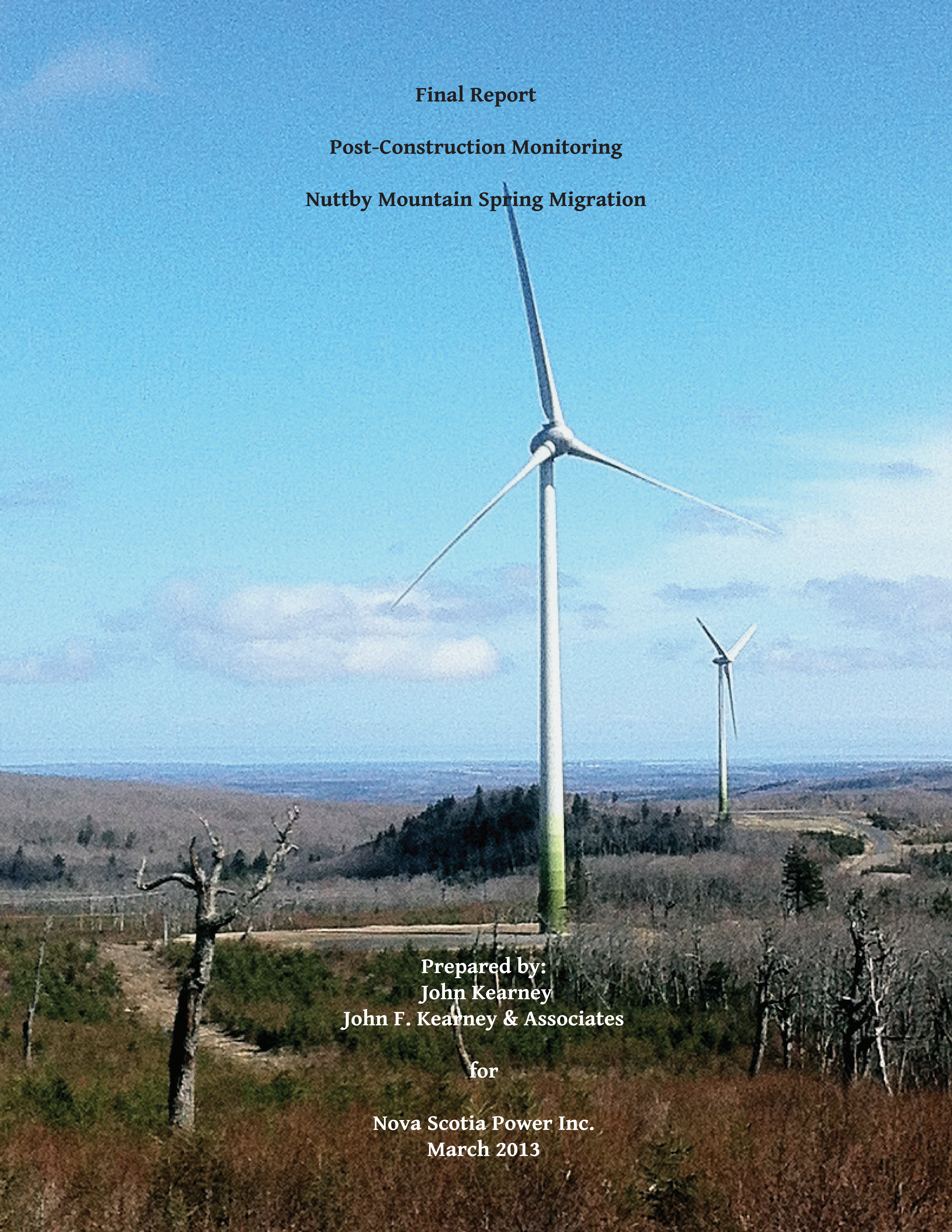

Final Report

Post-Construction Monitoring

Nuttby Mountain Spring Migration

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for

Nova Scotia Power Inc.
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Introduction

This chapter reports the results of the spring migration surveys conducted during the baseline study in 2009 and the post-construction monitoring in 2011 and 2012. The analysis provides the opportunity to compare the results of the studies conducted before construction of the Nuttby Mountain Wind Farm with those obtained during the two years immediately following the commissioning of the facility in 2010. The results of the baseline study were first presented in the registration document of the environmental assessment (CBCL 2008). The spring bird migration component of the environmental assessment was published later (Dalzell 2010).

The objectives of the post-construction spring migration studies were outlined in the post-construction monitoring plan submitted to the Canadian Wildlife Service and the Nova Scotia Department of Natural Resources in December 2010 (Kearney 2010). These objectives were further refined over the course of the study as follows:

1) To determine the relative abundance, species composition, and timing of migration stop-over, diurnal passage, and nocturnal passage in the study area,

2) To determine the effects of wind turbines and human activities on migrating birds in the study area as to:

a. the use of habitats by migrating birds in stop-over,

b. displacement from habitats,

c. avoidance of habitats,

d. the effects of habitat fragmentation on bird populations, and

e. the barrier effects on flight pathways,

3) To determine the effects of the project on the presence, abundance, and habitats of species of conservation concern, with a special focus on birds listed as endangered, threatened, or of special concern by the Province of Nova Scotia, the Government of Canada, and the Committee on the Status Endangered Wildlife in Canada, and

4) To contribute to the national database on avian wind facility studies.

This chapter will address all of these objectives except 2)b. to 2)e. which will be discussed at the conclusion of the chapter on the autumn migration.

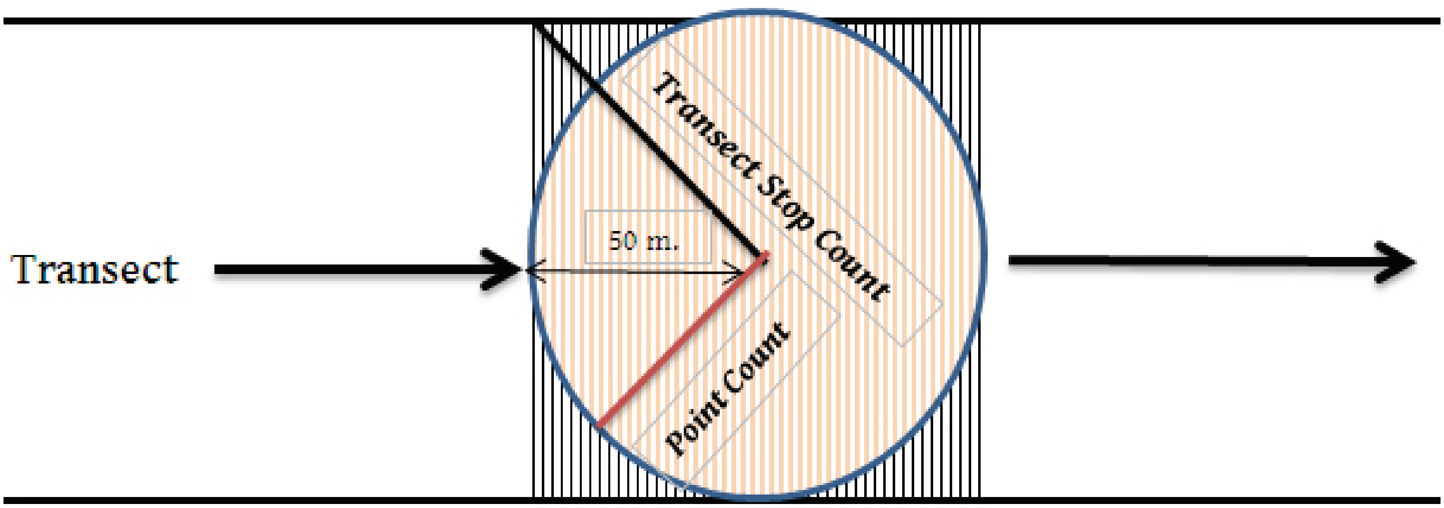
Field Methods

The study of spring migration at the Nuttby Mountain Wind Farm consists of three component studies; stop-over, diurnal passage, and nocturnal passage. The methods followed several government guidance documents pertaining to the environmental assessment of wind energy facilities (Environment Canada 2007a, b, Hanson et al. 2009, Ontario Ministry of Natural Resources 2011).

Stop-over

Four line-transects were used for the study of stop-over migration. Transects were 1,500 metres in length with all birds recorded in the following distance categories from the observer: <50 metres, 50-100 metres, >100 metres, and flying overhead. Transects followed already made trails, wood roads, or turbine access roads and thus were not straight lines. Transects were divided into three equal 500-metre segments which represent, as much as possible, distinct habitat types. Along each transect were six stops. The duration of a stop was ten minutes with birds recorded in the same distance categories as the rest of the transect line. The stops are similar to point counts in that all birds seen or heard during the ten minutes are counted as part of a distinct record. The stops differ from a point count in that the distance of the bird recorded is in reference to the transect line rather than a point location. Therefore a bird within 50 metres of the stop location is also within 50 metres of the transect line. However, an American Robin foraging on the transect path 55 metres ahead from the stop location is still within 50 metres of the transect line but 50-100 metres from the observer. In practical terms, however, birds counted within 50 metres of a stop location are roughly comparable with birds seen or heard within 50 metres of a point count location. But as seen in Figure 1, there is a difference.

Figure 1: Comparison of a Point Count and Transect Stop Count

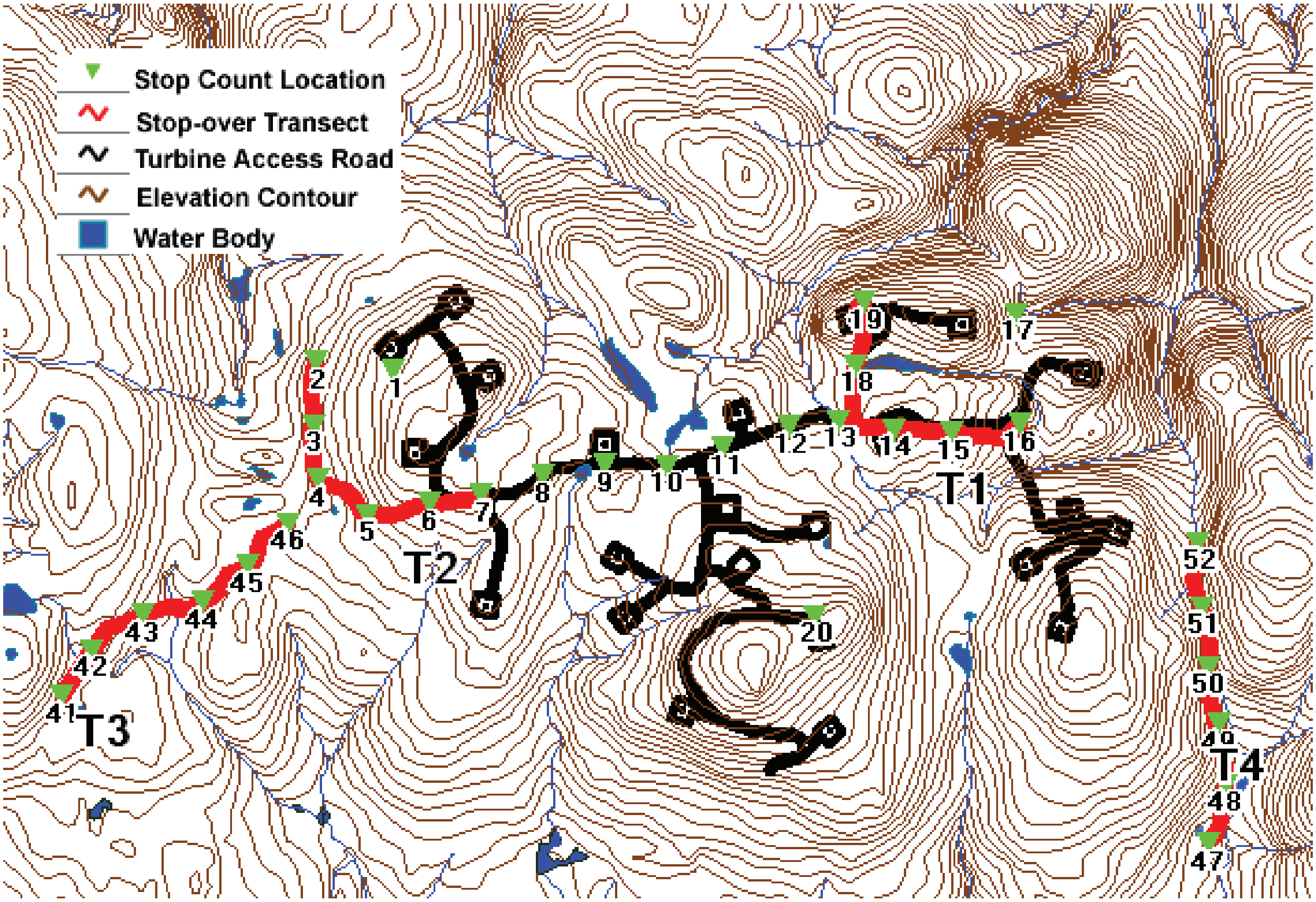


The stops serve two purposes: 1) it slows down, in a consistent and systematic fashion, the walking of a transect so there is a greater likelihood to detect birds in stop-over, and 2) the stops are situated in distinct habitat types so that finer detail can be obtained on habitat use.

Two transects were completed once each week on a rotational basis during the spring migration from late March to early June in 2011 and 2012. Transect surveys were started, on average, 1 hour after sunrise (from 40 minutes to 1 hour and forty-five minutes after sunrise). The location of the four post-construction stop-over transects are shown in Figure 2 along with their 24 stop count locations.

The spring migration component of the baseline study consisted of ten surveys between 5 May and 9 June 2009. Point count rather than a transect methodology was employed. There were 20 point counts which correspond to the point counts labeled 1 to 20 in Figure 2. Twelve of these point counts were

Figure 2: Map of Stop-over Transects with Stop Count Locations



incorporated into Transect 1 and Transect 2 as stop counts in the post-construction surveys. These stop counts and point counts are not strictly comparable for the reasons previously outlined. Other differences were:

1) The point counts were only 3 minutes in duration compared to 10 minutes for the stop counts,

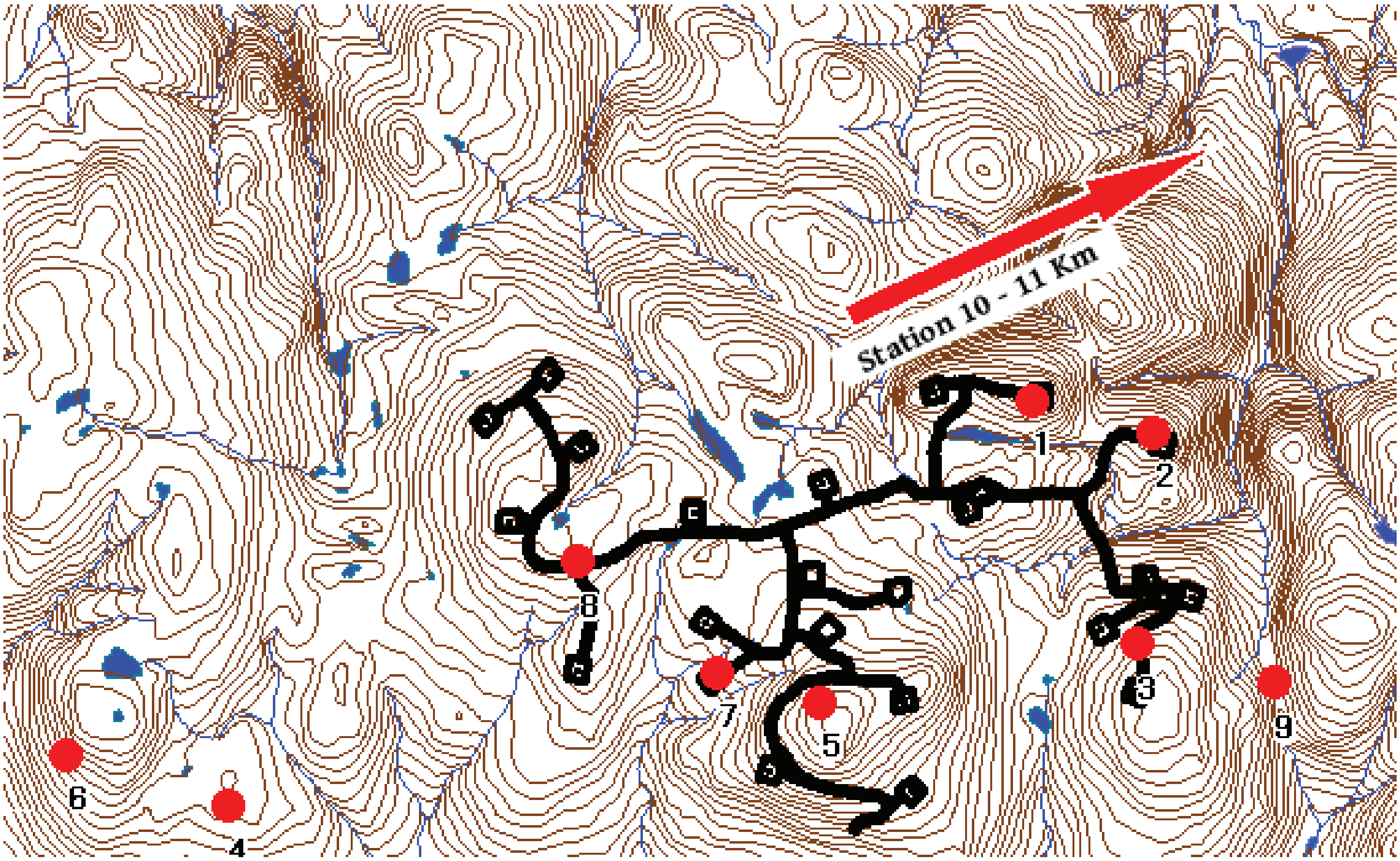
2) The point counts included all birds within 100 meters of the observer with no other distance categories,

3) The point count methodology does not include the birds seen or heard between stops as is the case with the transect methodology.

Diurnal Passage

Diurnal passage studies during the baseline consisted of estimating the number and altitude of birds flying over the point count locations. During the post-construction follow-up studies, three methods were used to study diurnal migration. Systematic diurnal passage observations were made at several stations with observations divided into 30-minute blocks. The observation stations are shown in Figure 3. Stations 1 to 8 were used for diurnal passage observations. The birds were noted by taxa, flock size, altitude, direction of flight, and distance from a turbine. In addition, birds in diurnal passage were noted separately during the stop-over transect surveys. Finally, for 30 minutes during the return trip of a transect, diurnal passage observations were recorded. For observations made during the conduct of a stop-over transects altitude and distance from turbine were not recorded.

Figure 3: Map of Observation and Listening Stations



Nocturnal Passage

Most of the mortalities from collisions with wind turbines come from passerine birds which migrate primarily at night (Manomet Center for Conservation Sciences 2009). Thus it could be important to know the magnitude and timing of nocturnal migration over a wind energy facility, especially one at a relatively high altitude which is the case at Nuttby Mountain.

During the post-construction follow-up studies, a partnership between Nova Scotia Power Inc., John F. Kearney & Associates, and the Cornell Lab of Ornithology led to the nocturnal recording of two full migration seasons in the autumn of 2011 and the spring of 2012. Two Song Meter recorders with a Night Flight Call plate microphone, both made by Wildlife Acoustics, were deployed at listening stations shown in Figure 3. The recordings were processed by a team of researchers at the Cornell Lab of Ornithology, and the night flight calls identified to taxa by Anne Klingensmith and Andrew Farnsworth, two of the leading experts in night flight call identification.

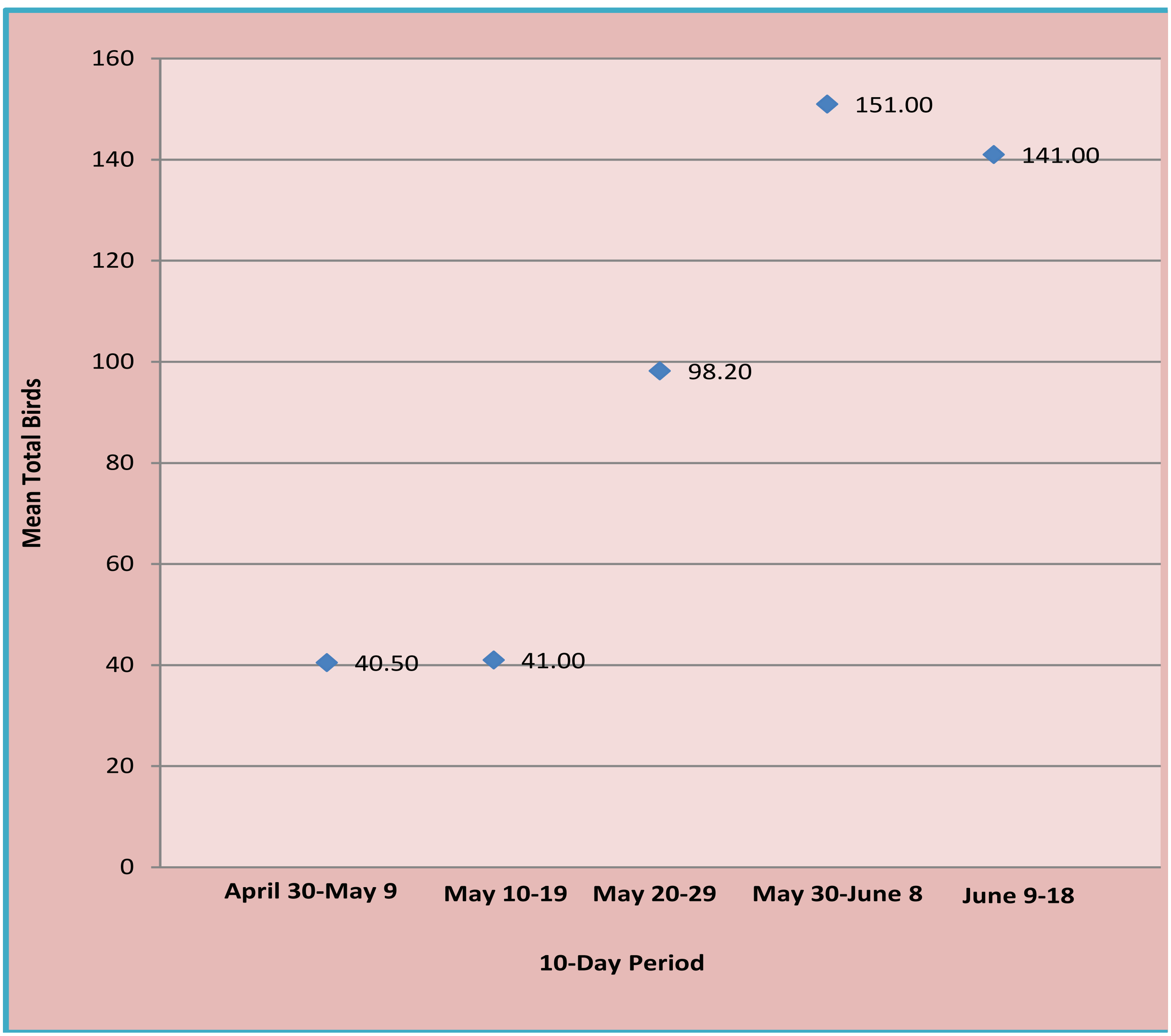
Results

Spring Migration Stop-over

Migration stop-over will be examined in reference to the effects of seasonality, weather, and habitat on the abundance and diversity of birds. Comparisons will be made between pre-construction and post-construction conditions. However, the difference in survey methods and the smaller sample size in the baseline study preclude an amalgamation of the data and allows for only limited comparative analysis.

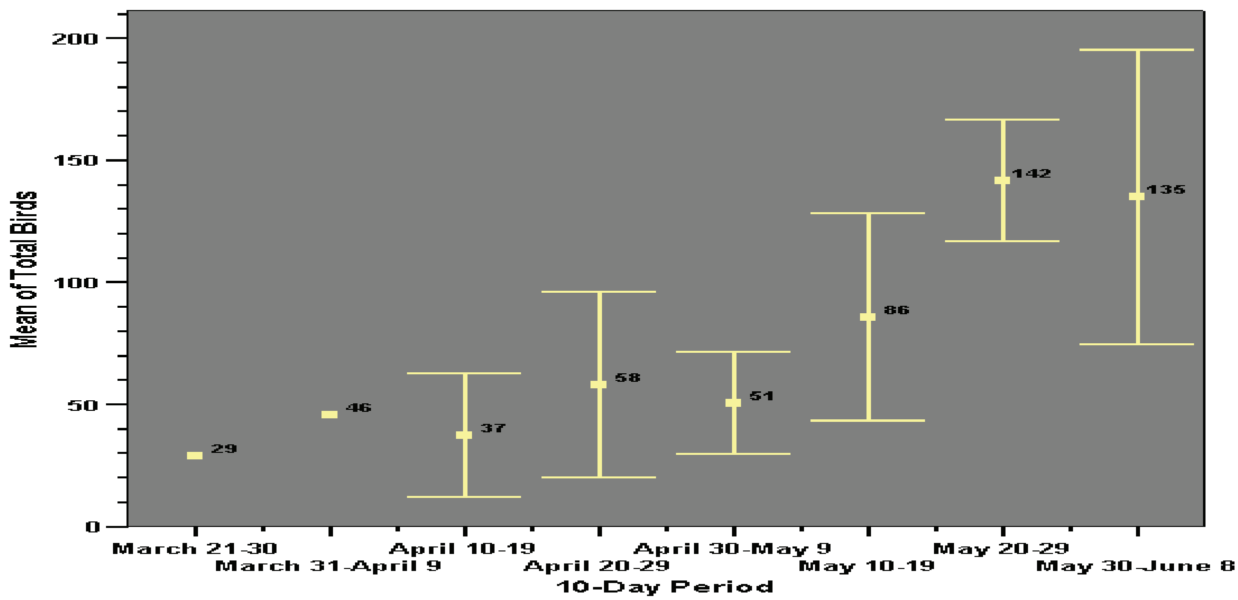
The spring stop-over survey in 2009 consisted of 20 point counts on each morning that a survey was conducted and as described in the field methods. Figure 4 shows the mean total birds on the point counts over 10-day periods. No surveys were done in April and the May and June results show a peak of 151 birds per survey in the period 30 May to 8 June.

Figure 4. Mean Total Birds on the Spring Point Counts in 2009 by 10-Day Period



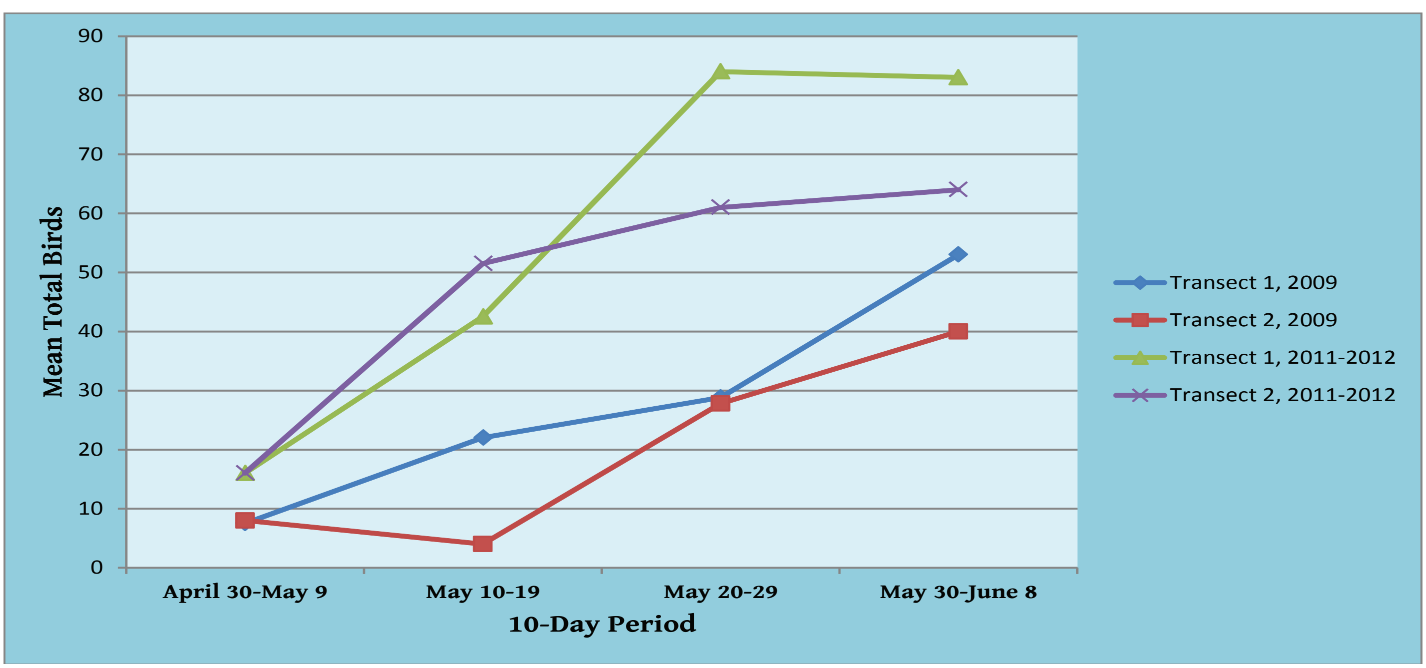
The mean total birds on the four transects during the stop-over surveys in 2011 to 2012 are given in Figure 5. The data show higher numbers in 2011-2012 for each of the corresponding 10-day periods than in 2009 except for May 30-June 8. Given the different methods in pre- and post-construction surveys, a comparison of the point counts in 2009 with the stop counts in 2011-2012 provides a more standardized approach. Some of the point counts in the 2009 surveys became the stop counts for Transect 1 and Transect 2 in 2011 and 2012.

Figure 5: Mean Total Birds per Stop-over Transect in 2011-2012 by 10-Day Period with 95% Confidence Limits



A comparison of these counts is presented in Figure 6. While a stop count and a point count are not

Figure 6: A Comparison of Point Counts in 2009 and Stop Counts in 2011-2012 on Transects 1 & 2



the exactly the same and the stop count was 7 minutes longer than the point count, this graph is the best comparison possible for pre- and post-construction spring bird populations. The seasonal pattern of total mean birds is similar in 2009 to 2011-2012. Counts are considerably higher in 2011-2012. Peak counts are spread from 20 May to 8 June in 2011-2012 but distinctly higher 30 May to 8 June in 2009.

Figures 7 and 8 demonstrate that despite difference in methods, the total species seen in a morning survey was quite similar in 2009 and 2011-2012.

Figure 7: Mean of Total Species in 2009

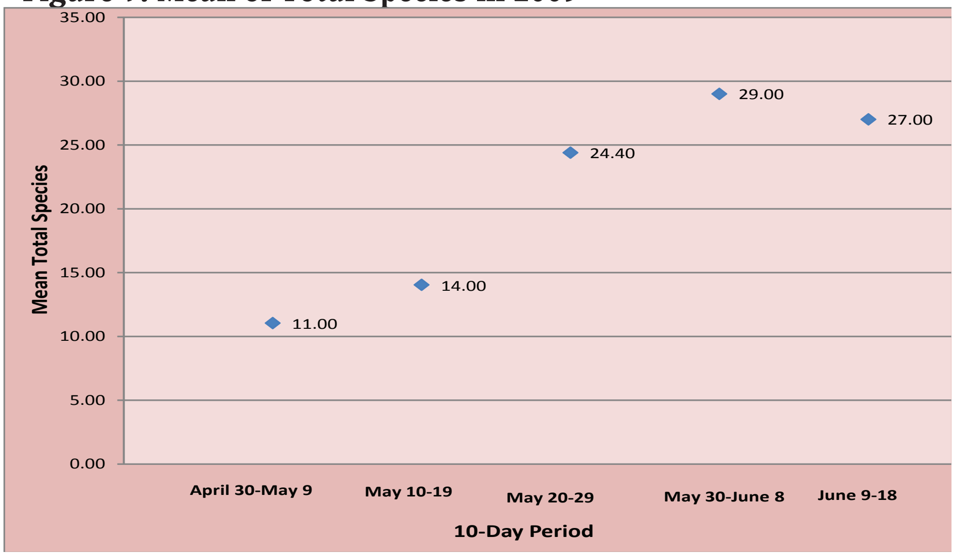
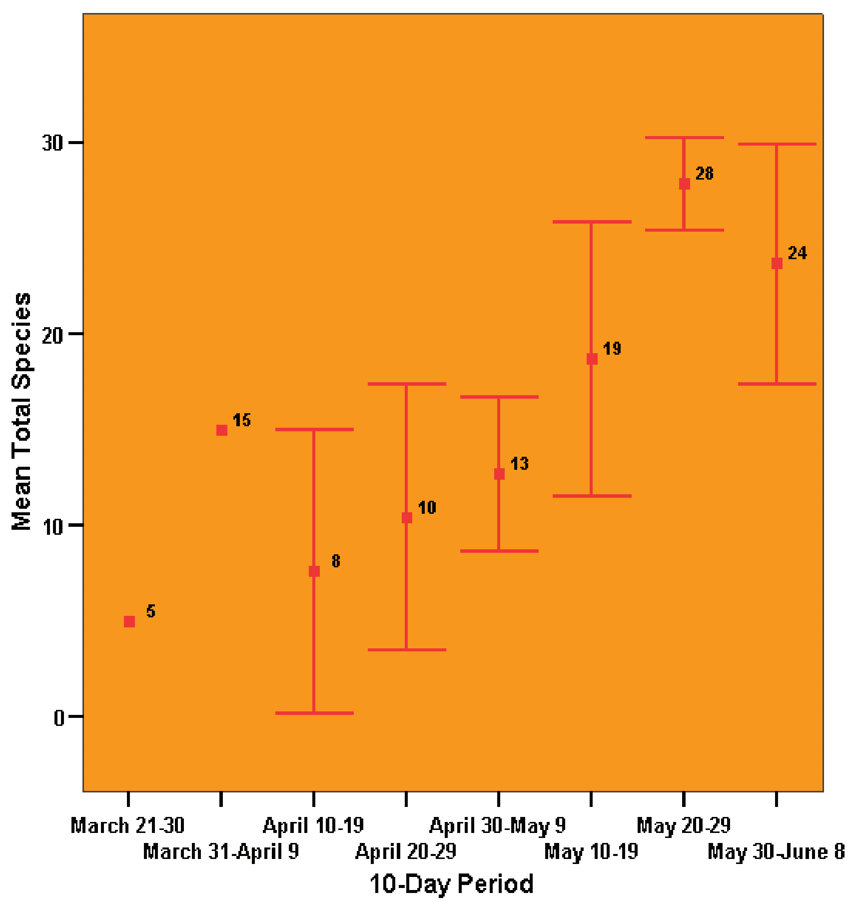


Figure 8: Mean of Total Species at All Distances in 2011-2012 with 95% Confidence Limits



Thus far, the calculations of the means have included all birds; those that are migrating and those that are local, those that are still migrating and those that are finished migrating and have commenced breeding activities. Through an analysis of variance of the means, it is possible to hypothesize which bird species exhibit migratory behaviour from significant differences in their mean numbers over the 10-day intervals.

This analysis indicated that there are 15 species of migratory birds, many of them neo-tropical migrants, using the transect area as stop-over habitat. The analysis is taken one step further by plotting the means of each migratory bird species over the spring season. The ten-day period following the maximum mean of the species is treated as the commencement of its breeding period (if it does breed in the study area). This analysis was used in conjunction with the breeding dates of bird species suggested by the Maritime Breeding Bird Atlas (Bird Studies Canada et al. 2012). Bird species that had been determined through these methods to have commenced breeding were eliminated from the analysis for that 10-period and subsequent ones. A shortcoming of this method is that it is likely that many species still have migrating individuals while others birds of their species are nesting. The plot of the mean total of migrating birds per transect with error bars is shown in Figure 9. It can be seen that the peak period is more clearly located in the 20-29 May period.

Figure 9: Mean Total Migrants on Stop-over Transects at All Distances in 2011-2012 with 95% Confidence Limits

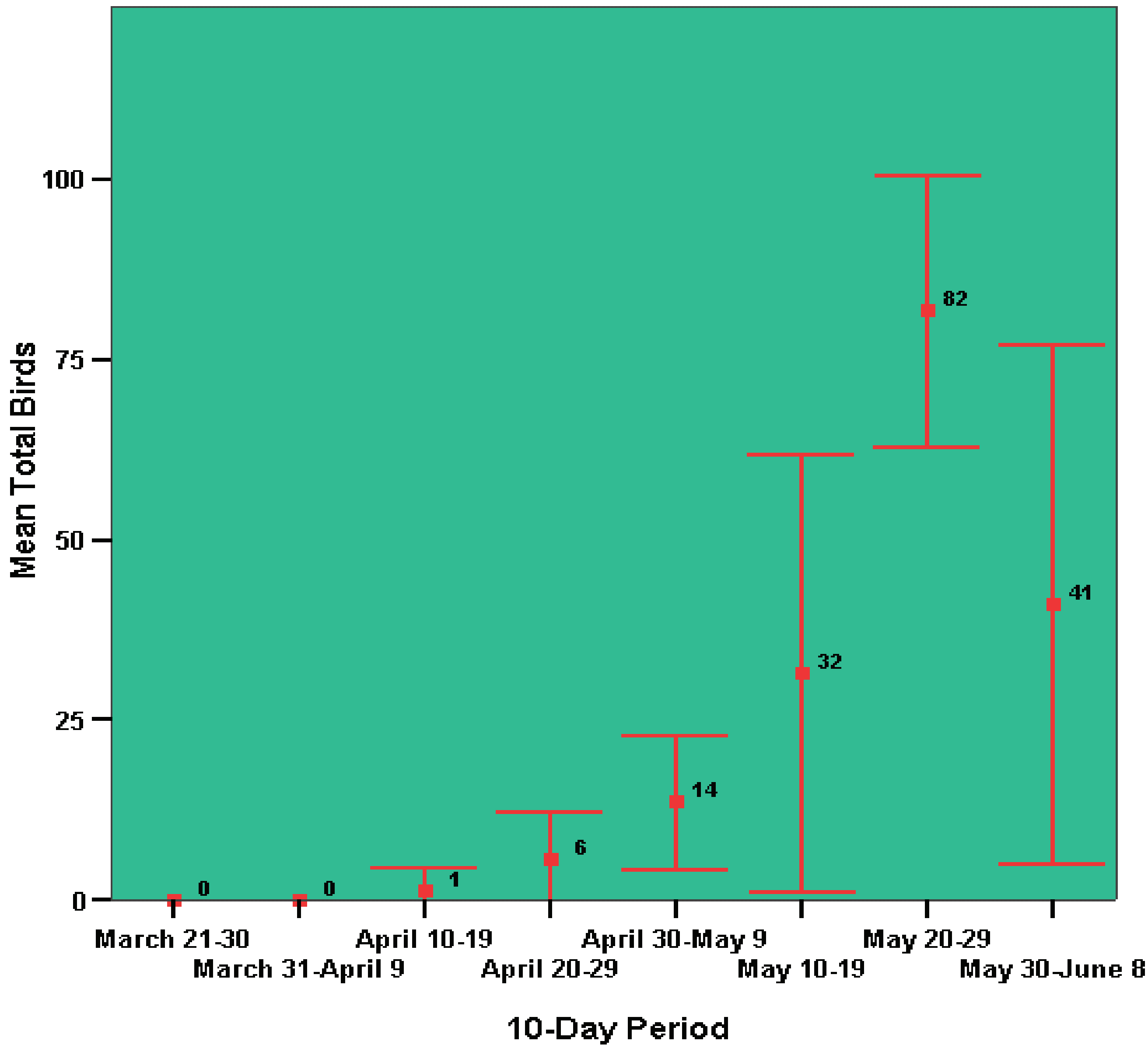
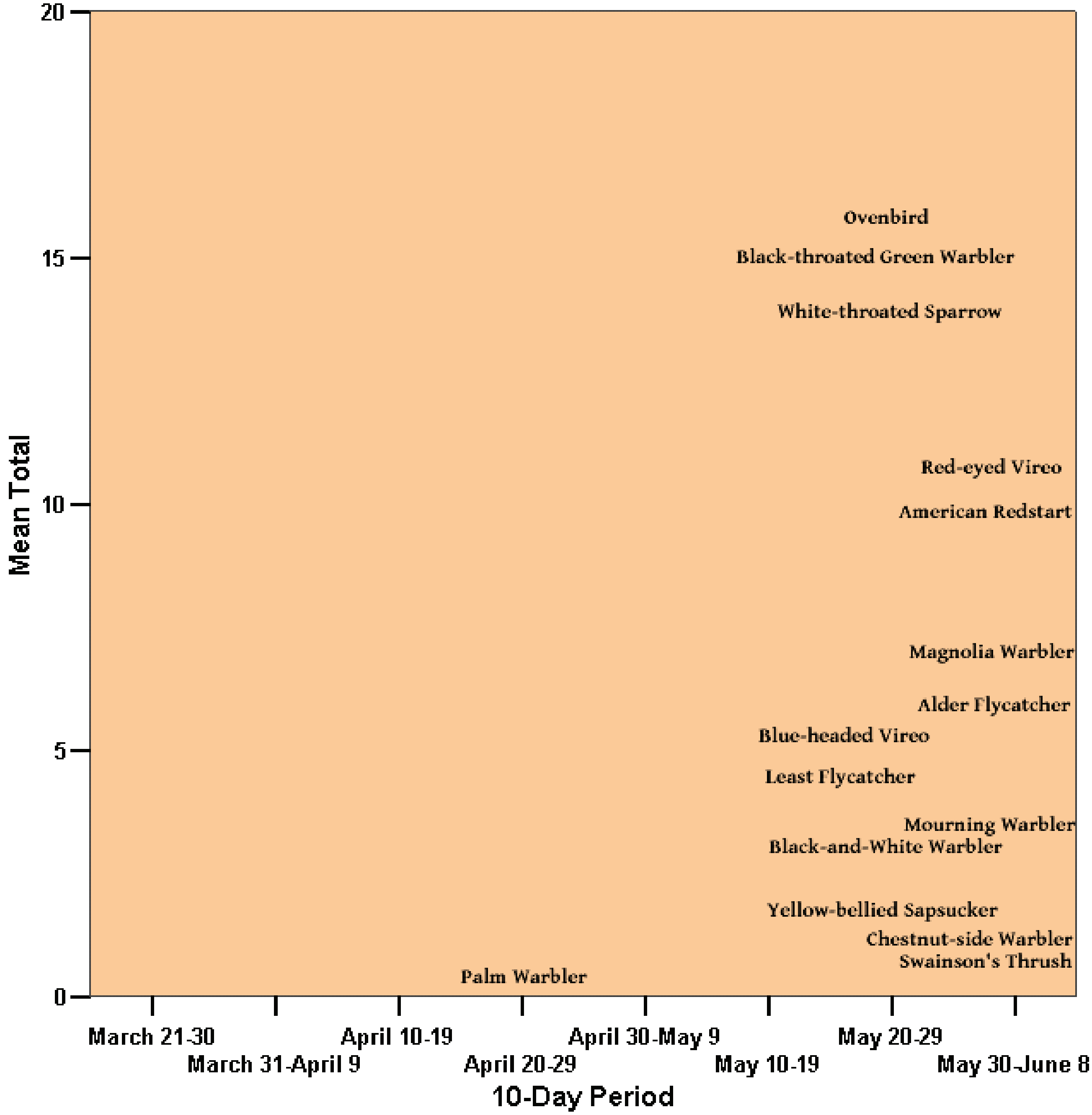


Figure 10 shows the 15 species of migratory birds with their peak mean number on the transects by 10-day period. All the species except Palm Warbler peak between May 20 and June 8 with the highest peak numbers recorded by Ovenbird, Black-throated Green Warbler, White-throated Sparrow, Red-eyed Vireo, and American Redstart in that order.

Figure 10: Timing of Peak Numbers of Migrant Species by 10-day Period, 2011-2012



A general linear model was used to analyze the different factors affecting the total birds observed on the transects during the spring migration. A variety of weather measurements were used in the model based on readings at the Environment Canada weather station at Caribou Point (48 km from the study area) for the day and night before each survey. In addition, weather readings were taken throughout the course of a transect survey.

The only weather factor showing a statistically significant effect on the total birds on the transect was the previous day's wind direction. This effect was strongest when birds at all distances were considered and not just those within 50 metres of the transect. As shown in Table 1, the effect of previous day wind direction was almost as strong as seasonality as measured by the partial Eta squared. The wind

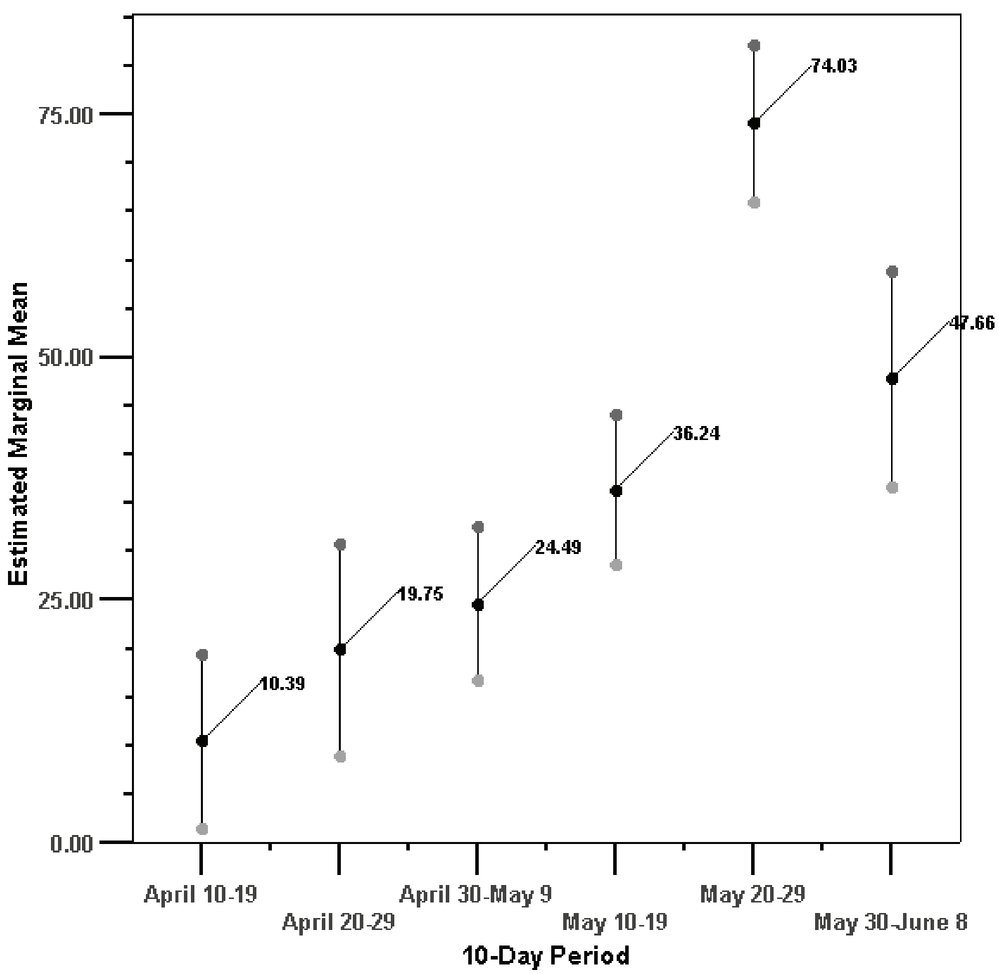
Table 1: Tests of Between-Subject Seasonality and Weather Effects at All Distances on Transects, 2011-2012

Dependent Variable: Total Birds							
Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Hypothesis	22510.879	1	22510.879	39.102	0.000	0.839
	Error	4323.626	8	575.691			
10-Day Period	Hypothesis	8699.031	5	1739.806	25.799	0.000	0.878
	Error	1213.886	18	67.438			
Previous Day Wind Direction	Hypothesis	5534.447	7	790.635	11.724	0.000	0.820
	Error	1213.886	18	67.438			

directions having the strongest effect on the number of birds were east and north winds on the previous day. These winds may have grounded birds in the transect area where they were seen the following day.

The General Linear Model also calculated the estimated marginal means of total birds for each 10-day period. The estimated marginal mean adjusts the mean based on its interaction with other factors in the model, such as weather effects. This graph is shown in Figure 11. Here it can be seen that there is a clear statistically significant peak of spring migrants in the period 20-29 May. In addition, the period from 10 April to 9 May is a statistical homogeneous subset at the 95% level while 10-19 May, 31 May - 8 June is another homogeneous subset.

Figure 11: Estimated Marginal Means of Migrants Adjusted for Weather Effects at All Distances on Transect, 2011-2012



An analysis of variance (ANOVA) indicated that there was not a significant difference in the total birds seen on all the transects in 2011 compared to 2012. The mean total birds on the four transects was 26.44 in 2011 for 16 surveys and the mean was 29.06 in 2012 for 17 surveys.

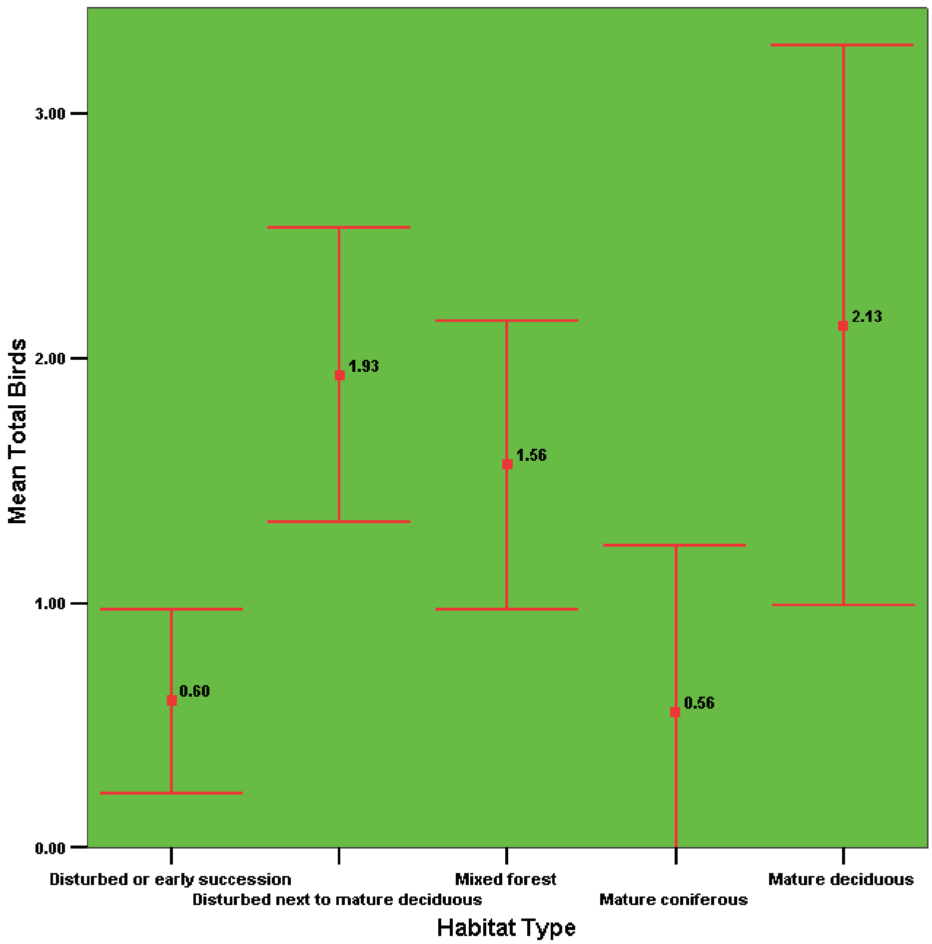
At the beginning of the post-construction study, transects were classified into 5 forest habitat types. Since the Cobequid Hills are dominated by a mature Sugar Maple/Yellow Birch/American Beech forest, the habitat types were based on the successional characteristics of this forest (Davis and Browne 1996). Thus, "mature deciduous" is one habitat type. When this forest is clearcut or otherwise disturbed, there is a distinct early successional flora dominated by alder, spruce, fir, poplar, birch, and aspen. This disturbed/early succession is another habitat type. When forest practices leave a clearcut on one side of an access road and mature deciduous on the other, this created another habitat type; clearcut next to mature deciduous. Sometimes a clearcut is replanted with spruce or pine. When this plantation becomes close to harvestable size, it creates another habitat type of mature coniferous. When left to natural succession, the disturbed forest progresses from early to mid and late succession as young sugar maples and yellow birch grow alongside the early successional species. This is the mixed forest habitat type. Finally, the shade tolerant species of the mature forest outstrip the shade intolerant early successional forest in a process that takes 100-150 years for completion. With the construction of a large wind energy facility, a different kind of forest harvesting took place in which mixed forests were cut to clear wide access road to allow the passage of construction cranes and create turbine tower pads. This was a new forest habitat of disturbed forest next to mixed forest that was present in the post-construction study. However, none of the stop-over transects traversed this habitat type.

Transect through Mature Deciduous Forest

The statistical analysis of habitat use, again including only migrating birds in stop-over, revealed that the 50-meter distance band on stop counts provided the most significant statistical results. As shown in Figure 12, birds in stop-over were most numerous in mature deciduous (mean of 2.13), mature deciduous next to disturbed areas (1.93), and mixed forests (1.56). Using Tamhane's Post-Hoc Pairwise Comparison, the number of birds in the disturbed habitat type and the mature coniferous type were significantly lower than the mature deciduous next to disturbed habitat type. Despite its higher mean, the mature deciduous habitat did not have statistically significant greater number of birds than other habitat types.

An analysis of variance also indicates some of the stop-over habitat preferences of migrating bird species. Table 2 lists the species for which statistically significant stop-over habitat associations

Figure 12: Mean Total Migrants in Stop-over by Habitat Type During Stop Counts in the Less than 50 Metres Interval, 2011-2012



were evident. Positive preferences for specific habitat types are noted in green while negative associations are in orange. Grey cells indicate the existence of statistically significant differences in habitat use overall at the 90 or 95 per cent level but were not found to be significant at the finer level of habitat type. Positive habitat relationships were largely with habitats associated with mature deciduous forest; the dominant forest type in the Cobequid Hills.

A univariate general linear model was employed to measure the effects of

Table 2: Habitat Relationships for Selected Species

Species	Disturbed or early succession	Disturbed next to mature deciduous	Mixed forest	Mature coniferous	Mature deciduous
Alder Flycatcher	0.13	0.03	0.02	0.00	0.00
Least Flycatcher	0.00	0.10	0.00	0.00	0.07
Swainson's Thrush	0.00	0.00	0.05	0.11	0.00
Black-throated Green Warbler	0.00	0.15	0.32	0.13	0.57
Black-and-White Warbler	0.00	0.15	0.06	0.00	0.04
American Redstart	0.00	0.23	0.18	0.00	0.13
Ovenbird	0.00	0.15	0.22	0.00	0.61
White-throated Sparrow	0.30	0.57	0.26	0.00	0.32

Positive Association for Habitat Type at 95% Confidence Level

Negative Association for Habitat Type at 95% Confidence Level

Statistically Significant Habitat Relationships at 95% or 90% Confidence Levels different factors on the stop counts at the 50-meter distance interval. Table 3 shows the relative effects of seasonality and habitat. While both factors have a significant effect at the 95% level on the number of migrants on the stop-over transects, habitat had a very small effect compared to seasonality (the 10-day periods). When weather factors are added to the model, as presented in Table 4, the previous day's wind direction was the only one that was statistically significant. The effect of habitat is no longer statistically significant, and the previous day's wind direction is about equal with seasonality in affecting the number of migrants on the transect as indicated by the Partial Eta Squared.

Table 3: Effects of Seasonality and Habitat on Migrants in the 50-Metre Interval of Stop Counts, 2011-2012

Tests of Between-Subjects Effects						
Dependent Variable: Total Bir	Type III					Partial Eta
Source	Sum of Squares	df	Mean Square	F	Sig.	Squared
Corrected Model	633.431	11	57.585	22.303	0.000	0.569
Intercept	102.471	1	102.471	39.687	0.000	0.176
10-Day Period	576.833	7	82.405	31.916	0.000	0.546
Habitat	29.027	4	7.257	2.811	0.027	0.057
Error	480.245	186	2.582			
Total	1618.000	198				
Corrected Total	1113.677	197				

Table 4: Effects of Seasonality, Habitat, and Weather on Migrants in the 50-Metre Interval of Stop Counts, 2011-2012

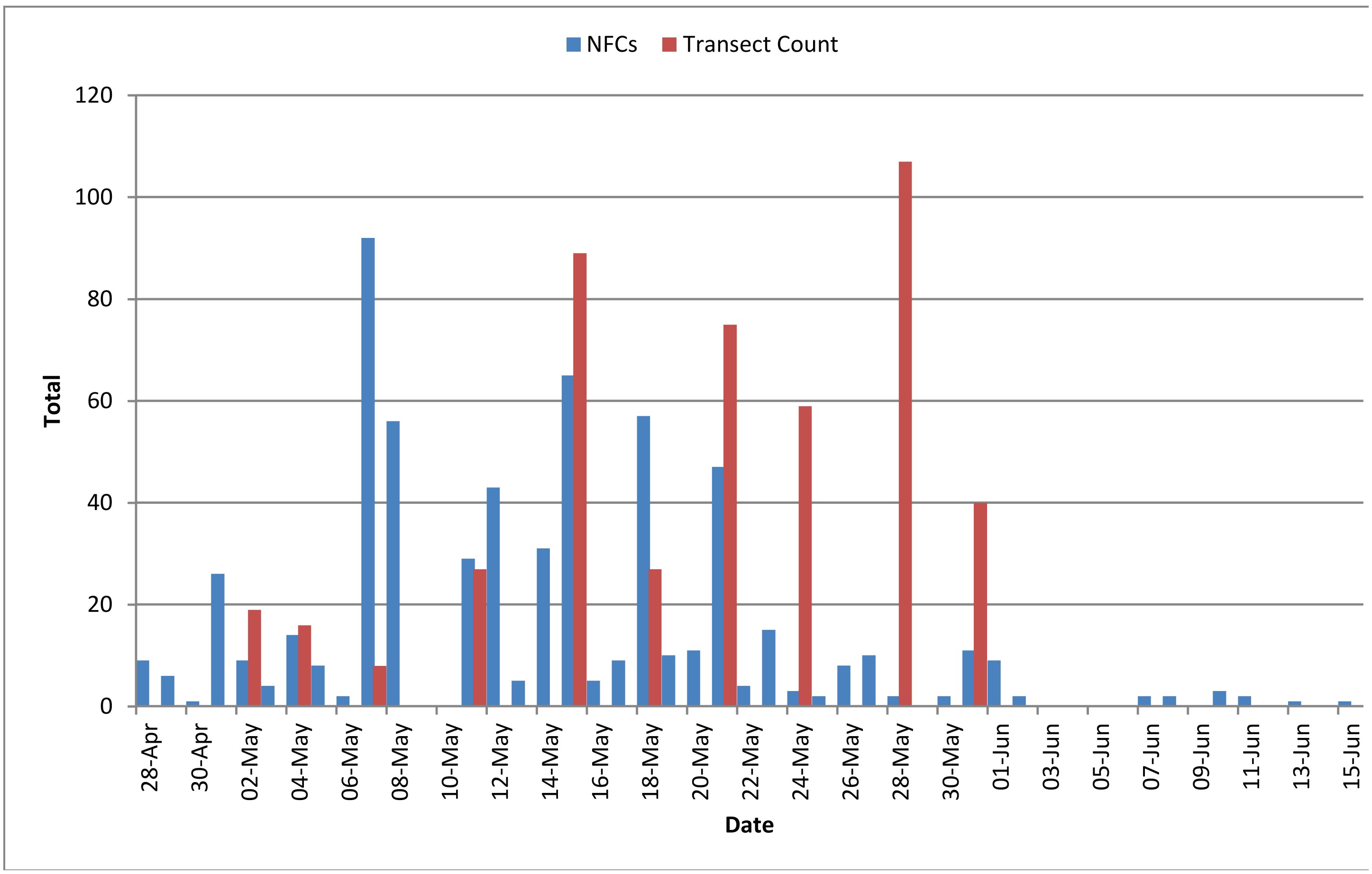
Tests of Between-Subjects Effects							
Dependent Variable: Total Birds		Type III					Partial Eta
Source		Sum of Squares	df	Mean Square	F	Sig.	Squared
Intercept	Hypothesis	194.944	1	194.944	17.541	0.003	0.674
	Error	94.177	8	11.114			
10-Day Period	Hypothesis	195.222	7	27.889	17.614	0.000	0.408
	Error	283.411	179	1.583			
Habitat	Hypothesis	11.211	4	2.803	1.770	0.137	0.038
	Error	283.411	179	1.583			
Previous Day Wind Speed	Hypothesis	196.835	7	28.119	17.760	0.000	0.410
	Error	283.411	179	1.583			

Nocturnal Passage

Nocturnal migration was monitored acoustically from 28 April to 15 June 2012 at Observation/ Listening Stations 9 & 10 (see Figure 3). Listening Station 9 was within the 50-metre distance band of Transect 4 while Station 10 was 11 kilometres away on a ridge overlooking McBain Corner.

A total of 263 night flight calls were recorded at Station 9 and 355 at Station 10. Although there is still only limited data from the use of acoustic monitoring technologies in Nova Scotia, these numbers would appear to be quite low. To facilitate a comparison of nocturnal passage with the stop-over transect counts, the data for both observation stations were combined and plotted against the transect counts in 2012. The results are shown in Figure 13. The graph shows no clear relationship between nocturnal passage and counts of birds on the ground. A possible interpretation of the data is that stop-over counts during much of the season reflect the arrival and departure of birds using the area for stop-over while counts late in the season represent a significant proportion of birds that are going to nest locally. In this interpretation, it is difficult to distinguish if calls recorded at night are coming from birds arriving, departing, or passing overhead. Nonetheless, in the case of the high count of 92 night flight calls on 7 May, it is evident that these represented departing birds and those passing overhead.

Figure 13: Total Night Flight Calls from Two Listening Stations and Transect Counts in 2012



When the relationship between night flight calls and stop-over counts is examined for a particular species or family of birds, a clearer picture begins to emerge. One of the most common bird species in stop-over is the White-throated Sparrow. Figure 14 plots the counts of White-throated Sparrows night flight calls from the two recording stations and the counts of this species on the four transects. The graph shows the arrival of White-throated Sparrows in stop-over in the first week of May with small to moderate number of night fligh call detections. This is followed by a period of more intense nocturnal migration in the second week of May with very few White-throats seen on the ground. The third week of May sees again the buildup of White-throated Sparrows in stop-over with low to moderate levels of nocturnal migration.

Figure 14: White-throated Sparrow Night Flight Calls at Two Stations Compared with Transect Counts of White-throated Sparrow

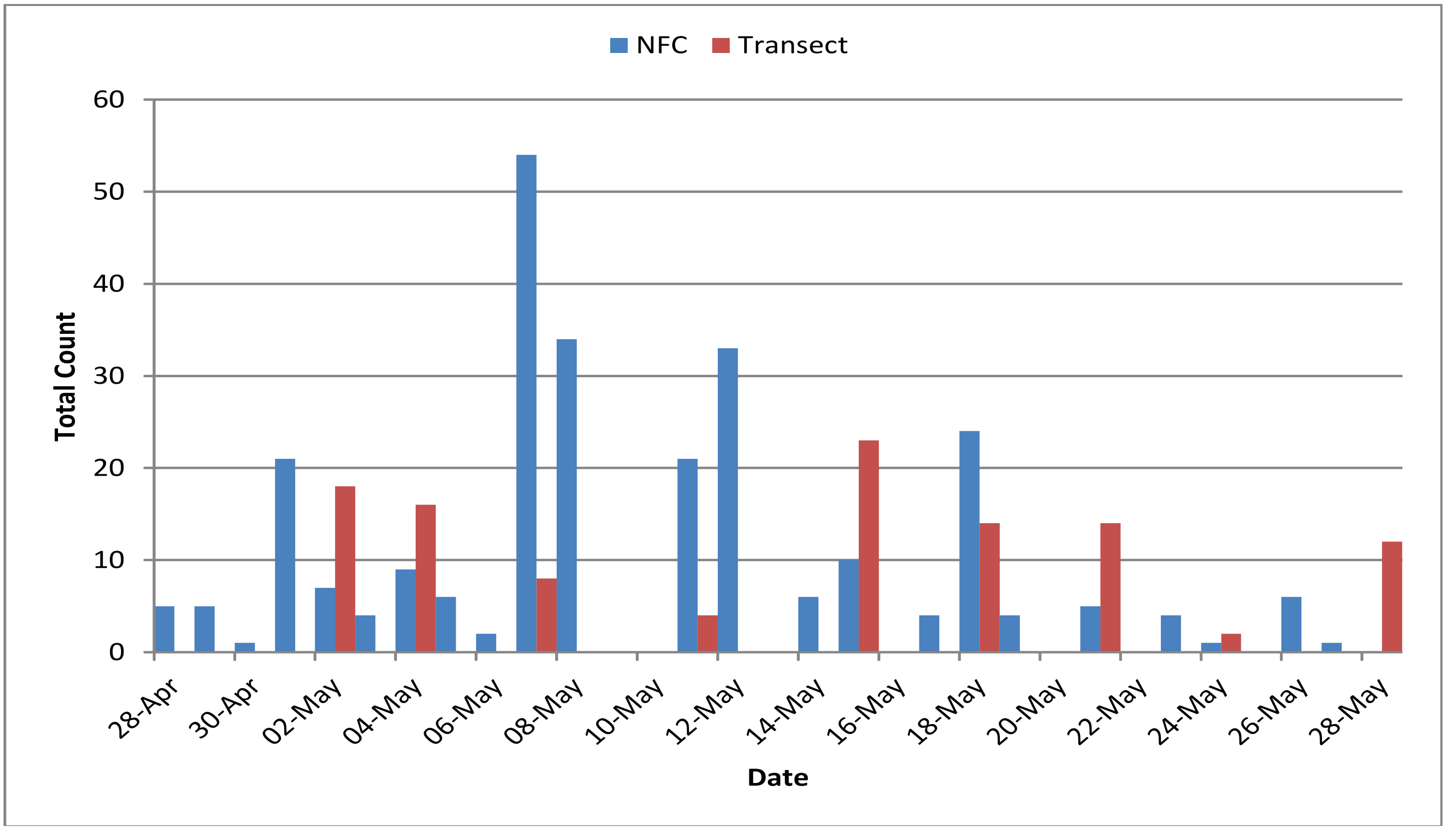
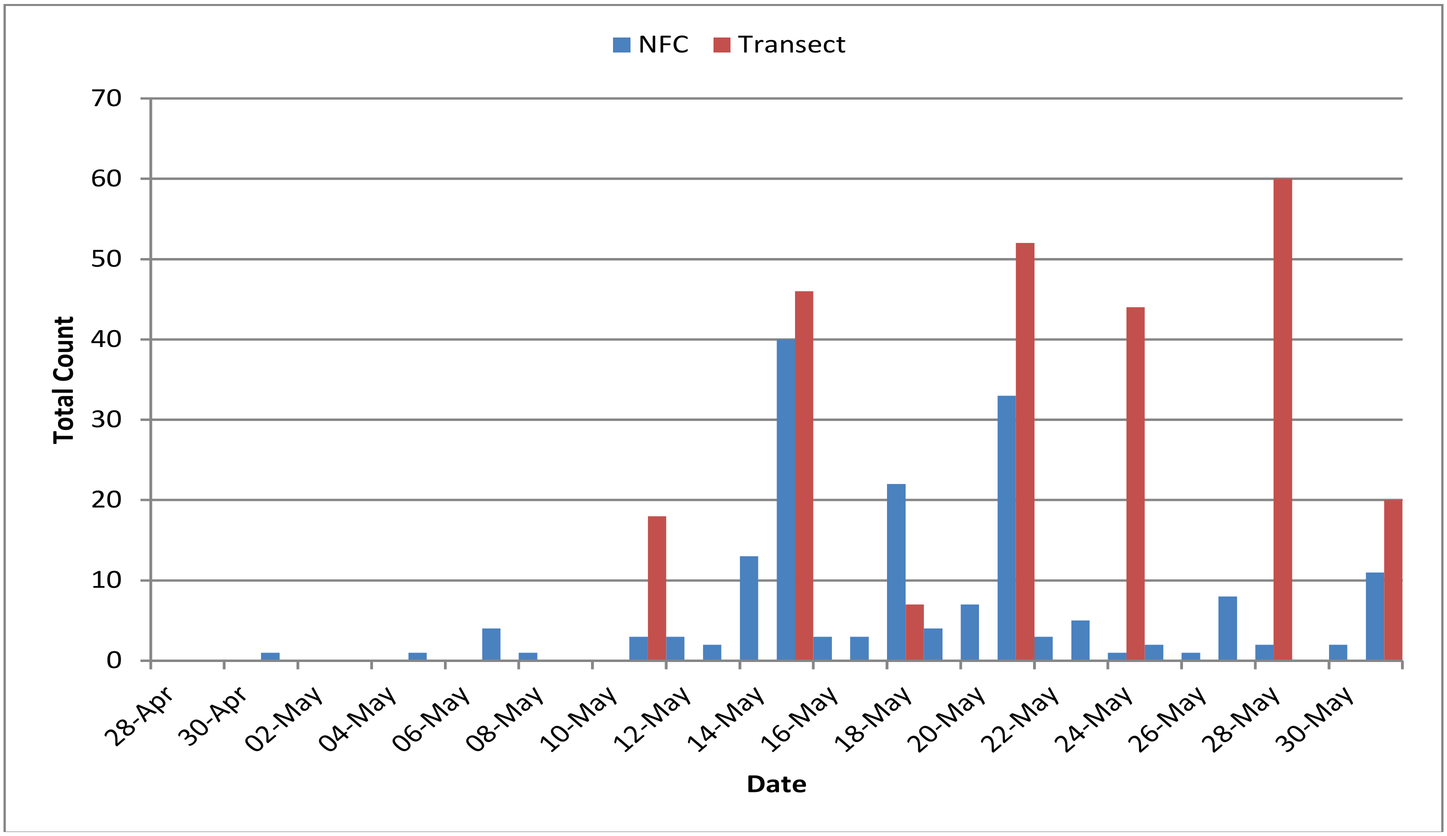


Figure 15 compares warbler night flight calls (Family Parulidae) recorded at the two listening stations with the counts of warblers on the four transects. There is an intense period of nocturnal migration in the third week of May with variable counts of warblers on the transects. In the fourth week of May there is small nocturnal migration but a continuing buildup of warblers on the transects.

The analysis of the relationship between night flight calls and stop-over counts for White-throated Sparrow and warblers support the initial interpretation of Figure 13 for all species. Namely that the in early to mid May, the most intense period of nocturnal migration was in the first to the third weeks of May at which times birds in stop-over were variable. In the fourth week of May, nocturnal migration was greatly diminished but birds in “stop-over” were still increasing in number. These birds may represent some combination of those that are establishing breeding territories locally and those still in stop-over.

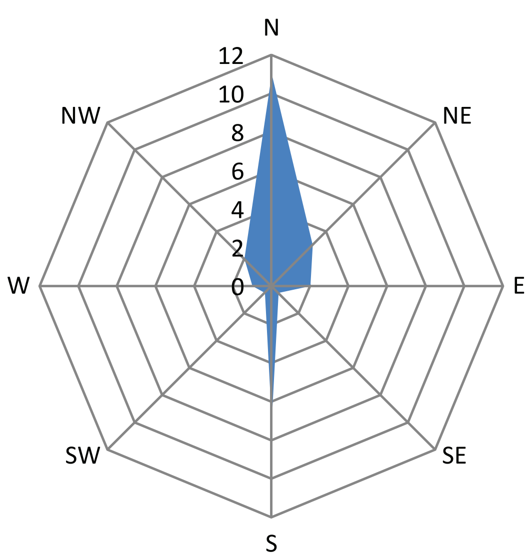
Figure 15: Warbler Night Flight Calls at Two Stations Compared with Transect Counts of Warblers



Diurnal Passage

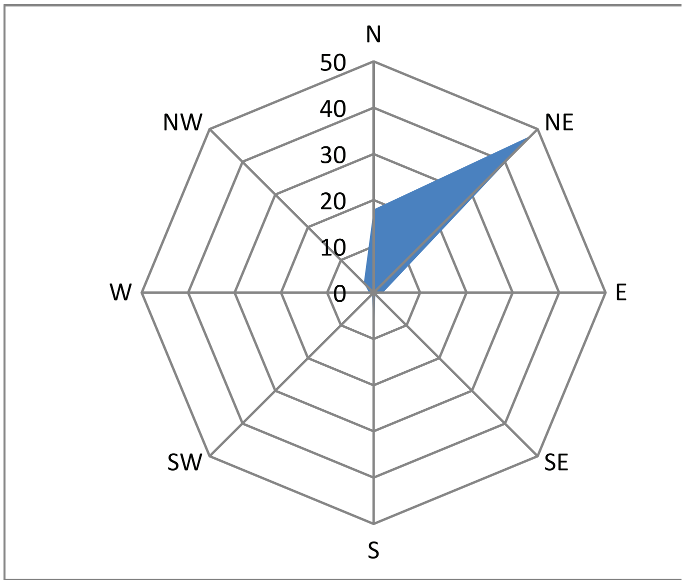
As described in the field methods, systematic observations were made of birds in diurnal passage in the two years of post-construction studies. In 2011-2012, diurnal counts were conducted at the observation/listening stations. In 2012, counts were also made during the stop-over transects, and on the return walk of the transect.

Figure 16: Flight Direction of Flocks in Diurnal Passage



An analysis of the flight direction of individual birds or an individual flock of birds for all three methods of observation for all three years is shown in Figure 16. A flock is here understood as one or more birds of a single species. These observations are for birds that were clearly in diurnal passage and not making local foraging flights. The radar graph shows the predominate heading of the birds in diurnal passage to be to north. Figure 17 shows the flight direction of all birds. The radar graph shows northeast as the predominate heading. However, these results were skewed by one flock of 45 Double-crested Cormorants flying high overhead on 2 April 2012. If these birds are removed from the analysis, the dominant heading would still be north.

Figure 17: Flight Directions of All Birds in Diurnal Passage



A total of 35 30-minute blocks of systematic observations of diurnal passage were made at the observation stations and return transects in the two years of the post-construction study. Out of these, 25 or 71% had no observations of birds in diurnal passage or in soaring flight above tree-top level in the spring. Table 5 shows the altitudes of the birds seen during the time blocks. The altitude category of 40-120 metres represents the height of the blade sweep of the Nuttby turbines. Thus 6% of individual birds and 18% of flocks of birds flying at a known altitude were at blade sweep level.

Table 6 shows the proximity of the birds or flocks of birds to a turbine in 2011-2012. Out of 17 occurrences, only 5 birds or flocks of birds flew within 50 meters of a turbine. Of these, there were no occurrences of birds flying at blade height.

Very few raptors were seen during the diurnal passage observations and most of these seemed to be local birds. A breakdown of birds by species or species groups is given in Table 7.

Table 5: Altitude of Birds in Diurnal Passage or in Soaring Flight as Seen from Observation Stations

Altitude in Metres	Flocks	Total Birds
<40	11	14
40-120	3	4
>120	3	47
Total	17	65

Table 6: Distance of Birds from a Wind Turbine in Diurnal Passage or Soaring Flight as Seen from Observation Stations

Distance from Turbine in Metres	Flocks	Total Birds
<50	3	3
50-100	2	2
>100	12	60
Total	17	65

Table 7: Kind of Birds Seen in Diurnal Passage or Soaring Flight as Seen from Observation Stations

Species	Flocks	Total Birds
Small Passerines	7	10
Common Raven	3	4
Northern Harrier	2	2
Red-tailed Hawk	3	3
Sharp-shinned Hawk	1	1
Double-crested Cormorant	1	45
Total	17	65

Species of Conservation Concern

Table 8 lists the species of conservation concern occurring in the study area during the spring migration period. The table lists their conservation status as determined by the Government of Canada and the Province of Nova Scotia (Canadian Endangered Species Conservation Council 2011, Canada 2012a, Canada 2012b) as well as annotations on the current status in the study area. Species of conservation concern that were seen during the spring portion of the baseline study in 2009 but not in the post-construction surveys are: American Kestrel, Common Loon, Eastern Wood-Pewee, Bay-breasted Warbler (in stop-over), Wilson's Warbler, and Rose-breasted Grosbeak.

Table 8: Species of Conservation Concern Occurring in the Study Area During the Spring Migration Period, 2011-2012

Species	NS Per CESCC Rank	SARA Schedule 1	COSEWIC Listed	COSEWIC Priority Candidates	Status in Study Area During Spring Migration
Olive-sided Flycatcher	At Risk	Threatened	Threatened		Two birds of this species were seen on Transect 4 on 3 June 2011
Yellow-bellied Flycatcher	Sensitive				One bird on Transect 4 on 3 June 2011 and 2 Transect 2 on 24 May 2012
Gray Jay	Sensitive				One on Transect 3 on 2 April 2012
Tree Swallow	Sensitive				One on Transect 1 on 31 May 2012
Boreal Chickadee	Sensitive				One on Transect 3 on 18 and 31 May 2011, one on 14 April 2012 and 3 on 11 May 2012
Golden-crowned Kinglet	Sensitive				Five on Transect 3 on 5 May 2011, and on 25 April 2012. One the same transect on 2 April, 7 and 21 May 2012. One on Transect 2 on 14 April and 24 May 2012
Ruby-crowned Kinglet	Sensitive				Seen on all transect in 2011 and 2012. High count in 2011 was 7 on Transect 2 on 31 May. High count in 2012 was 12 on Transect 2 on 29 April.
Tennessee Warbler	Sensitive				Recorded in nocturnal passage on 8 May 2012
Cape May Warbler	Sensitive				Recorded in nocturnal passage on 20 May 2012
Bay-breasted Warbler	Sensitive				Recorded in nocturnal passage on 15 and 24 May 2012
Blackpoll Warbler	Sensitive				Recorded in nocturnal passage on 14, 15, 27, 31 May and 2 June 2012
Canada Warbler	At Risk	Threatened	Threatened		One on Transect 4 on 20 May 2012. Recorded in nocturnal passage on 15, 21, 22, 31 May and 2 June 2012
Eastern Meadowlark	Sensitive		Threatened		A meadowlark of unknown species was seen flying high over Transect 2 on 11 May 2012
Pine Siskin	Sensitive				Seen on all four transects in 2011 and 2012. High count of 10 on 18 May 2011 and 14 April 2012
Evening Grosbeak				High	Seen on all four transects in 2011 and 2012. High count of 2 on several occasions in 2011 and 10 on 18 May 2012

Conclusion

Nuttby Mountain and the surrounding area provide spring stop-over habitat for a small but not insignificant number of migrating birds. There was a distinct peak in the number of birds in stop-over during the post-construction surveys in the last week of May. Special attention should be given to ensuring that there are no lights left on anywhere on the wind farm site during this time.

A qualitative comparison of pre- and post-construction bird surveys indicated that there were no significant changes in spring bird populations.

The dominant forest type of mature Sugar Maple and Yellow Birch clearly influences the habitat use of birds in stop-over and finer level variations in that forest did not greatly affect the number of birds in stop-over.

There appeared to be a low level of nocturnal migration over Nuttby Mountain with the peak flights taking place from 7-21 May.

Diurnal passage was very low and only a small number of raptors was seen during the entire study.

There was not a significant presence of species of conservation concern and some of the warbler species were noted only through recordings of their flight calls during nocturnal migration.

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