, with the exception of birds captured and processed earlier the same day (same-day repeats): these birds are released immediately at the nets.

At Prince Edward Point, the Standard Migration Count is an estimate of the number of individuals of each species in or passing through the Count Area during the Count Period based on the data collected using the Standard Observation and Standard Capture methods described above. At this station, two methods of developing a Standard Migration Count are being used:

- **Detected Total (DT)** corresponds to how many birds of each species were *actually detected* (seen, heard, or caught) on a particular day. The Standard Detected Total (DT) for each species is the sum of total Standard Capture (mist netting) plus the total of the Standard Observations (census and incidental observations), minus a correction for any birds that have been double-counted (i.e. observed *and* captured). The DT is never more than the sum of the Standard Captures plus the Standard Observations. Only individuals that are positively identified as to species are included in the DT.
- **Estimated Total (ET)** is an estimate of how many birds of each species were *actually present* (could potentially have been seen, heard, or caught if unlimited effort) on a particular day. The ET is based on the DT and knowledge of migration patterns on a particular day.

Both the DT and ET include individuals that passed through the Count Area and individuals that remained in the Count Area. Estimating the unseen and unknown part of the migration is quite complex and relies on local experience of migration patterns and on generalization on observation and capture rates (i.e. what proportion of the flight is captured in mist nets, observed on census, or observed throughout the morning). When very low numbers of a species are detected in a day, the estimated part of the total tends also to be very low, even null. For example, if only one individual of Magnolia Warbler was detected in a given day, even though it is likely that more warblers moved through the area, it is very difficult to assign an estimated part to the total. With more birds detected in one day, the assumption is made that there were indeed more individuals passing through on that day, especially if the birds detected were mostly through capture: it seems unlikely that all birds passing through would have been captured in mist nets. Thus, when daily counts are higher, the estimated part tends to usually be higher. The estimated part of ET is quite variable between days and years.

1.3 Migration Monitoring Period

Start and end dates for the migration monitoring periods at Prince Edward Point have been slightly different among years (Table 1.1). Unless specified otherwise, a consistent period was used in order to allow between-year comparisons. Hence, the spring period is considered to be, in this report, from April 8 to May 31, and the fall period from August 15 to October 31.

Year	Spr	ring	Fall					
	Start	End	Start	End				
2001	8 April	31 May	8 August	9 November				
2002	16 April	31 May	14 August	13 November				
2003	12 April	31 May	17 August	8 November				
2004	10 April	31 May	16 August	3 November				
2005	11 April	31 May	20 August	31 October				
2006	9 April	31 May	11 August	31 October				
2007	8 April	31 May	14 August	31 October				
2008	19 April	31 May	10 August	31 October				
2009	10 April	31 May	11 August	1 November				
2010	13 April	31 May	12 August	31 October				
2011	2 April	31 May	14 August	31 October				
2012	13 April	31 May	13 August	1 November				
2013	15 April	31 May	18 August	31 October				

Table 1.1. Standard migration monitoring period at Prince Edward Point, 2001-2013



Figure 1.1. Location of Prince Edward Point (star) and percentage of water and land in a 70-km radius from it

2.0 General overview of bird migration at Prince Edward Point

2.1 Species richness and abundance

Between 2001 and 2013, a total of 273 species and two hybrids (Brewster's and Lawrence's Warblers, hybrids between Blue-winged and Golden-winged Warblers, to be considered at the level of species in further discussion) have been detected (see full species list with seasonal ET in Appendices). In total, 249 species have been observed in the spring and 252 in the fall. Species richness is relatively similar between spring (average of 177 species, range: 157 - 195) and fall (average 179 species, range 145 - 195) (Fig. 2.1).

One species, Blue-winged Warbler, has been seen every spring but never in the fall. Likewise, Brewster's Warbler has been seen in 10 springs but never in the fall. Another species, Barred Owl, has been detected during 11 fall seasons but never in spring. In total, 21 species have been seen only in spring and 26 species have been seen only in the fall. Most species that are observed in only one season, either spring or fall, have usually been detected in only one or two years (Fig. 2.3). A few species such as Cerulean Warbler or Baird's Sandpiper have been observed three years or more, even though it always has been in either spring or fall. On the other hand, 99 species (i.e. 36% of the total number of species) have been detected in every season of every year. An additional 46 species have been detected every year although not every season, making a total of 145 species (i.e. 53% of total species detected) detected every year from 2001 to 2013. In fact, most species detected in both seasons have been detected during at least 10 years in the 2001-2013 period (Fig. 2.3). At the end of spring 2001, 163 species were detected (including the Brewster's Warbler). In the fall of 2001, an additional 49 species were detected. In the following twelve years, 61 new species were added during the standard migration monitoring period, with new species almost every season although the rate declined sharply after fall 2002 (Fig. 2.1).

Based on cumulative Estimated Totals across all years, distribution of abundance is skewed towards many rare or uncommon species: 96 species (35% of all species) have a cumulative total of less than 100 individuals over the 13 years of monitoring. Among them, 20 species have been represented by only one individual and another 30 species by 10 or fewer individuals. Another 46 species (17%) are relatively uncommon (between 100 and 500 cumulative Estimated Totals). About 29% of species (78 species) can be considered quite common, with ETs between 500 and 5000, whereas 17 species (6%) can be said to be abundant, with ETs between 5000 and 10,000. Only a few species (36 species or 13% of total) are extremely abundant (over 10,000 ET), with seven species reaching cumulative ETs over 100,000. The ten most abundant species (Double-crested Cormorant, Long-tailed Duck, Greater Scaup, Blue Jay, Bonaparte's Gull, White-winged Scoter, Ring-billed Gull, Canada Goose, American Goldfinch, and Common Grackle in decreasing order) represent 80% of all the estimated totals, with the two most abundant species (Double-crested Cormorant and Long-tailed Duck) representing 62% of the overall total (Fig. 2.2). These species are highly visible, tend to migrate in big flocks, and have an active diurnal migration. Seven of the 10 most abundant species are waterbirds that stage on Lake Ontario, usually in huge numbers, near Prince Edward Point. Staging behaviour, that is, staying put for a certain period of time in order to replenish fat reserves, means that the same birds may be counted several days in a row, which greatly inflates their seasonal Estimated Totals. It is especially the case with Double-crested Cormorant, which has large flocks roosting on a small offshore island in the fall. The next ten most abundant species only represent 6.5% of all the estimated totals. They are, in decreasing order: Cedar Waxwing, European Starling, Myrtle Warbler, Mallard, American Robin, Golden-crowned Kinglet, Redwinged Blackbird, Red-breasted Merganser, Ruby-crowned Kinglet, and Cliff Swallow.

Abundance and frequency interact together and determine the likelihood of seeing a given species in a given season (Fig. 2.2). For example, extremely abundant species, based on cumulative ET that are seen (almost) every season of every year, i.e., have a high frequency, are obviously very likely to be observed any day in a given season. These species are, notably, Double-crested Cormorant, Blue Jay, Canada Goose. Likewise, rare species (detected during only one or two seasons) are seen in small numbers. However, there are exceptions, mostly for species migrating in flocks. For example, Greater White-fronted Geese were seen only once, in fall 2008, but in a group of 54 individuals. On the other hand, some frequently observed species (at least 20 seasons out of 26) are also detected in small numbers (low cumulative abundance of 101-500 individuals, for example). It means these species are rarely seen in a given season, even though they are detected almost every year. These species are generally secretive (Mourning Warbler, for example), migrating mostly outside the migration monitoring period (American Tree Sparrow), low-density species slowly expanding their range (Common Raven), or rare (Peregrine Falcon).

In spring, there is a succession of birds moving through as the season progresses: Blackbirds and American Robins are detected in huge numbers in April. At the end of April and in early May, it is the turn of Myrtle Warblers, soon followed by a host of species. Most warblers and sparrows have their migration peak in mid-May. Blue Jays move through from mid-May to early June, usually in big numbers, although with important yearly variations. In the fall, a well-defined migration is also apparent: in August and early September, most warblers are moving through, as well as Cedar Waxwing. In mid-September, there is a lull of major movement, except for Blue Jay. Migration picks up again in late September with a new array of species that have their peak in October: Golden-crowned Kinglets, Sparrows, Myrtle Warbler, and American Robin.

The rarity, both in terms of frequency (10 or fewer seasons) and abundance (cumulative ET of 100 or fewer birds) of 97 species at Prince Edward Point could be explained by an array of reasons (see Appendices for complete list of rare species)

- Rare species with limited breeding range in Ontario, which does not include Prince Edward County: Eastern Tufted Titmouse, Prairie Warbler, and Yellow-breasted Chat, for example.
- Vagrants (species from the western part of the continent): White-winged Dove, Ash-throated Flycatcher, Lark Sparrow, Lazuli Bunting, and Dickcissel
- Spring overshoot: Black Vulture, Fish Crow, White-eyed Vireo, Worm-eating Warbler, and Yellow-throated Warbler, for example
- Lack of suitable habitat at the Prince Edward Point Wildlife Area (even if suitable habitats exist nearby): most shorebirds and dabbling ducks (Gadwall, Dunlin, etc.)
- Outside the normal ranges of mostly non-migratory species: Boreal Chickadee and Pine Grosbeak.
- Nocturnal or crepuscular species (not monitored with current protocol): Black-crowned Night-Heron, Short-eared Owl, and Whip-poor-will
- Species with migration timing mostly outside the monitoring period: Rough-legged Hawk, Northern Shrike, Bohemian Waxwing, and Lapland Longspur
- Seabird species: Common Eider, Great Cormorant, Kittiwake, Sabine's Gull, Pomarine and Parasitic Jaegers

There is no clear trend in observation of rare species between spring and fall, even though slightly more observations were made in spring.

2.2 Spring vs. fall migration patterns

2.2.1 Abundance

At Prince Edward Point, more birds are detected in fall than in spring. Based on Estimated Totals (ET), 66% of all birds move through Prince Edward Point in the fall, as opposed to 34% in spring. In the fall, the monitoring period is about 30% longer and hatch-year birds increase populations, which automatically leads to a higher number of birds being detected. Proportions are similar when the two most abundant species (Double-crested Cormorant and Long-tailed Duck) are excluded: 60% of birds are detected in the fall, as opposed to 40% in spring. 226 species are observed both in spring and fall. For 33 of those species more than 90% of the ET is in the fall. For example, more than 98% of Black-capped Chickadees are detected in the fall, a consequence of the irruptive nature of the young of this species following a good breeding season. About a third of the species (i.e. 73) detected both in spring and fall reach a much greater abundance in fall than in spring (i.e., 75% of the ET is counted in the fall). Conversely, only 20 species have more than 90% of the ET in spring and 49 species in total (i.e. 22%) have more than 75% of the ET in spring.

Despite the general pattern of a greater abundance in fall than in spring, there are some marked differences between groups of species (Fig. 2.4). More than 80% of raptors, corvids, and finches are detected in the fall. Likewise, kinglets and "waterbirds" (a broad category including loons, grebes, ducks, and geese) are more abundant in fall than spring, with 76% and 70% of their ET in the fall, respectively. Among waterbirds, a study in contrast is the two most abundant species at Prince Edward Point: 92% of all the Double-crested Cormorants are seen in the fall, whereas 99% of all the Long-tailed Ducks are seen in spring! As noted earlier, the almost daily presence in fall of large flocks of cormorants greatly inflates the seasonal ETs. Thrushes (including American Robin and Eastern Bluebird) are also more abundant in the fall than spring, with 62% of individuals seen in that season. Notable exceptions are Veery and Wood Thrush, which are predominantly detected in spring (77% and 94%, respectively, of their total). On the other hand, sparrows and warblers are, as groups, slightly more abundant in spring than in fall (only 46% and 40% of their total ET are in the fall, respectively). However, there are also marked differences within a group, especially a large one like warblers. Among the 35 species of warblers, only six species have more individuals in the fall than in the spring: for example, 78% of Black-throated Blue Warblers and 85% of Blackpoll Warblers are detected in the fall. Myrtle Warbler, the most abundant species in that group, is slightly more detected in spring, with about 60% of the total. On the other hand, more than 75% of Chestnut-sided, Mourning, Blackburnian, Cape May, and Yellow Warblers are seen in spring. This seasonal difference among warblers could be due to easier detection in spring due to increased vocalizations, bright plumage, and no foliage on trees to obstruct the view.

A total of 99 species are observed every season of every year with cumulative ET over all years ranging from 172 for Orange-crowned Warbler to 3,144,036 for Double-crested Cormorant. Among them, a total of 23 species are much more abundant in fall than in spring (ET of 75% or more in the fall), whereas 12 species are detected in approximately equal numbers in spring and fall. Only 42% of species are more abundant in spring than fall, with only 14 species having their ET more than 75% in spring (Fig. 2.5).

2.2.2 Age ratio

Determining age at the time of banding provides a means to assess the ratio of age classes within a population. In spring, it was possible to distinguish second-year (SY) from after-second-year (ASY) – and, more rarely, a few other age categories such as third-year – for more than 95% of the 56,915 birds of 133

species banded at Prince Edward Point. A few species are more difficult to age in spring and have a high proportion of after-hatch-year (AHY), which is a category that, at this time of year, includes second-year (SY) and after-second-year (ASY) birds. Only 18 species have a proportion of AHY 15% or more but they represent less than 5% of the total of birds banded in spring. For example, 78% of Mourning Doves were determined to be AHY, as well as 60% of Northern Cardinals and Brown Creepers. Among the 115 species with the proportion of AHY less than 15%, an average of 80% of birds banded were determined to be SY. Among these species, 66 species have at least 50 individuals banded (i.e., 53,706 individuals or 94% of the total banded in spring) and present the following results:

- 81% are SY on average, ranging from 56% SY for Yellow-shafted Flicker and Red-winged Blackbird to 93% SY for Red-breasted Nuthatch
- About half the species (i.e., 31 species) have the proportion of SY greater than 80%
- All three species of Vireos with at least 50 individuals banded (Blue-headed, Red-eyed, and Philadelphia Vireos) have a relatively low proportion of SY, at around 67%
- An outlier in warblers, the Northern Waterthrush has a percentage of SY of only 58%. The other warbler species have much higher proportions, from 70% for Black-and-white Warbler to 89% for Canada Warbler

Age determination is usually easier in the fall, with 99% of the 75,114 birds of 140 species banded during the standard monitoring period in the fall accurately aged. On average, 84% of the birds banded were hatch-year (HY). More particularly, for the 69 species with at least 50 birds banded (which represent 98% of all birds banded in fall):

- 84% of banded birds are HY, on average, for the 69 species
- 60 species (out of 69) have a percentage of HY greater than 75% and 29 species have a percentage of HY greater than 90%
- Species with less than 75% of HY represent about 15% of birds banded in the fall. These outliers include: American Goldfinches with 42% HY; Cedar Waxwings with 49% HY; Purple Finches with 50% HY; Mourning Doves with 51% HY; House Finches with 70% HY; Blackpoll Warblers with 74% HY

HY percentage is also high at other bird observatories in southern Ontario. At Cabot Head Research Station on the Bruce Peninsula, 90% of the 17,405 birds banded in the fall from 2002 to 2012 are HY (data BPBO). At Tommy Thompson Park Bird Research Station, 86.7% of the 11,295 birds banded from 2003 to 2005 are HY (data TTPBRS). Similarly, 86.7% of the 21,676 birds banded from 2003 to 2008 at Pelee Island Bird Observatory are HY (data PIBO). The percentage of HY is more variable at Long Point Bird Observatory, from 75.0% in fall 2007 to 88.1% in fall 2010 (data LPBO). Conversely, at Rock Point (Haldimand Bird Observatory) on the Lake Erie shoreline (about 80 kilometers east of Long Point), only 74% of the 12,742 birds banded in the fall between 2007 and 2011 are HY (data courtesy of Jim Smith).

2.3 Influence of weather on migration

Weather has a fundamental influence on migration, both locally and regionally (Richardson 1990). Weather determines when and from where millions of migrants may take off, land, and remain grounded. It was long believed that huge movements of songbirds and raptors usually precede a low-pressure system in spring and follow a high-pressure system in the fall (Richardson 1990) but recent radar studies do not find support for the notion that cold fronts promote strong nocturnal migration in the fall (Gagnon et al.

2011a). In extended periods of favourable weather – for example tailwinds, warm temperatures, and lack of rain in spring – most birds take off each night and migrate northward steadily. By morning they have diffused across the landscape. It may seem at times to the observer that migration is "slow", when in fact conditions are optimal for large numbers of migrants to move through an area quickly, thus impacting actual observer encounter rate and giving the impression of decreased abundance.

Precipitation and wind both strongly influence the extent and intensity of bird migration. In a radar study of the fall migration on both shores of the St. Lawrence River estuary, it was shown that extensive rain suppressed migration, although the extent of suppression interacted with date and wind. As well, light winds (regardless of direction) or stronger winds in a favourable direction (generally from the north) were associated with the heaviest migration (Gagnon et al. 2011a). Birds select for favourable wind conditions both at departure and while aloft to save energy, and for some migrants a tail-wind is an indispensable support to cross large barriers (see a review in Liechti, 2006). Apart from precipitation, wind is the most important weather factor affecting the departure decision of migratory birds. Generally, strong head-winds weaken a bird's propensity to take off and can promote an accumulation of birds ready for take-off. In contrast, weak winds and tail-winds promote take-offs.

Wind influence can be very local or widespread. At Prince Edward Point, southeast to west winds are more favourable in spring for bird migration. In the fall, favourable winds are from southwest to north. On overcast days, the birds linger longer and are active all day. On clear weather days, the birds move off quickly, usually by mid-morning. Precipitation also strongly affects migration, whether by forcing birds to land or by keeping them grounded. On September 14, 2008, the remnants of hurricane Ike went through the Prince Edward Point area, dumping 17 mm of rain. The following day, all nets and traps were in operation and record numbers of birds, mostly warblers, were caught and detected. ETs on that day were up to 10 or 20 times higher than usual: for example, ET of 240 Blackpoll Warblers, 122 Chestnut-sided Warblers, and 148 Black-throated Blue Warblers.





Figure 2.1. Seasonal number of species and cumulative number of new species seen at Prince Edward Point, 2001-2013 (Sp.: Spring; F.:the fall)



Figure 2.2. Abundance of species in relation to occasions of sightings at Prince Edward Point, 2001-2013



Figure 2.3. Number of species observed in relation to season and number of years they have been observed at Prince Edward Point, 2001-2013. (Top: observed in only one season; bottom: observed in both seasons)



Figure 2.4. Average Estimated Totals by season of the ten most abundant species and selected groups of birds at Prince Edward Point, 2001-2013. The "raptors" category includes Turkey Vulture, Bald Eagle, Sharp-shinned Hawk, Broad-winged, Red-tailed and Red-shouldered Hawks, American Kestrel, and Merlin. The "sparrows" category includes Song Sparrow, American Tree Sparrow, Chipping Sparrow, White-crowned Sparrow, White-throated Sparrow and Slate-coloured Junco. The "warblers" category includes Bay-breasted, Blackburnian, Black-and-white, Black-throated Blue, Black-throated Green, Canada, Cape May, Magnolia, Mourning, Nashville, Orange-crowned, Palm, Pine, Tennessee, Wilson's, and Yellow Warblers, Common Yellowthroat, Northern Waterthrush, and Ovenbird. The "blackbird" category includes Common Grackle, Red-winged Blackbird, Brown-headed Cowbird, and unidentified Blackbirds.



Figure 2.5. Percentage of Estimated Total by season for the 99 species observed every season of every year at Prince Edward Point, 2001-2013 continued on next page









3.0 Banding

From 2001 to 2013, a total of 151,046 birds of 166 species have been banded, including non standard banding, using mist nets, ground traps, and other means, during the migration monitoring at Prince Edward Point. A total of 133,150 birds of 152 species have been banded during the regular, standard monitoring (including Bobolink; see Bobolink section below) (Fig. 3.1). In addition, 9,643 owls have been banded in the fall during owl banding from late September to early November (see Owl banding section below). All results, unless otherwise specified, are based on regular banding done between 2001 and 2013. On average, more birds are banded in the fall (5,773 birds \pm 1,419) than in spring (4,470 birds \pm 1,009). However, variations in captures and diversity between seasons and years are important (Fig. 3.1&3.2). In spring, a total of 58,106 birds of 133 species have been banded (low of 2,595 of 92 species in spring 2001 - high of 5,272 of 100 species in spring 2006). The vast majority of birds in spring are captured in mist nets, as opposed to ground and J-traps: on average, 74% of birds are captured in mist nets, but there are large variations between springs, from a low of 51% in 2002 to a high of 87% in 2012 (Fig. 3.3). In the fall, 132 species have been captured for a total of 75,044 banded birds (range: 3,789 of 84 species in the fall 2008 – 8,775 of 99 species in the fall 2012). In the fall, a generally higher proportion of birds than in spring are captured in mist nets: on average, 81%, but variations are as important as in spring, with a low of 57% in 2012 and a high of 97% in 2006.the fall captures in ground and J-traps were particularly high in four years, 2001, 2007, 2009, and, especially, 2012 (Fig. 3.3). Birds captured in ground and J-traps during these four years represent 71% of the overall total of birds captured in these traps from 2001 to 2013.

Of the 151 species banded, 45 species have been banded every season of every year and 23 species have been banded only once (12 species in spring and 13 in the fall). Most species, even regularly captured one s, are banded in very small numbers: 69 species have had fewer than 50 birds captured in cumulative total, i.e. 45% of all species represent only 0.5% of the banding total. In contrast, there are seven species (4.6% of total) with more than 5,000 individuals banded over the 13 years and their total accounts for 45% of the banding total (Fig. 3.4).

The 10 most common species banded in a season (which represent from 10% to 14% of the diversity) amount to 51% to 74% of the season banding total (Tables 3.1 & 3.2). In spring, the top 10 species account on average for 57% of the season total (range: 51% in 2001 – 70% in 2004), indicating that captures are relatively spread out over the range of species. On the other hand, the top 10 species in the fall account on average for 68% (range: 60% in 2007 – 74% in 2002), indicating a heavier concentration of captures in a limited number of species. The composition of the top 10 species is very variable between seasons. In spring, only two species, Magnolia Warbler and Slate-coloured Junco, are in the top 10 species in every season. A total of 21 species in spring have occurred in the top 10 in the 13 years, with 12 species occurring in five springs or fewer. In the fall, 3 species are part of the top 10 every fall: Golden-crowned and Ruby-crowned Kinglets and Brown Creeper. From 2009 when a specific banding program was put in place onward, Bobolink has been in the top 10 (see Bobolink section below). To allow comparisons with previous years when there was no Bobolink banding, an 11th species was added for the years 2009 to 2013 for analysis purposes. A total of 23 species have occurred in the top 10 in the 13the fall seasons, with 13 species occurring in six seasons or fewer. A few species are consistently present, although not necessarily at every season, in the top 10 species both in spring and the fall, a reflection of their general abundance: Golden-crowned and Ruby-crowned Kinglets, Myrtle and Magnolia Warblers, White-throated Sparrow and Slate-coloured Junco. Some species are present in the top 10 only in spring or in the fall, usually an indication of a strong seasonal difference in migration patterns. For example, Yellow Warblers and

Brown-headed Cowbirds are banded in high numbers in spring but not in the fall (where they do not appear in the top 10). In the fall, but never in spring, Blue-headed Vireos are commonly in the top 10 species.

Diversity is usually higher in spring than fall, in number of species banded and in relative proportion. Even if only a handful of species account for 50% of the banding total in both seasons, the number of birds banded in spring is more spread across the range of species. The species with the highest total in spring represents between 8% (for Myrtle Warbler in 2005) and 23% (for Blue Jay in 2004) of the season total. On the other hand, banding in the fall is more often dominated by one species, usually accounting for up to 30% of the banding total (range: 11% in 2011 - 30% in 2004 both for Golden-crowned Kinglet).

Variations in numbers captured, either in mist nets or ground and J-traps, are heavily influenced by the 3 most commonly caught species in each capture type (Fig. 3.5 & 3.6). In spring, Myrtle Warblers were captured in mist nets in highest numbers in 2007 and 2006, with 1,122 and 674 birds, respectively. It also corresponds to the highest total numbers of birds captured in mist nets (5,339 birds in 2007 and 4,342 birds in 2006). In spring, Blue Jay, Brown-headed Cowbird, and American Goldfinch are the 3 most commonly captured species in ground and J-traps. Blue Jays and Brown-headed Cowbirds were captured in highest numbers in spring 2002, with 793 Jays and 800 Cowbirds. Brown-headed Cowbirds were never captured in such high numbers in any other spring (range: 64 birds in 2012 - 402 birds in 2004). On the other hand, Blue Jays were captured in high numbers in a few other springs: 535 birds in spring 2008 and 638 birds in spring 2004. However, some springs, very few Blue Jays were captured, with only 50 birds in 2012 or 90 birds in 2001. In the fall, the 3 most abundant species captured in mist nets are Goldencrowned and Ruby-crowned Kinglet and Black-capped Chickadee. The latter species is captured in high numbers only during invasive years, most notably in fall 2005, but also in 2001 and 2010. Both species of Kinglet are consistently captured in high numbers in mist nets in the fall, accounting for an average of 32% of the season total (range: 23% in 2001 and 2011 – 51% in 2004). In the fall, American Goldfinch is the species most captured in ground and J-traps by far in most years. American Goldfinches represent up to 81% of birds captured in these traps and are responsible for the 3 highest totals (fall seasons of 2007, 2009, and 2012). The two other most abundant species captured in ground and J-traps are Blue Jay and Slate-coloured Junco, although their numbers are usually less than American Goldfinches.

Captures, both in mist nets and ground and J-traps, are highly variable between weeks, although they tend to follow a general pattern. In spring, captures in mist nets tend to peak, on average, in mid-May (Fig. 3.7). The period from May six to 26 is usually when captures are at the highest, although variations between years can be very important. For example, average capture numbers in the week of May six – 12 are 573 birds (\pm 352) but the lowest weekly total was only 143 birds in 2001 while the highest weekly total was tenfold more, with 1,422 birds in 2007. Weekly captures in spring in ground and J-traps are even more variable between years and do not seem to follow a distinctive pattern. Captures tend to be slightly higher, on average, in late April and in mid-May. In the fall, average weekly captures in mist nets are usually quite low from mid-August to mid-September, then increase greatly to peak in mid-October, and finally decrease sharply in the last week of October (Fig. 3.8). As in spring, there are important variations between years: the average weekly total in the week of October four – 10 is 813 birds (\pm 259), with the lowest total for that week of October 18 – 24 in 2005, when 1,263 birds were captured in mist nets, 80% of which were the irruptive Black-capped Chickadees. Fall weekly captures in ground and J-traps are divided between high years (2001, 2007, 2009, and 2012) and low years (all the other years), as the

average total in high years is about fivefold the average total in low years (Fig. 3.8). In high years (which correspond with irruptions of America Goldfinch), the highest weekly totals occur from early to late September. The highest weekly total happened in the fall 2012, in the week of September 20 - 26, when 1,000 birds were captured in ground and J-traps, 90% of them American Goldfinches and 96% of all birds captured in ground traps. In low years, captures stay very low until late September. Capture numbers increase in October but still stay, on average, below 100 birds weekly. The highest weekly totals were 194 birds in October 11 - 17, 2005.

In spring and fall, some bird species are almost exclusively captured in ground and J-traps. Blue Jays, for example, are captured in ground and J-traps at 95% in the spring and 69% in the fall. Finches, as a group, are extremely attracted to the baited ground traps: American Goldfinches, for example, are captured in them at 92% and 98% of the spring and fall totals. Pine Siskins, likewise, are captured in ground traps at 94% and 99% of the spring and fall totals. Blackbirds are also overwhelmingly captured in ground and Jtraps: 97% of Brown-headed Cowbirds and 94% of Common Grackles in spring. Mourning Dove is another species captured in these traps, mostly in the J-trap. Only a couple of species of sparrows, Whitecrowned and Chipping Sparrows are also captured mostly in ground and J-traps (at 80% both in spring and fall for White-crowned Sparrow and 85% in spring and 87% in fall for Chipping Sparrow). On the other hand, many more species are captured almost uniquely in mist nets, especially the insectivorous species like kinglets and warblers. Seed-eater species like sparrows, nuthatches, and Rose-breasted Grosbeak, are captured both in mist nets and ground traps in various proportions. For example, about 30% in spring and 41% in fall of Slate-coloured Juncos are captured in ground and J-traps. Likewise, 41% in spring and 28% in fall of Song Sparrows are captured in these traps. About half of the 737 Rose-breasted Grosbeaks captured in spring are in ground and J-traps, whereas only one bird out of 107 in the fall was captured in these traps.



Figure 3.1. Number of banded birds captured in standard banding by season and year at Prince Edward Point, 2002 – 2013



Figure 3.2. Number of species captured in standard banding by season and year at Prince Edward Point, 2002 - 2013



Figure 3.3. Spring (top) and fall (bottom) numbers of birds banded by type of capture at Prince Edward Point, 2001-2013



Figure 3.4. Cumulative banding totals in relation to season of banding at Prince Edward Point, 2001-2013

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total	Frequency
Myrtle Warbler	180		229	299	318		1122	501	611	217	765	382	474	5098	11
Magnolia Warbler	311	161	169	156	297	674	301	345	216	264	342	219	153	3608	13
Blue Jay	98	811	216	698	215	233	236	557			196	152	183	3595	11
Ruby-crowned Kinglet	132	302	165	376	287	276	480	357	316	263		371	208	3533	11
Brown-headed Cowbird	168	801	344	185	214	202	299	191	248	286	193		173	3304	12
White-throated Sparrow	105	168	259	240	269	293	283	239	214	176		372	423	3222	12
Slate-coloured Junco	70	246	146	145	208	183	342	149	254	113	381	170	196	2603	13
Golden-crowned Kinglet	100	295		118	122	381	183		305	326		482		2312	9
Yellow Warbler	83	128			107	179	204	271	194	120				1354	9
White-crowned Sparrow				263				168		109	195	149	147	1031	6
Purple Finch		146						299			233		150	828	4
American Goldfinch			202	111			207		209					729	4
Nashville Warbler						137					199		89	425	3
Brown Creeper			100		101						184			385	3
Cedar Waxwing									263					263	1
Hermit Thrush										105		144		249	2
Chipping Sparrow	81		110											191	2
Common Yellowthroat											173			173	1
Song Sparrow		174												174	1
Rose-breasted Grosbeak						171								171	1
Swainson's Thrush												116		116	1
Total top 10	1328	3232	1958	2108	2138	2729	3657	3077	2830	1979	2861	2557	2196	32650	
Season Banding Total	2595	5024	3447	2990	4017	5272	6437	5115	5070	3614	5238	4273	3823	56915	
% Top 10	51%	64%	57%	71%	53%	52%	57%	60%	56%	55%	55%	60%	57%	57%	

Table 3.1. The 10 most abundant banded species in spring by year at Prince Edward Point, 2001 – 2013

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total	Frequency
Golden-crowned Kinglet	691	1000	716	1682	668	787	420	429	744	1132	510	715	1363	10857	13
Ruby-crowned Kinglet	339	550	612	827	809	1216	477	399	858	351	388	442	760	8028	13
American Goldfinch	361	320	520	273			1212		1865	210		2579		7340	8
Black-capped Chickadee	770				1491		216			731		322		3530	5
Brown Creeper	235	191	242	198	235	271	189	169	199	239	231	246	255	2900	13
Myrtle Warbler		363	141		600	363			164		180	363	82	2256	8
Hermit Thrush	269	251	193			179		165	313	173	154	222	224	2143	10
Slate-coloured Junco		122	166	276	349	179		149	163	210	241		275	2130	10
Magnolia Warbler		146		174	259	297	166	250	173	197	315		135	2112	10
Blue Jay	576		250				242	301	167			218		1754	6
Bobolink									389	415	246	311	199	1560	5
Black-throated Blue Warbler	212			155		226	166	252			209		125	1345	7
White-throated Sparrow		83	121	146		188	159			178			156	1031	7
Blue-headed Vireo		83		134	230			112	179				96	834	6
Purple Finch							345					350		695	2
Swainson's Thrush	219				231							216		666	3
Blackpoll Warbler								149			308			457	2
Pine Siskin	341													341	1
Red-eyed Vireo						161				166				327	2
Nashville Warbler					176									176	1
Gray-cheeked Thrush				163										163	1
American Redstart											154			154	1
White-crowned Sparrow			140											140	1
Total top 10	4013	3109	2961	4028	5048	3867	3592	2375	5214	4002	2936	5984	3670	50939	
Season Banding Total	6227	4210	4279	5525	7318	5937	5944	3789	7198	6158	4723	8792	5014	75114	
% Top 10	64%	74%	69%	73%	69%	65%	60%	63%	72%	65%	62%	68%	73%	68%	

Table 3.2. The 10 most abundant banded species in the fall by year at Prince Edward Point, 2001 – 2013


Figure 3.5. Spring numbers of birds, with the 3 most commonly caught species, captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013



Figure 3.6. Fall numbers of birds, with the 3 most commonly caught species, captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013



Figure 3.7. Spring weekly numbers of birds captured in Mist Nets (top) and Ground and J-traps (bottom) at Prince Edward Point, 2001-2013



Fig. 3.8. Fall weekly numbers of birds captured in Mist Nets (top) and Ground and J-traps (bottom; high years are: 2001, 2007, 2009, & 2012; low years: all the other years) at Prince Edward Point, 2001-2013

3.1 Bobolink

The Bobolink (*Dolichonyx oryzivorus*) is a grassland specialist bird, both in its summer and winter haunts. It is widely distributed across a wide belt from the Maritimes and New England to the northern Great Plains and into southern British Columbia and the northern intermountain west. In Ontario, its range is mostly restricted to the southwest part of the province, with scattered pockets in the southern Shield region (Cadman et al., 2007). The Bobolink breeds in hayfields and other grasslands, typically those with relatively tall vegetation, as nests are usually situated at the base of large forbs (Martin and Gavin, 1995). Bobolinks have a very long migration of about 10,000 kilometers that brings them to Argentina, where they winter in the pampas.

This species has been in decline over much of its range in North America and was designated threatened in Canada by COSEWIC in 2010. Since this species is typically not monitored through the regular migration program at Prince Edward Point, it was decided in 2008 to start a specific decoy program in the fall, using Bobolink call broadcasts and an array of nets set in an area of low shrubs and grasses at Prince Edward Point.

In the spring, Bobolinks are detected at Prince Edward Point yearly but usually in small numbers without any strong temporal patterns. There is no specific decoy program running in the spring because, most of the time, only a few individuals are detected, very often through flight calls without actually seeing the birds. Occasionally in spring a small group of nine to 30 birds is seen, which influences greatly the seasonal total. Spring ETs vary from one and six Bobolinks in 2013 and 2012, respectively (although small flocks were seen outside the standard monitoring period, in the afternoon) to 102 and 114 birds in 2004 and 2001, respectively. The first Bobolinks were detected on May 2, in 2001, 2008, and 2012, with the last on June 8, 2002. Despite large variations between days and years in number detected, it appears that Bobolinks migrate mostly during May, with a potential peak in the middle of the month. Only 18 Bobolinks were banded in the spring in the 2001-2013 period, 16 of them during non-standard banding. Of the 18 birds banded, 16 were males.

In the fall, there was no program specifically targeted at Bobolinks from 2001 to 2007: only 15 Bobolinks were detected during this period, with a maximum of six birds in fall 2003, and none was banded. Starting in 2008 and onward, broadcast calls were played to attract migrating Bobolinks toward an array of nets set up in a semi-open shrubby habitat. Dates of operation were slightly different between years but covered roughly from mid-August to early September (see Table 3.3). A total of 1843 Bobolinks have been banded, from a low of 185 in 2008 to a high of 415 in 2010. Calls indubitably attract migrating birds, even though not all of them get caught in the mist nets: from 2008 to 2013, the overall ET is 4445 birds, almost 3 times the total of banded birds (Fig. 3.9). In 2013, the broadcast system was not operating, due to a technical problem, from August 18 to September 5. During this period, despite nets being open, no Bobolinks were caught, showing how effective broadcast decoy calls are. In fact, flocks of Bobolinks were sometimes observed flying high but, suddenly, turning around and dropping down towards the nets when the broadcast calls were playing. Nonetheless, the effectiveness of broadcast calls has not been thoroughly tested at Prince Edward Point. It is likely to vary depending on strength and direction of wind: anecdotally, it was noted that broadcast calls could be heard or not about 500 meters south of the set-up in relation to wind conditions. It is possibly one reason why daily captures of Bobolinks are quite variable within and between seasons. Some falls (as in 2010 and 2012), the highest numbers of Bobolinks are banded and detected in late August, whereas in other years (as in 2011 and 2013), their highest numbers are in early September (Fig. 3.9). Among banded birds, the overall proportion of HY is 89%, with minor

variations between years (range: 79% in 2009 - 96% in 2013). Sex-ratio is greatly skewed towards males, with, on average, a third more HY males captured than HY females and 2.5 times more AHY males than AHY females (although the sample size of AHY is smaller). There are some variations between years but HY females predominated only in 2009, with slightly more females than males banded that year. It is possible that male Bobolinks react more to the broadcast call than females, but more research is needed.

	Monitoring dates		Hatch-Year			A	fter-Hatch	Ago rotio	Total	
	Start	End	Male	Female	Sex-ratio	Male	Female	Sex-ratio	Age-ratio	TOtal
2008	14 Aug	7 Sep	91	70	1.3	7	9	0.8	91%	185
2009	11 Aug	5 Sep	158	165	0.9	68	18	3.8	79%	413
2010	12 Aug	3 Sep	208	165	1.3	23	9	2.6	92%	415
2011	14 Aug	8 Sep	169	110	1.5	29	8	3.6	88%	317
2012	13 Aug	2 Sep	183	105	1.7	16	10	1.6	92%	314
2013	18 Aug	4 Sep	123	67	1.8	3	4	0.7	96%	199
Total	n/a		932	682	1.4	146	58	2.5	89%	1843

 Table 3.3. Bobolink fall migration monitoring at Prince Edward Point, 2008-2013

N.B.: Birds of unknown sex are not included in the table, except in the season totals.







Figure 3.9. Fall ET and banding total of Bobolink by year at Prince Edward Point (2001-2013). NB: The y-axis is at a different scale between years. No broadcast calls were played from August 23 to 31 in 2013.



Figure 3.10. Fall ET and banding total of Bobolink by year at Prince Edward Point (2001-2013). NB: The y-axis is at a different scale between years. No broadcast calls were played from August 23 to 31 in 2013.

3.2 Owl banding

Owl banding was done every fall from 2001 to 2013, from September 18 (a few days earlier in some years) to the end of October (continuing a few days in November in some years). Standard owl banding starts 30 minutes after sunset and lasts for four hours, using Northern Saw-whet Owl call broadcasts and an array of 10 owl nets set amidst the regular mist nets. Some nights, owl banding can continue throughout the night as non-standard banding. Although Northern Saw-whet Owls are the targeted species, a total of 127 birds of four other species of owls were captured during the 13 years, most commonly Barred Owl and Eastern Screech Owl (Table 3.4).

From 2001 to 2013, a total of 9516 Northern Saw-whet Owls were banded, 4,494 birds during standard banding and 5,022 birds during non-standard banding (Fig. 3.10; Note that no non-standard banding was done in 2013). There are important yearly variations in numbers captured during standard banding (comparisons between years for non-standard banding are impaired by variations in coverage of non-standard banding). An average of 346 Northern Saw-whet Owls per week (\pm 134) is banded every fall, but numbers vary from a low of 187 owls in 2001 to a high of 605 in 2007. Numbers of Northern Saw-whet Owls tend to closely track changes in small mammal abundance. Captures of Northern Saw-whet Owls tend to peak between 9:00pm to 11:00pm (Fig. 3.11), although important yearly variations occur. Very few owls are captured in mid- to late September, but numbers increase rapidly in early October to peak mostly in the second and third week of October, either for standard or non-standard banding (Fig. 3.12). As usual, there are strong yearly differences. For example, for the week of October six – 12 during standard banding, no owls were banded in 2005, whereas 299 owls were banded in 2010, the highest weekly total ever.

Despite important differences between falls, the overwhelming majority of owls captured are either Hatch-Year (HY) or Second-Year (SY) birds, ranging from 65% to 94% of all age classes. (Comparisons between years use only captures from standard banding; Fig.3.13). However, yearly variations are extremely wide. For example, there are hardly any HY birds in some falls (9% in 2013; 13% in 2008), whereas HY birds dominate the captures in other years (67% in 2012; 72% in 2007). Most of the time, SY birds account for 20% to 40% of all captures, except in a few years when they reach higher proportions (51% in 2004; 68% in 2013; 70% in 2008). In the four years with the highest number of owls banded during standard banding, the proportion of HY was high (between 65 to 72%), with the notable exception of fall 2004, when only 31% of birds captured were HY.

Sex-ratio is strongly skewed toward females: about six times more female owls are captured than male owls, possibly a consequence of females being more attracted to the audio lure (of a male call) than males. The average sex-ratio (number of males divided by number of females) is 0.18, but ranges to a low of 0.03 in 2006 to a high of 0.31 in 2012. Even in the fall of 2012, there were 3 times more females than males among owls of known sex. (It is not possible to assign a gender to 25% of birds on average.)

Numbers of owls captured (either during standard or non-standard banding) do not seem to reflect the moon cycle, notably during full or new moons. In some years, captures were very low during new or full moons, whereas they were high in other years. For example, in 2010, during standard banding, 54 Northern Saw-whet Owls were captured on the night of the new moon (on October 7), with high numbers in the following nights as well. In 2005, 65 owls (the highest daily standard banding total of the season) were captured during the full moon (on October 17). Light levels from the moon, which are also affected by cloud cover, potentially influence owl migration. A bright full moon might help navigating but also

enhances predation risks. A number of intertwined factors certainly affect owl migration: time of year and night, wind, rain, cloud cover, moon cycle.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Barred Owl	2	4	7	5	9		18		4	3	2	23	1	78
Eastern Screech Owl	3		3	2	1	4	6	3	4	3		2	1	32
Great Horned Owl		1												1
Long-eared Owl	4		4			1	4		1		1	1		16

Table 3.4. Owls banded during Northern Saw-whet Owl banding at Prince Edward Point, 2001-2013



Figure 3.11. Number of Northern Saw-whet Owls captured in standard and non standard banding by year at Prince Edward Point, 2002 – 2013



Figure 3.12. Hourly number of Northern Saw-whet Owls captured in standard (before midnight) and non standard (after midnight) banding at Prince Edward Point, 2002 – 2013



Figure 3.13. Fall weekly numbers of Northern Saw-whet Owls captured during standard (top) and non standard (bottom) banding at Prince Edward Point, 2001-2013



Figure 3.14. Numbers of Northern Saw-whet Owls by age classes captured during standard (top) and non standard (bottom) banding at Prince Edward Point, 2001-2013

4.0 Recoveries of banded birds

Between 2001 and 2013, well over 150,000 birds were captured during the day at Prince Edward Point Bird Observatory (including all recaptures, even multiple within-season recaptures of the same individuals). Among them, only 23 birds of 11 species already had a band on their leg attached somewhere else in the Americas, a so-called "foreign recovery". Also, of the 149,845 birds that were first banded at Prince Edward Point during the 13 years (including non-standard banding), only 131 individuals of 32 species were ever recaptured or recovered elsewhere in North America (summarized in Table 4.1), which represents a 0.08% recovery rate (which is slightly higher than the rate <0.01% in North America for small passerines (Hobson, 2003). The diversity of recovered birds is high, representing a broad spectrum of migration strategy: "non-migratory" species like Black-capped Chickadee; short-distance migrants like Blue Jay and Hermit Thrush; long-distance neotropical migrants like Black-and-white Warbler and Rose-breasted Grosbeak; irruptive and invasive species like Pine Siskin.

Owls banded at Prince Edward Point, on the other hand, have been recovered at a much higher rate: 274 Northern Saw-whet Owls were recovered throughout North America, which represents 2.88% of the total Saw-whets banded. Out of a total of 77 Barred Owls banded from 2001 to 2013, one individual was recovered (a recovery rate of 1.30%). One Eastern Screech Owl was also recovered from 32 birds banded (a recovery rate of 3.23%). During owl banding, 35 Northern Saw-whet Owls of "foreign" origin were recovered.

Despite the extremely low recapture rates for diurnal birds, each one of these recaptures helps bring a better picture of connectivity, survival, and migration strategies. The vast majority of recoveries were within the Great Lakes area, because of the concentration of bird observatories and the short distances involved. Of the birds banded elsewhere and recaptured at Prince Edward Point, only six were banded outside the Great Lakes area. A greater proportion of the birds banded at Prince Edward Point and recaptured elsewhere was recaptured outside the Great Lakes area. Some birds were recaptured within the same migration, providing a unique glimpse of distance travelled, areas used, and timeframe. Others were recaptured many years after their initial banding, having survived many seasons of migration.

4.1 Owls

4.1.1 Owls banded at PEPtBO and recaptured elsewhere

High numbers of Northern Saw-whet Owls were banded at Prince Edward Point, with a total of 9,516 birds captured in the fall and six in the spring from 2001 to 2013. Very few owls of other species were banded (see Owl banding section 3.2). Nonetheless, one Barred Owl was recaptured 100 kilometers north of Prince Edward Point and 3 years after banding. One Eastern Screech Owl was also recovered, but much closer to the location of original banding: this bird was banded on September 20, 2010 and recaptured only 40 days later, on November 9, and 25 kilometers to the west. A total of 274 Northern Saw-whet Owls banded at Prince Edward Point were recaptured, with 37% of them recaptured less than a month after banding and another 10% recaptured between one and two months after banding (Figs. 4.1 and 4.4). Another 25% of recaptured owls were recaptured after one to two years, usually the following fall after banding, as almost all recaptures of owls happen in the fall, when owl monitoring stations usually operate (Fig. 4.5). The longest time between banding and recapture was seven years and 21 days for an owl recaptured in central Massachusetts. This owl was banded as a hatch-year, which means it was seven years and a few months old at recapture. The longest known lifespan for this species, in the wild according

to banding record, is nine years and five months (see http://www.pwrc.usgs.gov/bbl/longevity/Longevity_main.cfm).

A majority of owls (63% of the total) was recaptured within 500 kilometers of PEPtBO, with only four birds recaptured under a 100 kilometers radius. Another 33% were recaptured between 500 and 1000 kilometers (Fig. 4.6). Many of the recaptures are concentrated in the northeast of the USA, which is also where many of the owl monitoring stations are located (Fig. 4.7). Only seven Northern Saw-whet Owls (2%) were recaptured more than 1000 kilometers away, all of them west of the Great Lakes. They were all recaptured the following fall migration of their banding, except for the bird recaptured in North Dakota which was recaptured 3 years later. Two owls were recaptured at Thunder Cape, about 1000 kilometers from PEPtBO on the northern shore of Lake Superior (with one banded on October 20, 2006 and recaptured on October 11, 2007 and the other banded on October 5, 2008 and recaptured on October 1, 2009); two were recaptured in Wisconsin about 1000 kilometers away as well, with one banded on October 4, 2008 and recaptured on October 16, 2009 and the other banded on October 9, 2010 and recaptured on October 11, 2011; two were recaptured in Minnesota, 1200 and 1300 kilometers away, with one banded on November 6, 2001 and recaptured on October 16, 2002 and the other banded on October 6, 2007 and recaptured on September 27, 2008; finally, the furthest recapture was in western North Dakota, 1980 kilometers to the west of PEPtBO. Along with these "western" owls, four other owls were recaptured in the western Great Lakes: 3 were recaptured at Whitefish Point on Lake Superior (675 kilometers from PEPtBO) and one just north of the Strait of Mackinac which separates Lakes Michigan and Huron, 630 kilometers from PEPtBO. One of these owls, banded on September 29, 2007, was recaptured the following spring migration, on April 3, 2008 at Whitefish Point, possibly flying up through Michigan, well west of Prince Edward Point. Anecdotal as these few recaptures seem, they give an indication of important potential variations of general migratory pathways for the same individual during its lifetime.

There were 15 owls recaptured 10 days or less after their initial banding, offering a glimpse into direction and speed of travel. The shortest time was for an owl recaptured only one day after its banding and 115 kilometers west of PEPtBO on the northern shore of Lake Ontario. This owl was banded at 10:40 pm at PEPtBO. Unfortunately, its time of recapture is not known. Another owl was recaptured two days after banding, in the Hudson River valley near Albany in New York State, 260 kilometers from PEPtBO in a southeast direction. Another bird recaptured 3 days later in Pennsylvania travelled 382 kilometers almost due south from PEPtBO. A rough and minimum estimate of speed is distance travelled divided by number of days between banding and recapture (which would assume that birds fly every night). The fastest birds are thus the latter two owls, with around 130 kilometers per night. The slowest bird would be an owl banded on October 23, 2003 and recaptured nine days later and 113 kilometers away on the northern shore of Lake Ontario on November 1, 2003, for an estimated speed of only 12.5 kilometers a night. On average, for the 15 owls recaptured within 10 days, they travelled about 60 kilometers per night. In this group, the longest distance travelled was for an owl recaptured near Richmond in Virginia, 720 kilometers and nine days after banding, an average of 80 kilometers a night. Individual conditions most likely influence travel speed: two owls were banded on the same night on October 4, 2007 and were both recaptured six days later. One was recaptured "only" 120 kilometers away, on the northern shore of Lake Ontario, whereas the other one was recaptured about 400 kilometers away in Pennsylvania, almost due south of PEPtBO.

The southernmost recaptured Northern Saw-whet Owl was on the coast of Virginia near Norfolk, at 36.9°N of latitude and about 830 kilometers from Prince Edward Point (which sits at 43.9°N). This owl

was banded on October 14, 2007 and recaptured on November 23, 2007. It is possible that it stayed there all winter on a wind-swept, pine-lined beach dune, a very different habitat than its summer boreal forest. A total of 74 owls were recaptured south of the Mason-Dixon line (that is, south of Pennsylvania, or 39°43'N), mostly in November. Only seven of them were recaptured in October, with the earliest date being October 19 (in 2009) for a bird recaptured in Maryland, 530 kilometers to the south and 13 days after banding at PEPtBO. Among the 74 owls recaptured south of the Mason-Dixon line, 36 were recaptured within the same fall migration and, on average, 30 days after initial banding. The shortest time between banding and recapture was nine days, for an owl banded on October 22, 2001 and recaptured on October 31, 2001 in Virginia, 720 kilometers to the south. The longest time was 62 days for an owl recaptured in southwest Ohio on December 15, 2002 about 760 kilometers away from PEPtBO.

A total of only 40 owls (including the Barred Owl) were recaptured north of PEPtBO, with 21 Northern Saw-whet Owls (7% of total) recaptured north of 45°N. The scarcity of recaptures could be explained in part by the rarity of owl monitoring stations at these latitudes. Among these "northern" owls, five owls were recaptured in September, the only one s ever captured at this time of year, indicating an earlier migration than farther south. Not surprisingly, almost all the owls recaptured north of PEPtBO were recaptured in a subsequent migration, usually the following fall, but up to 3 years later for five individuals. Interestingly, 3 Northern Saw-whet Owls were recaptured north of PEPtBO just a few days after banding, but only a short distance away: one along the shore of Lake Ontario and the other two near Peterborough, Ontario about 120 kilometers away. Prince Edward County protrudes into Lake Ontario, with Prince Edward Point extending quite far south into the lake. If owls do not cross Lake Ontario, it means they have to fly north for a while before resuming a southerly direction during fall migration. The northernmost recapture was in Québec, near Lake Abitibi, at 48.36°N and 545 kilometers from PEPtBO.

Only five Northern Saw-whet Owls were recaptured during the following spring migration after banding. As previously mentioned, one owl was recaptured on the Upper Peninsula of Michigan. Another owl, banded on October 10, 2012, was recaptured on March 16, 2013 in Ontario, only 100 kilometers to the west of Prince Edward Point. An owl banded on October 13, 2010 was still in central Pennsylvania on March 19, 2011, 360 kilometers from PEPtBO. A Northern Saw-whet Owl banded on October 9, 2007 was recaptured near Quebec City on April 15, 2008. In contrast, an owl banded on October 30, 2010 as an HY was still in western Pennsylvania on May 28, 2011. It is the latest date in spring for a recapture and may indicate that this owl would not migrate further north. There is a breeding population of Northern Saw-whet Owls in most of Pennsylvania. An additional seven Owls were recaptured in the spring, although at least one year after banding, with five of them in March and only one individual in April and May each. Recaptures in March were in Michigan (one bird was also recaptured in November; see Multiple recaptures below), in New York (3 birds), and in Pennsylvania (1 bird). Owls recaptured later (on April 21 and May 11) were in Ontario, west of or near Toronto. At this time of year, Northern Saw-whet Owls are already actively engaged in breeding.

The easternmost recapture was in Maine, at 69.75°W longitude and 540 kilometers almost due east of PEPtBO. This owl was banded on October 16, 2010 and recaptured the following fall, on October 7, 2011. Given the time and location of the recapture, it seems unlikely that this owl migrated through Prince Edward Point in the fall of 2011. As with recaptures far to the west, it is a small but telling indication of strong variations in migratory paths for some individuals. However, migration route fidelity appears to be high in the general population of owls (Beckett and Proudfoot, 2011). Several recaptures were well east of PEPtBO, that is, east of 74°W: a total of 29 owls were recaptured south of PEPtBO and east of 74°W,

with 13 of them recaptured during the same fall migration (in, for example, Massachusetts or New Hampshire). The within-season recaptures indicate that some Northern Saw-whet Owls migrate in a southeasterly direction, most likely skirting Lake Ontario on its east end. For example, two owls were recaptured in Rhode Island during the same fall migration as banding, the easternmost locations for within-season recaptures. Both of them were recaptured 14 days after banding and about 500 kilometers away from PEPtBO, but in different years, with one relatively early in the season (banded on October 7, 2011) and the second one later (banded on October 27, 2007). Another owl was recaptured on the extreme northeast point of New Jersey, 470 kilometers away and 25 days after banding, indicating that this owl most likely navigated through the metropolitan area of New York City, the biggest urban area of eastern North America!

On the other hand, there were 10 within-season recaptures along the northern shores of Lakes Ontario and Erie, which points to some birds following a southwest direction in migration.

Multiple recaptures

A total of 15 Northern Saw-whet Owls were recaptured twice and one bird was recaptured three times (Fig. 4.2). The bird recaptured three times was first banded on October 20, 2005 but not recaptured until four years later when it was caught in the Appalachian Mountains of northern Virginia on November 6, 2009. A year later, on October 12, 2010, it was recaptured at Long Point on the northern shores of Lake Erie. Its third recapture was also at Long Point 28 days later, on November 1.

Out of the 15 owls with multiple recaptures, four of them had their first and second recaptures during the same migration (with two in the year of the initial banding), offering a tantalizing glimpse of their migratory behaviour. One owl, banded on October 30, 2010, was first recaptured 15 days later, on November 15, at the north end of the Chesapeake Bay in Maryland, and then recaptured a second time at the exact same location and only 3 days later. (Because the second recapture was at the same location as the first, this bird is not represented in the figure of multiple recaptures). Another owl (band #0924-50950), banded on October 5, 2008, was first recaptured on October 17, 2008 in the southern end of the Catskill Mountains of New York. Then it was recaptured again only 14 days later, on November 1, just north of Harrisburg in eastern Pennsylvania. The general direction of migration for this bird was first southeast, from Prince Edward Point to New York, but then shifted to southwest when it flew into Pennsylvania. The owl #0924-50468 was first recaptured two years after banding, on October 26, 2009 in Maryland at the north end of Chesapeake Bay, and then was recaptured again about a month later, on November 22, in the Shenandoah area of Virginia. The last bird, #0924-50882, was recaptured twice at the same location at the very end of Lake Erie in Michigan, but first during the spring migration, on March 19, 2010, and second, during its fall migration, on November 1, 2010, showing a strong fidelity of its migratory pathway. (Note on the map Fig. 4.2: It was necessary to slightly shift coordinates to make recaptures at same locations visible.).

All the other owls were recaptured during different years between the first and second recaptures, all of them in the fall, except for one bird. This bird, #0924-15137, had its second recapture in Virginia on March 5, 2008, whereas the first recapture was further north in central Pennsylvania during the fall migration, on October 12, 2004, only 3 days after being banded at PEPtBO. One bird, #1333-19550, was recaptured both times in Virginia, possibly in its wintering grounds, on November 9, 2007 and December 19, 2008 (with initial banding on November 3, 2001). The owl #1014-46975 was recaptured on both sides of Lake Ontario. The first recapture was on the southern shore of Lake Ontario near Rochester, on

November 4, 2012, 13 days after banding at PEPtBO. The second recapture was on the northern shore of Lake Ontario, near Toronto, on November 2, 2013.

For all birds, the northernmost recapture is always at an earlier date than the southernmost recapture. For example, the owl #1014-08077 was recaptured in western Massachusetts on October 25, 2011 at about 42.3°N. Its second recapture was in Pennsylvania on November 5, 2012 at about 40.7°N. Despite potential yearly differences in migration timing, it is possible that birds captured in the fall in the New England states and New York State are just passing through to reach wintering grounds further south. The longest distances between the recaptures are for two birds recaptured first in Québec. The bird #1014-08817 was first recaptured at Tadoussac, where the Saguenay River empties into the St. Lawrence River, at the early date of September 14, 2011. It was recaptured a second time in northern Virginia, on November 7, 2012, a distance of about 2000 kilometers from the Quebec recapture location. The bird #0924-33287 was first recaptured in northwest Québec on October 8, 2007 after being banded on October 21, 2006. It was then recaptured again in central Wisconsin on October 20, 2008, southwest of its first recapture location.

4.1.2 Owls banded elsewhere and recaptured at PEPtBO

A total of 36 Northern Saw-whet Owls were recaptured at PEPtBO. They were banded at 23 different locations across North American, from Minnesota to Maine (Fig. 4.3). All but one were initially banded in the fall. The owl banded on June 9, 2006, possibly in its breeding grounds in northwest Québec, was recaptured the following fall on October 21, 2007 at PEPtBO about 450 kilometers away. Like owls banded at PEPtBO and recaptured somewhere else, the majority of owls (55%) recaptured at PEPtBO were banded between 100 and 500 kilometers away, with 33% more banded from 500 to 1000 kilometers away (Fig. 4.5). Only 3 owls were banded more than 1000 kilometers away. They were actually banded (in two different falls) at the same location, on the western end of Lake Superior near Duluth in Minnesota, 1170 kilometers away. Nine owls (25% of the total) were recaptured within a month of their initial banding, whereas 19 owls (53%) were recaptured the following fall and only five and 3 were recaptured two and 3 years after banding, respectively (Fig. 4.4).

For the nine owls recaptured at PEPtBO during the same fall migration, all their banding locations were north of PEPtBO except for one. Two owls recaptured at PEPtBO in the fall of 2002 were banded at the same latitude but 113 kilometers to the west on the Lake Ontario shoreline, four and nine days before. It is noteworthy that the following fall, an exchange occurred as well between the two locations, but in the other direction, from east to west. It is possible that owls follow the shoreline of the lake indifferently to the east or west, instead of trying to cross Lake Ontario. The shortest time was for an owl recaptured only one day after its banding but only 23 kilometers north of PEPtBO. Another owl was recaptured 3 days after being banded on October 25, 2007, near Peterborough (Ontario) about 120 kilometers away. This owl followed a mostly southeasterly direction to reach PEPtBO, as opposed to the owl banded near Ottawa (Ontario), which must have followed a southwest direction to be recaptured at PEPtBO 22 days and about 200 kilometers after banding on October 6, 2004. The last four owls recaptured during the same fall migration were all banded at the same location in northern Ontario, near the border of Quebec, 430 kilometers northwest of PEPtBO. They were all recaptured between 21 and 27 days after initial banding, with 3 of them banded in the same fall, in September 2007 (on September 16, 20, and 30).

The banding locations of 13 owls recaptured at PEPtBO were south of Prince Edward Point, from Virginia to Maryland and in the extreme southwest of Ontario. As expected, all the recaptures were done on

subsequent falls and, usually, at an earlier date in the fall than the original capture, indicating the temporal progression of migration on the north-south axis.

As with owls banded at PEPtBO and recaptured elsewhere, there is a broad range of longitude in the banding locations, as far west as Wisconsin and Minnesota to eastern locations like Vermont and coastal Maine. It shows again the flexibility – at least for some individuals – in the migratory pathways taken between years.

Timing of banding loosely correlates with latitude, with captures in the early fall, notably September for four owls, for northern locations, whereas captures are in late October to early November for locations like Virginia and Maryland. There are two exceptions, with an owl banded on November 11, 2001, in Michigan just south of Detroit and another owl banded on December 11, 2001, just across the Detroit River in Ontario, a possible indication of wintering birds in the warmest and least snowy corner of Ontario.

4.2 Other species

4.2.1 Birds banded at PEPtBO and recaptured elsewhere

Of the birds banded at PEPtBO, only 131 birds of 32 species were ever recaptured somewhere else, divided between three species of waterbirds, one species of raptor, and 28 species of passerines (Table 4.1). Only four species have more than 10 individuals recaptured: Blue Jay, Brown-headed Cowbird, American Goldfinch, and Sharp-shinned Hawk (in decreasing order). For 11 species, only one bird was ever recaptured. Most recaptures happened in the spring and fall (72% of all recaptures), which are also seasons when most bird observatories and banding stations operate (Fig. 4.10). Very few recaptures are in summer (less than 5%) but 18% of recaptures are in winter (defined as the months of January, February, and March). Almost 20% of all recaptures occurred during the first two months after banding, but the vast majority (58%) of recaptures happened three years or more after banding. The longest time between banding and recapture was for a Blue Jay, which was recaptured in the western part of New York State five years, 11 months, and three days after its initial banding. The shortest time between banding and recapture was for an American Goldfinch, banded on April 12, 2012 and recaptured the next day, 78 kilometers almost due east in New York State as well, not far from the eastern shore of Lake Ontario.

Distances between banding and recapture are quite variable among groups and species, ranging from as low as a 50 kilometers radius (for 17% of recaptures) to more than 2000 kilometers (for only 2% of birds) (Fig. 4.12). About a third of birds were recaptured within 100 to 500 kilometers, for an overall average of 468 kilometers (±542). The shortest distance was less than three kilometers (for one Brown-headed Cowbird and a Rose-breasted Grosbeak, recaptured during non-standard banding done near PEPtBO). The longest distance was 2344 kilometers for a Black-and-white Warbler, recaptured near Austin in Texas during the spring migration on May 4, 2005. It was almost a year after its initial banding on May 17, 2004. Given its western and inland location at recapture, it is possible that this Black-and-white Warbler migrated over Mexico instead of crossing the Gulf of Mexico like many of its species. The second and third longest distances were also for birds recaptured in Texas: one Brown-headed Cowbird, recaptured in winter on February 12, 2005, 2048 kilometers and two years, eight months, and 25 days after its banding at PEPtBO; one American Goldfinch, also recaptured in the winter of 2005 and in Texas, on January 7, 2,056 kilometers and one year, two months, and 29 days after its banding at PEPtBO. In contrast to these

long-distance recaptures, most birds are recaptured within the Great Lakes area, most certainly because of the concentration of bird observatories there and the short distances – and often time – involved.

A total of 18 Blue Jays banded at PEPtBO have been recaptured, a higher number than any other species. Only a few of them were recaptured outside the Great Lakes area, with one in southern Indiana and one in Tennessee, south of Nashville. Likewise, most of the 16 Brown-headed Cowbirds banded at PEPtBO and ever recaptured were also in the Great Lakes area. Of the 13 American Goldfinches recaptured, 8 of them were less than 200 kilometers away from PEPtBO, with three birds recaptured less than 25 kilometers away. However, one was recaptured about 500 kilometers away, near Point Pelee (Ontario), another one 740 kilometers away in Virginia, and two were recaptured in the panhandle of Florida, about 1700 kilometers away. As mentioned previously, one was also recaptured in Texas, over 2000 kilometers away from Prince Edward Point. Like the other species with more than 10 individuals recovered, there is a wide range of distance and direction in the recapture locations of Sharp-shinned Hawks: from 55 kilometers northeast of PEPtBO (recaptured in winter) to almost 2000 kilometers due south, in Florida. A high proportion of Sharp-shinned Hawks (61%, more than any other species) were recaptured less than two months after the initial banding. The shortest time between banding and recapture for this species is only eight days, for two birds. One was banded on September 29, 2003 and recaptured on October 7, 2003, about 350 kilometers to the southwest near Long Point on the shore of Lake Ontario. The other one was banded on October 6, 2004 and recaptured on October 14, 2004, but 619 kilometers away in Delaware on an almost due south course. However, since soaring birds like Sharp-shinned Hawks are extremely reluctant to cross large bodies of water, it is possible that this bird went around the eastern end of Lake Ontario before resuming a more southerly course. Another within-season recapture was a Sharp-shinned Hawk banded in early fall on September 8, 2011 and recaptured on the coast of North Carolina, 1080 kilometers and 54 days later, on November 1, 2011. In total, three Sharp-shinned Hawks were recaptured during the same fall in a southwest direction from PEPtBO (two near Long Point, and one in Michigan just south of Detroit), whereas five were recaptured in a more southerly direction (three in Pennsylvania, one in Delaware, and one in North Carolina). Among species with several individuals recaptured, the Black-capped Chickadee has the lowest average distance, 143 kilometers (± 58 ; range: 89 - 224). The two chickadees recaptured during the same fall had travelled only 89 kilometers (in 48 days) and 190 kilometers (in 23 days).

About 19% of the recovered birds (i.e. 24 birds out of 127) were recaptured within the same migration season, which provides some information on general directions of migration and speed. After the American Goldfinch (mentioned above), recaptured one day after its banding the shortest time between banding and recapture is seven days for a Chipping Sparrow banded on May 26, 2003 and recaptured on June 2, interestingly enough, on the south shore of Lake Ontario, near Rochester, New York (about 100 kilometers away). Only one Blue Jay (out of 18 recovered) was recaptured within the same migration season; it was banded on September 30, 2003 and recaptured 714 kilometers away on October 13 of the same year in northern Indiana. Three Brown-headed Cowbirds were recaptured within the same season but, unlike the Blue Jay, very close to the banding station. One bird, banded on April 19, 2002, was recaptured on June 2, 2002, only 23 kilometers from PEPtBO. Another one, banded on May 12, 2004, was recaptured 22 days and 78 kilometers away, close to Lake Ontario in New York State. The third was banded on April 11, 2006 and recaptured 19 days later, on October 27, north of Toronto, about 235 kilometers away from PEPtBO. More interestingly, a Hermit Thrush was banded at PEPtBO on October 18, 2001 and recaptured 25 days later, on November 12, but in North Carolina, 1080 kilometers away,

which represents a minimum daily distance of 43 kilometers. Another Hermit Thrush was also recaptured in North Carolina, very close to the other location. That bird was banded on October 21, 2002 and recaptured in fall 2002, although the exact date is not known. A Slate-coloured Junco banded on October 22, 2009 was recaptured 13 days later, on November 4, 2009 and 555 kilometers away in Maryland.

Very few birds were recovered in summer. A Gray Catbird banded on May 18, 2005 was recaptured on July 2 of the same year, about 140 kilometers northeast of Prince Edward Point. A Swainson's Thrush was banded on May 19, 2005 and, like the Gray Catbird banded a day before it, also recaptured the same summer, on July 3, but further away, near Quebec City, a distance of about 535 kilometers. A Northern Cardinal banded in the fall was recaptured only 20 kilometers away the following summer. A Purple Finch banded on April 20, 2008 was recaptured on July 21, 2009, 275 kilometers away in Quebec (north of Ottawa).

All but one of the eight Pine Siskins recovered were banded in the fall of 2012, which was a fall of a massive irruption for this species. They were recovered from New Jersey and Delaware, about a month and 580 kilometers away (two birds), to North Carolina (two birds) and Georgia (three birds), 1000 kilometers and more away. The more southerly recovered birds were recaptured the following winter and spring, from February 13, 2013 (for a bird in North Carolina) to as late as May 5, 2013 (for a bird still in Georgia, 1280 kilometers away from PEPtBO and far from its northern breeding grounds).

Of the 225 young Double-crested Cormorants banded in July 2002 on a small island near Prince Edward Point, six were subsequently recovered, with four of them within the same year. The shortest distance was 64 kilometers for the Cormorant recaptured in August 2002 on the other side of Lake Ontario. The other ones recovered the same year were recaptured much further away in the southern states, with one in Alabama, 1340 kilometers away (in December 2002), one in the panhandle of Florida, 1780 kilometers away (in October 2002), and one in Arkansas, 1630 kilometers away (in November 2002).

Mourning Doves are mostly resident in their extensive range, but they are migratory in their northern fringe. At PEPtBO, there is likely a mix of residents and migrants. Indeed, two Doves banded in the spring at PEPtBO were recaptured in late fall – early winter far to the south, one in Virginia more than 700 kilometers away in the same year, the other one in South Carolina, 1100 kilometers away in the following winter.

4.2.2 Birds banded elsewhere and recaptured at PEPtBO

From 2003 to 2013, only 16 birds of eight species were recaptured at PEPtBO, divided between three species of waterbirds and five species of songbirds (Fig. 4.9). Only one individual of each songbird species was recaptured, except for American Goldfinch, with two birds. Most recaptures of songbirds occurred from three to 12 months after initial banding (Fig. 4.13). The shortest time between banding and recapture was for a Black-capped Chickadee, banded on October 11, 2001 about 22 kilometers from PEPtBO and recaptured 11 days later. The longest time between banding and recapture was for an American Goldfinch, which was banded on November 1, 2007 in southwest Pennsylvania, about 500 kilometers from PEPtBO, and was recaptured almost two years later, on September 11, 2009. Most songbirds were banded in a 500 kilometers radius from PEPtBO. A Black-throated Blue Warbler was banded during spring migration on May 1, 2001 in the foothills of the Blue Ridge Mountains in Virginia, 577 kilometers from Prince Edward Point where it was recaptured the following fall migration on September 28, 2001. The longest distance was for a Rose-breasted Grosbeak, which was banded on April 16, 2004 in a dry forest in Colombia on the Caribbean Sea shore, 3700 kilometers from PEPtBO and

recaptured on May 10, 2007. The second-longest distance was for a Myrtle Warbler banded on November 29, 2001, in Florida, 1800 kilometers away. Given the location and timing of banding, it is possible that the Myrtle Warbler was in its wintering location. It was recaptured the following fall migration on October 3, 2002 at PEPtBO.

In total, two Double-crested Cormorants, four Mallards, and five Canada Geese were recaptured at PEPtBO. The Cormorants were banded only 30 kilometers from Prince Edward Point, on islands in Lake Ontario. Mallards recaptured at PEPtBO came from diverse locations: close by in New York State near the eastern end of Lake Ontario; in northern Ontario, 600 kilometers away; along the St. Lawrence River in Quebec; in Wisconsin, near Lake Michigan, 830 kilometers almost due west from PEPtBO.

Table 4.1. Species other than owls banded at Prince Edward Point and recovered elsewhere: Distance between banding and recapture locations and time between banding and recapture

Group	Species banded at PEPtBO			Distance	(km)		Time between banding and recapture (in days)			
Group	and recaptured elsewhere	n	Average	StDev	Min.	Max.	Average	StDev	Min.	Max.
Waterbirds	Canada Goose	4	48	53	19	128	1254	752	115	1946
	Double-crested Cormorant	6	1197	611	64	1789	216	250	31	656
	Wood Duck	1	1024				148			
	All species	11	764	715	19	1789				
Raptors	Sharp-shinned Hawk	13	501	522	54	1987	119	135	8	442
Songbirds	American Goldfinch	13	571	749	23	2057	443	438	1	1407
	American Robin	3	5	0	5	5	867	547	390	1464
	Black-and-white Warbler	2	1360	1392	375	2345	722	523	352	1092
	Black-capped Chickadee	7	143	58	89	224	200	168	23	537
	Blue Jay	18	326	357	20	1245	674	660	13	2164
	Cedar Waxwing	1	460				367			
	Chipping Sparrow	1	101				7			
	European Starling	1	1351				234			
	Golden-crowned Kinglet	2	297	88	235	360	197	252	19	375
	Gray Catbird	3	65	67	13	140	225	165	45	369
	Hermit Thrush	3	777	531	164	1088	32	10	25	39
	House Finch	2	208	38	181	235	223	209	75	371
	Magnolia Warbler	2	15	3	13	17	0			
	Mourning Dove	3	619	550	23	1107	282	265	71	580
	Myrtle Warbler	2	158	216	5	310	485	133	391	579
	Northern Cardinal	1	20				288			
	Ovenbird	1	306				1125			
	Pine Siskin	8	921	331	487	1280	117	60	31	187
	Purple Finch	1	274				457			
	Rose-breasted Grosbeak	2	22	27	3	41	862	858	255	1469
	Slate-coloured Junco	2	558	1	557	559	203	269	13	393
	Song Sparrow	1	199							
	Swainson's Thrush	1	535				45			
	White-throated Sparrow	1	41				113			
	Yellow Warbler	2	423	159	310	535	320	50	284	355
	All species	83	427	510	3	2345				
Blackbirds	Brown-headed Cowbird	14	535	640	3	2048	503	474	22	1816
	Common Grackle	4	245	292	23	662	1006	573	518	1786
	Red-winged Blackbird	1	198				385			
	All species	19	456	573	3	2048				
All species		126	468	542	3	2345				



Figure 4.1. Locations of owls banded at Prince Edward Point and recovered elsewhere, 2001-2013



Figure 4.2. Locations of Northern Saw-whet Owls banded at Prince Edward Point and recovered elsewhere multiple times, 2001-2013



Figure 4.3. Locations of Northern Saw-whet Owls banded elsewhere and recovered at Prince Edward Point, 2001-2013



Figure 4.4. Time between banding and recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)



Figure 4.5. Season of recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)



Figure 4.6. Distance between banding and recapture for owls banded at PEPtBO and recaptured elsewhere and for owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)



Figure 4.7. Location of Northern Saw-whet Owl monitoring stations across North America, as inventoried by Project Owlnet (www.projectowlnet.org)



Figure 4.8. Locations of species other than owls banded at Prince Edward Point and recovered elsewhere, 2001-2013



Figure 4.9. Locations of species other than owls banded and recovered at Prince Edward Point, 2001-2013 elsewhere







Figure 4.11. Time between banding and recapture for species other than owls banded at PEPtBO and recaptured elsewhere (data 2001-2013)







Figure 4.13. Time between banding and recapture for species other than owls banded elsewhere and recaptured at PEPtBO (data 2001-2013)

5.0 Catchment areas of migrant birds passing through Prince Edward Point

When observing or catching a bird at a migration monitoring station, there is much information that can be gathered in addition to species, including its age and sex, its general condition (if its plumage is intact or not, bright or dull, moulting, etc.), and its behaviour. If the bird is in hand, a series of morphometric measurements are taken as well.

However, a question that has been vexing generations of bird banders is: where does the bird go and come from for its wintering and breeding seasons? In spring, for example, we wonder if this particular Yellow Warbler might stop just a few kilometers west of Prince Edward Point or continue all the way to Alaska (the extreme northwest expanse of its range)? General winter and breeding ranges, as well as broad migration routes, are well known. But a more precise spatial linkage between sites used throughout the annual cycle is definitively needed both for theoretical and conservation issues. To better achieve PEPtBO goals, establishing spatial linkages between migratory stopover sites and breeding or wintering origins is especially important: it will help in interpreting population trends from migration monitoring data (Dunn et al. 2006). Thus, establishing methods to better link migrants to their breeding origins could enhance our ability to track the population dynamics of migratory species.

Traditionally, ornithologists have attempted to link breeding, wintering, and stopover sites using markrecapture approaches such as bird banding. These attempts have been hampered by very low recapture rates (i.e., often <0.01% in North America for small passerines (Hobson 2003), and difficulties in establishing unbiased cohorts of marked individuals (Hobson et al., 2009). Recently, new, sophisticated techniques have been developed to answer this most vexing but important question. These techniques are statistically and technically complicated but their principles are relatively simple. At the base, they use stable isotopes of selected elements. For example, hydrogen has three naturally occurring stable isotopes, deuterium being one of them. The ratio of stable-hydrogen isotopes in rainfall in North America and elsewhere varies with latitude and altitude (e.g., Bowen et al., 2005). This composition is ultimately reflected in the food web, and, hence, in bird feathers. Bird feathers, being metabolically inert tissues, contain the hydrogen isotopic composition of the diet in the ecosystem where they were formed. Thus, the choice of which feathers to collect will give information on the areas where these feathers grew. In most passerines, wing and tail feathers are replaced during the summer (Pyle, 1997). By collecting these feathers, information from the summer range can be inferred. It has to be kept in mind that a feather collected in spring carries the geochemical signature of the previous summer. Thus, it might not reflect where the bird is heading to for the summer in that particular spring, especially if there is low site fidelity (in this species and/or age/sex class - see below for discussion). A feather collected in fall reflects actual summer locations in the same year.

By collecting bird feathers from birds on migration and analysing their stable isotope composition it is thus now possible to assign them to a broad latitudinal range because of known geographical predictable patterns in stable isotope compositions of rainfall. However, the known patterns are restricted mostly to latitudes; therefore, other data is needed to refine longitudinal resolution. Without getting into complex details (see Hobson and Van Wilgenburg, 2014), a likelihood approach is favoured and refined by using band recoveries. Band recoveries, despite their scarcity, yield information on migration direction/flyway and can be used to "limit" assigned origins based on stable isotope analysis. Combining all this information produces maps of "catchment areas" or most likely geographical origins of migratory birds passing through the CMMN stations.

At Prince Edward Point, we collected tail feathers from a diverse array of selected species in 2007. We collected only one rectrice (one of the long tail feathers) from each individual and were extremely careful about whom to "pluck" from. If the bird seemed in less favourable condition (e.g., low weight, frayed or discoloured plumage, etc.), no feathers were collected from this bird.

The geochemical signature of these feathers provides a map of the most likely summer range for five species captured in both spring (summer range of previous year) and fall (same year), for a total of eight species (Figs. 5.1 to 5.5). (Maps courtesy of Hobson and Van Wilgenburg, 2014). Unfortunately, because the feathers were pooled together, it is not possible to assign one specific individual passing through Prince Edward Point to one specific area. It appears that, for these species, their summer haunts are mostly contained in Quebec and Labrador (with marked species-specific differences on how far north) and sometimes extending into the Maritimes and the northeastern United States.

Variations in geochemical origins appear between the sampled species, mostly reflecting the species breeding range, with higher densities in origin most likely reflecting higher breeding densities, but sometimes revealing localized sources of origin. For example, Northern Waterthrushes captured in spring appear to have spent the previous summer mostly in northern Quebec and Labrador, with very few birds from more southerly latitudes in the Maritimes and New England. Origins reflect the breeding range of this species, with highest density in the northernmost extension of the boreal forest in Quebec (Fig. 5.5). The Northern Waterthrush breeds in wet mixed and deciduous woodlands, usually with dense cover near ground level and presence of water. Likewise, Lincoln's Sparrows were found to originate mostly from a broad latitudinal band in northern Quebec and Labrador between 50° and 58°N, extending into Newfoundland (Fig. 5.5). This species breeds in sub-boreal, boreal, and sub-arctic regions, preferring peatland and shrub wetland habitats. The catchment area for this species at Prince Edward Point is then most of its breeding range from Quebec all the way to Newfoundland. On the other hand, more Wilson's Warblers originate from southeast Quebec, northern Maine, and New Brunswick than from other parts of its breeding range, reflecting a more localized source of origin for this species (Fig. 5.2).

Origins of a few species (Magnolia and Palm Warblers) have been determined from birds captured both in spring and fall. Ranges for both groups are relatively similar, indicating a consistent summer breeding ground for birds moving through Prince Edward Point (at least for the two species sampled; (Figs. 5.3 & 5.4). Of particular interest, Palm Warblers sampled have their origin in the breeding range of the subspecies *hypochrysea* (or Yellow Palm Warbler). However, among banded birds, it is mostly the more western subspecies, *palmarum* (or Western Palm Warbler) that is captured (457 *palmarum* were banded against only 27 *hypochrysea* from 2001 to 2013).

Most birds come from a breeding range north to northeast of Prince Edward Point Bird Observatory. Nonetheless, almost all species have a few birds originating in Newfoundland, indicating that some birds migrate along a strong east-west axis. A few other species, like Swainson's Thrush and Wilson's Warbler, also have individuals originating in the Maritimes and New England, almost due east of Prince Edward Point.

For birds with breeding ranges in northeast Quebec and Labrador, a direct south flight migration in fall means that birds would encounter the St. Lawrence gulf and estuary. The St. Lawrence estuary is the biggest estuary in the world, making it a major barrier to bird migrants. Radar studies along the St. Lawrence gulf and estuary have shown that a vast majority of birds migrating in the fall follow southwest and west-southwest directions for strong and medium migration, mostly avoiding crossing the estuary

(Gagnon et al. 2011a and b). Tracing orthodrome routes (a "great circle" or "orthodrome route" is the shortest path connecting two points on the surface of a sphere. (Gudmundsson and Alerstam 1998)) from the Côte-Nord along the mean flight direction during strong migration suggests that birds may fly along the St. Lawrence before following the western slope of the Appalachian ridge to the Gulf of Mexico. For these birds, crossing the estuary may represent an unwanted detour, with the St. Lawrence acting as a leading line along the intended route (Gagnon et al. 2011a), leading birds to encounter the Great Lakes during their fall migration. It is possible that some of these birds, experiencing the Great Lakes region during their fall migratory flight, have a tendency to fly back in spring through familiar terrain.

No birds collected in southeast Ontario and southwest Quebec come from the northwest, that is, Ontario. Bird Observatories further west along the Great Lakes (Long Point, Pelee Island, Bruce Peninsula Bird Observatories) capture birds with summer ranges coming from northwest to northeast, encompassing most of Ontario and Quebec (see, as an example, the catchment areas of Ruby-crowned Kinglet and Myrtle Warbler in Fig. 5.6).


Figure 5.1. Catchment areas of Swainson's Thrush captured in spring (left; sample size n=21) and of Hermit Thrush captured in the fall (right; n=13) at Prince Edward Point Bird Observatory (red dot)



Figure 5.2. Catchment areas of Traill's Flycatcher captured in fall (left; n=12) and of Wilson's Warbler captured in spring (right; n=14) at Prince Edward Point Bird Observatory (red dot)



Figure 5.3. Catchment areas of Magnolia Warbler captured in spring (left; n=16) and in the fall (right; n=12) at Prince Edward Point Bird Observatory (red dot)



Figure 5.4. Catchment areas of Palm Warbler captured in spring (left; n=16) and inthe fall (right; n=4) at Prince Edward Point Bird Observatory (red dot)



Figure 5.5. Catchment areas of Northern Waterthrush captured in spring (left; n=11) and of Lincoln's Sparrow in the fall (right; n=3) at Prince Edward Point Bird Observatory (red dot)



Figure 5.6. Catchment areas of Ruby-crowned Kinglets captured in spring (left) and of Myrtle Warblers captured in spring (right) in Bird Observatories other than PEPtBO (red dots) around the Great Lakes

6.0 Priority Species for migration monitoring at Prince Edward Point

Priority Species are bird species for which migration counts are potentially the best means to gather data for long-term population trend analysis. These include raptors, which are often too sparsely distributed and secretive to be well sampled by the Breeding Bird Survey (BBS), neotropical migrants which breed in the boreal forest and winter in neotropical regions, escaping coverage both by BBS and Christmas Bird Counts, and migrants that breed in arctic and boreal z one s and winter in the US. In total, this represents more than 150 North American landbird species. In Canada, the breeding ranges of about 80 landbird species (for example, Swainson's Thrush and Wilson's Warbler) are largely north of the road network and are much less accessible. Because these northern breeding birds migrate through southern Canada and the United States in spring and fall, where people, birders, and migration monitoring stations are concentrated, surveying birds during migration is a logical focus for monitoring their populations. Moreover, migration monitoring is particularly important for neotropical species that are not monitored on their wintering grounds, unlike temperate species which are monitored by programs such as Christmas Bird Count and Project FeederWatch.

Species that are considered a high priority for migration monitoring by the CMMN (Francis and Dobbyn 1997), and are being monitored at Prince Edward Point in spring and fall, are divided into four categories (see box) according to the amount of their breeding range covered by the BBS and of their wintering range in U.S. and Canada.

Priority A. Species with <50% of North American (Canada & U.S. only) breeding range covered by BBS, and <60% of their winter range in U.S. and Canada.

Priority B. Species with <50% of North American (Canada & U.S. only) breeding range covered by BBS, but 60% of winter range in U.S. and Canada

Priority C. Species with <60% of their Canadian and Alaskan breeding range (but 50% of North American range) covered by BBS, and <60% of their winter range in U.S. and Canada.

Priority D. Species with <60% of their Canadian and Alaskan breeding range (but >50% of North American range) covered by BBS, but >60% of their winter range in U.S. and Canada.

For a species to be analysed as a Priority Species, some conditions need to be fulfilled:

- Migration counts: Estimated Totals are used for calculating trends
- Seasonal migration windows: if a clear peak in migration is apparent within the average seasonal coverage at a station, the species is included in the analysis. If a peak in migration is not apparent, this suggests that the migration counts are confounded by the presence of local breeding (or wintering) residents or that part of the migration is not monitored (early or late migrants, e.g., Brown Creeper in spring)
- Species selection: population trend analyses are restricted to migrants detected at a minimum rate of 10 individuals and five observation days per migratory season (spring or fall). Even with sufficient sample sizes, some species are excluded from analysis because of the presence of local breeding populations or local roosts (especially swallows and blackbirds)

At Prince Edward Point, 25 species generally meet the conditions and are analyzed. Species are presented with a short introduction including information on their breeding and wintering grounds, with their preferred summer habitat. Their migration phenology at Prince Edward Point is then described in some detail (along with figures) with their associated detected and banded numbers. If relevant, the population trend is also briefly discussed. Population trends are produced by Bird Studies Canada on behalf of the Canadian Migration Monitoring Network. Trends were calculated using the years from 1995 to 2011 in spring and from 2001 to 2011 in fall. According to CMMN guidelines, trend estimates should be interpreted with caution for a variety of reasons, which could be species-specific, habitat-related, or observer-related. Trends based on fewer than 15 years of data can be heavily influenced by a few high/low data points that occur at the start and end points (the "tails") of the overall sampling period. In fact, trends for now are deemed usable only for fairly common passerines (J. McCracken, BSC, *pers. com.*).

There are seven species in the Priority A group, five in the Priority B group, 11 in the Priority C group, and two in the Priority D group.

Priority A species: Yellow-bellied Flycatcher; Gray-cheeked Thrush; Swainson's Thrush; Magnolia Warbler; Blackpoll Warbler; Northern Waterthrush; Wilson's Warbler.

Priority B species: Ruby-crowned Kinglet; Yellow-rumped Warbler; Western Palm Warbler; Whitecrowned Sparrow; Slate-coloured Junco.

Priority C species: Least Flycatcher; Blue-headed Vireo; Philadelphia Vireo; Red-eyed Vireo; Nashville Warbler; Chestnut-sided Warbler; Black-throated Green Warbler; Black-and-white Warbler; Ovenbird; Canada Warbler; White-throated Sparrow.

Priority D species: Brown Creeper; Hermit Thrush.

6.1 Priority A

6.1.1 Yellow-bellied Flycatcher

The Yellow-bellied Flycatcher breeds mostly in moist and mossy coniferous forests and wooded peat lands of the boreal regions of North America. It winters from Mexico to Panama (Gross and Lowther, 2001). Its period of residence on the breeding grounds is very short with a spring migration at Prince Edward Point peaking in a short window at the end of May and early June and a fall migration already well under way when monitoring beings in mid-August (Fig. 6.1). As a consequence, numbers detected and banded are quite small (banding average of 27 birds in spring and 32 in fall) and not conducive to accurate trend analysis.

6.1.2 Gray-cheeked Thrush

Among the *Catharus* thrushes, the Gray-cheeked Thrush is the northernmost breeding species in North America, breeding from Newfoundland to Alaska and even in northeastern Siberia. It is a long-distance migrant, wintering in northern South America, east of the Andes (Lowther et al., 2001). In Ontario, it breeds only in the extreme north, close to the Hudson Bay shoreline (Cadman et al., 2007).

At Prince Edward Point, this species is scarcely detected in spring but is more abundant in fall (on average, four times more than in spring). Most of the birds are detected through banding. It is a late migrant in spring with the first birds arriving after mid-May (earliest on May 13, 2009) and increasing rapidly at the end of May and early June. In fall, migration shows a very clear peak centered in the second half of September in a narrow period of about two weeks (Fig. 6.2).

Second-year birds are predominant in spring but at a lower proportion than that of most other species, representing 68% of captured birds of known age. In fall, 90% of birds banded are Hatch Year (HY) birds.

Between 2001 and 2011, there is no significant positive trend either in spring or fall (as analyzed by BSC). In spring 2007, a very high number of Gray-cheeked Thrushes were detected and banded: at 67, the banding total in 2007 was three to four times higher than the other years (ranging from two in 2001 to 38 in 2006). In fall, numbers of banded and detected birds are much higher than in spring, with an average banding total of 87 birds and an average ET of 163 (banding range: 37 in 2008 – 163 in 2004; ET range: 64 in 2009 - 330 in 2005).

6.1.3 Swainson's Thrush

The Swainson's Thrush breeds in the northern mixed forest and the boreal forests across Canada and winters in northern South America (Evans Mack and Yong, 2000). It does not breed in Prince Edward County, although it does -- at low density -- relatively close by in the southeast end of the Southern Shield region (Cadman et al., 2007). The species is very secretive during migration and is difficult to study for either stage of its life history (Evans Mack and Yong, 2000).

Spring migration of Swainson's Thrush at Prince Edward Point starts around mid-May, with the earliest birds appearing in early May (earliest record is May 3, 2012). Numbers build up rapidly towards a peak at the end of May. Migration still continues in early June, with decreasing numbers (Fig. 6.3). A significant part of the Swainson's Thrush migration is thus not covered in years when monitoring stops on May 31. Numbers detected are extremely variable, with a low ET of 26 in spring 2001 to a high of 274 in spring 2007, for an average of 152 birds. Likewise banding numbers range from 22 birds in 2001 to 152 in 2007, with an average of 79 birds.

The fall migration of Swainson's Thrush is fully covered during the fall monitoring period at PEPtBO. Only a few birds are detected in mid-August, with numbers slowly increasing in early September to reach a peak in mid- to late September. The relatively broad peak in the general phenology indicates an annual variation in the timing of the migration peak. In fall 2001, for example, the migration peak was quite early, with a seasonal ET high of 100 birds on September 11. In 2005, highest numbers were seen just after mid-September, whereas in 2009, 2012, and 2013, the migration peak was later, centred on September 24. Numbers of Swainson's Thrush decline quite rapidly in early October, this species becoming quite rare after October 10 (the latest record on October 24) (Fig. 6.3). Over the years studied, there is a fourfold difference in ET, with the lowest 76 in 2003 and the highest 430 in 2001 (an average of 210). Differences in banding are even larger: a low of 38 birds banded in 2003; a high of 231 in 2005 (an average of 115). The highest one -day banding total happened on September 11, 2001, when 66 birds were banded, which is higher than the seasonal total of four fall seasons (2002, 2003, 2004, and 2013) and very close to two other seasonal totals (71 birds banded in the fall of 2011 and 81 in 2008).

The population trend, from 1995 to 2011, (produced by BSC) for Swainson's Thrush in the spring is statistically significant, with an increase of 9.2% per year. However, spring migration is not fully covered by the monitoring period, which makes interpretation of trends difficult. The fall trend does not show significant population differences. This species is an abundant breeder in Ontario's northern forests and has shown a significant increase of 5% in the probability of observation in the Northern Shield region in the 20 years between the two Breeding Bird Atlases (Cadman et al., 2007). Nonetheless, population declines have been noted elsewhere, such as in Alaska and in the Northeastern US (Evans Mack and Yong 2000). The Swainson's Thrush is by far the most numerous of the spotted thrushes in North America. In Ontario, the population was estimated at eight million birds using data collected by the 2001-2005 Ontario Breeding Bird Atlas, of which six million live in the Northern Shield area (Cadman et al., 2007).

6.1.4 Magnolia Warbler

The brightly coloured Magnolia Warbler breeds in boreal and mixed forests across Canada and in the northeast of the USA and winters in Central America and the Greater Antilles (Hall, 1994).

Spring migration through Prince Edward Point is well concentrated in the second half of May. The first Magnolia Warblers are detected in early May (although the very first record is on April 17, 2012), but numbers are very small up to mid-May. Magnolia Warblers then move through the area en masse during a two-week period. Fewer and fewer birds migrate afterwards in June, with the last Magnolia Warbler detected on June 8 in 2002 and 2003 (Fig. 6.4). As in most species, males (with no marked difference between Second Year (SY) and After Second Year (ASY) birds) migrate about ten days earlier than females (especially SY) (Fig. 6.5). In spring, ASY males are captured almost three times more than ASY females and SY males are captured slightly more than SY females (precisely 1.45 times more). Second-year birds are dominant in the spring, representing 86% of captured birds of known age.

Magnolia Warblers are a little less common in the fall than spring (both banded and detected). Birds move during a one month period, from mid-August to the end of September, with a marked peak in mid-September. Numbers of Magnolia Warbler decline steadily afterwards, with the last ones in early October (latest record on October 23, 2001) (Fig. 6.4). Most birds (91%) captured in the fall are hatch year, and therefore, gender is very difficult to determine.

Between 1995 and 2011, there was a barely statistically significant positive population trend in the spring (as analyzed by BCS). However, at PEPtBO, numbers are fairly variable between springs, with highs of

about 1,000 ET in 2006 and 2011 and lows of 263 ET in 2002 and 328 ET in 2013.the fall trends are not statistically significant.

6.1.5 Blackpoll Warbler

The Blackpoll Warbler breeds across boreal and subarctic North America north of about 51°N, with a few more southerly locations. The species has the most northerly breeding distribution of any warbler in the province, breeding from the limit of trees south through the Hudson Bay Lowlands to northern parts of the Northern Shield region (Cadman et al. 2007).

The Blackpoll Warbler is a late migrant in spring, with the first birds arriving at Prince Edward Point in the second week of May (the earliest on April 30, 2010). Migration peaks in the second half of May, with numbers dropping quickly afterwards. The bulk of birds move through the area in a 10-day period (Fig. 6.6). Not enough birds were captured to provide meaningful gender phenology. Numbers detected and banded are quite small in spring, with usually fewer than a hundred birds seen during the whole period. Only in 2009, 2011, and 2012 were ETs over 100 birds. The average ET is 67 birds, with a low of 14 in 2006 and a high of 211 in 2012. Banding totals are quite small as well, with a spring average of 11 birds. Only two Blackpoll Warblers were banded in 2005, the lowest total. In spring 2007 and 2012, 22 and 21 birds were banded, respectively. In the fall, migration is more protracted, covering most of September. The first birds are seen at the end of August (the earliest on August 14, 2002), with numbers increasing sharply in early September and staying at a plateau for most of the month. Numbers declined very sharply at the end of September (Fig. 6.6). The last individual was detected on October 29, 2005. Numbers of Blackpoll Warblers are much higher in the fall than spring, with an average ET of 353 birds (range: 109 in 2003 to 954 in 2011) and an average banding total of 116 (range: 39 in 2003 to 308 in 2011).

In the spring and fall, there is a statistically significant positive population trend, with a higher rate in the fall than in spring. However, numbers detected in the spring are quite small.

6.1.6 Northern Waterthrush

The Northern Waterthrush is a common summer resident through much of Canada north to the tree line, absent only in western British Columbia and the southern Prairie Provinces. It winters in the West Indies, Mexico, Central America, and South America. The preferred breeding habitat in Ontario is wet mixed and deciduous woodlands, including flooded forests and swamps, lake edges and riverbanks, and wooded ravines (Eaton 1995).

Spring migration at Prince Edward Point is quite extended, from late April to early June. The first Northern Waterthrushes are noted in late April (the earliest record on April 19, 2008) and numbers build up slowly in early May. The peak occurs in the third week of May. Numbers decline quite rapidly afterwards but there are still Northern Waterthrushes moving through in early June at Prince Edward Point (Fig. 6.7). Numbers are small overall, with an average ET of only 39 birds (range: 16 in 2001 to 98 in 2012) and an average banding total of 21 birds (range: 10 in 2003 to 44 in 2012).the fall migration is already under way in mid-August when regular monitoring begins. With numbers detected being low, there is no apparent peak in migration: birds move through Prince Edward Point regularly until mid-September (Fig. 6.7). Afterwards, very few Northern Waterthrushes are detected, especially in October (only five birds seen in that month, with the latest record on October 15, 2001). As in the spring, numbers are quite low: an average ET of 29 birds (low of 8 in 2009; high of 51 in 2006) and an average banding number of 21 (low of seven in 2009; high of 33 in 2006). In the fall, banding represents, on average, 77%

of the Estimated Totals, compared to 55% in the spring. This species is very secretive, favouring dense cover near ground level, where its brown plumage makes it even more difficult to see. As a consequence, a lot of detection in the spring is through singing individuals. Birds in the fall rarely sing, which leads to less detection during this season. It is very likely that Northern Waterthrushes are overlooked in the fall.

Sample size, both in spring and fall, is small, which renders interpretation of population trends weak. The spring trend, from 1995 to 2011, is statistically significant, with a 4.4% rate of increase. The fall trend is not significant.

6.1.7 Wilson's Warbler

The Wilson's Warbler is a summer resident across much of the boreal forest of Canada, from western Alaska and British Columbia, and more locally south through the western US to southern California and New Mexico. It winters throughout much of Central America and in the extreme southern US along the coast of the Gulf of Mexico (Ammon and Gilbert, 1999). This species does not breed in southern Ontario. Its breeding range in Ontario is generally north and west of Sault Ste. Marie and Lake Nipissing, reaching its greatest density in the northern part of the Canadian Shield and in the Hudson Bay Lowlands (Cadman et al. 2007).

Like the Blackpoll Warbler, the Wilson's Warbler is a late spring migrant, with the first birds arriving in the second week of May (the earliest on May 7, 2011). Migration peaks at the end of May, with numbers dropping quickly afterwards but with migration continuing into early June (Fig. 6.8). Numbers detected and banded are quite small in the spring, with an average ET of 49 birds (range: 17 in 2010 to 99 in 2005). Banding totals are quite small as well, with a spring average of 26 birds, ranging from 12 in 2010 to 44 in 2007. Even though the sample size of banded birds is small, it appears that males – as expected – migrate earlier than females. Age-ratio is strongly biased towards males by a factor of 3, possibly reflecting the missed later female migration in June. In the fall, migration is more protracted than in spring, covering a 3-week period from the end of August to the end of September. The first birds in the fall are seen in mid-August (the earliest on August 16, 2008 and 2012), with numbers increasing sharply at the end of August and staying at a plateau for most of the month. Numbers seen declined very sharply after mid-September. Very few Wilson's Warblers are seen in October, with the last record on October 15, 2001 (Fig. 6.8). Numbers of Wilson's Warblers are similar in the fall and spring, showing major yearly variations as well, with an average ET of 66 birds (range: 16 in 2013 to 164 in 2008) and an average banding total of 27 (range: nine in 2001 to 48 in 2005).

Because Wilson's Warblers are detected in relatively small numbers at PEPtBO both in the spring and fall seasons, meaningful population trends cannot be determined.



Figure 6.1. Spring (top) and fall (bottom) phenology of Yellow-bellied Flycatcher at Prince Edward Point (2001-2013)



Figure 6.2. Spring (top) and fall (bottom) phenology of Gray-cheeked Thrush at Prince Edward Point (2001-2013)



Figure 6.3. Spring (top) and fall (bottom) phenology of Swainson's Thrush at Prince Edward Point (2001-2013)



Figure 6.4. Spring (top) and fall (bottom) phenology of Magnolia Warbler at Prince Edward Point (2001-2013)



Figure 6.5. Spring (top) and fall (bottom) phenology in relation to age and sex for Magnolia Warbler at Prince Edward Point (average 2001-2013)



Figure 6.6. Spring (top) and fall (bottom) phenology of Blackpoll Warbler at Prince Edward Point (2001-2013)



Figure 6.7. Spring (top) and fall (bottom) phenology of Northern Waterthrush at Prince Edward Point (2001-2013)



Figure 6.8. Spring (top) and fall (bottom) phenology of Wilson's Warbler at Prince Edward Point (2001-2013)



Figure 6.9. Spring phenology in relation to age and sex for Wilson's Warbler at Prince Edward Point (average 2001-2013)

6.2 Priority B

6.2.1 Ruby-crowned Kinglet

An abundant summer bird of the boreal forest and the western mountains the Ruby-crowned Kinglet winters in the southern states of the USA and in Mexico (Ingold and Wallace, 1994). Though extremely abundant during migration, this species does not breed in Prince Edward County.

Ruby-crowned Kinglets are already present in small numbers at Prince Edward Point in the spring when migration monitoring starts in mid-April. Numbers increase sharply in the second half of April to peak at the end of the month and early May (Fig. 6.10). However, movements of Ruby-crowned Kinglets present two distinct peaks, corresponding to gender class in migration: male Kinglets migrate at Prince Edward Point, on average, 15 days earlier than the females, peaking in late April, whereas females peak in early May (Fig. 6.11). After mid-May, Ruby-crowned Kinglets become rare, the last one being detected on May 31, 2004. Numbers are highly variable between years, from a low ET of 264 in 2001 to a high of 1,612 in 2007 (an average of 879). Banding numbers are not as variable, but still present marked yearly differences. On average, 282 Ruby-crowned Kinglets are banded in the spring, but it varies from 132 in 2001 to 480 in 2007.

Fall migration of Ruby-crowned Kinglets starts in mid-September (the first on September 4, 2006) and is finished at the end of October, showing a strong peak around October 10-13 (Fig. 6.10). As in the spring, there is a high degree of variability, both in numbers detected and banded and in temporal patterns, usually influenced by weather patterns. For example, the highest one -day ETs happened on October 5, 2004 with 400 birds, on October 10, 2006 with 350 birds, and on October 15, 2013 with 500 birds. The seasonal average ET is 2,020 birds, from a low of 951 in 2001 to a high of 3,292 in 2006. Banding numbers are quite high as well: on average, 617 kinglets are banded in the fall (range: 339 in 2001 to 1,216 in 2006). There have been a total of 10 days with more than a hundred Ruby-crowned Kinglets banded, happening in seven falls out of 13 (with the highest total ever of 148 birds on October 12, 2005). As in the spring, there is a gender temporal difference in migration, although much less marked. Some females migrate earlier than males in the fall (Fig. 6.11). This difference in the timing of migration by gender is observed across North America (Swanson et al., 1999).

Despite a very adequate sample size and a very well monitored migration pattern, no significant population trends were detected for Ruby-crowned Kinglets in any seasons. In contrast, between Ontario Breeding Bird Atlases a significant population decline was observed in the southern part of the breeding range, and a significant increase in the northern part. The population is estimated at six million birds in Ontario.

6.2.2 Yellow-rumped (Myrtle) Warbler

The Myrtle Warbler (the subspecies of Yellow-rumped Warbler that breeds in, and migrates through, Prince Edward Point) breeds across a vast area of North America and winters mainly in the south of the USA, as well as in Central America and the West Indies (Hunt and Flaspohler, 1998).

It is an early migrant, being already present in small numbers in mid-April when migration monitoring starts. Numbers of Myrtle Warbler rapidly build up toward the end of April to peak in early-to-mid May, but then drop rapidly during the third week of May, with only a few Myrtle Warblers seen at the end of May (Fig. 6.12). This general pattern is relatively variable between years. For example, the highest daily ETs were recorded on May 3, 2012, with 800 birds, on May 10, 2004 and 2007, both with 800 birds as

well, and on May 12, 2011, with 1,200 birds. On average, the spring ET is 2,161 birds but varies from a low of 536 in 2001 to a high of 5,143 in 2011. Most of the time, Myrtle Warblers move rapidly in loose flocks flying above the tree canopy and perch only for relatively brief periods. This behaviour could explain the wide discrepancy between numbers detected and numbers banded: banding birds represent only 11 to 34% of the ET. Banding average is only 453 birds (range: 115 in 2002 to 1,122 in 2007). The average phenology of banded birds does not show the same pattern as the general phenology, indicating that birds captured are not necessarily an unbiased sample of the migrating population. Therefore, it is difficult to draw strong inferences from banding data, especially on phenology in relation to age and gender.

Fall migration typically starts slowly in mid-August. (Birds detected at this time might be local breeders.) Numbers increase steadily towards a very marked peak in early October, then decline rapidly afterwards, with little observation after mid-October (Fig. 6.12). As in the spring, ETs are extremely variable between years, with a low of 356 birds in fall 2004 and a high of 3,277 in fall 2005, for an average of 1,519. Likewise, the general phenology pattern is quite variable between years. For example, the highest daily ETs happened on October 3, 2001 and 2011, with 1,000 and 900 birds respectively, on September 19, 2005, with 800 birds, and on October 9, 2007, with 750 birds. Banding is similarly variable, reflecting, in part, variations in ETs: a low of 75 Myrtle Warblers in 2004; a high of 600 in 2005; an average of 217 birds. In the fall, as for many other species, HY birds dominate the banding sample, with 85% of captured individuals.

Like the Ruby-crowned Kinglet, despite very adequate sample size and a well-monitored migration, no significant population trends were detected for any of the seasons.

6.2.3 Western Palm Warbler

The Palm Warbler breeds in bogs and fens in the boreal forest from the Northwest Territories to Newfoundland, and winters in the southern United States and the Caribbean (Wilson 1996). Though it is one of the first warblers to return in the spring, it does not migrate as early as the Yellow-rumped Warbler. The Western Palm Warbler is the subspecies migrating through Prince Edward Point, although a few Yellow Palm Warblers are detected (mostly through banding, with only seven birds in the spring and eight in the fall for the 2001 to 2013 period).

Although the first individuals at Prince Edward Point are detected in late April (April 18, 2002 for the first record), Palm Warblers start to move through the area in number in early May. Their numbers increase rapidly to peak in the second week of May and then decline just as rapidly afterwards. This species is rarely detected after May 20, with the last record on May 25, 2008. Estimated totals were quite variable between years, with lows of nine in 2013 and 27 in 2001 and highs of 175 in 2009 and 307 in 2004. Accordingly, the timing of peak migration is also relatively variable between years, despite being centred on early to mid-May (Fig. 6.13). Banding totals average about 25 birds a spring but vary from a low of six in 2013 to a high of 42 in 2007.

Very few Western Palm Warblers are detected during fall migration, with usually less than a hundred birds seen during the whole period. Only in 2002, 2008, and 2010 were ETs over 100 birds. As a consequence, these 3 years greatly influence the overall migration pattern, which is reflected in the phenology figure by the various small peaks (Fig. 6.13). As no Palm Warblers breed in Prince Edward County, the first birds detected in late August are true migrants (the earliest one on August 22, 2006). Numbers stay small until early September, then increase during the second week of the month to peak at a

variable date in the second half of September. After the migration peak, some birds are still detected up to mid-October (October 25, 2012 is the latest record). As mentioned, ETs are quite low in the fall, with an average of 58 birds (range: 12 in 2007 to 122 in 2009). Banding varies from four birds in 2004 to 24 in 2002 (an average of 10).

No significant trends were detected in the 2001 to 2013 period for either season.

6.2.4 White-crowned Sparrow

This species breeds from northern Alaska east across the northern mainland of Canada to northern Newfoundland, and in western North America south to California and New Mexico. It is more common in western North America than in the east, but nonetheless it is a locally common breeder in northern Ontario, principally restricted to the Hudson Bay Lowlands. The subspecies that migrates through Prince Edward Point is predominantly *leucophry* (or the Eastern White-crowned Sparrow), which breeds from northern Ontario to Labrador. Very few birds of the subspecies *gambelli* (or Gambel's White-crowned Sparrow), which breeds over a broad territory from northwest Ontario to Alaska and down the Rocky Mountains up to the Canadian border) have been banded during the years surveyed (one in spring 2004; two in fall 2003 and one in fall 2013).

At Prince Edward Point, spring migration usually peaks in early to mid-May (with the earliest birds seen on April 16, 2013) and numbers decline rapidly after May 20. A few birds are still seen in June (Fig. 6.14). Spring counts vary across the years, with a low of 142 ETs in 2001 and a high of 716 ETs in 2011, for an average of 486. Banding is variable too, but to a lesser extent: an average of 124 birds (range: 44 in 2001 to 263 in 2004). In the fall, the earliest White-crowned Sparrows usually arrive in mid-September, with numbers building up towards a peak in mid October, then declining rapidly afterwards (Fig. 6.14). The earliest record was on August 25, 2013, most likely the individual that got banded on September 4. Estimated Totals, as in the spring, vary greatly: a low of 107 in 2011 and a high of 1,004 in 2003 (an average of 526). The banding average is 75 birds, with a low of 15 in 2011 and a high of 191 in 2009.

No significant population trends were detected in spring and fall for this species.



6.2.5 Slate-coloured Junco

The Dark-eyed Junco, with well-defined sub-species, has an extensive range across North America. The "Slate-coloured Junco" is the most widespread and common form of the species, and the subspecies that migrates through Prince Edward Point. This subspecies breeds from Alaska to Newfoundland in boreal and northern mixed forests and winters all across the USA and in northern Mexico (Nolan et al. 2002). The Slate-coloured Junco is an uncommon possible local breeder in Prince Edward County. The Oregon Junco, a subspecies of the Northwest and the West Coast, was seen a few times at Prince Edward Point: October 11, 2001; September 16, 22, 25, 2005; September 30, 2006.

Slate-coloured Juncos are already present in good numbers when regular spring migration monitoring starts at Prince Edward Point in mid-April (Fig. 6.15). Large fluctuations in numbers and phenology exist between years. For the 11 years with similar starting dates (from April seven to 11), the cumulative percentage of total birds already detected by April 15 varied from a low of 12% in 2004 to a high of 64% in 2012. In other words, the spring migration of juncos can be quite early in some years, with, for example, 95% of birds detected by April 25 in 2001, and can be late in others, as in 2006, when only 75% of the seasonal total were detected by April 25. By April 30, more than 90% of juncos have already moved through the area and only small numbers are detected in early May. In all years, juncos are rarely detected at Prince Edward Point after mid-May, the latest record being on May 28, 2002, which, paradoxically, was also the earliest spring for this species. On average, 757 juncos are detected in the spring, ranging from a low of 132 in 2011 to a high of 1,358 in 2011. Banding is less variable, with a low of 70 in 2001 to a high of 381 in 2011, for an average of 201 birds. As for most species in the spring, males migrate earlier than females, which make them more likely to be missed, especially in an early spring. Sex-ratio at banding is indeed very low, at 0.33, indicating that females outnumber males by a factor of 3. Because the monitoring migration period in the spring does not include enough of this species' migration window, only fall annual indices data are presented.

No Slate-coloured Juncos have been detected in August at Prince Edward Point when the fall migration monitoring starts, indicating that the possibility of a local breeding population near the Point is very small. Even though the earliest bird was detected on September 4, 2005, this species is rarely encountered before the end of September, with a rapid increase in its numbers afterwards. Juncos are relatively common migrants throughout October, but abundance and temporal patterns are quite variable between years, as in the spring. Accordingly, the end of the junco migration is more or less covered in the monitoring window: numbers of juncos detected are still high when monitoring ends on October 31, indicating that this species is still moving through the area at this time (Fig. 6.15). As is the case with most species, hatch-year birds dominate in captured individuals (89%), although this proportion varies remarkably between a low of 81% in 2012 and a high of 97% in 2005. Fall ETs fluctuate from 658 and 701 (in 2007 and 2006, respectively) to 2,484 and 4,194 birds (in 2004 and 2005, respectively). As in the spring, variations in banding numbers are not as extreme: a low of 122 in 2002 to a high of 349 in 2005 (an average of 199). There was no statistically significant population trend in the fall.



Figure 6.10. Spring (top) and fall (bottom) phenology of Ruby-crowned Kinglet at Prince Edward Point (2001-2013)



Figure 6.11. Spring (top) and fall (bottom) phenology in relation to age and sex for Ruby-crowned Kinglet at Prince Edward Point (average 2001-2013)



Figure 6.12. Spring (top) and fall (bottom) phenology of Myrtle Warbler at Prince Edward Point (2001-2013)



Figure 6.13. Spring (top) and fall (bottom) phenology of Western Palm Warbler at Prince Edward Point (2001-2013)



Figure 6.14. Spring (top) and fall (bottom) phenology of Eastern White-crowned Sparrow at Prince Edward Point (2001-2013)



Figure 6.15. Spring (top) and fall (bottom) phenology of Slate-coloured Junco at Prince Edward Point (2001-2013)



Figure 6.16. Spring phenology in relation to age and sex for Slate-coloured Junco at Prince Edward Point (average 2001-2013)

6.3 Priority C

6.3.1 Least Flycatcher

A small drab flycatcher of open woods, the Least Flycatcher is one of the smallest and most common flycatchers in North America. It breeds across a large band from southern Yukon to Newfoundland and the northern states of the USA (farther south along the Appalachians). It winters from southern Mexico to Central America (Briskie 1994).

In spring, the first Least Flycatchers at Prince Edward Point were detected on April 25, 2009. However, very few birds are detected before early May: first arrivals are within the first week of May. The latest first observation arrival was in 2003 and 2008, on May 6. In mid-May, numbers reach a peak at Prince Edward Point. Then, as migration draws to an end in late May, numbers detected decline rapidly. ETs are quite variable between springs, with lows of 22 and 57 birds in 2013 and 2008, respectively and highs of 168 and 216 in 2003 and 2005. The average ET is 120 individuals. Banding numbers are quite small and less variable, with an average of 30 birds (range: 11 in 2013 to 69 in 2006).

Numbers detected in the fall are much fewer than in the spring for ET but not banding. On average, thethe fall ET is 69 birds, ranging from 30 and 31 in 2013 and 2011, respectively, to 92 and 159 in 2012 and 2005. Numbers of banded birds vary from 15 in the fall of 2011 to 46 in 2012, for an average of 27 birds. Fall migration is already underway in mid-August (when monitoring starts), although numbers are still small. They increase rapidly to reach a peak at the end of August. Numbers decline slowly afterwards up to mid-September, with very few Least Flycatchers detected after September 15. The latest Least Flycatcher was detected on October 7, 2012 (Fig. 6.17).

Population trends are not significant for spring or fall. However, sample sizes are relatively small.

6.3.2 Blue-headed Vireo

The Blue-headed Vireo is unique among vireos in Canada for its preference to coniferous trees, although it can be found in mixed forests as well. It breeds from eastern British Columbia to southwestern Newfoundland and south into the highlands of the eastern US (James 1998). It is a short-distance migrant that winters mostly in the southern states of the US and in the eastern parts of Mexico.

Very few Blue-headed Vireos are detected or banded at Prince Edward Point in the spring (an average ET of 53 and banding of 10). The Blue-headed Vireo migration is the earliest among vireo species at Prince Edward Point: the first Blue-headed Vireos arrive in mid-April (the earliest on April 15, 2012). Numbers increase rapidly at the end of April and early May and stay high until after mid-May when they decline sharply. Very few Blue-headed Vireos are seen after May 25 (Fig. 6.18).

In a mirror image of spring, fall migration of Blue-headed Vireo is the latest among vireos, with birds first trickling through at the end of August and early September (first record: August 17, 2005). Numbers start building after mid-September and increase sharply to a peak in early October. Fewer and fewer Blue-headed Vireos move through during the second half of October, with barely any birds after October 25 (Fig. 6.18). In contrast with the spring, numbers in the fall are quite high, with an average ET of 314 (range: 155 in 2002 to 448 in 2005) and average banding numbers of 137 (74 in 2003 to 230 in 2005). On September 18, 2005, 44 Blue-headed Vireos were banded, the highest daily banding total ever, likely a consequence of the fallout generated by Hurricane Ike (as mentioned in "Influence of weather on migration", section 2.3).

The population trend in the spring is highly significant, with an increase rate of 12.9%, whereas thethe fall trend is not significant. It is possible that the spring trend was heavily influenced by the last year available, i.e. 2011, which was exceptional with an ET of 120 birds, much higher than other years. ETs in the following years were much lower (81 and 36, in 2012 and 2013, respectively) and more in line with the years before 2011.

6.3.3 Philadelphia Vireo

The Philadelphia Vireo is a bird of the boreal forest, widely distributed across Canada and into the extreme northern US. It is a bird of open, early successional woodlands (Moskoff and Robinson 1996).

Although based on very small numbers, spring migration at Prince Edward Point shows a distinct, steep curve peaking in the second half of May (Fig. 6.19). The first birds arrive in early May (the earliest on May 4, 2001) and it is likely that a few birds are still moving through in early June. On average, the seasonal ET is 27 birds, but with extreme yearly variations, from a low of five in 2008 to a high of 90 in 2011. Less variation exists in banding: only 3 Philadelphia Vireos were banded in 2002 and 2003, whereas the highest total is 17 birds in 2011 (average: seven birds).

Numbers are relatively similar in the fall, with only an average ET of 17 birds (range: nine in 2001 to 34 in 2008) and a banding average of nine birds (range: two in 2001 to 20 in 2006). Contrary to spring, no well-defined fall migration phenology appeared. Philadelphia Vireos are detected over an extended period, although in very small numbers (Fig. 6.19). Birds are detected from late August (the earliest on August 19, 2001) until early October (the last on October 4, 2008 and 2012), with a "peak" in mid-September.

Too few Philadelphia Vireos are detected to produce meaningful trends.

6.3.4 Red-eyed Vireo

The Red-eyed Vireo breeds across most of North America and winters in the Amazonian basin (where there is a resident population). It is a very common bird and is found across most of the forested parts of North America (Cimprich et al. 2000) but seems to avoid conifer-dominated stands.

Although the earliest Red-eyed Vireos detected at Prince Edward Point were seen on April 22, 2004, spring migration usually starts in mid-May, peaks in late May, and decreases rapidly at the end of May and early June (Fig. 6.20). The end of the spring migration is thus not well covered by monitoring efforts at Prince Edward Point. Numbers of Red-eyed Vireos are quite variable between years, with an average ET of 160 birds, but a low of 47 in 2013 and a high of 293 in 2012. Similarly banding numbers range from 15 in 2013 to 59 in 2006, with an average of 38 birds. This species tends to stay high in the canopy, thus reducing its likelihood of being captured.

Very few Red-eyed Vireos are present in mid-August at Prince Edward Point when fall migration monitoring begins, but their numbers increase rapidly during this month to peak in early September. Numbers stay relatively high during September to decline sharply towards the end of the month and early October (Fig. 6.20). Very few Red-eyed Vireos are detected after mid-October but quite a few individuals linger through this month, as 11 individuals have been detected after October 15 in the 13-year period (the latest record on October 29, 2010). Numbers in the fall are much higher than in the spring, with an average ET of 264 birds (63 in 2003 to 475 in 2005). Banding numbers are almost 3 times higher than in the spring, with an average of 94 birds. There are, though, extreme variations between falls, from lows of 24 and 26 (in 2003 and 2002, respectively) and highs of 161 and 166 (in 2006 and 2010). HY birds, easily

aged by their brown eyes, represent the overwhelming majority of birds captured in the fall, from 85% (in 2007 and 2013) to 99% (in 2011) of birds banded.

6.3.5 Nashville Warbler

A small songbird of second-growth forests, the Nashville Warbler breeds across much of north-central North America and in an isolated portion of the mountainous Pacific Northwest. It nests on the ground and feeds almost exclusively on insects in summer. It winters primarily in southern Mexico where it switches its diet to a fruit and nectar base (Williams 1996).

It is amongst the earliest migrant warblers in the spring, preceded only by Myrtle, Pine and Palm Warblers most years. The first individuals of Nashville Warbler are detected in late April (the earliest on 25 April, 2009), but this species becomes more common at Prince Edward Point in early May. Numbers increase rapidly in the first part of May, then peak in the middle of the month and decline afterwards as rapidly, with very few individuals left (including territorial singing birds) at the end of May (Fig. 6.21). The spring migration is thus very much concentrated into a two-week time frame in May. Within this short period, males migrate on average about five to ten days earlier than females (Fig. 6.22). About twice as many males (both SY and ASY) as females are captured in the spring. Among warblers with good sample size, three other species, Myrtle Warblers, Magnolia Warblers, and Common Yellowthroats show a similar bias toward males captured in the spring.

The fall migration of the Nashville Warbler is more extended than the spring. Very few birds are detected at the beginning of the monitoring period in mid-August, probably indicating that few breeders are present in the area. Numbers build up slowly to reach the greatest abundance at the end of September. This species is rarely detected afterwards, although birds are seen well into mid-October (the latest record being on October 23, 2011). Contrary to what occurs in the spring, males and females, regardless of age, migrate at the same time in the fall and the gender ratio is relatively balanced (Fig. 6.21).

There was a statistically significant trend in the spring but not in the fall. It is possible that the spring trend was heavily influenced by the last year available, i.e. 2011, which was exceptional with the highest ET of 697 birds, about two to 3 times higher than other years. ETs in the following years were much lower (156 and 306 in 2012 and 2013, respectively) and more in line with previous years. Estimates made for the Ontario Breeding Bird Atlas found that the Nashville Warbler is the most abundant bird in Ontario, with a population of 15 million birds (Cadman et al. 2007).

6.3.6 Chestnut-sided Warbler

The Chestnut-sided Warbler is a summer resident throughout much of eastern North America. It winters in Central America from southern Mexico to Panama (Richardson and Brauning 1995). Its preferred breeding habitats include shrubby second-growth deciduous woodlands, forest edges, abandoned fields, and small clearings.

Spring migration is fairly concentrated at Prince Edward Point in a 15-day period starting in mid-May (Fig. 6.23). The first birds are detected in early May (with the earliest on April 27, 2001) and numbers peak in mid-May. The last birds are seen in early June. ETs are quite variable between years: a low of 59 in 2013 and a high of 447 in 2011. Likewise, banding totals range from 23 birds in 2003 to 98 in 2011. Like many other species in spring, males tend to arrive a few days earlier than females (Fig. 6.24). This pattern is more marked for ASY birds than SY, even though sample sizes for the former are relatively

small. There is almost no temporal overlap in the migration of ASY birds, whereas an important one exists for SY birds.

Very few Chestnut-sided Warblers are already present in mid-August when migration monitoring resumes. Numbers increase slowly throughout August and September but drop sharply at the end of September (Fig. 6.23). The narrow peak in mid-September in the phenology graph is mostly due to September 15, 2008, when an unusual number of Chestnut-sided Warblers (as well as other species of warblers) were noted (see "Influence of weather on migration", section 2.3): the ET of 122 Chestnut-sided Warblers of that specific day is much higher than the seasonal total of all the other years (which ranges from 17 in 2001 to 83 in 2003). Banding numbers are relatively low as well: from 13 birds in 2001 to 37 in 2006, the fall 2008 being the exception again with a total of 50 birds.

As with the Nashville Warbler, there was a statistically significant trend in spring but not fall. Likewise, it is possible that the spring trend was heavily influenced by the last year available for population analysis, i.e. 2011, which was exceptional with the highest ET of 447 birds, about two to 3 times higher than other years. ETs in the following years were much lower (253 and 59 in 2012 and 2013, respectively) and more in line with previous years. Estimates made for the Ontario Breeding Bird Atlas found that the Chestnut-sided Warbler is an abundant bird in Ontario, with a population of five million birds (Cadman et al. 2007).

6.3.7 Black-throated Green Warbler

The Black-throated Green Warbler is a long-distance migrant, breeding in a large belt of coniferous and mixed forest across North America, through Ontario north to the southern boreal forest, and down the Appalachian Mountains. The species winters in Mexico and Central America with small numbers in the Caribbean and northern South America (Morse, 1993).

In spring, Black-throated Green Warblers arrive at Prince Edward Point first in late April (the earliest record on April 19, 2002 and 2004), then build up slowly in numbers in early May to peak in mid-May and then taper off in June (Fig. 6.25). Numbers are quite variable between years, with a low of 73 ET in 2002 and a high of 443 in 2011, for an average of 204 birds. Banding is as variable, from a low of 14 birds banded in 2003 to a high of 99 in 2011, with an average of 52 birds. As usual, the earliest birds to arrive at Prince Edward Point are males. However, unlike species like Nashville Warbler and Ruby-crowned Kinglet, there is a considerable overlap in the migration timing of males and females (Fig. 6.26).

Black-throated Green Warblers are detected in relatively small numbers in mid-August, when monitoring starts again. Then, numbers rise slowly during the second half of August and early September to peak in the middle to the end of September. Afterwards, the detected numbers of Black-throated Green Warblers decline sharply in early October, with the last birds seen in mid-October (Fig. 6.25). The latest observation of just one individual was made in October 21 in 2005. Thus, the fall migration is quite extended over four weeks. The average banding total of 44 birds in the fall (a range of 16 in 2004 to 84 in 2005) is about the same as in spring. However, fewer Black-throated Green Warblers are detected in the fall than in spring, with an average ET of only 122 birds (a low of 69 in 2007; a high of 221 in 2008). In the fall, about 88% of birds banded are HY, although the age-ratio is quite variable. There were 3 falls when no adult birds were caught at all (2004, 2007 and 2013), whereas in four other falls, AHY represented between 22% and 30% (2001, 2009, 2010 and 2012).

As with some warbler species, there was a statistically significant trend in the spring but not fall. Again, it is possible that the spring trend was heavily influenced by the last year available, i.e. 2011, which was

exceptional with the highest ET of 443 birds, about two times higher than the average. ETs in the following years which were much lower (162 and 83, in 2012 and 2013, respectively).

6.3.8 Black- and-white Warbler

The Black-and-white Warbler is quite a distinctive warbler, in both plumage and behaviour. Wearing its namesake plumage, it forages for insects while creeping along the trunks and branches of trees. Common in summer throughout the eastern United States and Canada, it has an unusually extensive winter range that extends from Florida to Venezuela and Colombia (Kricher 1995).

At Prince Edward Point, the first Black-and-white Warblers are seen in late April (the first record on April 17, 2002), but as with most warblers, numbers increase steadily in early May to peak in mid-May. Numbers decline very sharply just after the peak. Barely any Black-and-white Warblers are seen after May 25. Male Black-and-white Warblers arrive earlier than females, with the first males moving through the area in late April and early May. Both sexes are present during the peak, but more females are migrating towards the end of the spring migration (Fig. 6.27). As with most warblers, numbers detected are quite variable between springs, with an average of 96 birds (range: 34 in 2001 to 199 in 2010). Numbers banded are relatively small, with an average of only 24 birds, a low of 10 in 2003 and high of 39 in 2010. In the fall, Black-and-white Warblers are already present, albeit in small numbers, when monitoring starts in mid-August. Numbers detected are quite variable across the years, but mostly small, with no real peak from mid-August to late September (Fig. 6.27). The "peak" in mid-September is due to a high ET on September 15, 2008, when 58 Black-and-white Warblers were detected. As noted previously, on that date, many warbler species and other bird species were observed in higher numbers than usual, because of a fall-out resulting from the passage of Hurricane Ike. Detection of Black-and-white Warblers becomes very rare after early October (with the last record on October 11, 2003).

6.3.9 Ovenbird

Like the Black-throated Green Warbler, the Ovenbird is a long-distance migrant that breeds in a wide swath in eastern and central North America and winters in Central America and the West Indies. It is a very common summer bird of deciduous, mixed, and southern boreal forests, conspicuous while singing its telltale song. A ground-nesting bird, it is considered a sensitive species because of its preference for large unfragmented mature forests (Gibbs and Faborg, 1990, Van Horn and Donovan, 1994).

In the spring, Ovenbirds arrive in early May (April 30, 2004 and 2011, being the earliest date), increase steadily in numbers in the first half of May and reach a narrow peak in mid-May. Migrant numbers decline sharply afterwards with limited sightings at the end of May (the latest observation on June 8) (Fig. 6.28). Numbers detected, especially for a common warbler like Ovenbird, are relatively small, ranging from 37 birds in 2001 to 134 in 2007, for an average ET of 73. Likewise, the numbers of banded birds in the spring are fewer than 50 birds, except in 2007 with 66 Ovenbirds banded, the highest total ever. On average, only 36 birds are banded in the spring season, with a low of 20 in 2003. Ovenbirds, when not singing, can be quite secretive, as they have a cryptic plumage and spend most of their time on the ground. Consequently, it is not surprising that banding numbers represent between 40 and 76% of the overall ET, as opposed to around 20 to 30% for other species of warblers.

The fall migration of Ovenbirds is poorly monitored at Prince Edward Point, as most birds detected are through banding and in small numbers (Fig. 6.28). On average, 70% of detected Ovenbirds in the fall are through banding. It is one of the highest proportions of detection through banding among priority species.

Two other secretive species, Canada Warbler and Northern Waterthrush, also have high proportions (65% and 77%, respectively), which definitively reflects their behaviour. Because of the small numbers detected, the migration phenology of Ovenbirds is not well defined, but it appears that Ovenbirds migrate during a quite extended window, from the start of monitoring in mid-August up to the third week of September. The latest Ovenbird was detected on October 12. Only 36 birds are detected in the fall on average (the ET ranges from 20 in 2003 to 72 in 2008) and the banded average is 24 birds (from 16 in 2003 to 34 in 2005). No migration phenology based on gender could be determined, as Ovenbirds do not show gender difference in plumage.

6.3.10 Canada Warbler

The Canada Warbler is a summer resident across central and southern Canada, northeastern US and south through the Appalachian Mountains. This species is one of the last of the wood warblers to arrive on its nesting grounds and one of the first to depart. It is usually found in moist forests with well-developed understories, especially in low-lying areas such as cedar woods and talus slopes where they nest in tumbled-over tree roots and mossy crevices (Conway 1999). It was federally designated a Threatened Species-at-Risk by the Committee on the Status of Endangered Wildlife in Canada in April 2008 (www.cosewic.gc.ca).

In the spring at Prince Edward Point, Canada Warblers are mostly detected – albeit in small numbers -- in the second half of May and in early June with a peak around the end of May (Fig. 6.29). The earliest Canada Warbler was detected on May 3, 2012 while the latest ones were on June 8 in 2003. Although this species has a loud and distinctive song, it is mostly detected through banding, which accounts for 47% to 79% of individuals detected (except in 2003, with only 29%). Numbers banded at Prince Edward Point are relatively small, and in a narrow range, from seven in 2002 to 36 in 2011. The spring 10-year trend was not statistically significant.

This species is also rarely detected in the fall with ETs ranging from six in 2013 to 81 in 2011 (with banded numbers ranging from six in 2013 to 41 in 2011). As with the Yellow-bellied Flycatcher, the migration of the Canada Warbler is already under way in mid-August (Fig. 6.29). As a consequence, its migration is not well monitored at Prince Edward Point, which prevents meaningful interpretation of population trends. Numbers decline slowly but steadily from mid-August to early September. Very few Canada Warblers are seen after September 10, with the latest record on September 23, 2009.

6.3.11 White-throated Sparrow

A very common bird of boreal and mixed forests, the White-throated Sparrow breeds across Canada and winters all across the midwestern and eastern United States, as well as in the American Southwest and on the Pacific Coast. It is an extremely abundant bird of the boreal forests, maybe one of the most common songbirds of this biome (Falls and Kopachena 1994), with a population in Ontario estimated at 12 million birds, 10 million of them in the Northern Shield region (Cadman et al. 2007). Despite numerous studies on this species, migration routes and behaviour are not well documented (Falls and Kopachena 1994). Therefore, even if numbers of White-throated Sparrows detected or banded at Prince Edward Point are very small in relation to the global population, monitoring can provide significant insights into this species' migratory habits.

In the spring, a few White-throated Sparrows are already present at Prince Edward Point when migration monitoring starts in mid-April. Numbers detected then increase quite sharply in the last week of April,

with migration peaking in early May, and numbers staying quite high for only a few days. Birds move through the area quite rapidly, as numbers detected decline quickly after the peak and White-throated Sparrows become rare at Prince Edward Point after mid-May (Fig. 6.30). Like other early migrant species (i.e. Myrtle Warbler, Slate-coloured Junco), numbers of White-throated Sparrows are highly variable between springs: the lowest ET of 199 in 2001, lows of 643 and 685 in 2002 and 2012, respectively, and highs of 1,409, 1,455 and 1,753 in 2012, 2003 and 2013, respectively. Banding numbers range from 59 in 2004 to 423 in 2013 (an average of 247).

Very few White-throated Sparrows are present in August at Prince Edward Point, suggesting that it is a rare breeder in the immediate area (even though it breeds throughout the County). Numbers start to increase rapidly only after mid-September and stay quite high up to early to mid-October. This sparrow then becomes much less common but is still present in small numbers until the end of fall migration monitoring (Fig. 6.30). As in the spring, although not as marked, yearly differences, both in numbers and phenology, in fall migration are important: Estimated Totals usually range between 500 to 1,000 birds, with lows of 543 and 572 in 2002 and 2005 and highs of 966 and 994 in 2003 and 2010, respectively. Peaks or highest daily ETs are sometimes in late September (an ET of 110 birds on September 29, 2001), more usually in early October (ETs of 100 on October 2, 2010 and October 3, 2013 and of 150 on October 3, 2002), and rarely in mid-October (an ET of 150 on October 11, 2003). Of the 1,801 sparrows banded in the fall from 2001-2013, there was an average of 94% HY (from 86% in 2007 to 98% in 2005 and 2013). Population trends are not statistically significant in the spring or fall.


Figure 6.17. Spring (top) and fall (bottom) phenology of Least Flycatcher at Prince Edward Point (2001-2013)



Figure 6.18. Spring (top) and fall (bottom) phenology of Blue-headed Vireo at Prince Edward Point (2001-2013)



Figure 6.19. Spring (top) and fall (bottom) phenology of Philadelphia Vireo at Prince Edward Point (2001-2013)



Figure 6.20. Spring (top) and fall (bottom) phenology of Red-eyed Vireo at Prince Edward Point (2001-2013)



Figure 6.21. Spring (top) and fall (bottom) phenology of Nashville Warbler at Prince Edward Point (2001-2013)



Figure 6.22. Spring phenology in relation to age and sex for Nashville Warbler at Prince Edward Point (average 2001-2013)



Figure 6.23. Spring (top) and fall (bottom) phenology of Chestnut-sided Warbler at Prince Edward Point (2001-2013)



Figure 6.24. Spring phenology in relation to age and sex for Chestnut-sided Warbler at Prince Edward Point (average 2001-2013)



Figure 6.25. Spring (top) and fall (bottom) phenology of Black-throated Green Warbler at Prince Edward Point (2001-2013)



Figure 6.26. Spring phenology in relation to age and sex for Black-throated Green Warbler at Prince Edward Point (average 2001-2013)



Figure 6.27. Spring (top) and fall (bottom) phenology of Black-and-white Warbler at Prince Edward Point (2001-2013)



Figure 6.28. Spring (top) and fall (bottom) phenology of Ovenbird at Prince Edward Point (2001-2013)



Figure 6.29. Spring (top) and fall (bottom) phenology of Canada Warbler at Prince Edward Point (2001-2013)



Figure 6.30. Spring (top) and fall (bottom) phenology of White-throated Sparrow at Prince Edward Point (2001-2013)

6.4 Priority D

6.4.1 Brown Creeper

One of the smallest and most inconspicuous of songbirds, the Brown Creeper breeds from Alaska to Newfoundland and south to the Mid-Atlantic States in the east, and to Central America in the west. It is a permanent resident throughout much of its range, withdrawing only from the northernmost areas of its breeding range in winter (Hejl et al. 2002a). Its preferred habitat is mature and older coniferous and mixed forests containing large trees.

There is a clearly defined migration of Brown Creepers at Prince Edward Point (Fig. 6.31). This species is an early migrant in the spring; thus most of the migration is missed by the monitoring process in an early spring. Numbers of Brown Creepers detected and banded are already high in mid-April and actually drop sharply soon afterwards. Despite missing a good proportion of the migration, numbers are quite high, with an average ET of 253 birds (range: 117 in 2001 to 413 in 2012) and a banding average of 104 birds (63 in 2001 to 184 in 2011). These numbers include coverage before April 15. In some years when monitoring started earlier, high numbers of Brown Creepers were banded before April 15. As an early migrant, the Brown Creeper exhibits much flexibility in timing, most likely in relation to spring weather conditions. For example, in 2011, migration was early, peaking around April 11. Spring 2005 seems to have been an average year, with a peak around mid-April. At the other end of the range, spring 2007 was very late, with a migration peak of Brown Creepers around April 22.

Migration coverage is much more adequate in the fall, as the entire migration window of this species is covered. The first Brown Creepers are detected in late August, although in extremely small numbers: only six birds have been noted in August, about 0.01% of the total of 5,855 birds counted over 13 years. Numbers remain low until mid-September when they start to increase, to peak in October (Fig. 6.31). Because of important yearly variations in numbers detected, the timing of peak migration is also quite variable. Numbers of Brown Creepers detected decline sharply in the last week of October, indicating that most birds have moved through the area by that time. Numbers detected in the fall are quite variable, ranging from a high ET of 693 in 2011 to a low ET of 258 in 2007 (an average of 450 birds). Banded numbers show less drastic variation: from 169 birds in 2008 to 271 birds in 2006, for an average of 222 birds. No trends were detected in spring or fall.

6.4.2 Hermit Thrush

The Hermit Thrush breeds in mixed forests and throughout the boreal forest in eastern North America and winters in the southern states of the USA. A short-distance migrant, its migration is earlier in the spring and later in the fall than the other *Catharus* thrushes (J one s and Donovan 1996). This species does not breed in Prince Edward County, although it has greatly expanded the southern limit of its range in the last 20 years and breeds now in Northumberland County immediately to the west.

At Prince Edward Point, a few Hermit Thrushes are already present in early April (the earliest on April 7, 2007 and 2008). However, the majority of Hermit Thrushes migrate from mid April to early May, with a marked peak in late April-early May (Fig. 6.32). Numbers then decline rapidly, and very few individuals are seen after May 20 (the latest on June 1, 2002). Seasonal totals fluctuate between years, with a low ET of 81 in 2008 a high of 317 in 2012, for an average of 194 birds. Banded numbers show wide variations as well: 51 banded Hermit Thrushes in 2008; 144 banded birds in 2013; an average of 79 thrushes.

In the fall, only a few individuals are detected in August and early September. Interestingly, of the 16 Hermit Thrushes banded from August 15 to September 10, 11 birds were AHY, whereas 94% of all the thrushes banded in the fall are HY. The 16 birds banded during this 3-week period represent an infinitesimal proportion of the seasonal total of 2,552. Numbers stay very low until migration picks up in the third week of September with numbers then increasing very sharply. The peak is in early to mid-October, with Hermit Thrush numbers diminishing rapidly afterwards (Fig. 6.32). More birds are detected and banded in the fall than in spring, with an average ET of 467 (range: 233 in 2005 to 866 in 2009). The banding average is 197 birds, with a low of 134 in 2004 and a high of 313 in 2009.

There is no significant population trend in spring or fall.







Figure 6.31. Spring (top) and fall (bottom) phenology of Brown Creeper at Prince Edward Point (2001-2013)



Figure 6.32. Spring (top) and fall (bottom) phenology of Hermit Thrush at Prince Edward Point (2001-2013)

7.0 Species Phenology

Even for very abundant species, there is great temporal variation in abundance patterns both within and between seasons. Species like Black-capped Chickadee and Pine Siskin show irruptive patterns, with one or a few seasons contributing disproportionately to the ET total. Other species are particularly abundant every spring, but only common or even very rare in the fall. The fall migration of some of these species, especially Swallows, is simply too early to be monitored within the regular season at PEPtBO. Similarly, many species more abundant in the fall migrate too early in the spring to be accurately monitored (American Tree Sparrow and Snow Bunting, for example). However, the geographic features of Prince Edward County, acting as a trap in the fall but not spring, could explain seasonal differences in abundance for many species. This temporal pattern -- a heavy fall migration and almost none in the spring -- is particularly evident for birds of prey (especially soaring species like Turkey Vulture, Broad-winged Hawk, and Sharp-shinned Hawk). The more active singing behaviour of spring could also lead to a higher detection rate, resulting in higher measured abundance. Absent or reduced foliage in the spring could also positively affect the detection of songbirds.

At Prince Edward Point, an Estimated Total of more than 6.6 million birds of 273 species was monitored from 2001 to 2013. The top 30 species account for about 90% of the total, with the two most abundant species, Double-crested Cormorant and Long-tailed Duck, accounting for 62% of the overall total. Excluding these two "super-abundant" species from the overall total, the 28 most abundant species after them still represent 74% of the total, in numbers, of birds detected at PEPtBO.

The 30 most abundant species represent a wide taxonomic variety, belonging to 15 different families. They can broadly be grouped into waterbirds (10 species from the following families: Anatidae, Phalacrocoridae, and Laridae), raptors (only one species, Turkey Vulture), and passerines (19 species). The Passerines can be further divided into sub-group, according to their taxonomy.

In the following description of each group, after a short, general introduction, the species sections (in taxonomic order by group) provide a rapid account of breeding and wintering ranges, details on migration phenology (by age and sex, if appropriate), residence time, numbers detected, and other information. (Note on graphs: The y-axis scale varies for each graph.)



7.1 Waterbirds

The waters surrounding Prince Edward Point are an important migration and staging area for many species of waterfowl, with Long-tailed Duck, Greater Scaup, and White-winged Scoter being the most abundant (in decreasing order). Waterfowl counts present multiple challenges: birds are highly mobile over a vast area of water, moving according to food sources and other variables; birds could be present but far from shore; birds stay over several days, resulting in being counted every day and inflating the seasonal total. For example, large rafts of Red-breasted Mergansers were often noted along the northern shore of Prince Edward Point, an area too far from the normal count area of PEPtBO. On the other hand, groups of Double-crested Cormorants roost on a small island off Prince Edward Point and reside for several days, even weeks, resulting in high daily counts of several thousands of birds. Added over the whole season, it produces an inflated Estimate Total of several hundreds of thousands of birds, which does not reflect the reality.

There is a large within- and between-season variability in numbers seen for this group, another reflection of the extreme mobility and/or difficulty of observation of these species. Bonaparte's Gulls are a regular spring and, in lesser numbers, fall migrant, but their numbers are extremely variable. Spring ETs range from a low of 1,945 birds in 2001 to a high of 95,875 in 2005. An estimated 85,000 Bonaparte's Gulls were detected on May 4, 2005. Many water bird species migrate in early spring, with dates influenced in part by the time of the spring thaw, and migrate quite late in the fall, usually in late October to early November. As a consequence, parts of their migration are often missed during regular monitoring at PEPtBO, with possible large yearly variations, since some spring migrations could be very early and some fall migrations very late.

7.1.1 Brant

The Atlantic Brant (the "light-bellied" subspecies *hrota*) is a low Arctic breeder, nesting in the Foxe Basin from Northern Baffin south to Southampton Island and wintering principally along the mid-Atlantic coast of the US. A large proportion of the eastern breeding population stages in southern James Bay during migration. Their migration path to the Atlantic coast encompasses Lake Ontario, where Brants are seen in the spring in mid to late May and in the fall from mid to late October (Fig. 7.1). At PEPtBO, migration numbers have been very variable between years, with more birds seen in the spring (average (\pm SD): 1,251 (\pm 1,301); range: 0 and 20, in 2013 and 2002, respectively to 4,795 in 2007) than fall (average (\pm SD): 171 (\pm 403); range: 0 in 2005, 2006, 2009, 2011, 2012, and 2013 to 1,477 in 2003).

7.1.2 Canada Goose

This well-known species is both a common year-round resident in southern Ontario and a migrant, breeding at higher latitudes (especially in the Hudson Bay Lowlands in Ontario). This is reflected in patterns observed at Prince Edward Point, with constant, low numbers of Canada Goose present at all times and peaks at migration time, mostly in mid-April in the spring and late September in the fall (Fig. 7.2). At PEPtBO, migration numbers have been very variable between years, with about as many birds in the spring (average (\pm SD): 1,688 (\pm 1031); range: 661 in 2008 to 4,207 in 2003) as in the fall (average (\pm SD): 1,700 (\pm 1,035); range: 440 in 2013 to 4,005 in 2001).

7.1.3 Mallard

This common, often urban species is also a denizen of the northern climes, as far north as Alaska and northern Québec. As with the Canada Goose, its numbers at PEPtBO are a mix of resident and migrant

birds. However, there is no marked temporal peak in Mallard numbers, indicating no strong migration through Prince Edward Point (Fig. 7.3). As with most species of water birds, migration numbers have been very variable between years at PEPtBO, with very few birds in the spring (average (\pm SD): 148 (\pm 64); range: 37 in 2013 to 245 in 2003) compared to fall (average (\pm SD): 3,387 (\pm 2120); range: 126 in 2013 to 6,618 in 2001).

7.1.4 Greater Scaup

The Greater Scaup is the only diving duck with a circumpolar breeding distribution. In North America, the species is widely distributed across arctic and subarctic regions from Alaska to Labrador. In Ontario, it breeds mostly in the Hudson Bay Lowlands. It is found in migration throughout the continental interior but winters primarily in coastal waters and the Great Lakes. This species is the third most abundant bird detected at PEPtBO, with an absolute total of more than 300,000 birds (99.9% of them in the fall). Spring migration of the Greater Scaup at PEPtBO is too early to be effectively monitored, with no birds seen after April 15 in four years, and only a few individuals in the other years (except in 2010 when 262 Scaups were detected). In contrast, the fall migration is better monitored, with the first birds arriving in late September to early October and numbers building up until mid to late October (Fig. 7.4). Towards the end of October, it is likely that Greater Scaups observed at PEPtBO could be a mix of migrant and wintering birds. Huge numbers of Greater Scaup are seen at PEPtBO, it being the second-most abundant species in the fall in total, and one of the reasons for the designation of the Prince Edward County South Shore Important Bird Area. On average (±SD), 24,121 (±25,210) birds are counted but with strong variations between years (a low of 3,580 in 2013 to a high of 95,667 in 2008). As with other water bird species, large rafts of Greater Scaup can be seen using the waters around Prince Edward Point, sometimes on a daily basis. Staging birds definitely affect seasonal ET upwards and make yearly comparisons difficult. The highest daily ET was 16,600 birds on October 27, 2008. Daily totals of up to 10,000 and more were seen regularly that fall. There was a daily total of 10,000 birds only one other fall, on October 31, 2001. The highest daily ETs in the other falls were from a few to several thousand birds.

7.1.5 White-winged Scoter

The White-winged Scoter breeds across the northern tier of the continent, from the low Arctic tundra through the boreal forest to open prairies. In Ontario, it breeds mostly in the northern Hudson Bay Lowlands but it is also present in the boreal forest of the Shield, albeit in much smaller numbers. It winters mostly on the Atlantic coast but has become common on Lake Ontario since the introduction of zebra mussels. Unlike that of the Greater Scaup, the spring migration of White-winged Scoter, being later, is relatively well monitored at PEPtBO. Peak migration is in late April, with between-year variations mostly linked to weather and food availability. Fall migration, on the other hand, seems slightly later than for Greater Scaup, with significant numbers seen only in late October (Fig. 7.5). At PEPtBO, migration numbers have been very variable between years, with more birds seen in the spring (average (\pm SD): 7,579 (\pm 13,993); range: 376 in 2006 to 52,525 in 2011) than fall (average (\pm SD): 2,716 (\pm 1,930); range: 18 in 2013 to 5,724 in 2010). The highest daily total in the spring was 8,000 birds on April 21, 2011.

7.1.6 Long-tailed Duck

The Long-tailed Duck is a small, Holarctic sea duck, characterized by its bold plumage patterns, distinctive calls (which gave it its old name of Old Squaw), and the long central tail feathers of the breeding male (which give it its current name). In North America, it breeds from about 50°N in Labrador northward throughout the Canadian Arctic mainland and archipelago, reaching high latitudes above 73°N,

and westward to coastal southwest Alaska. It winters close to shore on both oceans but also in the Great Lakes, more common on Lake Ontario.

It is the second most abundant species at Prince Edward Point, having total counts of over a million birds in the 2001 to 2013 period, with 99.4% of them detected in the spring. Spring migration occurs mostly in the second half of April and early May, with some birds lingering into late May in some springs (Fig. 7.6). On average (\pm SD), 78,108 (\pm 110,669) birds are counted in spring but with extreme variations between years (from lows of 1,023 in 2013 and 8,956 in 2008 to highs of 283,931 in 2003 and 355,703 in 2001). Patterns of migration between the two highest years (2001 and 2003) were very different: a strong but constant migration over several weeks in 2001, whereas a quarter of a million Long-tailed Ducks were counted in a single day in 2003 (on April 17). Most springs, good numbers of this northern duck could still be seen after mid-May: for example, 10,000 birds on May 14, 2001; 2,000 on May 19, 2010. The last individuals were observed on May 31, 2005 and 2009. In the fall, this species arrives in late October (Fig. 7.6), like Greater Scaup and White-winged Scoter, but in insignificant numbers compared to these species and spring numbers (fall average (\pm SD): 368 (\pm 280); range: 3 in 2013 to 894 in 2012).

7.1.7 Red-breasted Merganser

The Red-breasted Merganser is the most northerly breeding of the piscivorous ducks, ranging in North America from the Aleutian Islands eastward to Newfoundland and from the Arctic coast of the Yukon south to the Great Lakes. In Ontario, this species is widely distributed along extensive water bodies at coastal and inland sites. Red-breasted Mergansers breed commonly along the Lake Superior shoreline, and around islands of Georgian Bay and Lake Huron. On Lake Ontario, it breeds primarily in the waters surrounding Prince Edward County and in the Thousand Islands area of the St. Lawrence River. It winters on the Pacific, Atlantic, and Gulf coasts but also inland in the southern Plains as well as on the Great Lakes.

Small numbers of Red-breasted Mergansers are constantly present around Prince Edward Point in the spring, possibly a mix of migrant and resident birds. Numbers increase slowly in May to peak around mid to late May, with large annual variations, both in timing and numbers (Fig. 7.7). Daily totals range from a low of 16 birds on April 11, 2002 to a high of 2,000 on May 14, 2012. On average (\pm SD), 1,834 (\pm 1,788) Red-breasted Mergansers are counted in the spring but with extreme variations between years (range: 166 in 2003 to 6,643 in 2012). Despite a regional breeding population, very few Red-breasted Mergansers are seen in August and September. Numbers only start to build up in October, with no apparent peak (Fig. 7.7). The highest daily ET was on October 26, 2005, with 6,000 birds (creating the apparent late October peak on the graph). Fewer birds are counted in fall than spring, with an average of 1,130 (\pm 1,768), a low of 31 in 2013 and a high of 6,713 in 2005.

7.1.8 Double-crested Cormorant

The fish-eating Double-crested Cormorant always breeds near water, primarily through the central prairies and the Great Lakes. There are several breeding colonies of more than a thousand nests near Prince Edward County, which makes distinction between migrant birds and residents almost impossible.

This species has the highest overall ET at PEPtBO, with more than 3 million birds (92% of them counted in the fall). However, as discussed previously, there is a roost on a small island off Prince Edward Point of several thousand Cormorants, lasting usually from August to the end of September. As a consequence,

seasonal counts are comprised of multiple repeats of the same birds, greatly overestimating the actual number of birds.

Very few Cormorants are already present in mid-April when migration monitoring starts. Numbers build up gradually and reach a plateau after mid-May (Fig. 7.8). Highest daily ETs are quite similar between years, from 1,000 to 3,000, and fairly frequently at the end of May. In the fall, numbers of Double-crested Cormorants are much higher, routinely reaching 5,000 to 10,000 daily ETs, from late August into mid-September. Numbers drop substantially in early October, usually with very few Cormorants left in late October (although an ET of 2,000 was noted on October 28, 2013) (Fig. 7.8). The highest daily ET in the fall was 30,000 on September 8, 2008.

7.1.9 Bonaparte's Gull

A small, elegant gull of high latitudes and altitudes, the Bonaparte's Gull is the only gull that nests almost exclusively in trees. In Ontario, breeding is confined to the Hudson Bay Lowlands and Northern Shield regions, as long as there are trees (for example, along major rivers in the otherwise treeless tundra of Hudson Bay). Bonaparte's Gulls winter along the west coast and across a broad swath of the southern US. They are also present in winter along the Niagara River, which becomes a major staging area in April and early May (along with selected locations on Lakes Erie and Ontario).

At Prince Edward Point, spring migration is concentrated from late April to early May, with barely any Bonaparte's Gulls seen after mid-May (Fig. 7.9). Peak migration is highly variable between springs, influenced by a few days with huge numbers, as on May 4, 2011 and April 20, 2004, with an ET of 5,000 each day. These numbers make this species the fifth most abundant species detected at PEPtBO, with more than 95% of the ET occurring in the spring. The average ET in spring is 11,521 (\pm 7,200), ranging from 1,945 in 2001 to 26,288 in 2009. Fall migration detection involves much smaller numbers. There seems to be a regular, albeit relatively small, influx of Bonaparte's Gulls throughout August and September. After early October, very few birds are detected until the end of the month, when small numbers of Bonaparte's Gulls are again detected (Fig. 7.9). The fall average ET is only 875 birds (\pm 1,034), with as few as 28 in 2009 and a season high of 3,826 in 2002.

7.1.10 Ring-billed Gull

This abundant, seemingly ubiquitous gull is present year-round in southern Ontario, making it a familiar bird for many (with often not-so-graceful nicknames). It has a broad breeding range, from the boreal forest of the Northwest Territories south to the Northern Rockies and eastward to Newfoundland, encompassing all the Great Lakes. It is highly migratory in the majority of its breeding range, leaving its summer haunts to winter over much of the USA and Mexico. The resident birds live in the Rockies and the lower Great Lakes (including Lake Michigan). In Ontario, the Ring-billed Gull is a very abundant breeding bird along the Great Lakes shorelines, particularly on Georgian Bay and Lake Ontario. One of the largest colonies at 58,000 pairs (Cadman et al. 2007) is at Presqu'ile Provincial Park, to the west of Prince Edward County.

Ring-billed Gulls are present in good numbers throughout both the spring and fall migration monitoring periods, with no apparent peaks (Fig. 7.10). There is a small to large – depending on the spring – increase in numbers at the end of May. The average ET in the spring is 2,686 (\pm 1,611), ranging from 191 in 2001 to 4,838 in 2012. The highest daily ET was 1,000 gulls on May 27, 2010 and June 6, 2002. Totals detected in the fall are smaller, with an average ET of 1,716 (\pm 934), and a range of 102 in 2013 to 3,504 in 2012. The highest daily ET was only 400 gulls on August 19, 2012.



Figure 7.1. Spring (top) and fall (bottom) phenology for Brant at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.2. Spring (top) and fall (bottom) phenology for Canada Goose at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.3. Spring (top) and fall (bottom) phenology for Mallard at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.4. Spring (top) and fall (bottom) phenology for Greater Scaup at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.5. Spring (top) and fall (bottom) phenology for White-winged Scoter at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.6. Spring (top) and fall (bottom) phenology for Long-tailed Duck at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.7. Spring (top) and fall (bottom) phenology for Red-breasted Merganser at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.8. Spring (top) and fall (bottom) phenology for Double-crested Cormorant at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.9. Spring (top) and fall (bottom) phenology for Bonaparte's Gull at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.10. Spring (top) and fall (bottom) phenology for Ring-billed Gull at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.2 Raptors

A total of 16 species of raptor were seen at Prince Edward Point from 2001 to 2013, with the two most abundant being Sharp-shinned Hawk and Turkey Vulture (the latter in the top 30) and the least likely being Black Vulture (seen only on two occasions, on September 20, 2003 and on May 29, 2004). Raptor migration is more visible in the fall than spring, with 87% of all raptors seen in this season. Most raptors, especially soaring species like Vultures, *Buteo* and *Accipiter* hawks, avoid crossing large bodies of water. In the spring, Lake Ontario acts as an effective barrier, with raptors migrating either north or south of it. In the fall, Prince Edward County, protruding south into Lake Ontario, likely represents a "trap" to migrating raptors: birds, especially inexperienced juveniles, fly in a southerly direction and congregate at the southern end of the County, blocked by the watery expanse of Lake Ontario. This effect is even more pronounced with strong northerly winds. As a consequence, there are no obvious temporal patterns in the fall migration. Nonetheless, October is the busiest month for soaring raptors, with "big days" scattered throughout the month (Fig. 7.11). For example, the biggest day was on October 16, 2005, with 910 Redtailed Hawks, 358 Sharp-shinned Hawks, and 120 Cooper's Hawks. Flapping raptors like Osprey, American Kestrel, and Merlin, being less hampered by wind, never congregate in big numbers and are usually observed in one s or twos (Fig. 7.11). Bald Eagles are not an uncommon sight around Prince Edward Point, although ETs in the spring are very low. Bald Eagles are relatively often observed outside the standard monitoring period. They are more common in the fall, being seen throughout the season, with the population increased by migrating juvenile and immature birds (Fig. 7.12). There are no breeding pairs vet at the eastern end of Lake Ontario. Golden Eagles have been detected in only 3 springs, each time with only one individual (on May 3 and May 25, 2003; on April 26, 2004; and on May 10, 2010). This species is, however, almost a yearly occurrence in the fall, missed only in 2002 and 2003. Numbers of Golden Eagle seen in the fall range from one individual to 10 birds in 2006. Golden Eagles are a late migrant, with most of the birds detected in late October (the earliest date was September 19, 2012, with two individuals) (Fig. 7.12).

7.2.1 Turkey Vulture

The Turkey Vulture is a large, soaring raptor, frequently seen rocking on its long wings in their characteristic dihedral position. It commonly breeds across North America, reaching the southern fringes of Canada, where its range has been expanding rapidly. In Ontario, it breeds in a broad swath from the extreme southwest to boreal forests of the Northern Shield. It is highly migratory, moving in large flocks during migration.

Spring migration is early in Ontario, with Turkey Vultures already coming back in March in southern parts of the province. At PEPtBO, numbers seen in the spring are relatively small and do not show any peak. Fall migration is more evident, with the numbers of Turkey Vultures spiking in October, usually during the first half of that month (Fig. 7.13). The highest daily ET was on October 16, 2005, with 700 Turkey Vultures. Conditions on that particular day must have been particularly enticing to soaring raptors, as it is also the biggest day for other species (see above). Other big days involve between 400 and 600 Turkey Vultures. Turkey Vultures are definitively reluctant to cross a large body of water, like Lake Ontario, resulting in flocks turning around when arriving at the southern shore, increasing the risk of double-counting at Prince Edward Point. Flocks of Turkey Vultures are very often seen "milling", flying in one direction and then another, always along the shoreline and never heading out far over Lake Ontario. Special care is taken to prevent double-counting within the same day: following flocks, and not counting a

flock of approximately the same size flying back. It is, however, impossible to completely prevent doublecounting.





Figure 7.11. Soaring (top) and flapping (bottom)the fall phenology for Raptors at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years). Soaring raptors include: Cooper's and Sharp-shinned Hawks, Red-tailed and Broad-winged Hawks, and Northern Harrier. Flapping raptors include: Osprey, Merlin, and American Kestrel.


Figure 7.12. Spring (top) and fall (bottom) phenology for Bald and Golden Eagles at Prince Edward Point (3-day average of 2001-2013)



Figure 7.13. Spring (top) and fall (bottom) phenology for Turkey Vulture at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.3 Corvids

Only 3 species of corvids occur regularly, although in varying abundance, at Prince Edward Point. A fourth species, Fish Crow, was seen only in the spring of 2013, on May two and a few other days outside the standard monitoring period. Common Ravens are resident birds, possibly breeding at a few locations in Prince Edward County. That species' presence has been steadily increasing at PEPtBO, from virtually no birds in the early years to multiple sightings of several individuals (up to four or 5) (Fig. 7.14). The American Crow, despite being abundant in southern Ontario, is a rather rare bird at Prince Edward Point. Although detected almost every day both in the spring and fall, this species is almost never seen in big numbers. Usually, only a few individuals are seen, most likely the local birds. On migration, American Crows form sizable flocks, so it appears that Prince Edward Point is outside the migratory paths of this species. The only corvid with a visible, important migration at PEPtBO is the Blue Jay.

7.3.1 Blue Jay

The conspicuous Blue Jay breeds across most of North America east of the Rocky Mountains in a wide variety of habitats. It is mostly a permanent resident, except for the extreme northern fringe of its range. At PEPtBO, it is the most abundant land bird and the fourth most abundant species overall, with more than a quarter of a million birds detected from 2001 to 2013, 92% of them in the fall.

Very few Blue Jays are present at Prince Edward Point in April and numbers start to increase significantly in early May. The spring migration of Blue Jay reaches a broad peak from mid- to late May (Fig. 7.15). Spring migration numbers have been very variable between years: a low of 426 and 587 birds in 2001 and 2013, respectively; a high of 3,396 and 3,928 in 2010 and 2004, respectively; an average of 1,678 birds (\pm 1,037). Fall migration is very well defined, with Blue Jays arriving in mid-September and rapidly increasing in number to reach a peak in late September to early October. Numbers then decline rapidly, with few Blue Jays detected after mid-October (Fig. 7.15). As in the spring, numbers in the fall are highly variable between years, but much higher: the average (\pm SD): 18,281 (\pm 12,555); range: 2,369 in 2013 to 47,196 in 2008. The highest daily ET was on September 27, 2008, when an estimated 9,600 Blue Jays moved through the area.





Figure 7.14. Number of days in spring (green) and fall (orange) with observation of Common Raven at Prince Edward Point from 2001 to 2013



Figure 7.15. Spring (top) and fall (bottom) phenology for Blue Jay at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.4 Swallows

At Prince Edward Point, three species of swallows, Tree, Cliff, and Barn Swallows, are detected in large numbers and breed in the area, notably on cottages and the lighthouse. Two other species, Northern Rough-winged and Bank Swallows are detected relatively regularly but with opposite patterns: the former species is overwhelmingly seen in the spring (over 90% of the total), whereas the latter species is detected mostly in the fall (88% of the total). The one other species of swallow seen at Prince Edward Point is the Purple Martin. Even though it sometimes breeds at the Point, its numbers are quite small.

Swallows are extremely visible birds and easily detected. Tree Swallows are the first swallows to come back in the spring, usually in early to mid-April (Fig. 7.16). They are followed in late April by Northern Rough-winged, Cliff and Barn Swallows (Fig. 7.17 and 7.18). Very few Bank Swallows and Purple Martins are observed in the spring. The highest daily ETs were 300 Tree Swallows and 200 Cliff Swallows on May 3, 2002 and 100 Barn Swallows on both April 20 and 22, in 2013 and 2011 respectively. The fall migration monitoring period likely misses the earliest migrants, as most swallows are seen in August, with their numbers dropping quite rapidly in September (Fig. 7.16, 7.17 and 7.18). The last Bank Swallow, for example, was seen on September 25, 2005. However, some large flocks are still seen, indicating the potential of large-scale migration. Often, swallows are seen feeding over the water of Lake Ontario, both in the spring and fall. The emergence of insects likely influences the presence and abundance of swallows at certain times. Some high daily ETs are for Tree Swallows: 800 on August 29, 2003, 500 on September 2, 2005, 650 on September 10, 2006; for Barn Swallows: 600 on August 19, 2001, 1,800 on August 28, 2011, 800 on August 30, 2012; for Cliff Swallows, the highest daily ET was only 80 birds on August 28, 2011.

Swallows, as a group, have shown drastic declines over a broad range of their distribution in the last 20 years. Raw numbers at Prince Edward Point do not necessarily show a decrease, but estimates are compounded with a local breeding population. A systematic survey of swallow nets at Prince Edward Point would help clarify the status of these still common birds.





Figure 7.16. Spring (top) and fall (bottom) phenology for Tree Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.17. Spring (top) and fall (bottom) phenology for Cliff Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.18. Spring (top) and fall (bottom) phenology for Barn Swallow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.5 Black-capped Chickadee

The Black-capped Chickadee is widely distributed across North America. It is a sedentary bird, but with irruptive behaviour after years of good breeding (Smith 1993). It breeds everywhere in Ontario, with the exception of the northern part of the Hudson Bay Lowland. The Black-capped Chickadee is essentially a non-migratory species, vacating northern portions of the breeding range only during periods of food shortage. Large irruptions occur with regularity.

At Prince Edward Point, there is a small resident population of Black-capped Chickadees. Numbers detected in the spring are quite small and relatively constant. In the fall, however, several irruptive episodes of various amplitudes have occurred every four or five years (Fig. 7.18). Irruptions occurred in the falls of 2001, 2005, and 2010. These irruptions are reflected in banded numbers, with the highest total of 1,491 Black-capped Chickadees banded in fall 2005, and 770 and 731 birds banded in fall 2001 and 2010. Almost all birds (96%) banded in the fall during irruption are hatch year birds. In non-irruptive years, Black-capped Chickadees are mainly resident and sedentary.

Temporal patterns of irruption differ greatly between years (Fig. 7.20). In 2001, Black-capped Chickadees started to arrive in good numbers in mid-September, and became more numerous throughout most of October without any major peak (the highest daily ET was 400 on 3 different days). On the opposite, in 2005, there were very few Black-capped Chickadees until mid-October, when a total of 2,000 birds were estimated on October 20. Only 47 Chickadees were counted the preceding day. The fall of 2010 shows an intermediate pattern, with Black-capped Chickadees arriving in good numbers in early October. Their numbers then stayed quite high throughout the month, but peaked at the end, with the highest daily ET 1,000 on October 31.





Figure 7.19. Spring (green) and the fall (orange) seasonal ET for Black-capped Chickadee at Prince Edward Point, 2001-2013



Figure 7.20. Fall phenology for Black-capped Chickadee at Prince Edward Point (3-day average of 2001-2013 and the 3 highest ET years)

7.6 Kinglets

Golden-crowned and Ruby-crowned Kinglets are both small, abundant birds of coniferous woodlands occurring in a broad range across the boreal forests and western mountains. They differ slightly in size and plumage, as well as in migratory behaviour, with Ruby-crowned Kinglets being more migratory than Golden-crowned Kinglets.

7.6.1 Golden-crowned Kinglet

The Golden-crowned Kinglet is an abundant bird of coniferous forests. It breeds from Alaska eastward to Newfoundland, southward to the northern United States and further southward along the eastern and western mountain ranges. It is a short-distance migrant (some populations being sedentary), wintering from southern Alaska and southern Canada to the southern United States and northern Mexico (Ingold and Galati 1997).

The spring migration of Golden-crowned Kinglets is already underway at Prince Edward Point when monitoring starts in mid-April. The sex ratio (as calculated by the number of males divided by the number of females) of banded individuals is strongly biased towards females (average of 0.64), which indicates that males migrate earlier than females, as is the case with the Ruby-crowned Kinglet. After the peak of migration in late April (mostly composed of females) numbers of Golden-crowned Kinglets decline sharply and this species is already quite rare after the first week of May (even though the last record is on May 26 in 2008) (Fig. 7.21). Spring migration numbers have been very variable between years: a low of 90 birds in 2008; a high of 1,658 in 2012, respectively; an average of 519 birds (\pm 404). As an early migrant, variations in numbers detected are most likely related to spring weather conditions. In early, warm springs, most Golden-crowned Kinglets have already passed through before mid-April.

Fall migration, in contrast, is well monitored within the time window at Prince Edward Point. The fall migration of Golden-crowned Kinglets starts in late September (with the earliest record on September 11, 2010), with most individuals moving through in October (Fig. 7.21). Detected numbers decline sharply at the end of October. However, abundance is quite variable, with a fivefold difference between the lowest ET of 936 birds in fall 2007 and the highest ET of 4,936 in fall 2010, for an average of 2,614 birds (\pm 1,355). A very high proportion of birds banded in the fall are hatch year (94%). Contrary to that of the Ruby-crowned Kinglet, the timing of migration in the fall is similar between sexes for the Golden-crowned Kinglet.

7.6.2 Ruby-crowned Kinglet

The seasonal spring ET average is 879 birds (\pm 362), with a low of 264 birds in 2001 and a high of 1,612 birds in 2007. In the fall, the seasonal ET average is 2,020 birds (\pm 741), with a low of 951 birds in 2001 and a high of 3,292 birds in 2006. See Fig.7.22 and the 5.0 Priority Species section for more details.



Figure 7.21. Spring (top) and fall (bottom) phenology for Golden-crowned Kinglet at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.22. Spring (top) and fall (bottom) phenology for Ruby-crowned Kinglet at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.7 American Robin

The American Robin is the largest, most abundant, and most widespread thrush in North America. In Ontario, it breeds throughout the province, reaching higher abundance in the southern parts, from the Ottawa valley to the extreme southwest. At Prince Edward Point, there is a large population of breeding birds. In total, the American Robin is the 15th most numerous species detected at PEPtBO.

The spring migration of American Robins is already underway in mid-April, as attested by relatively good numbers detected at that time (Fig. 7.23). A small peak is present in the second half of April, although numbers of Robins stay high throughout the spring, an indication of a resident population at PEPtBO. Numbers detected in the spring are highly variable between years, ranging from a low ET of 636 birds in 2001 to a high of 1,908 birds in 2005 (an average of $1,219 \pm 422$). The highest daily ET was on April 19, 2007, with 450 American Robins moving through. Other high daily ETs in other springs ranged from 100 to 130 birds.

In the fall, American Robins are present in small numbers from mid-August to late September, likely representing the local breeding population. Fall migration per se occurs in October, when larger numbers of Robins are detected, peaking in mid-month (Fig. 7.23). There are very large variations in numbers detected between fall seasons, with a 20-fold difference between the lowest and the highest ETs: there were only 401 and 546 birds detected in 2013 and 2005, respectively, whereas 9,028 American Robins were estimated in fall 2010 (with 3,000 birds in a single day, on October 18). Apart from these extremes, there are usually between 1,000 and 3,000 American Robins detected in the fall, for an average of 2,047 birds (\pm 2,246).





Figure 7.23. Spring (top) and fall (bottom) phenology for American Robin at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.8 European Starling

The European Starling, as an introduced species to North America, is one of the most disliked birds, although it is very familiar due to its abundance. In Ontario, it is widespread and very common in southern Ontario but very rare in the Shield region and far North, reflecting its close association to human development and agriculture. Only birds in the northern parts of its range are migratory.

At Prince Edward Point, there is no clear pattern in the spring, with overall numbers relatively small and a constant presence around the Point (Fig. 7.24). It is possible that migrants move earlier or simply do not go through the County in the spring migration. High numbers at the end of May certainly indicate a local breeding population. The average ET in spring is 691 (\pm 281), ranging from 218 in 2013 to 1,327 in 2003. The highest daily ET was 200 starlings on April 13, 2009.

In fall, European Starlings are present during the entire migration monitoring period, but there is a clear movement of large flocks in mid-October (Fig. 7.24). Totals detected in the fall are much higher than in the spring, with an average ET of 3,007 (\pm 3,199), ranging from 111 in 2013 to 12,727 in 2008. The highest daily ET of 3,456 starlings was on October 16, 2008, followed two days later by an ET of 3,019. It is noteworthy that the seasonal ET for 11 falls out of 13 is lower than the highest daily ET.





Figure 7.24. Spring (top) and fall (bottom) phenology for European Starling at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.9 Cedar Waxwing

The Cedar Waxwing is the more familiar member of the Bombycillidae family, due to its abundance and more southerly distribution than the other member, the Bohemian waxwing. It breeds across the southern half of Canada and the northern half of the US (Witmer et al. 1997). Most of the Canadian population is migratory, wintering in the southern half of the US as well as Mexico and Cuba.

Cedar Waxwings have a protracted migration, as attested by birds detected throughout the entire monitoring period of both spring and fall at Prince Edward Point. In the spring, small numbers are seen in April. Numbers slowly increase in May to reach a peak in the second part of this month (Fig. 7.25). As with other species, numbers of Cedar Waxwings detected in the spring are highly variable between years, ranging from a low ET of 194 birds in 2013 to a high of 7,526 birds in 2009 (average of 1,827 \pm 2,252). The highest daily ET was on May 21, 2009, with 750 Cedar Waxwings moving through. Seasonal ETs of over a thousand birds occurred in only four springs, whereas they were fewer than 600 birds in seven springs.

In the fall, Cedar Waxwings are present in good numbers from mid-August to mid-September. The Cedar Waxwing is a late breeder, in response to the increased abundance of fruit later in the summer, and it often forages in flocks a considerable distance from the nest site. It is thus possible that flocks of Cedar Waxwings observed at the end of summer (from mid-August to mid-September) are breeders still looking for food and not yet migrating. Numbers of Cedar Waxwings observed drop from mid-September to mid-October before peaking again at the end of October, when they are more likely to be migrant birds (Fig. 7.25). Variations in numbers detected between falls are not as large as in spring, with only a fourfold difference between the lowest and the highest ETs: a low of 1,170 birds detected in both 2001 and 2013; a high of 4,754 in 2010; an average of 2,602 birds (\pm 1,115). The highest daily ET was on October 31, 2006, with 1,000 birds.





Figure 7.25. Spring (top) and fall (bottom) phenology for Cedar Waxwing at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.10 Warblers

Wood warblers of North America are a diverse, beloved group of birds with bright plumage, cheerful songs, and spectacular migration. At Prince Edward Point, a total of 35 species of warblers have been detected from 2001 to 2013. Some of them are very rare at PEPtBO, having been detected in fewer than 10 seasons (out of a total of 26 seasons of monitoring). They are either vagrants, or spring overshoots (that is, birds returning to their breeding areas overshoot and end up further north than intended), or very secretive or simply rare in southern Ontario. The Lawrence's Warbler was seen only once, on May 24, 2008. The second most rarely-seen warblers are spring overshoots, the Worm-eating Warbler and the Yellow-throated Warbler, each detected in only three seasons, always in the spring (springs 2009, 2011, and 2013 for Worm-eating Warbler and springs 2002, 2004, and 2011 for Yellow-throated Warbler). There are four other species of warbler detected in four to 10 seasons: Prairie Warbler (in three springs and one fall), Yellow-breasted Chat (in five springs and two falls), Cerulean Warbler (in nine springs but never in the fall). Brewster's Warbler (in 10 springs), and Connecticut Warbler (also in 10 seasons, but two springs and eight falls). No species of warbler was detected only in the fall.

Of the other 27 species, the vast majority (22) have been detected in every single season and two others were missed only in one (Mourning Warbler) or three (Pine Warbler) seasons (Fig. 8.26). The last three species were mostly or exclusively detected in the spring: The Hooded Warbler was seen in 10 springs but only three falls. The Blue-winged Warbler was seen in all 13 springs but never in the fall. The closely-related Golden-winged Warbler was also detected in every spring but, unlike the Blue-winged, was detected in three falls as well.

The 22 species of warbler detected in every season of the 13 years of monitoring range from quite uncommon (with an overall total of fewer than 500 birds) to very abundant (with an overall ET of more than 15,000 birds) (Fig. 7.27). The three most abundant species (in decreasing order) are the Myrtle, Yellow, and Magnolia Warblers.

The spring migration of warblers is concentrated in May, except for the early Myrtle Warbler (Fig. 7.31). Overall, a few warblers arrive in late April, with numbers steadily increasing in early May. Warbler migration peaks in mid-May but numbers stay quite high until the last week of May. A few warblers are still migrating in late May and early June, mostly late migrant species like Wilson's and Blackpoll Warblers. In the fall, migration is more protracted, with some species migrating early in mid-August (or even earlier, as shown by Yellow Warblers) (Fig. 7.30) and the last species (most notably Myrtle Warblers) still moving through in October (Fig. 7.28). However, most species migrate through in September, with no apparent peak.

7.10.1 Magnolia Warbler

The seasonal spring ET average is 879 birds (\pm 362), with a low of 264 birds in 2001 and a high of 1,612 birds in 2007. In the fall, the seasonal ET average is 2,020 birds (\pm 741), with a low of 951 birds in 2001 and a high of 3,292 birds in 2006. See Fig.7.29 and the 6.0 Priority Species section for more details.

7.10.2 Yellow Warbler

The Yellow Warbler has the most widespread breeding range of all the wood warblers, nesting across much of North America from Alaska to Newfoundland and south to Mexico. It is a familiar and abundant bird in broadleaf woodlands and thickets, with a strong affinity for riparian corridors, especially in arid or open lands. It also tends to avoid denser forested habitats (Lowther et al. 1999). In Ontario, the species

breeds all across the province, with higher abundance in the south, from the Ottawa Valley to the Lake Erie shoreline, and also along the coastal areas of the Hudson Bay Lowlands.

At Prince Edward Point, the first Yellow Warblers in the spring are detected in late April (with April 23, 2002 being the earliest). Bird numbers build up quite rapidly over the first 10 days of May and reach a peak in mid-May (Fig. 7.30). The precise timing of the peak is quite variable between years, as indicated by large variations in numbers for any given week and by the extended plateau of high numbers from mid-to late May. No sharp decrease in numbers is apparent at the end of May, mainly due to the abundant breeding population at the Point. The seasonal spring ET average is 826 birds (\pm 435), with a low of 559 birds in 2001 and a high of 1,877 birds in 2009.

In the fall, migration is already underway when monitoring starts in mid-August. Numbers peak in mid-August and decline sharply afterwards to just a few birds in early September (Fig. 7.30). The latest Yellow Warbler was detected on September 24, 2011. The seasonal fall ET average is 124 birds (\pm 80), with a low of 27 birds in 2013 and a high of 351 birds in 2002.

7.10.3 Myrtle Warbler

The seasonal spring ET average is 879 birds (\pm 362), with a low of 264 birds in 2001 and a high of 1,612 birds in 2007. In the fall, seasonal ET average is 1,519 birds (\pm 775), with a low of 661 birds in 2013 and a high of 3,277 birds in 2005. See Fig.7.31 and the 6.0 Priority Species section for more details.



Figure 7.26. Number of species of warblers observed in relation to season and number of years they have been observed at Prince Edward Point, 2001-2013



Figure 7.27. Abundance of species of warblers in relation to occasions of sightings at Prince Edward Point, 2001-2013



Figure 7.28. Spring (top) and fall (bottom) phenology for warblers at Prince Edward Point (3-day average of 2001-2013 and warblers with highest overall ET)



Figure 7.29. Spring (top) and fall (bottom) phenology for Magnolia Warbler at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.30. Spring (top) and fall (bottom) phenology for Yellow Warbler at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.31. Spring (top) and fall (bottom) phenology for Myrtle Warbler at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.11 Sparrows

Sparrows (family Emberezidae) of North America are as diverse a group as the wood warblers, but do not seem to garner the same general excitement: they often are dismissively called LBJs or Little Brown Jobs. Nonetheless, they are as remarkable as any warblers in regard to migration. At Prince Edward Point, a total of 18 species of sparrow have been detected from 2001 to 2013. A few of them are very rare at PEPtBO, having been detected in only one season. The Lark Sparrow detected on April 25, 2009, was a vagrant from a more western breeding range. The other 3 species only detected once (Le Conte's, Nelson's Sharp-tailed, and Grasshopper Sparrows) are secretive species. However, the Grasshopper Sparrow breeds in Prince Edward County.

All the other 14 species are detected regularly at Prince Edward Point, with nine of them seen every single season. Abundance (as expressed by overall ET) ranges from a low of 90 birds for Vesper Sparrow to a high of 26,700 birds for Slate-coloured Junco.

Migration phenology is presented for all sparrow species, with the exception of the 3 most abundant species (in increasing abundance), Song Sparrow, White-throated Sparrow, and Slate-coloured Junco, which have their own graphs. The spring migration of sparrows is mostly concentrated in the first two weeks of May, with the exception of a few early species, most notably the Slate-coloured Junco (see below and 5.0 Priority Species section). Other very early spring migrants include Fox and American Tree Sparrows (Fig.7.32). In the spring, Chipping and White-crowned Sparrows account together for more than a third of the overall total (when the 3 most abundant sparrows are excluded). In the fall, White-crowned Sparrow numbers represent over 50% of the total, whereas Chipping Sparrow numbers account for about 28%.the fall migration is mostly from late September continuing into early November with late species like American Tree and Fox Sparrows (Fig.7.32). Sparrows detected in August are mostly Chipping Sparrows, which certainly represent a local, abundant, breeding population.

7.11.1 Song Sparrow

The Song Sparrow is one of the most widespread and abundant of North American birds. It is found mostly in shrubby areas. In Ontario, it is more abundant in the southern part of the province. Although a few Song Sparrows winter in southern Ontario, most migrate south into the US in the autumn.

At Prince Edward Point, Song Sparrows are already present in good numbers in mid-April, an indication of a spring migration underway. Numbers decline progressively and slowly into May but stay relatively high throughout the spring, due to the numerous local breeders (Fig.7.33). The seasonal spring ET average is 575 birds (\pm 341), with a low of 387 birds in 2012 and a high of 1,372 birds in 2002. In the fall, the local breeding population, reinforced by hatch year birds, is even more evident in the high numbers of Song Sparrows detected in August. Numbers decline steadily in September to climb again and reach a peak in mid-October with migrants moving through, although the timing and importance of it is very variable between years (Fig. 7.33). On average the fall ET is 437 birds (\pm 243), with a low of 112 birds in 2011 and a high of 940 birds in 2001.

7.11.2 White-throated Sparrow

The seasonal spring ET average is 965 birds (\pm 409), with a low of 199 birds in 2001 and a high of 1,753 birds in 2013. In the fall, the seasonal ET average is 726 birds (\pm 142), with a low of 543 birds in 2002 and a high of 994 birds in 2010. See Fig.7.34 and the 6.0 Priority Species section for more details.

7.11.3 Slate-coloured Junco

The seasonal spring ET average is 370 birds (\pm 322), with a low of 131 birds in 2001 and a high of 1,343 birds in 2011. In the fall, the seasonal ET average is 1,354 birds (\pm 991), with a low of 658 birds in 2007 and a high of 4,194 birds in 2005. See Fig.7.35 and the 6.0 Priority Species section for more details.





Figure 7.32. Spring (top) and fall (bottom) phenology for Sparrows at Prince Edward Point (3-day average of 2001-2013)



Figure 7.33. Spring (top) and fall (bottom) phenology for Song Sparrow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.34. Spring (top) and fall (bottom) phenology for White-throated Sparrow at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.35. Spring (top) and fall (bottom) phenology for Slate-coloured Junco at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.12 Blackbirds

The commonly called blackbirds are members of the family Icteridae, which also includes the brightly coloured Orioles, the melodious Meadowlarks, and the unique Bobolink. Of the four species detected at Prince Edward Point, only the Rusty Blackbird does not breed in the area. This species breeds throughout the Boreal Forest and subarctic regions from Newfoundland across the continent to Alaska and has been affected by a long-term dramatic decline. At PEPtBO, it is the least common blackbird: although detected every single season, its seasonal numbers range from a handful of individuals to a few hundred (and up to 3,290 birds in fall 2011). It is possible that the Rusty Blackbird is sometimes overlooked in big flocks of blackbirds.

7.12.1 Red-winged Blackbird

The Red-winged Blackbird is a widespread and abundant bird of wetlands and some upland habitats. It is among the most numerous species of birds in North America, with an estimated population of 193 million birds (Rich et al. 2004). It breeds across the continent, generally south of the Boreal Forest. All the northern part of the population is migratory.

At Prince Edward Point, small flocks of Red-winged Blackbirds are seen throughout the spring, with variable peaks both in terms of numbers and timing (Fig. 7.36). No large flocks are seen, with the highest daily ET of 200 birds on April 12, 2010. Numbers stay relatively high towards the end of May, potentially linked to the presence of local birds. The seasonal spring ET average is 1,158 birds (\pm 251), with a low of 659 birds in 2002 and a high of 1,487 birds in 2007. In the fall, there are a few Red-winged Blackbirds seen from August to early October, possibly local birds. However, the data shows a definite increase in numbers detected in mid-October, with large flocks in some years, especially at the end of the month (2,415 birds detected on October 31, 2003; 2,700 birds on October 29, 2009; 1,000 birds on October 27, 2010) (Fig.7.36). The seasonal fall ET average is 1,845 birds (\pm 1390), with a low of 373 birds in 2013 and a high of 4,558 birds in 2001.

7.12.2 Common Grackle

The Common Grackle is abundant throughout much of North America east of the Rockies. It is found in a variety of habitats, frequenting open areas with scattered trees. It is migratory in the northern and western parts of its range, wintering in the rest of its range. In Ontario, it breeds throughout the province but is most abundant in the south.

At PEPtBO, there is no general pattern in the spring, with low numbers seen throughout the season (Fig. 7.37). It appears that Common Grackles either bypass Prince Edward Point during spring migration or that migration begins earlier than monitoring and that most birds detected are likely to be local. The seasonal spring ET average is 936 birds (\pm 336), with a low of 382 birds in 2013 and a high of 1,400 birds in 2004. In the fall, Common Grackles follow the same general pattern as Red-winged Blackbirds (Fig. 7.37): the presence in small numbers of local birds from August to early October and movements of migrants in mid-October, sometimes in large flocks (3,000 birds on October 25, 2010, for example). More birds are detected in fall, on average, than in spring, although yearly variations are quite high. The seasonal fall ET average is 3,368 birds (\pm 2,688), with a low of 318 birds in 2007 and a high of 8,469 birds in 2006.

7.12.3 Brown-headed Cowbird

The Brown-headed Cowbird is an obligate brood parasite, laying its eggs in the nests of other birds and relying on the host for parental care of its young. Its range has expanded considerably during the 20^{th}

century and now extends across much of North America south of the Boreal Forest. In Ontario, it breeds mostly in the southern part of the province.

At PEPtBO, this species is present disproportionately in the spring, when it readily takes advantage of the food used to bait ground traps. It is almost absent in the fall. There is no apparent peak of migration in the spring, with numbers slowly decreasing throughout the season (Fig. 7.38). The seasonal spring ET average is 1,987 birds (\pm 735), with a low of 803 birds in 2013 and a high of 3,177 birds in 2003. Very few Brown-headed Cowbirds are seen in the fall, with birds detected mostly in August and October in no apparent pattern (Fig. 7.38). The seasonal fall ET average is 69 birds (\pm 40), with a low of 29 birds in 2011 (and no birds in 2013) and a high of 142 birds in 2003.





Figure 7.36. Spring (top) and fall (bottom) phenology for Red-winged Blackbird at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)


Figure 7.37. Spring (top) and fall (bottom) phenology for Common Grackle at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)



Figure 7.38. Spring (top) and fall (bottom) phenology for Brown-headed Cowbird at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

7.13 Finches

Finches are a family of seedeaters breeding mostly, but not uniquely, in northern latitudes and western mountains. Their reliance on unreliable "cone crops" for food induces in many species a nomadic lifestyle and the formation of flocks of "winter finches" roaming south in winter.

At Prince Edward Point, 8 species of finches have been detected from 2001 to 2013 but only 3 of them (American Goldfinch, House and Purple Finches) are regularly seen every season. Pine Grosbeaks were seen only in 3 seasons, with only one individual in each: falls 2001 and 2005, and spring 2002. White-winged Crossbills were seen only slightly more often: in fall 2001 with 17 birds, and in springs 2002 and 2009 and fall 2012 with only one bird on each occasion. Common Redpolls and Evening Grosbeaks are more often detected but still in small numbers and not every season. Common Redpolls are early spring and late fall migrants, easily missed during the monitoring period at PEPtBO. This species was detected in 8 years out of 13, with about the same frequency in spring and fall, but with higher numbers in fall. Evening Grosbeaks were detected every year but not every season. The last "uncommon" finch species at Prince Edward Point is the Pine Siskin, a highly irruptive species. It was completely absent during six seasons (out of 26) and seen in very small numbers (fewer than 60 birds) in 11 other seasons. However, it reached high to very high abundance in a few other seasons: an ET of 786 birds in spring 2009, 1,295 birds in fall 2001, and an amazing 5,346 birds in fall 2012.

7.13.1 American Goldfinch

The American Goldfinch is the most familiar of the finches, having a colourful plumage (for the male) and a breeding range encompassing southern Canada and most of the US, and being a regular visitor to bird feeders. It is resident in most of its range, except in the extreme northern part. In Ontario, it breeds across the province, except in the northern part. It is most abundant in the extreme south.

At Prince Edward Point, the spring and fall migrations are well marked. In spring, most birds move through during the first two weeks of May (Fig. 7.39). The seasonal spring ET average is 545 birds (\pm 266), with a low of 230 birds in 2013 and a high of 1,158 birds in 2003. More birds are seen in the fall than spring. Numbers of Goldfinches increase slowly from mid-August to early September, and then American Goldfinches move through in bigger numbers during September into early October. Numbers decline sharply after early October (Fig. 7.39). The seasonal fall ET average is 3,817 birds (\pm 2,161), with a low of 1,041 birds in 2013 and a high of 7,419 birds in 2012. The highest daily ET of 1,000 American Goldfinches was on September 22, 2012.



Figure 7.39. Spring (top) and fall (bottom) phenology for American Goldfinch at Prince Edward Point (3-day average of 2001-2013 and lowest and highest ET years)

8.0 Migration strategy in the Great Lakes area

Peninsulas, islands, and other land formations have been thought to provide significant stopover and travel routes for migrating birds near large bodies of water, likely performing the function of a leading line, a landmark used by migrants for orientation (Alerstam and Pettersson 1977).

Migration routes include risk assessments made between shortest-distance and changing environmental factors, such as wind direction and strength, which cause changes in chosen migratory routes between birds and years. When travel direction is only slightly altered by the alignment of the coast, birds may favour routes that remain over land when risk is heightened (Alerstam and Pettersson 1977). The Great Lakes represent a large potential barrier for migrating landbirds causing them to make the behavioural decision to circumnavigate the lakes, or to cross in one flight, as the lakes offer no resting or feeding opportunities.

Recent technologies have allowed further study into the movements of migrating birds, including chemical tissue isotopes, genetic markers, Radio Frequency Identification Tags, Very High Frequency telemetry, geolocators, satellite telemetry, and radars (Robinson et al. 2010). Because of the small size and weight of most land birds, weather radars have been found to be of most use in the study of large-scale bird migration because of the large area covered (Robinson et al. 2010). These radars have been used to identify important stopover habitats, understand the locations and timing of migratory activities, and study the behavioural responses to migratory barriers (Diehl et al. 2003). Before the 1990s, bird migration patterns and behaviours around the Great Lakes were poorly understood due to the lack of suitable technology (Diehl et al. 2003); however, with the development of Doppler weather radar technology in 1988, data for bird migration has since become more widespread and available for studies. NEXRAD (or WSR-88D) is a system of 159 radars spread across the United States that is suited to viewing large-scale patterns of bird migration.

Radar studies can be used to understand migratory intensity and timing where weather, light conditions, and size of study area do not permit the study of migrants at night. The Great Lakes have recently been studied as a potential barrier to movement using radar technology. Diehl et al. (2003) used ten NEXRAD radars along the southern edge of the Great Lakes to understand where migrants crossed the Great Lakes, if the Great Lakes were avoided, why migrants regularly ascended at dawn and re-oriented towards land, and if these behaviours would impact the location of coastal habitats used as stopover points. It was found that large numbers of birds crossed the Great Lakes, and lake avoidance was not the norm.

When reaching a coastline that runs perpendicular to the desired direction of travel, birds can choose to cross or follow the coastline and avoid the crossing. According to Diehl et al. (2003), migrant birds had a tendency towards greater lake avoidance at Lake Ontario in the spring than in the fall due to the orientation of the lake. However, another study, done at the eastern end of Lake Ontario and the Thousand Islands of the St. Lawrence River, found the opposite: birds seem to cross Lake Ontario more in the spring than fall (Williams et al. 2013). It seems that in the fall, many birds flying south arrive on the north shore of Lake Ontario and then fly around all or part of the lake, over the northeastern shoreline and the St. Lawrence River. In contrast, spring patterns of migratory activity seem to indicate a large number of birds directly crossing the lake. This may represent a more risky migratory strategy in the spring, when birds are heading north and hurrying to the breeding grounds, so may be more likely to take direct routes across bodies of water and other potential obstructions (Williams et al. 2013). Conflicting results, as above, indicate the need for more long-term studies at different spatial scales in order to better understand lake

crossing strategies of bird migrants. Birds flying over water generally re-oriented their flight towards the closest land at dawn (likely due to increased visibility) after an initial dawn ascent – likely to gain a better vantage point and possibly avoid predators. It was also found that migrants took off from staging grounds after sunset, with peak migration occurring over the Great Lakes at 11:30pm (Diehl et al. 2003).

Because landbird migrants tend to fly overnight and select their stopover habitats between midnight and 2:00 am (Kerlinger and Moore 1989), low light conditions do not favour the use of coastlines and other landform features for orientation, unless birds can perceive the coastline because of low flying height, strong moonlight for visibility, or the presence of whitecaps on the water (Griffin 1969). Whether they choose to fly along the coastline or depart over a large body of water has been related to their migratory urge, the angle between the preferred flight direction and the coastline, the bird's flying altitude, and wind conditions (Alerstam and Pettersson 1977). Because wind speed is reduced near ground level due to increased friction, Alerstam and Pettersson predicted that the same conditions that would provide the fastest crossing time (strong tailwinds) would also see birds flying at higher altitudes (to use the maximum wind capacity) over the straightest distance (over water). Therefore, species that carefully select migration times on wind direction and speed will also likely be the species that fly at high altitude over water, which is the case for most nocturnal migrants.

9.0 Recommendations for future monitoring of migrant birds

No park or reserve can be managed as an island (Janzen 1983). The Greater Park Ecosystem concept, as derived from ecosystem management thinking, is an integrative, cooperative, and adaptive approach that embodies understanding ecological processes at the landscape level, integrating all aspects of conservation from wildlife populations and movement corridors to the region's stakeholder interests and policy making. Even large to global scale changes such as climate change, on which parks or reserves have minimal influence but which can impact the park or reserve ecosystems, also must be considered.

Monitoring bird migration is a difficult science due to the variability between locations, bird species, weather, habitat change and other factors. Obtaining statistically significant data while being able to recognize and reduce bias requires large amounts of data collected over a long period of time and under well thought out, repeatable scientific methods. Understanding the bigger picture of migration corridors (i.e., where and why birds move) requires landscape level study. There are a number of recommendations for increasing the understanding of migrant birds at Prince Edward Point National Wildlife Area and within the greater ecosystem of Prince Edward County as outlined below. Note that recommendations are not ranked, neither by importance nor feasibility.

9.1 Understanding which species cross large water bodies

Prince Edward Point is surrounded by large water bodies on a thin, east-pointing peninsula within Prince Edward County (Fig. 1.1). While it is well known (through radar surveys) that songbirds do cross large bodies of water and that most soaring birds avoid long crossings due to the lack of thermals over water (Newton 2008), there is a lack of knowledge of which bird groups do attempt crossing along the southern shore of Prince Edward County both in spring and fall.

Recommendation: Conduct simultaneous visible migration watches at different points across the southern shore of Prince Edward Count during spring and fall migration to describe migration patterns and bird movements relative to the geography of the region. For example, bird movement surveys could involve a two- or three-person team stationed at Point Petre (the southwest corner of the County's south shore), and Prince Edward Point (with, potentially a third person in the middle of the south shore), to simultaneously observe any bird movements, focusing on whether larger birds, such as raptors, woodpeckers and corvids, cross this section of water.

9.2 Focal species

Observing and accurately estimating totals of all species, particularly rare species, can be difficult during peak migration. It may be worth focusing in on specific species, or groups of species, in order to better estimate their totals. For example, monitoring Species at Risk can be an important part of work with any taxa; however, with migratory birds, observing Species at Risk that migrate through a migration monitoring station is an important way of gathering data and understanding declining populations.

Supplementing mist-netting data with local data (through species- or group--specific monitoring such as census transects, hawk watches and lake watches), in addition to regional data from point counts would increase the understanding of bird movements and population trends.

Recommendation: Increase the emphasis on surveys (e.g. visible migration) that detect Species at Risk such as Rusty Blackbird, Common Nighthawk and Bobolink etc. Prince Edward County has a significant number of Species at Risk. PEPtBO could play a larger role in monitoring and studying Species at Risk in the County, whether migrants or resident species.

9.3 Aiming for statistical significance/reducing bias

Reducing bias in sampling methods is one way to increase the number of species with statistically significant population trends. The local breeding resident bias is caused by a potentially high, though unknown, proportion of capture of resident individuals, which does not allow for statistical significance in the way the population trends are modeled.

Recommendation: Include summer breeding bird surveys, targeting specifically American Robin, Yellow Warbler, Song Sparrow and other local species, whether through a Monitoring Avian Productivity and Survivorship (DeSante 1992) station or point counts. Such surveys could help reduce this bias by providing numbers to remove from migration monitoring data to account for those individuals that are considered resident. During migration monitoring banding, especially in June and August, keep more detailed records on moult limits, cloacal protuberance, brood patch, and any characteristics potentially indicating breeding (at least for target species).

An additional bias, which leads to some species not showing statistically significant population trends is that their migration period extends outside the current monitoring period of PEPtBO. Examples of these species include Brown Creeper, Golden-crowned Kinglet, Yellow Warbler and Slate-coloured Junco.

Recommendation: Extend the PEPtBO migration monitoring period to include these priority species at both ends of the spring and fall migration.

9.4 Understanding stopover ecology habitat variables at Prince Edward Point

The choice of stopover habitat depends on multiple variables, most notably shelter and food availability. The latter, in turn, depends on climate and weather, vegetation, soil types, presence of water, and geomorphology of the local landscape (Carlisle et al. 2009). While some of these variables (soil types and geomorphology) do not vary from year to year, weather and food availability can (e.g. spring midge emergence timing and fruit production on trees and shrubs), and may help to explain yearly variations in detected totals.

Recommendation: Establish a project to determine, quantify, and describe the importance and function of Prince Edward Point as a stop-over site. Include yearly vegetation surveys, estimating berry production and note dates of midge emergence, to try to correlate bird population trends with food availability at Prince Edward Point. Identify and target specific species that potentially use Prince Edward Point as a stop-over site.

9.5 Internships

The development and training of young biologists not only creates strength in the biological and local communities, but also increases the likelihood of young biologists returning as future station scientists and other members of the organization's team. Internships provide field biologists with training in data collection, standardized protocols, data management, and an understanding of how their work fits in with larger research questions. It also provides the organization with a fresh set of eyes on the methods, and a commitment greater than from a regular volunteer. It is not necessary that internships be paid; instead, internships demand a greater commitment to mentorship and involvement than would a volunteer. The Point Reyes Bird Observatory (PRBO) established in 1966, has a strong internship program (Porzig et al. 2011) which has created many 'alumni' in the conservation community, ultimately increasing interorganization collaboration. The PRBO internship program also supports the local biological community and has increased local involvement in the bird observatory.

Recommendation: Hire a spring and/or fall intern, with the understanding that this person would stay for the entire season and be involved in a greater level of detail than a regular volunteer (such as data entry and management and training of volunteers where possible). In exchange, this intern could receive compensation, such as the daily per diem and further career mentorship.

9.6 Publish interesting results

Publishing the results and data analyses of monitoring – particularly in response to specific research questions – allows for collaboration between scientific groups, encourages further understanding and critical thinking of PEPtBO data, and increases the credibility of PEPtBO with interns, volunteers, the general public, policy makers and the birding community.

Recommendation: Encourage and conduct more relevant science related to bird migration and biological and ecological research that takes better advantage of the opportunities PEPtBO provides. This could also mean encouraging graduate student involvement in the station and specific projects from time to time. One outcome would be regular publication (in both peer reviewed and popular media).

10.0 Acknowledgements

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11.0 Appendix

Spring Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013.

Fall Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013.

Spring standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013.

Fall standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013.

Spring non--standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013.

Fall non standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013.

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Long-tailed Duck	355703	79627	283931	81139	28374	41318	36307	9006	20081	30570	37382	16403	1023	1020864
Double-crested Cormorant	3909	8022	10497	15551	14531	23598	21803	38265	18745	50836	15238	17135	6460	244590
Bonaparte's Gull	1945	7136	7808	17409	15875	14932	10616	3532	26288	14632	8028	10293	1247	139741
White-winged Scoter	386	2376	3202	4387	836	376	5196	3633	2494	11118	55535	11503	747	101789
Ring-billed Gull	191	2705	2165	3114	1897	4922	3210	3034	2237	4830	4512	4858	664	38339
Canada Goose	1546	3836	4469	1947	1525	2420	3171	664	1199	1746	12569	891	669	36652
Cliff Swallow	1068	1746	2923	3700	4045	2678	3015	2250	2438	3318	1614	3131	383	32309
Myrtle Warbler	536	553	1896	2693	1428	2425	3682	1738	2892	1193	5143	2349	1565	28093
Brown-headed Cowbird	1167	3297	3293	1963	2298	2540	2265	1553	2671	1687	2487	1027	803	27051
Red-breasted Merganser	277	436	209	1154	1642	1656	1784	2631	1689	3844	1853	6659	228	24062
Blue Jay	426	2099	1300	4225	1331	1737	1135	2605	1151	3396	1708	1262	587	22962
Cedar Waxwing	596	676	2031	585	744	605	406	893	7526	1402	899	5548	194	22105
American Robin	636	1074	1200	1022	1952	1315	1788	692	1137	1420	1913	1542	879	16570
Red-winged Blackbird	665	946	1323	1373	1173	1188	1487	1025	1296	1298	1753	1173	1253	15953
Black Brant	250	20	531	1610	456	146	4795	638	1795	1720	1534	1514		15009
Yellow Warbler	559	1119	1220	1286	1078	1264	1022	1055	1877	1312	1097	1286	826	15001
Common Grackle	454	915	1185	1567	1365	1215	1069	564	1082	733	1688	1142	382	13361
White-throated Sparrow	199	644	1455	1136	894	1109	922	700	895	743	685	1409	1753	12544
Ruby-crowned Kinglet	264	818	541	1468	887	876	1612	935	891	776	548	1126	757	11499
Tree Swallow	971	1223	1027	1329	1299	948	474	305	633	520	787	1035	627	11178
Song Sparrow	665	1761	921	823	1041	949	968	542	715	436	690	390	575	10476
European Starling	547	1006	1143	1041	858	1412	724	551	811	481	965	482	218	10239
Magnolia Warbler	690	284	557	622	824	1059	719	705	600	738	1049	707	328	8882
Slate-coloured Junco	131	683	808	816	768	662	1049	314	700	339	1358	490	757	8875
Bufflehead	266	525	539	928	455	450	443	411	929	597	1813	511	686	8553
American Goldfinch	292	682	1217	804	274	512	809	662	605	370	594	300	230	7351
Golden-crowned Kinglet	199	625	219	496	368	346	527	115	745	779	539	1663	192	6813
White-crowned Sparrow	142	345	427	665	462	516	611	394	331	570	716	679	491	6349
Chipping Sparrow	338	682	722	661	696	564	504	360	402	334	366	268	161	6058

Table 11.1. Spring Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Mourning Dove	172	332	326	387	443	548	572	461	649	569	779	413	316	5967
Barn Swallow	295	395	465	692	685	600	381	196	319	290	328	649	495	5790
Purple Finch	52	388	37	293	170	338	245	904	350	133	1236	66	509	4721
Yellow-shafted Flicker	135	274	267	423	334	675	426	180	469	216	410	286	312	4407
Baltimore Oriole	133	135	384	368	421	617	308	342	448	324	369	359	157	4365
Gray Catbird	159	174	382	375	229	415	545	199	429	235	380	503	190	4215
Nashville Warbler	87	74	207	413	325	394	403	210	360	339	697	156	306	3971
Herring Gull	200	368	242	476	158	416	498	224	546	346	218	176	73	3941
Turkey Vulture	202	240	355	504	344	287	393	254	325	265	352	261	94	3876
N. Rough-winged Swallow	105	177	387	207	271	271	184	223	622	211	540	387	14	3599
Brown Creeper	117	229	227	315	283	250	308	120	303	144	393	413	198	3300
Common Yellowthroat	134	223	226	372	280	295	221	154	194	158	324	271	369	3221
Rose-breasted Grosbeak	32	129	166	179	269	505	211	197	162	220	376	204	113	2763
Black-throated Green Warbler	180	76	143	260	185	318	265	193	203	189	443	162	83	2700
Black-capped Chickadee	106	228	189	197	295	257	144	151	256	136	318	130	201	2608
Chestnut-sided Warbler	91	75	127	253	183	162	245	163	171	312	447	253	59	2541
Hermit Thrush	98	155	170	196	208	209	263	81	263	222	157	317	182	2521
Common Merganser	38	103	133	136	202	230	275	88	138	330	504	146	58	2381
Rusty Blackbird	25	6	150	335	123	204	584	69	55	138	325	302	14	2330
American Redstart	100	110	130	225	225	199	137	132	285	150	281	191	129	2294
Red-eyed Vireo	85	113	185	133	285	239	181	97	190	133	256	293	47	2237
House Wren	33	87	94	218	149	175	211	205	305	184	238	196	112	2207
Mallard	190	247	283	249	212	178	119	93	171	104	140	63	37	2086
Swainson's Thrush	26	59	103	95	249	266	274	62	166	186	162	213	213	2074
Philadelphia Vireo	17	10	11	33	39	20	20	1539	44	13	90	53	6	1895
American Crow	154	213	271	233	192	107	106	52	83	124	128	94	55	1812
Brown Thrasher	35	71	114	154	139	152	166	129	179	199	163	181	87	1769
Field Sparrow	133	108	124	229	228	165	124	90	68	105	149	99	57	1679
Least Flycatcher	120	79	110	168	154	216	174	57	155	94	141	111	22	1601
Eastern Towhee	23	31	157	198	178	109	151	169	160	107	104	123	83	1593

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Common Loon	72	122	166	120	97	89	144	104	143	167	258	85	19	1586
Black Scoter	107		6	10	1	5	1328	1	83	2	7			1550
Blackburnian Warbler	56	38	52	227	67	132	152	145	116	126	250	84	22	1467
Eastern Kingbird	70	116	123	177	102	58	65	73	176	132	102	133	33	1360
Palm Warbler	27	52	84	314	91	56	144	88	176	89	129	92	16	1358
Black-throated Blue Warbler	44	64	94	100	75	143	187	56	110	127	148	106	85	1339
Ruby-throated Hummingbird	33	100	209	177	104	76	80	90	147	68	87	158	8	1337
Dunlin		50	4	900			25	10	282					1271
Black- and-white Warbler	34	45	69	165	61	115	104	78	112	199	115	91	58	1246
Pine Siskin	9	24		46	2	25		24	786		154	6	58	1134
Blue-gray Gnatcatcher	78	113	97	110	146	33	36	59	101	70	95	51	46	1035
Eastern Phoebe	92	125	50	81	65	115	86	22	132	20	87	81	67	1023
Killdeer	92	197	113	109	17	50	67	62	91	69	85	26	37	1015
Ovenbird	37	58	51	83	72	112	134	40	66	83	75	68	88	967
Blackpoll Warbler	33	37	34	79	35	18	88	49	105	39	117	211	53	898
Downy Woodpecker	30	61	81	63	62	102	77	39	95	38	107	40	21	816
Caspian Tern	53	61	63	127	75	97	53	15	43	76	54	67	28	812
Lincoln's Sparrow	23	24	129	79	88	57	92	47	41	19	79	61	28	767
Wood Thrush	20	34	42	75	68	120	129	38	40	49	66	51	32	764
Swamp Sparrow	19	44	62	116	77	92	69	25	41	50	20	60	66	741
Tennessee Warbler	25	15	7	29	46	30	97	53	32	15	131	182	67	729
Veery	23	19	34	63	102	78	137	32	38	54	51	43	38	712
Northern Harrier	12	82	37	66	103	67	101	80	37	30	27	39	10	691
Blue-headed Vireo	13	15	53	43	40	50	67	65	55	52	120	81	36	690
Wild Turkey	40	30	64	56	78	70	66	22	51	45	104	44	13	683
Scarlet Tanager	12	18	68	51	37	70	73	41	94	67	72	52	24	679
Ruffed Grouse	29	32	20	39	81	57	73	31	55	40	60	78	66	661
Wilson's Warbler	30	27	33	45	107	70	96	35	77	17	54	34	33	658
Bobolink	114	46	29	102	36	53	62	39	95	26	46	6	1	655
Great Blue Heron	59	139	70	133	55	43	56	14	20	17	14	15	3	638

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Warbling Vireo	16	16	61	79	45	64	50	22	102	56	61	47	6	625
Yellow-bellied Flycatcher	54	51	81	80	44	62	47	17	30	26	61	44	26	623
Northern Parula	3	24	26	18	38	31	69	60	83	54	139	62	13	620
Traill's Flycatcher	23	31	85	76	79	96	49	13	35	40	29	43	16	615
Great Crested Flycatcher	32	32	50	99	34	48	35	22	59	56	49	90	8	614
Bay-breasted Warbler	19	23	13	32	86	68	57	39	50	25	100	79	19	610
House Finch	36	138	148	35	16	34	38	52	9	25	59	2	13	605
Surf Scoter		14		1		11	53	20	4		476		2	581
Eastern Wood-Pewee	34	49	58	74	80	48	33	14	47	59	32	31	5	564
American Bittern		5	2	1	15	1	501	2	20			7	7	561
Gray-cheeked Thrush	2	17	24	23	36	123	146	15	32	32	37	12	29	528
Yellow-bellied Sapsucker	11	34	32	25	22	37	109	10	24	35	50	126	9	524
Red-necked Grebe		3	2	1	2	3	502		3	1	5			522
White-breasted Nuthatch		58	16	50	22	117	35	51	7	43	93	7	22	521
Winter Wren	28	48	62	39	49	35	46	23	42	23	55	55	12	517
Northern Waterthrush	16	26	29	47	25	32	37	44	42	40	32	98	39	507
Northern Cardinal	5	57	29	64	9	21	49	3	14	35	11	11	172	480
Canada Warbler	33	23	45	47	32	26	35	23	40	34	59	37	27	461
Fox Sparrow	5	3	12	10	47	12	210	15	17	7	88	25	3	454
Wilson's Snipe	16	17	26	65	52	58	56	31	17	30	48	27	6	449
Sharp-shinned Hawk	20	35	64	48	52	26	26	13	30	28	57	15	7	421
Belted Kingfisher	28	52	62	29	13	43	24	37	38	31	28	23	10	418
Wood Duck	24	78	47	28	36	36	26	16	40	18	43	10	15	417
Savannah Sparrow	43	95	104	49	37	28	12	1	6	4	9	8	5	401
Common Goldeneye	22	54	16	44	45	20	96	8	29	14	33	4	8	393
Indigo Bunting	7	35	29	24	47	34	34	28	30	18	49	34	11	380
Great Black-backed Gull	33	47	56	36	27	31	42	40	14	6	14	10	1	357
Cape May Warbler	1	1	9	15	16	10	71	21	69	31	70	18	22	354
Red-breasted Nuthatch	6	58	1	6	16	48	4	35	17	7	120	1	23	342
Red-tailed Hawk	31	24	26	59	32	14	28	30	11	35	21	13	15	339

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Greater Scaup	1	5	1	21		11	26		2	262	1			330
Eastern Meadowlark	49	41	34	31	22	38	22	8	17	7	19	6	9	303
Bank Swallow			6	132	21	3	5	1	73	20	3	5	5	274
Hairy Woodpecker	17	24	13	14	64	8	37	5	31	13	11	14	4	255
Snow Goose		254									1			255
Mourning Warbler	12	12	13	21	16	18	13	10	19	29	41	25	10	239
Purple Martin	2	16	3	1	1	7	27	10	25	18	32	64	13	219
Broad-winged Hawk	19	4	2	11	2	9	4	1	20	6	35	90	2	205
Bohemian Waxwing		40				15		1				60	86	202
Whimbrel				101			17		80	2				200
Clay-coloured Sparrow	10	47	27	52	24	17	10	4			2	1	1	195
Spotted Sandpiper	44	23	17	35	12	14	12	6	23	2	2	3		193
American Woodcock	2	6	5	25	20	13	7	14	44	9	40	3	4	192
Harlequin Duck									6	126	45	4		181
Red-bellied Woodpecker	4	6	4	27	7	4	15	28	24	12	20	17	10	178
Black-billed Cuckoo	13	8	5	23	12	14	29	12	16	20		14	2	168
Lesser Scaup			87		55	2	2	7	2					155
Pine Warbler	2		10	19	8	4	11	7	36	20	13	17	3	150
Chimney Swift	4	15	13	9	8	8	22	7	17	16	8	12	8	147
American Tree Sparrow	7	20	8	7	13	15	7	3	8		38	2	7	135
Orchard Oriole		1	10	25	7	6	6	3	10	19	14	26	3	130
Least Sandpiper			7	19	5		2	1	9	13	1	65	6	128
Common Raven	2				8	2	9	9	5	15	27	38	12	127
Little Gull			2	45	1	7	1			1	1	59		117
Blue-winged Warbler	4	9	4	7	3	11	10	12	6	8	13	5	7	99
Eastern Bluebird	6	11	3	12	3	5	18	4	14		7	4	6	93
Golden-winged Warbler	1	2	2	5	10	10	11	7	10	4	9	2	12	85
Hooded Merganser		49	1		20	3				1				74
Orange-crowned Warbler	3	2	9	6	5	5	2	11	8	4	7	8	1	71
Gadwall	14	32	1	4	3	7	1		1		2			65

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
House Sparrow	1	34		2	3	6	9	5	1	2	2			65
Pileated Woodpecker	3	11	3	16	2	4	2	2	5	4	8	3	1	64
Cooper's Hawk	5	5	5	4	3	4	13	4	3	2	4	4	2	58
Merlin	2		8	1	7	4	1	1	12	4	4	6	7	57
Green Heron		1	5	3	4	8	20	3	4		2	7		57
Evening Grosbeak		19	1	10		7		8			5	1	3	54
Common Tern		5		13			10		7			15	2	52
Willow Flycatcher	2	4	6	1	4	1	1		2	8	18	2	1	50
Vesper Sparrow	11	9	3	3			3		7	5	1	4	3	49
American Kestrel	2	7	7	3	6	4	3	3	2	1	4	3	2	47
Northern Mockingbird	5	7	3	8	1	3	4	3	5	1	2	3	2	47
American Green-winged Teal			6	5	3	2	1		18		6	3		44
Osprey	2		2	1	6	1	8	3	2	3	2	12	2	44
Red-headed Woodpecker	3	1		6		4	2		5	2	8	6		37
Hooded Warbler				1	3	5	2	6	5	3	4	7	1	37
Sandhill Crane	1	3	5	2	1	1	10	2	3	3	3		1	35
Brewster's Warbler	1		1	2		1	8	7	6	5	1	3		35
Horned Grebe		3		7		4				16		3		33
Blue-winged Teal		7	14	1	4	4			2				1	33
Cerulean Warbler	1		1	12	2			2	5	4	4		2	33
Rock Pigeon	23		1					1	1		4	1		31
Common Redpoll		6						1			19		2	28
Whip-poor-will	1			8	1		3	1	9		2	1		26
Red-shouldered Hawk	2	2	11		1			1			5		2	24
Solitary Sandpiper		1			1	1	7			7	2	4		23
Black Tern		16	1	2		1				2				22
Bald Eagle	1		1	7	2		1	2	2	3			2	21
Great-horned Owl	1	1	1	7	5	2		2	2					21
Forsters Tern							2			19				21
Yellow-throated Vireo			1	5	2	1	1	1	1	3	3	2		20

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Peregrine Falcon	2		2	1		4	2	2	5			1		19
Greater Yellowlegs	1	3					3			1	4	1	5	18
Mute Swan			1	4			4				8			17
Olive-sided Flycatcher	1		2	1	3	1			1		5	2		16
American Black Duck	4	3		3		2		2			1			15
American Pipit	1		2	2		4			1	1	4			15
Lesser Yellowlegs			2	2	1	4				3		3		15
Ruddy Turnstone		4	1									10		15
Alder Flycatcher		1	2				2	1	1		1		6	14
Rough-legged Hawk	1		2	5	1		1	1	1		1			13
Black-crowned Night Heron		1		1	1	2	4				1	2		12
Semi-palmated Sandpiper		1				3	6		1					11
Common Nighthawk		4		4			2		1					11
Semi-palmated Plover			5	1			1		1			3		11
Yellow-billed Cuckoo					3	1	1		3	1	1	1		11
Horned Lark		3		1			2			3		1		10
White-eyed Vireo	1		1	3					2	2	1			10
Yellow-throated Warbler		5		4							1			10
Yellow-breasted Chat	1		2				4		1		1			9
Northern Goshawk			1		2	1	1			1	1	1		8
Lapland Longspur							8							8
Northern Saw-whet Owl					1			6						7
Red Knot								7						7
Northern Shoveler			2			1	3			1				7
Summer Tanager				3			1		1	1		1		7
Red-throated Loon			4	1								1		6
Dickcissel				5								1		6
American Wigeon							1		2	2				5
Northern Pintail		1	2								2			5
Upland Sandpiper		2	1	1								1		5

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Golden Eagle			2	1						1				4
Redhead							3					1		4
Cackling Goose					3						1			4
Eastern Tufted Titmouse					1			2			1			4
Worm-eating Warbler									1		1		2	4
Grasshopper Sparrow	4													4
Black-bellied Plover												3		3
Short-billed Dowitcher			1	2										3
Pied-billed Grebe	1	2												3
Virginia Rail						2						1		3
Prairie Warbler	1			1						1				3
Sanderling		2												2
Eastern Screech Owl				2										2
Northern Shrike											2			2
Long-eared Owl				2										2
White-winged Crossbill		1							1					2
Connecticut Warbler										1		1		2
Pectoral Sandpiper												2		2
Short-eared Owl				1			1							2
Lesser Black-backed Gull				2										2
Iceland Gull					1				1					2
Marsh Wren		1						1						2
Snow Bunting									1					1
White-rumped Sandpiper				1										1
Boreal Chickadee						1								1
Pine Grosbeak		1												1
Black Vulture				1										1
White-winged Dove								1						1
Fish Crow													1	1
Great Cormorant				1										1

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Lark Sparrow									1					1
Lawrence's Warbler								1						1
Lazuli Bunting						1								1
Le Conte's Sparrow											1			1
Sabine's Gull												1		1
Sedge Wren									1					1
Snowy Owl									1					1
Willet												1		1
Total	380430	134538	348492	169660	180308	126208	127143	89244	117968	151256	180698	119510	32738	2158193
Total Species	163	175	181	195	172	178	184	171	187	171	184	180	157	2298

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Double-crested Cormorant	79151	91072	164461	243466	213020	270417	202780	391621	172783	196045	338250	306600	229780	2899446
Greater Scaup	10152	27986	14956	39060	54391	40108	12460	95667	8654	6966	14889	7685		332974
Blue Jay	11186	6089	29490	7026	32129	10665	21738	47196	24148	15296	22278	18909	2369	248519
American Goldfinch	4102	2738	7587	4342	1795	1480	4964	5281	5442	2451	2354	7419	1041	50996
Mallard	6883	3935	3869	6912	4044	2796	2242	6568	2117	3758	1371	647	126	45268
Common Grackle	1909	1574	1797	3089	696	8469	318	4515	1794	6015	2914	8293	2639	44022
European Starling	3469	5338	3229	2373	1402	3010	2644	12727	1583	1871	611	1589	111	39957
White-winged Scoter	2458	798	926	2115	1865	3046	6902	3713	2239	5724	3567	2546	18	35917
Cedar Waxwing	1295	2449	2534	3483	3090	3765	1354	3956	1629	4754	2987	2239	1170	34705
Golden-crowned Kinglet	2166	3323	2448	4687	1819	1870	936	2199	2019	4936	1845	1099	4669	34016
Black-capped Chickadee	5222	368	574	603	8787	186	1211	364	1166	5797	583	2667	454	27982
American Robin	1444	1013	3085	1407	564	2473	1259	2671	1031	9028	1007	1347	401	26730
Ruby-crowned Kinglet	951	1690	2075	2568	2436	3292	1049	2111	2444	1608	1292	218	3140	24874
Red-winged Blackbird	4594	823	3862	1239	1092	2143	865	1513	3871	2111	751	835	373	24072
Ring-billed Gull	1527	809	1609	1607	1468	1368	1045	1956	1687	3191	2634	3504	102	22507
Canada Goose	4061	3354	1035	1348	1433	1078	1666	2214	1324	2441	1024	880	440	22298
Myrtle Warbler	1229	2083	715	362	3280	1924	1573	1544	992	1372	2116	1915	661	19766
Barn Swallow	1324	3154	1789	981	553	742	662	823	1072	1576	3262	2087	97	18122
Slate-coloured Junco	1599	747	1567	2618	4219	701	658	1223	899	1058	828	798	909	17824
Turkey Vulture	1052	1046	715	886	1429	1209	756	1938	1292	1720	3593	1140	728	17504
Red-breasted Merganser	272	166	248	625	6818	1053	773	2261	704	725	740	512	31	14928
Bonaparte's Gull	2176	3826	1102	687	230	676	584	1025	28	500	573	186	46	11639
Lesser Scaup	14	200	6	172	4	2	2	2	7348			1	3580	11331
Sharp-shinned Hawk	834	1080	676	584	861	819	649	759	747	1315	1555	398	313	10590
White-throated Sparrow	776	543	966	823	573	657	587	749	770	994	746	664	603	9451
Northern Saw-whet Owl	354	272	349	927	621	441	1687	1096	513	1126	784	900	230	9300
Pine Siskin	1295		18	850	18		174	185	21	171	244	5346		8322
Purple Finch	605	1	373	386	99	155	1700	2153	270	654	75	1220	24	7715
Rusty Blackbird	150	23	666	587	34	294	255	453	135	1003	3290	441	184	7515

Table 11.2.Fall Estimated Totals (in decreasing order) of birds at Prince Edward Point Bird Observatory, 2001-2013

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Brown Creeper	431	333	439	527	1530	508	258	437	319	399	693	302	782	6958
White-crowned Sparrow	918	323	1006	459	495	469	751	480	643	571	107	223	414	6859
Red-tailed Hawk	398	586	132	326	1078	503	387	2430	136	139	350	251	119	6835
Magnolia Warbler	394	349	208	506	760	575	357	1146	403	455	775	423	299	6650
Tree Swallow	618	322	1447	1045	926	865	35	267	68	134	576	239	6	6548
Long-tailed Duck	1259	323	246	1445	341	320	88	120	610	674	33	894	3	6356
Hermit Thrush	563	529	525	289	236	355	273	565	866	450	321	380	720	6072
Song Sparrow	943	637	525	828	264	382	397	362	437	160	112	367	277	5691
Black-throated Blue Warbler	414	117	149	278	278	404	278	971	333	333	448	426	282	4711
Blackpoll Warbler	205	151	109	132	373	384	181	850	248	358	954	412	228	4585
Bobolink	2	5	6	1			1	713	772	869	887	811	393	4460
Herring Gull	445	353	207	176	335	215	397	97	849	301	212	395	207	4189
Blue-headed Vireo	296	155	180	287	448	230	207	384	572	373	371	333	246	4082
Mourning Dove	113	67	240	301	317	386	322	308	336	257	329	435	51	3462
Red-eyed Vireo	170	83	63	224	475	324	216	451	241	451	296	339	101	3434
Chipping Sparrow	422	453	178	514	279	190	129	477	238	200	90	183	45	3398
Winter Wren	93	159	82	177	166	206	147	114	135	104	141	1438	39	3001
Swainson's Thrush	430	91	76	95	430	151	163	219	197	235	129	337	178	2731
Yellow-shafted Flicker	309	222	320	151	290	230	132	131	79	185	207	209	158	2623
American Redstart	137	121	120	190	228	160	135	263	211	257	424	234	117	2597
American Crow	284	580	330	287	29	115	257	201	99	71	143	105	40	2541
Common Yellowthroat	135	231	245	309	219	269	144	150	121	143	157	177	150	2450
Horned Grebe	6	3	2001		4	18	114	26	180	11		26	16	2405
Black Brant	63	326	54	1477	34			36	146		85			2221
Nashville Warbler	105	78	86	120	397	185	111	340	157	175	236	100	96	2186
Red-breasted Nuthatch	90	4	151	242	143	6	209	213	89	292	9	668	43	2159
Gray-cheeked Thrush	161	87	108	352	330	119	278	99	64	102	80	159	178	2117
Bank Swallow	48	218	361	40	350	286	92	189	10	113	233	67		2007
Gray Catbird	184	167	120	95	82	178	150	161	200	127	180	143	148	1935
Eastern Phoebe	236	169	153	143	125	182	94	119	201	151	115	158	65	1911

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
White-breasted Nuthatch	280	7	246	47	175	85	364	54	210	58	35	101	14	1676
Yellow Warbler	137	351	135	143	55	131	83	97	84	109	82	184	27	1618
Black-thr. Green Warbler	97	83	83	96	198	146	69	221	109	107	113	146	119	1587
Eastern Kingbird	82	159	146	168	160	81	89	170	75	96	129	144	44	1543
Ruby-throated Hummingbird	89	123	144	192	134	81	99	100	105	85	108	151	19	1430
Great Black-backed Gull	367	215	213	160	51	52	22	65	45	48	15	21		1274
Common Merganser	340	61	95	131	204	36	46		12	31	33	196	38	1223
House Finch	110	409	57	14	52	212	130	73	30	15	9	58		1169
House Wren	26	211	67	196	71	71	44	184	144	52	38	27	18	1149
Sanderling	202	311	75	52	1	1	13	192	5		191	7		1050
Cliff Swallow	12	113	89	84		31	32	194	117	86	170	84	29	1041
Yellow-bellied Sapsucker	46	15	39	67	34	119	90	65	232	84	41	90	95	1017
Northern Harrier	62	131	115	67	40	101	98	72	51	74	80	67	19	977
Eastern Towhee	50	62	130	111	57	43	62	153	52	39	56	84	76	975
Hairy Woodpecker	80	23	116	69	56	34	77	71	78	55	45	36	220	960
Common Loon	46	51	29	99	37	123	73	128	127	80	86	53	8	940
Belted Kingfisher	105	108	75	78	47	71	69	93	46	57	86	67	15	917
Killdeer	278	264	176	26	5	35	85		5	19	1	21		915
Least Flycatcher	56	48	48	89	159	84	58	85	55	65	31	92	30	900
Brown-headed Cowbird	66	92	142	117	52	129	69	65	18	32	29	81		892
Wilson's Warbler	17	44	31	46	161	66	48	164	45	59	128	37	16	862
Great Blue Heron	135	101	117	79	58	58	36	32	39	51	21	51	15	793
Palm Warbler	31	108	61	23	84	21	13	104	82	125	35	47	30	764
Cooper's Hawk	45	41	38	43	175	66	60	74	24	45	113	34	4	762
Chestnut-sided Warbler	17	30	83	37	59	55	54	186	39	45	72	49	24	750
Black-and-white Warbler	64	72	36	51	44	63	42	108	47	50	65	56	37	735
Broad-winged Hawk	3	49	80	94	51	45	84	12	114	100	25	53	16	726
Downy Woodpecker	70	40	81	63	54	88	70	74	56	49	37	15	23	720
Ruffed Grouse	68	19	75	57	18	82	60	20	84	75	68	70	23	719
Semi-palmated Sandpiper	267	57	340	8	3	20	2			4	10	2		713

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Black Scoter	11		2	28	16	15	8		530	6		81		697
Yellow-bellied Flycatcher	40	37	16	49	31	43	48	113	58	39	50	61	92	677
Bufflehead	19	8	53	320	99	26	37	26	50	2	7	20		667
American Black Duck	126	38	13	56	39	25	35	86	53	102	6	53		632
Surf Scoter				37	18		1		539		17	10		622
Merlin	25	31	37	48	41	32	25	71	52	84	69	86	18	619
Eastern Wood-Pewee	80	69	76	52	44	50	26	58	70	19	13	30	17	604
Baltimore Oriole	55	52	41	51	29	102	20	19	48	39	40	55	37	588
Least Sandpiper	79	169	189	18		13	48	4	18	26	18	3	1	586
Traill's Flycatcher	53	54	15	42	23	63	22	38	75	21	40	80	55	581
Common Nighthawk	1	3		1	20	33	107	60	52	151	108	33	1	570
Caspian Tern	44	54	22	14	48	66	34	59	37	61	27	28	15	509
Purple Martin	14	5	19	4		19	17	26	124	84	153	20	6	491
Ovenbird	41	29	20	27	42	33	24	72	43	34	34	30	46	475
Blue-gray Gnatcatcher	49	60	53	47	63	49	23	7	67	13	10	20	8	469
Brown Thrasher	19	52	52	13	9	30	54	39	20	22	32	47	55	444
Spotted Sandpiper	40	95	25	18	3	38	8	56	61	22	37	16	2	421
Great Crested Flycatcher	64	33	7	52	37	31	56	46	11	34	8	33	3	415
Bay-breasted Warbler	28	22	28	26	61	37	21	44	41	36	25	29	16	414
Bald Eagle	20	20	19	17	18	43	18	38	51	47	38	56	22	407
Eastern Bluebird	71	6	57	85	3	34	21	28	15	5	8	57	9	399
N. Rough-winged Swallow	7		175	18	2	70	9	4	12	64	27	4		392
Northern Waterthrush	34	28	12	13	47	51	22	34	8	21	49	34	21	374
American Kestrel	36	62	31	35	14	12	25	32	24	35	17	19	3	345
American Pipit	11	16	69	15	8	3	14	2	57	79	28	14	28	344
Canada Warbler	17	17	9	15	16	26	25	44	24	25	81	28	5	332
Rose-breasted Grosbeak	12	30	16	49	19	16	29	44	43	13	32	19	4	326
Lesser Yellowlegs	7	190	31	2	3	26	12		1	13	8	10	2	305
Fox Sparrow	17	13	23	48	25	35	26	7	36	29	14	9	9	291
Blue-winged Teal	42	79	2	2	49	59		15	18	21	3			290

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Tennessee Warbler	5	9	6	9	49	15	16	29	17	25	50	15	42	287
American Green-winged Teal	6	110	53	31	10	5	49	7	7	2	6	1		287
Northern Goshawk	52	21	15	24	15	24	26	12	11	10	41	14	2	267
Red-shouldered Hawk	10	12	2	22	92	44	36	20	2	6	6	5	4	261
Philadelphia Vireo	9	14	20	15	16	26	12	34	17	26	24	32	11	256
Scarlet Tanager	23	18	7	11	39	16	18	22	18	32	15	19	8	246
Northern Parula	6	22	6	14	18	18	12	32	25	26	35	17	8	239
Field Sparrow	36	5	27	57	14	20	4	23	5	9	3	24	8	235
Northern Cardinal	15	4	6	9	3	3	36		26	10	7	104	5	228
Blackburnian Warbler	6	12	15	13	27	22	16	37	21	11	19	13	11	223
Common Goldeneye	47	7	24	98	2	8	2	10	7			16		221
Veery	38	4	5	7	19	12	28	14	10	26	11	32	4	210
American Wigeon	35	33	50	14		11	5	40				21		209
American Bittern	200								1			1		202
Common Raven				1	1	4	9	14	17	55	38	34	23	196
Evening Grosbeak	43			1	59		24		2	1		62		192
Semi-palmated Plover	79	21	43	16	8	1	1	3		12	6			190
Black-bellied Plover	56	66	1	13	8	1		26	6		5	1		183
Golden Eagle	3			8	10	10	7	124	2	1	9	7	1	182
Wild Turkey			3	11	7	18		5	6	23	89	2	14	178
Chimney Swift	7	13	10	39	31	5	2	10	5	31	9	6	2	170
Black-billed Cuckoo	1	23	27	14	6	9	13	12	11	20	12	3	2	153
Solitary Sandpiper	4	12	22	8	13	3	16	4	6	1	56	7		152
Redhead	3		3	6	95	40		2			1			150
Swamp Sparrow	11	13	19	20	17	17	7	5	11	8	6	7	4	145
Mute Swan				1		3				18	29	24	55	130
American Tree Sparrow	41	16	8	11	5	22	2	1	7	4	7	3	2	129
Osprey	2	12	2	7	37	5	6	3	6	9	9	24	6	128
Warbling Vireo	3	13	11	17	4	10	7	4	5	11	9	16	15	125
Common Redpoll	12		2				30	70				1		115

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Barred Owl	2	7	3	14			33	1	11	14	3	26	1	115
Horned Lark	3	3	5	47	9	1	5	28				2	1	104
Orange-crowned Warbler	5	14	4	14	5	3	4	12	17	6	6	10	1	101
Dunlin	47	15		5	2			11	10					90
Lincoln's Sparrow	9	13	3	5	6	4	7	4	2		1	5	31	90
Red-necked Grebe	2	4	1	15	5	1	4	15	12	1	21	8		89
Wood Duck	25	5	13	9	4	5		4	9	4	9			87
Great-horned Owl	1	2	2	30	9	11	10	11	4	1	3	1		85
Snow Goose		7		1	70		1				2			81
Green Heron	38	2		3				3	2		11	17	4	80
Bohemian Waxwing							1			1			75	77
Snow Bunting		1	3			8	2	18	15	10		17	3	77
Northern Pintail	18		2	3		4	3	28		13		3		74
Eastern Screech Owl	3		3	7	1	9	18	3	4	3		21	1	73
Gadwall	6	9	12	19	9		5	4	3			5		72
Rough-legged Hawk		4	3	28	11	2	4	8		3			4	67
Mourning Warbler		3	2	3	4	6	4	8	9	4	4	14	4	65
Peregrine Falcon	8	7	7	6	4	2	6	3	4	1	3	7	5	63
Red Knot		1	8	45			2							56
Gr. White-fronted Goose								56						56
Eastern Meadowlark	3	4	9	3	14	7	4	2	1	1		6	1	55
Greater Yellowlegs		22	2	4	2	1	5		1	6	2		8	53
Common Tern	7	35				2	1	2		1				48
Savannah Sparrow	3	25		3	2	6		1	3		3	1		47
Clay-coloured Sparrow		8	7	26	1	3		1	1					47
Northern Shrike	3	6		12	4		5	1	3	2	6	4	1	47
Ruddy Turnstone		11		13							22			46
Cape May Warbler	1	1	1	2	5	6	2	5	2	6	6	5	3	45
Wood Thrush	17	1	2	1	2		3	2	3	2	4	3	4	44
Lapland Longspur								44						44

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Vesper Sparrow	2	1	28		4	1		3	1		1			41
Long-eared Owl	4	1	2	2		2	13	2	2	3	2	2		35
Pine Warbler		4		1		1	6	3	7	3	3	4	2	34
Rock Pigeon	1	7	2	2	10	3	3		1					29
American Woodcock	7		2	3		4	1	1	1	4	1	4		28
Red-throated Loon	2	2	1		1		3	10		1		8		28
Hooded Merganser		2	4	9	2		7							24
Olive-sided Flycatcher	2	5		1	1	2	4	4		2		2		23
Indigo Bunting			4	1	1	4	2	2	2		3	1	1	21
Pileated Woodpecker	4	2		2		6	2	2		3				21
Yellow-billed Cuckoo	2	9	1		2		2				1	2	2	21
Baird's Sandpiper	7	5		1			1	6		1				21
White-winged Crossbill	17											1		18
Red-bellied Woodpecker				2	1		2		2	7		3		17
Black Tern		17												17
Canvasback	10				6									16
Black-crowned Night Heron	2	1						2	3	4		2		14
Tundra Swan										14				14
Wilson's Snipe	1	1	4		4	1				2				13
Whip-poor-will	1	1			3	2	3	1	2					13
Hudsonian Godwit												12		12
Red-headed Woodpecker	1	2			1	1						2	4	11
Connecticut Warbler		2		1	2				1	1	2	1	1	11
Pectoral Sandpiper	2	2		3	1							1		9
Forster's Tern	3	3				2								8
Little Gull		1			1	5								7
White-eyed Vireo				1				4		2				7
Cackling Goose							3	2				2		7
Short-billed Dowitcher		5					2							7
Whimbrel	1	1		3					1					6

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
House Sparrow	2		1							3				6
Hooded Warbler								2		2		2		6
Northern Shoveler			3									3		6
Upland Sandpiper		4				1								5
Eastern Tufted Titmouse	1		1								1	2		5
Short-eared Owl	1				2								1	4
Kittiwake						1						3		4
Stilt Sandpiper		1	3											4
Common Eider			4											4
Golden-winged Warbler	1					1					1			3
Sandhill Crane	2								1					3
Yellow-throated Vireo			1				1					1		3
Pied-billed Grebe	1				2									3
Virginia Rail	2			1										3
Lesser Black-backed Gull				1			1		1					3
White-rumped Sandpiper				1					1		1			3
Boreal Chickadee					1					2				3
American Golden Plover	1				2									3
Carolina Wren								2				1		3
Parasitic Jaeger	1			2										3
Ring-necked Duck				2			1							3
Willow Flycatcher								2						2
Yellow-breasted Chat	1								1					2
Dickcissel	1									1				2
Pine Grosbeak	1				1									2
Boreal Owl	1			1										2
Bicknell's Thrush				2										2
Buff-breasted Sandpiper												2		2
Orchard Oriole											1			1
Northern Mockingbird		1												1

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Prairie Warbler						1								1
Black Vulture			1											1
White-winged Dove										1				1
Ash-throated Flycatcher							1							1
Fork-tailed Flycatcher								1						1
Glossy Ibis										1				1
Great Egret					1									1
Nelson's Sharp-tailed														
Sparrow		1												1
Pacific Loon						1								1
Pomarine Jaeger			1											1
Purple Sandpiper				1										1
Western Sandpiper		1												1
White Ibis									1					1
Total	170185	179565	267435	351396	363680	376858	283324	615617	262446	295751	711966	396154	261220	4535597
Total Species	195	188	179	193	182	178	183	181	179	176	168	185	145	2332

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Great Blue Heron			1	1										2
Canada Goose		1												1
Wood Duck											1			1
Sharp-shinned Hawk	3	3	3	3	6	3	2	3	3	2	2	4		37
Killdeer			1								1			2
American Woodcock		1	1	1	1	1			1				1	7
Mourning Dove	3	18	20	14	23	37	36	45	54	26	39	28	37	380
Black-billed Cuckoo	2	3		2	1	4	3	3	2					20
Yellow-billed Cuckoo						1	1				1			3
Northern Saw-whet Owl								5						5
Whip-poor-will	1													1
Belted Kingfisher			1											1
Red-headed Woodpecker		1		3										1
Red-bellied Woodpecker				3	1		1		1				1	7
Yellow-bellied Sapsucker	4	11	6	5	4	10	15	2	7	10	11	25	2	112
Downy Woodpecker	1	4	6	2	2	6	5	2	1	2	3	2	4	40
Hairy Woodpecker	3	2		4	1		3					2	1	16
Yellow-shafted Flicker	4	8	6	6	10	10	8	5	10	11	2	5	2	87
RedXYellow-shafted Flicker		2			2	2	1	3			2	1	3	16
Pileated Woodpecker	2						1							3
Olive-sided Flycatcher	1													1
Eastern Wood-Pewee	10	14	5	12	8	14	17	6	3	6	7	5	3	110
Yellow-bellied Flycatcher	40	34	37	50	21	37	45	13	17	23	46	30	10	403
Traill's Flycatcher	13	13	33	33	24	45	38	7	16	16	27	22	8	295
Willow Flycatcher			1								1	1		3
Alder Flycatcher			1								1			2
Least Flycatcher	37	32	21	39	34	69	43	21	21	14	26	31	11	399
Eastern Phoebe	21	25	6	5	2	12	4	4	5	1	12	3	5	105
Great Crested Flycatcher	2	3	4	7	5	9	6	5	1	3	6	7	1	59

Table 11.3. Spring standard banding totals of birds captured at Prince Edward Point Bird Observatory 2001-2013, highest totals in yellow

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Eastern Kingbird	1	2		3	1	1	2			2	6		2	20
Northern Shrike											1			1
White-eyed Vireo				1						2				3
Blue-headed Vireo	6	8	4	2	5	14	9	12	8	9	20	24	12	134
Warbling Vireo		1	3		1	1	2	3	4	1	1	2		19
Philadelphia Vireo	6	3	3	4	6	11	4	11	8	4	17	7	5	89
Red-eyed Vireo	25	37	36	19	49	59	71	58	29	35	52	37	15	522
Blue Jay	98	811	216	698	215	233	236	557	182	286	196	59	183	3970
Tree Swallow	10						2	2	6	6	5	11	2	44
N. Rough-winged Swallow	1													1
Cliff Swallow	10													10
Barn Swallow	8							1			2			11
Black-capped Chickadee	6	22	6	13	34	18	4	26	12	3	18	3	20	185
Boreal Chickadee						1								1
Eastern Tufted Titmouse					1			1						2
Red-breasted Nuthatch	3	13	1		2	10	1	10	1	3	6	1	7	58
White-breasted Nuthatch		19	3	6	3	10	2	2	1	1	2		5	54
Brown Creeper	63	120	100	74	101	95	111	68	140	82	184	152	72	1362
House Wren	3	9	10	29	32	29	38	28	23	16	14	11	16	258
Winter Wren	15	13	12	14	24	19	32	11	9	11	11	8	7	186
Golden-crowned Kinglet	100	295	99	118	122	120	183	50	305	326	195	482	61	2456
Ruby-crowned Kinglet	132	302	165	376	287	276	480	357	316	263	136	371	208	3669
Blue-gray Gnatcatcher	4	6	3	4	7	2	1	3	3	3	3	1	1	41
Veery	17	11	12	24	28	45	45	21	20	35	23	22	25	328
Gray-cheeked Thrush	2	10	14	15	25	38	67	16	20	28	29	9	18	291
Swainson's Thrush	22	31	53	48	93	133	152	56	72	101	75	116	79	1031
Hermit Thrush	60	84	61	70	84	81	104	51	111	105	68	144	73	1096
Wood Thrush	15	14	12	27	24	48	35	17	12	17	15	21	18	275
American Robin	21	48	40	49	68	32	77	27	68	55	44	40	24	593
Gray Catbird	62	66	64	77	54	134	157	86	97	77	81	99	70	1124

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Northern Mockingbird				1										1
Brown Thrasher	6	6	12	11	7	12	19	11	14	9	9	13	10	139
European Starling	2	8	1	1	1	3	13	7	4		2		1	43
Bohemian Waxwing		3										1		4
Cedar Waxwing	15	13	21	18	12	24	4	15	263	8	9	104	1	489
Blue-winged Warbler	2	2	1		1	6	4	4	2	3	3	2	6	36
Brewster's Warbler	1			1		1	5	3	1	3	1	1		17
Golden-winged Warbler		2	1		3	5	2	5	2	2	5		6	33
Tennessee Warbler	14	2	3	4	3	13	17	16	15	4	32	9	15	147
Orange-crowned Warbler	3	2	2	1	2	3	2	8	2	3	4	3	1	36
Nashville Warbler	65	34	67	92	96	137	143	103	106	105	199	56	89	1292
Northern Parula	3	1	2	1	7	8	9	9	6	13	12	10	4	85
Yellow Warbler	83	128	93	68	107	179	204	271	194	120	126	61	68	1702
Chestnut-sided Warbler	48	32	34	37	53	61	63	57	45	52	98	45	31	656
Magnolia Warbler	311	161	173	169	297	381	301	345	216	264	342	219	153	3332
Cape May Warbler			1	1	2	1	12		9	7	8	1	7	49
Black-throated Blue Warbler	18	23	28	27	21	55	71	32	27	44	37	40	29	452
Myrtle Warbler	180	115	229	299	318	674	1122	501	611	217	765	382	474	5887
Black-throated Green Warbler	67	16	20	52	56	95	75	67	36	33	99	40	30	686
Blackburnian Warbler	22	10	5	22	16	51	39	35	18	25	44	11	6	304
Yellow-throated Warbler		1												1
Pine Warbler			1	3		2	2	3	6	1	1	6	2	27
Prairie Warbler	1													1
Western Palm Warbler	18	17	12	32	24	16	42	35	40	27	28	26	6	323
Yellow Palm Warbler			1	4		5	1			1		1	6	19
Bay-breasted Warbler	13	11	2	6	14	29	8	10	8	7	17	7	9	141
Blackpoll Warbler	12	6	5	8	3	8	23	17	19	9	13	21	6	150
Cerulean Warbler				1									1	2
Black-and-white Warbler	15	12	11	16	15	34	31	36	20	39	29	29	27	313
American Redstart	44	36	39	46	52	67	55	49	63	40	80	59	50	680

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Worm-eating Warbler													1	1
Ovenbird	28	30	23	36	36	47	68	30	22	48	26	50	35	479
Northern Waterthrush	12	14	10	17	12	17	24	31	19	31	19	44	20	270
Mourning Warbler	8	8	6	11	10	13	16	12	9	19	22	13	7	154
Common Yellowthroat	30	59	59	81	64	97	89	56	54	30	64	52	52	787
Hooded Warbler				1	1	5		2	3	1	2	2	1	18
Wilson's Warbler	23	15	16	20	36	43	44	34	38	12	34	15	17	347
Canada Warbler	21	14	16	24	21	19	28	13	22	27	36	25	14	280
Yellow-breasted Chat	1		2				2		1					6
Summer Tanager				1										1
Scarlet Tanager	1	4	9	2	1	14	8	2	2	3	3		6	55
Eastern Towhee	4	4	3	2	4	8	6	5	5	7		3	4	55
American Tree Sparrow	7	11	3	3	10	3	3	3	6		5	2	5	61
Chipping Sparrow	81	117	110	96	95	89	79	125	27	28	36	20	48	951
Clay-coloured Sparrow					1	1								2
Field Sparrow	4	8	8	10	15	11	12	10	9	11	2	3	8	111
Vesper Sparrow													1	1
Savannah Sparrow		1			1	3	1				2	1	1	10
Fox Sparrow	5	1	5	7	22	7	60	9	10	4	23	7	2	162
Song Sparrow	50	174	78	49	64	86	126	81	52	30	76	33	63	962
Lincoln's Sparrow	21	20	42	33	36	36	47	37	25	16	29	32	25	399
Swamp Sparrow	16	22	16	47	40	42	47	22	29	22	10	34	29	376
White-throated Sparrow	105	168	259	240	269	293	283	239	214	176	166	372	423	3207
Eastern White-crowned Sparrow	44	82	71	263	83	107	127	168	95	109	173	149	147	1618
Gambel's White-crowned Sparrow		2	2			3	3	1		1		3		15
Slate-coloured Junco	70	246	160	146	208	183	342	149	254	113	381	170	196	2618
Northern Cardinal	3	7	2	2	1	1	2	1	5	1	2		57	84
Rose-breasted Grosbeak	7	70	31	18	81	171	51	60	32	51	77	56	50	755
Lazuli Bunting						1								1
Indigo Bunting	2	8	6	7	7	10	16	5	1	3	8	4	3	80

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Bobolink								1			1			2
Red-winged Blackbird	34	38	16	11	31	10	25	26	35	16	39	10	41	334
Rusty Blackbird		1			5		1	1	2	2		8	1	21
Common Grackle	18	37	56		46	25	47	60	54	38	59	67	61	637
Brown-headed Cowbird	168	801	185	418	214	202	299	191	248	75	193	66	173	3159
Orchard Oriole		1		1		1					1			4
Baltimore Oriole	8	17	5		43	83	37	40	21	20	12	5	12	320
Purple Finch	8	146	53	53	26	41	22	299	79	24	233	8	150	1093
House Finch	9	30	1	1	1	4	2	7	2	5	7		4	99
Common Redpoll		2						1						3
Pine Siskin		5	15	15	1	3		10	169		21	3	31	258
American Goldfinch	26	110	101	109	9	47	207	144	209	70	119	74	84	1412
Evening Grosbeak		6	1	1		4		1			2		1	15
House Sparrow	1	4	1	1	2	2	2	2	1					15
Total	2595	5024	3447	4190	4017	5272	6437	5115	5070	3614	5238	4264	3823	58106
Number of species	92	98	92	97	95	100	98	97	93	89	99	89	96	133

Species name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Northern Harrier	1													1
Sharp-shinned Hawk	30	26	25	26	56	55	48	48	57	71	71	59	28	600
Cooper's Hawk	2	1		1	2	2	4	1	1	1	2	1		18
Northern Goshawk	1				1						1	1	1	5
Broad-winged Hawk		1		1			5		3	1	1	1		13
Red-tailed Hawk	1	1		1										3
Merlin			1						2	1	3	2		9
Semi-palmated Plover	3													3
Spotted Sandpiper	1													1
Least Sandpiper									2					2
American Woodcock												1		1
Mourning Dove	1		5	7	6	5	14		13	4	6	18	3	82
Black-billed Cuckoo	1	2	3	2	1	4	2	1	5	3	1	2		27
Yellow-billed Cuckoo	1	2	1				1				1		2	8
Eastern Screech Owl	3		2	1	1	3	4		4	2		1	1	22
Great Horned Owl		1												1
Barred Owl	2	4	2	5	3		6		2	1		15	1	41
Long-eared Owl	4		1				2					1		8
Northern Saw-whet Owl	187	271	332	436	273	196	605	352	279	451	338	562	212	4494
Whip-poor-will		1			1	1								3
Belted Kingfisher				1		2	1					1	1	6
Red-headed Woodpecker												1		1
Red-bellied Woodpecker				1					1	1		1		4
Yellow-bellied Sapsucker	18	7	8	19	11	41	42	12	45	30	8	35	25	301
Downy Woodpecker	5	4	4	5	5	12	8	9	13	3	3	2	4	77
Hairy Woodpecker	9	2	18	7	1	4	16	3	11	4	3	4		82
Yellow-shafted Flicker	11	8	6	6	5	24	16	13	6	7	8	13	18	141
Flicker Intergrade	1								1			1		3

Table 11.4. Fall standard banding totals of birds captured at Prince Edward Point Bird Observatory 2001-2013, highest totals in yellow

Bird Migration Monitoring at Prince Edward Point, 2001-2013

Species name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Pileated Woodpecker							1	1						2
Olive-sided Flycatcher	1						1							2
Eastern Wood-Pewee	15	8	6	12	16	13	14	5	16	12	6	11	9	143
Yellow-bellied Flycatcher	25	30	12	40	23	31	30	40	37	31	31	44	52	426
Traill's Flycatcher	18	19	12	19	10	32	18	12	27	13	25	43	32	280
Least Flycatcher	22	24	23	34	43	36	28	18	22	23	15	46	20	354
Eastern Phoebe	42	46	35	26	12	29	12	10	42	27	21	32	34	368
Great Crested Flycatcher	2			3	4	8	5	1	5	9	2	2	2	43
Eastern Kingbird		1						1		1	4	1	1	9
Northern Shrike	2			1					3	2	1	1		10
White-eyed Vireo				1				2		1				4
Blue-headed Vireo	171	83	74	134	230	123	125	112	179	139	144	175	96	1785
Warbling Vireo	1	1	1	2		4	2	1	1	5	7	8	10	43
Philadelphia Vireo	2	4	7	11	8	20	8	13	3	8	14	17	7	122
Red-eyed Vireo	55	26	24	69	153	161	82	93	78	166	130	129	61	1227
Blue Jay	576	46	250	76	108	103	242	301	167	142	98	218	78	2405
Purple Martin											1		5	6
Barn Swallow	5										2	1		8
Black-capped Chickadee	770	11	37	65	1491	14	216	27	134	731	24	322	22	3864
Boreal Chickadee					1									1
Eastern Tufted Titmouse	1		1											2
Red-breasted Nuthatch	28		33	33	20	1	39	7	16	45	1	129	2	354
White-breasted Nuthatch	46		27	9	42	4	56	5	31	6	6	23	1	256
Brown Creeper	235	191	242	198	235	271	189	169	199	239	231	246	255	2900
Carolina Wren								1				1		2
House Wren	7	26	13	25	20	13	15	13	19	6	8	8	7	180
Winter Wren	22	44	27	34	76	88	79	33	51	34	24	20	22	554
Golden-crowned Kinglet	691	1000	716	1682	668	787	420	429	744	1132	510	715	1363	10857
Species name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
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Ruby-crowned Kinglet	339	550	612	827	809	1216	477	399	858	351	388	442	760	8028
Blue-gray Gnatcatcher		2	1	2	4	6			5		2	2	1	25
Eastern Bluebird								1						1
Veery	27	4	5	4	16	9	17	7	9	22	10	25	3	158
Gray-cheeked Thrush	84	71	63	163	135	89	145	37	57	66	63	91	68	1132
Gray-ch./Bicknell's Thrush	2						1							3
Bicknell's Thrush				1										1
Swainson's Thrush	219	65	38	60	231	102	105	81	119	130	71	216	65	1502
Hermit Thrush	269	251	193	134	135	179	153	165	313	173	154	222	224	2565
Wood Thrush	10	1	1	1	1		2	1	2	2	2	2	4	29
American Robin	26	14	15	4	8	29	22	16	33	32	18	16	21	254
Gray Catbird	27	11	8	11	9	25	25	23	24	21	21	22	14	241
Brown Thrasher	4	4	4	2	2	5	6	4	6	5	9	11	10	72
European Starling						1	3	1			1	1		7
Cedar Waxwing	1	1	22	6	9	4	1	13	4	13	23	18	8	123
Golden-winged Warbler	1					1					1			3
Tennessee Warbler	4	7	2	5	27	13	12	11	10	17	28	10	19	165
Orange-crowned Warbler	4	8	2	8	3	2	4	4	12	4	1	6	1	59
Nashville Warbler	56	54	50	46	176	97	69	80	74	88	92	56	49	987
Northern Parula	3	5	3	2	14	15	8	10	12	10	22	10	2	116
Yellow Warbler	5	14	5	17	5	34	8	6	8	5	21	26	7	161
Chestnut-sided Warbler	13	14	25	14	23	37	23	50	24	28	30	25	14	320
Magnolia Warbler	187	146	80	174	259	297	166	250	173	197	315	198	135	2577
Cape May Warbler		1		1	2	5	1	1	1	4	2	1	2	21
Black-thr. Blue Warbler	212	75	82	155	145	226	166	252	149	149	209	209	125	2154
Myrtle Warbler	165	363	141	75	600	363	143	77	164	107	180	363	82	2823
Black-thr. Green Warbler	39	37	29	16	84	76	27	59	37	41	37	58	37	577
Blackburnian Warbler	2	6	4	9	12	9	10	11	12	9	17	8	9	118

Species name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Pine Warbler		1					1	1	1	3	1	1	2	11
Western Palm Warbler	10	24	11	4	21	8	9	5	10	8	5	9	10	134
Yellow Palm Warbler		1	1		2		1			1		2		8
Bay-breasted Warbler	14	7	7	14	27	29	13	12	17	26	16	12	12	206
Blackpoll Warbler	81	53	39	59	174	157	70	149	77	104	308	160	78	1509
Black-and-white Warbler	29	25	16	20	17	44	22	31	23	31	45	28	21	352
American Redstart	44	39	41	45	93	101	63	65	98	98	154	107	79	1027
Ovenbird	28	20	16	20	34	27	17	28	31	24	24	22	27	318
Northern Waterthrush	24	18	10	11	31	33	16	19	7	19	37	28	21	274
Connecticut Warbler				1	1					1	1	1	1	6
Mourning Warbler		3	2	3	3	4	2	3	8	2	4	9	4	47
Common Yellowthroat	45	31	53	75	63	65	65	33	39	38	57	66	48	678
Hooded Warbler								1				1		2
Wilson's Warbler	9	16	13	27	48	35	22	45	14	39	53	17	13	351
Canada Warbler	10	7	6	9	7	21	18	19	17	21	41	21	6	203
Yellow-breasted Chat	1								1					2
Scarlet Tanager	9	3	4	7	18	14	10	8	5	18	11	7	4	118
Eastern Towhee	5	2	12	2	4	5	4	8	3	1	7	7	6	66
American Tree Sparrow	6	2	3	2	1	6			3	2	1	2	2	30
Chipping Sparrow	25	15	9	48	23	27	21	45	17	32	18	17	21	318
Clay-coloured Sparrow			1	6										7
Field Sparrow	7	4	2	17	3	2	1	2		2	2	7	2	51
Vesper Sparrow					1			1					3	5
Savannah Sparrow											1			1
Fox Sparrow	10	10	10	19	9	19	17	2	9	8	8	7	8	136
Song Sparrow	66	22	33	61	30	50	74	33	36	16	17	48	69	555
Lincoln's Sparrow	8	3	2	3	4	1	4		1		1	2		29
Swamp Sparrow	9	2	5	3	2	6	6	2	4	2	1	1	4	47

Species name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
White-throated Sparrow	127	83	121	146	155	188	159	92	128	178	124	144	156	1801
White-crowned Sparrow	39	28	122	39	58	52	123	24	72	89	15	34	20	715
Eastern White-crowned Sparrow	46		18	13	9	7	68	8	32	9		8	47	265
Gambel's White-crowned Sparrow			2										1	3
Slate-coloured Junco	200	122	166	276	349	179	143	149	163	210	241	123	275	2596
Oregon Junco					1	2								3
Northern Cardinal	4	2		1	2		4		6	4		20	1	44
Rose-breasted Grosbeak	2	9	4	9	10	11	15	13	17	3	14	6	2	115
Indigo Bunting			2			3	2				2		1	10
Dickcissel	1													1
Bobolink								1	389	415	246	311	199	1561
Red-winged Blackbird	1		1			1								3
Rusty Blackbird	3		3			5				1	10	2	5	29
Common Grackle	8	1	1	1		14		1	2	15	7			50
Brown-headed Cowbird	2			1							2			5
Orchard Oriole											1			1
Baltimore Oriole	16		1	3	2	5	1		2		4	5	10	49
Pine Grosbeak	1													1
Purple Finch	37		12	4	22	35	345	17	49	120	12	350		1003
House Finch	43	13	3	4	3	19	7	4	3	1	4	18		122
White-winged Crossbill	1													1
Common Redpoll	13													13
Pine Siskin	341		5	5	1		54	2	2	30	2	202		644
American Goldfinch	361	320	520	273	128	31	1212	26	1865	210	96	2579	45	7666
Evening Grosbeak	8						10		1			18		37
House Sparrow	2		1							1				4
Total	6414	4481	4611	5961	7591	6133	6549	4141	7477	6609	5061	9354	5022	79404
Number of species	105	83	91	94	89	88	93	86	93	93	98	104	87	135

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Canada Goose	3			4	2	2	2	2	2	1			18
Wood Duck					1			1	1				3
Sharp-shinned Hawk		4			1			2					7
Killdeer	1			2		3	2	5	3				16
Greater Yellowlegs			1										1
American Woodcock								2	1				3
Mourning Dove		3		5	4			17	5	8	2		44
Black-billed Cuckoo								1					1
Northern Saw-whet Owl				1									1
Chimney Swift									4				4
Yellow-bellied Sapsucker		1			3	2							6
Downy Woodpecker				1	2	1		1		1	1		7
Yellow-shafted Flicker	1				7			3		4	1		16
Red X Yellow-shafted Flicker								1			1		2
Pileated Woodpecker	1												1
Olive-sided Flycatcher				1									1
Eastern Wood-Pewee		4	4	5	2	1		6		4			26
Yellow-bellied Flycatcher		7	5	2	9			20		3	1		47
Traill's Flycatcher		4	6	5	9			25	2	4			55
Least Flycatcher		6	16	17	10	8	3	5	1	1			67
Eastern Phoebe		14	12	5		1		2			2		36
Great Crested Flycatcher				4	1	2		1		2			10
Eastern Kingbird				2		1		2					5
Yellow-throated Vireo				1						1			2
Blue-headed Vireo		1	3	5	3	2		1	1	7			23
Warbling Vireo				1	3	4			1	2			11
Philadelphia Vireo		2	1	10	1	2		7	1	5			29
Red-eyed Vireo		10	11	20	12	3	9	19	2	12	4		102
Blue Jay	7	30	220	36	15	5	5	36	28	8	3		393

Table 11.5. Spring non-standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Tree Swallow	23	46	30	25	38	26	13	14	9	3			227
N. Rough-winged Swallow				3					1				4
Cliff Swallow	16	16	4	7	3	8	8	26	1			3	92
Barn Swallow	15	65	60	22	1	9		2	4				178
Black-capped Chickadee		1	5	5	3	1				6			21
Eastern Tufted Titmouse								1					1
Red-breasted Nuthatch				6	7					1			14
White-breasted Nuthatch						2				3			5
Brown Creeper		7			7	6	1	1		25	5		52
House Wren			5	10	4	3		3	1				26
Winter Wren					5	2		1			2		10
Golden-crowned Kinglet		13			10	10		14		26	29		102
Ruby-crowned Kinglet	4	30	2	31	64	68	11	35	5	7	7		264
Blue-gray Gnatcatcher					2	2	1	1					6
Veery		3		18	3	3	1	3	2	1			34
Gray-cheeked Thrush		2		1	37			9		1			50
Swainson's Thrush		6		12	28	5	2	14	4	3	3		77
Hermit Thrush	1	3	3	4	4	9	2	7		1			34
Wood Thrush		1		10	4	2		1	1				19
American Robin	5	3	10	14	15	9	2	18	12	10	2		100
Gray Catbird	1	9		17	14	9		24	4	12	5		95
Brown Thrasher	3	1	2	4	3	2		1	2	2			20
European Starling		13	14	5	19	19	23	31	12				136
Bohemian Waxwing											3		3
Cedar Waxwing		35		2	5	1	4	393		2	6		448
Blue-winged Warbler		1		2		2	2		2	1			10
Brewster's Warbler						3	1						4
Golden-winged Warbler		1	2	4		1							8
Tennessee Warbler				2	5	8	3	3	1	6	2		30
Orange-crowned Warbler					1			1					2

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Nashville Warbler	3	9	1	58	27	55	18	14	10	39	1		235
Northern Parula			2	7	1	5		2	2	1	1		21
Yellow Warbler		30	22	115	62	76	46	62	50	50	7		520
Chestnut-sided Warbler		6	8	32	18	17	11	17	17	16	4		146
Magnolia Warbler	2	42	36	67	73	49	3	56	32	29	9		398
Cape May Warbler				4		8		4	2	4	1		23
Black-throated Blue Warbler		3	4	18	15	13	6	3	11	1	4		78
Myrtle Warbler	1	91	140	132	134	200	43	49	64	108	2		964
Black-throated Green Warbler	2	17	20	39	32	30	14	9	4	34	3		204
Blackburnian Warbler		4	11	11	15	13	7	7	9	16	4		97
Pine Warbler				1	2	1		2					6
Palm Warbler	2	3	15	12	2	15	5	4	5	1			64
Yellow Palm Warbler			1										1
Bay-breasted Warbler		2	2	7	10	6	2	4	4	4			41
Blackpoll Warbler		4	1		4	1		4		5	1		20
Cerulean Warbler								1					1
Black-and-white Warbler		6	10	20	10	7	5	5	13	5			81
American Redstart	1	13	13	24	19	10		18	2	9			109
Ovenbird	1	5	7	33	5	14	2	1	5	1	1		75
Northern Waterthrush		3	2	3	1	1	2	1			1		14
Mourning Warbler		1	1	4	2	1		4		1			14
Common Yellowthroat		9	13	28	9	11		11	2	6	3		92
Hooded Warbler							2						2
Wilson's Warbler		5	2	5	5	4	1	7	1	1			31
Canada Warbler		5	3	1	1			8		5	3		26
Scarlet Tanager		2		12	7	4	4	1		7			37
Eastern Towhee				1	1					2			4
American Tree Sparrow					2					9			11
Chipping Sparrow		7	19	41	10	3	2	5		2	1		90
Clay-coloured Sparrow		1	3	2									6

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Vesper Sparrow								1					1
Savannah Sparrow				2		1		2		1			6
Fox Sparrow		1				8			1		1		11
Song Sparrow	5	2	1	8	10	13	3	8	2	35	3		90
Lincoln's Sparrow	1	10	8	11	2	7	4	4		9	2		58
Swamp Sparrow	1	3	6	5	1	6		1					23
White-throated Sparrow	1	50	18	52	23	17	7	7	6	19	1		201
Eastern White-crowned Sparrow	1	13	14	16	5	21	4	7	6	10	4		101
Gambel's White-crowned Sparrow								1					1
Slate-coloured Junco		4	1	15	5	35	6	14	1	25	8		114
Northern Cardinal								2					2
Rose-breasted Grosbeak		5		44	5	20	4	4	7	12			101
Indigo Bunting		3	1	4	2	1	2	1	1	1			16
Bobolink					1	1	2	8	4				16
Red-winged Blackbird			3	6		2	6	23	3	22	2		67
Eastern Meadowlark				5		1		1	1				8
Rusty Blackbird					3	1	3	3	2	1	2		15
Common Grackle		6		4	7	4	6	16	2	31	4		80
Brown-headed Cowbird		17	1	20	14	11	3	14	1	117	1		199
Orchard Oriole								1	2				3
Baltimore Oriole		3		44	7	14	9	16	7	4	2		106
Purple Finch			23	3	20	17	9	11		62			145
House Finch	1					4				1			6
Common Redpoll												1	1
Pine Siskin							6	121		6			133
American Goldfinch	4	40	54	11	7	31	6	15	1	38	2		209
Evening Grosbeak			1		2								3
House Sparrow					1	2				1			4
Total	107	767	883	1258	949	1008	348	1342	393	924	157	4	8140
Number of species	27	67	57	82	83	83	53	91	61	75	46	2	118

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Double-crested Cormorant		225				10								235
Mallard												1		1
Sharp-shinned Hawk		9	2	3	5	8	8		4	7	7			53
Coopers Hawk							4			1	4			9
Northern Goshawk					1							1		2
Broad-winged Hawk									1					1
Red-tailed Hawk												2		2
Merlin								1						1
Black-bellied Plover		1												1
Semi-palmated Plover			2											2
Killdeer						2								2
Solitary Sandpiper									1					1
Spotted Sandpiper		2												2
Red Knot			1											1
Sanderling		12	1											13
Semi-palmated Sandpiper		3	16											19
Least Sandpiper	1	16	2									1		20
Baird's Sandpiper		1												1
Pectoral Sandpiper		1												1
Mourning Dove			4		2							1		7
Black-billed Cuckoo					1			2	2	1				6
Whip-poor-will					2		1	1	1					5
Chimney Swift										1				1
Red-headed Woodpecker						1								1
Red-bellied Woodpecker					1							1		2
Yellow-bellied Sapsucker		1		7	1		1	1	5	3	3	10		32
Downy Woodpecker		1	1							3				5
Hairy Woodpecker			1					1	1					3
Yellow-shafted Flicker		4		3			1				1			9

Table 11.6. Fall non-standard banding totals of birds captured at Prince Edward Point Bird Observatory, 2001-2013

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Eastern Wood-Pewee		4		2	2			1		1		1		11
Yellow-bellied Flycatcher		3		1	2			4			1			11
Traill's Flycatcher		1		1	3			5	7	3		5		25
Willow Flycatcher								1						1
Alder Flycatcher								1						1
Least Flycatcher		3		3	14			4	7	3				34
Eastern Phoebe		5	4	6		3			6	5	3	8		40
Great Crested Flycatcher		1			2				1	1				5
Eastern Kingbird								1		3				4
Northern Shrike			1		1						1			3
Blue-headed Vireo		15	4	17	22	1	3	5	23	26	8	12		136
Philadelphia Vireo				1	2				1	2	1	1		8
Red-eyed Vireo		3		8	21			3	6	8	3	4		56
Blue Jay		8	1	3	6	5	9	29	10	18	12	8		109
Purple Martin													5	5
Tree Swallow									5	2	15			22
N. Rough-winged Swallow										2				2
Bank Swallow		1								3	4	4		12
Cliff Swallow							2	5	2	2	3	1		15
Barn Swallow		20				1	7	13	51	21	70	45		228
Black-capped Chickadee		2	12	13	89		49		28	268	3	317		781
Boreal Chickadee										2				2
Red-breasted Nuthatch			1	2	2		5		5	11		26		52
Brown Creeper		15	13	5	21	7	4		12	24	3	5		109
Carolina Wren				1										1
House Wren		1		9	4		5	8	9	5	1			42
Winter Wren		10	1	5	5	2	4		7	3	1			38
Golden-crowned Kinglet		66	20	69	16	32	5	3	26	92	28	38		395
Ruby-crowned Kinglet		44	31	33	55	25	5	1	33	25	38	25		315
Blue-gray Gnatcatcher		1		1				1	1			1		5

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Veery					1									1
Gray-cheeked Thrush		4	1	2	6		2	1	1	3		3		23
Swainson's Thrush		6		2	7				5	7		7		34
Hermit Thrush		23	12	12	3	4			10	5	11	4		84
American Robin		5	6	2	1	6		1	3	5	21	1		51
Gray Catbird		1						5	4	1				11
Brown Thrasher		1			1					1				3
Cedar Waxwing		1						1	24	11	7			44
Tennessee Warbler		2			7			3	1	1	5			19
Orange-crowned Warbler				1	1						1	1		4
Nashville Warbler		9			35			9	14	12	12	1		92
Northern Parula					1					1	1			3
Warbling Vireo				1	1				4	3	1	4		14
Yellow Warbler		68		13	7	2		24	77	41	6	19		257
Chestnut-sided Warbler		2			4		1	3	1	2	1			14
Magnolia Warbler		25		1	47		2	14	6	10	8	8		121
Cape May Warbler												1		1
Black-throated Blue Warbler		10	1	6	18		4	2	12	12	7	7		79
Myrtle Warbler		55	8	4	154	21	5	5	8	22	29	72		383
Black-throated Green Warbler		3		1	20	1		2	2	6	4	2		41
Blackburnian Warbler		2			3			3	2			1		11
Pine Warbler									2					2
Western Palm Warbler		2		1	3			10		1	3	2		22
Yellow Palm Warbler			2		3		11		6	2	1	8		33
Bay-breasted Warbler		4		1	9			1	3	3		1		22
Blackpoll Warbler		3		6	30		1	5	12	8	20	1		86
Black-and-white Warbler		6			6			4	1	1				18
American Redstart		9			11			1	4	4	2	2		33
Ovenbird		1		1	1									3
Northern Waterthrush		2		1	3			1		2	2	1		12

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Connecticut Warbler					1						1			2
Mourning Warbler								1	1	2				4
Common Yellowthroat		3		5	8			9	4	13	4	8		54
Wilson's Warbler		1			11			3	2	3				20
Canada Warbler		2			2			1		1				6
Scarlet Tanager		2		1	5					3		1		12
Eastern Towhee		1		1										2
American Tree Sparrow		1	1		1			1	2		2			8
Chipping Sparrow		8	1	1	24	1		9	9			7		60
Clay-coloured Sparrow								1						1
Field Sparrow		2		1				3	2	1	1	4		14
Vesper Sparrow					1				1					2
Savannah Sparrow			1					1	2			1		5
Fox Sparrow		2	2		2	4								10
Song Sparrow		10		5	5	1	2	26	33	10	6	5		103
Lincoln's Sparrow		1			1									2
Swamp Sparrow		2			1					1				4
White-throated Sparrow		9	8	20	13	4	3		6	32	23	26		144
Eastern White-crowned Sparrow			1	1	2		1		2	1		1		9
White-crowned Sparrow		3	10	6	3	1			8	11		2		44
Slate-coloured Junco		21	135	26	250	9	12		36	37	6	17		549
Oregon Junco					1									1
Northern Cardinal			1								1	8		10
Rose-breasted Grosbeak					1			4	5		3			13
Indigo Bunting											1			1
Bobolink								184	24		71	3		282
Red-winged Blackbird								1	4		1	9		15
Rusty Blackbird									1	16	10	9		36
Common Grackle		3							2					5
Brown-headed Cowbird			2					1	2	2		1		8

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Orchard Oriole										1				1
Baltimore Oriole				1	3	1		1	4	13	2	1		26
Purple Finch			2	7	4		99	10	23	7		37		189
House Finch		7	11	2		6	2		18	2		5		53
White-winged Crossbill												1		1
Common Redpoll												2		2
Pine Siskin			8	335	1		10		12	59		1625		2050
American Goldfinch		66	180	320	13		196	17	327	53	17	340		1529
Evening Grosbeak			1							33		17		51
Total	1	867	512	980	1016	158	464	459	987	1011	501	2794	5	9755
Number of species	1	68	38	51	70	23	29	56	70	72	53	63	1	118

12.0 Literature Cited

Alerstam, T. and S.G. Pettersson. 1977. Why do migrating birds fly along coastlines? Journal of Theoretical Biology 65:699-712.

Ammon, E.M. and W.M. Gilbert. 1999. Wilson's Warbler (*Wilsonia pusilla*). *In* The Birds of North America, No. 478 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Badzinski, D. S. and C. M. Francis. 2000. An evaluation of species coverage by the Canadian Migration Monitoring Network. Unpublished report by Bird Studies Canada.

Bart, J. 2005. Monitoring the abundance of bird populations. The Auk 122(1):15-25

Beckett, S.R. and G.A. Proudfoot. 2011. Large-Scale Movement and Migration of Northern Saw-Whet Owls in Eastern North America. The Wilson Journal of Ornithology, 123(3):521-535.

Bowen, G. J., L. I. Wassenaar, and K. A. Hobson. 2005. Global application of stable hydrogen and oxygen isotopes to wildlife forensics. Oecologia 143:337–348.

Briskie, J. V. 1994. Least Flycatcher (*Empidonax minimus*). *In* The Birds of North America, No. 99 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706pp.

Carlisle, J.D. et al. 2009. Landbird Migration in the American West: Recent Progress and Future Research Directions. The Condor 111(2): 211–225

Cimprich D. A., F. R. Moore, M. P. Guilfoyle. 2000. Red-eyed Vireo (*Vireo olivaceus*). *In* The Birds of North America, No. 527 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Conway, C.J. 1999. Canada Warbler (*Wilsonia canadensis*). *In* The Birds of North America, No. 421 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

DeSante, D.F. 1992. Monitoring Avian Productivity and Survivorship (MAPS): a sharp, rather than blunt, tool for monitoring and assessing landbird populations. In: D. R. McCullough and R. H. Barrett (Eds.), Wildlife 2001: Populations, pp. 511-521. (London, U.K.: Elsevier Applied Science).

Diehl, R.H., R.P. Larkin, and J.E. Black. 2003. Radar Observations of Bird Migration over the Great Lakes. The Auk. 120:278-290.

Eaton, S.W. 1995. Northern Waterthrush (*Seiurus noveboracensis*). *In* The Birds of North America, No. 540 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Evans Mack, D., and W. Yong. 2000. Swainson's Thrush (*Catharus ustulatus*). *In* The Birds of North America, No. 540 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Falls, J. B., and J. G. Kopachena. 1994. White-throated Sparrow (*Zonotrichia albicollis*). *In* The Birds of North America, No. 128 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Gagnon, F., J. Ibarzabal, J.-P. L. Savard, P. Vaillancourt, M. Bélisle, and C.M. Francis. 2011a. Weather effects on autumn nocturnal migration of passerines on opposite shores of the St. Lawrence estuary. The Auk 128(1):99-112

Gagnon, F., J. Ibarzabal, J.-P. L. Savard, M. Bélisle, and P. Vaillancourt. 2011b. Autumnal patterns of nocturnal passerine migration in the St. Lawrence estuary region, Quebec, Canada: a weather radar study. Canadian Journal of Zoology 89:31-46.

Gauthreaux, S. A., Jr. 1996. Bird migration: Methodologies and major research trajectories (1945-1995). The Condor 98:442-453

Gibbs, J. P., and J. Faaborg. 1990. Estimating the viability of Ovenbird and Kentucky warbler populations in forest fragments. Conservation Biology 4:193-196.

Griffin, D.R. 1969. The physiology and geophysics of bird navigation. Quarterly Review of Biology 44:255-276.

Gross, D. A., and P.E. Lowther. 2001. Yellow-bellied Flycatcher (*Empidonax flaviventris*). *In* The Birds of North America, No. 448 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Hall, G. A. 1994. Magnolia Warbler (*Dendroica magnolia*). *In* The Birds of North America, No. 136 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Hejl, S.J., K.R. Newlon, M.E. McFadzen, J.S. Young, and C.K. Ghalambor 2002a. Brown Creeper (*Certhia americana*). *In* The Birds of North America, No. 669 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Hobson, K. A. 2003. Making migratory connections with stable isotopes. Pages 379–391 in P. Berthold, E. Gwinner, and E. Sonnenschein, editors. Avian migration. Springer-Verlag, Berlin, Germany.

Hobson, K. A. 2005. Stable isotopes and the determination of avian migratory connectivity and seasonal interactions. The Auk 122(4):1037–1048.

Hobson, K. A., and S. L. Van Wilgenburg. 2014. A report on the stable-hydrogen isotope analysis of feathers from Canadian Migration Monitoring Network Stations sampled in 2007 with preliminary catchment area depictions. Unpublished report, Environment Canada, Saskatoon.

Hunt, P. D., and D. J. Flaspohler. 1998. Yellow-rumped Warbler (*Dendroica coronata*). *In* The Birds of North America, No. 376 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Ingold, J. L., and R. Galati. 1997. Golden-crowned Kinglet (*Regulus satrapa*). *In* The Birds of North America, No. 301 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Ingold, J. L., and G. E. Wallace. 1994. Ruby-crowned Kinglet (*Regulus calendula*). *In* The Birds of North America, No. 119 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

James, R.D. 1998. Blue-headed Vireo (*Vireo solitarius*). *In* The Birds of North America, No. 261 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Janzen, D. H. 1983. No park is an island: increase in interference from outside as park size decreases. Oikos 41: 402-410.

J one s, P. W., and T. M. Donovan. 1996. Hermit Thrush (*Catharus guttatus*). *In* The Birds of North America, No. 261 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Kricher, J. C. 1995. Black-and-white Warbler (*Mniotilta varia*). *In* The Birds of North America, No. 158 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Liechti, F. 2006. Birds: blowin' by the wind? Journal of Ornithology. 147:202-211.

Lowther, P. E., C. C. Rimmer, B. Kessel, S. L. Johnson, and W.G. Ellison. 2001. Gray-cheeked Thrush (*Catharus minimus*). *In* The Birds of North America, No. 591 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Lowther, P. E., C. Celada, N.K. Klein, C. C. Rimmer, and D.A. Spector. 1999. Yellow Warbler (*Dendroica petechia*). *In* The Birds of North America, No. 591 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Marra, P.P. et al. (1998) Linking winter and summer events in a migratory bird by using stable-carbon isotopes. Science 282, 1884–1886

Martin, S.G. and T.A. Gavin. 1995. Bobolink (*Dolichonyx oryzivorous*). *In* The Birds of North America, No. 716 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Millikin, R. L. 2005. Migration Monitoring with Automated Technology. USDA Forest Service General Technical Report PSW-GTR-191.

Morse, D. H. and A. F. Poole (2005). Black-throated Green Warbler (*Dendroica virens*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Online database: <u>http://bna.birds.cornell.edu/BNA/account/Black-throated Green Warbler/doi:10.2173/bna.55</u>

Moskoff, W. and S.K. Robinson. 1996. Philadelphia Vireo (*Vireo philadelphicus*). *In* The Birds of North America, No. 716 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Newton, I. 2008. The migration ecology of birds. Elsevier Academic Press.

Nolan, V., Jr., E. D. Ketterson, D. A. Cristol, C. M. Rogers, E. D. Clotfelter, R. C. Titus, S. J. Schoech, and E. Snajdr. 2002. Dark-eyed Junco (*Junco hyemalis*). *In* The Birds of North America, No. 716 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Okines, D. 2009. Migration Monitoring Protocol. Prince Edward Point Bird Observatory.

Pyle, P. 1997. Identification Guide to North American Birds Part I First Edition. Slate Creek Press.

Porzig, E.L., K.E. Dybala, T. Gardali, G. Ballard, G.R. Geupel, and J..A. Wiens. 2011. Forty-five years and counting: Reflections from the Palomarin field station on the contribution of long-term monitoring and recommendations for the future. The Condor 113(4):713–723

Rich, T.D., C.J. Bearmore, H. Berlang, P.J. Blancher, M.S.W. Bradstreet, G.S. Buthcer, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, and T.C. Will. 2004. Partners in Flight North American landbird conservation plan. Cornell Lab of Ornithology, Ithaca. http://www.partnersinflight.org/cont_plan/default.htm

Richardson, W. J. 1990. Timing of bird migration in relation to weather: updated review. In: Gwinner, E. (Ed.) Bird migration. Springer, Berlin Heidelberg New York, pp 78–101

Richardson, M. and D.W. Brauning. 1995. Chestnut-sided warbler (*Dendroica pensylvanica*) *In* The Birds of North America, No. 716 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia, PA.

Robinson, W.D., M.S. Bowlin, I. Bisson, J. Shamoun-Baranes, K. Thorup, R.H. Diehl, T.H. Kunz, S. Mabey, and D.W. Winkler. 2010. Integrating concepts and technologies to advance the study of bird migration. Front Ecological Environment 8(7): 354–361.

Smith, S.M. 1993. Black-capped Chickadee (*Poecile atricapillus*). *In* The Birds of North America, No. 277 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Swanson, D. L., E. T. Liknes, and K. L. Dean. 1999. Differences in migratory timing and energetic condition among sex/age classes in migrant Ruby-crowned Kinglets. Wilson Bulletin, 11:61-69.

Van Horn, M. A. and T. Donovan. 1994. Ovenbird (*Seiurus aurocapilla*). *In* The Birds of North America, No. 88 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Williams, J. M. 1996. Nashville Warbler (*Vermivora ruficapilla*). *In* The Birds of North America, No. 205 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Williams, K.A., E.M. Adams, J. Fiely, D. Yates, P.B. Chilson, C. Kuster, D.C. Evers. 2013. Migratory Bird and Bat Monitoring in the Thousand Islands Region of New York State: Final Report, March 2013. Report to the U.S. Fish and Wildlife Service Columbus, Ohio Field Office. Report BRI 2013-11, Biodiversity Research Institute, Gorham, Maine.

Wilson, W.H., Jr. 1996. Palm Warbler (*Dendroica palmarum*). *In* The Birds of North America, No. 238 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Witmer, M.C., D.J. Mountjoy, and L. Elliot. 1997. Cedar Waxwing (*Bombycilla cedrorum*). *In* The Birds of North America, No. 238 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.