

Abstract

This chapter reports on the breeding bird surveys conducted after the construction of the Nuttby Mountain Wind Farm located in a mature deciduous forest of northern Nova Scotia. Survey methods included early breeding (3rd week of March to 1st week of June) transect surveys and peak season (2nd week of June to 1st week of July) point count surveys within project and control areas. Mature deciduous habits were significantly less in the project area and disturbed areas significantly greater in general than in the control area. Changes in bird populations and species composition in the project area were largely as expected from the disturbance of a Sugar Maple/Yellow Birch/American Beech forest. Two exceptions were the White-throated Sparrow and Blue-headed Vireo which underwent significant and unexpected decreases. A review of the literature indicates that these two species may be particularly sensitive to industrial noise, such as produced by wind turbines, or the proximity of human activities during the breeding season.

Introduction

This chapter reports on the breeding bird surveys conducted after the construction of Nuttby Mountain Wind Farm. Construction was completed near the end of 2010 and the post-construction surveys began in April of 2011 and continued to the end of October 2012. Results of the post-construction mortality study (Kearney 2013a), migration surveys (Kearney 2013c), and winter surveys (Kearney 2012) are presented in separate documents. This document describes the methods used for the breeding bird surveys and the results obtained. It will conclude with a brief discussion of the meaning of the results.

Methods

Ideally a post-construction study should be able to compare the results of surveys in both a project area and a control area before and after wind farm construction (Hanson et al. 2009). In this case, the pre-construction bird surveys were limited to the project area. In addition, the main survey instrument, the point count, was used at a time of day, for a length of time, and during weeks that preclude their comparison with the point counts made during the post-construction surveys. Therefore the analysis in the present study will rely on comparing bird populations in the project area with a control area during the post-construction period in order to assess the possible effects of the wind farm on local avifauna.

The breeding season is divided into two parts; early breeding and peak breeding. Those species beginning their breeding activities during the first week of May or earlier are treated here as early breeding birds. The analysis of their presence in the study area is conducted for the weeks from mid-March to 3 June.

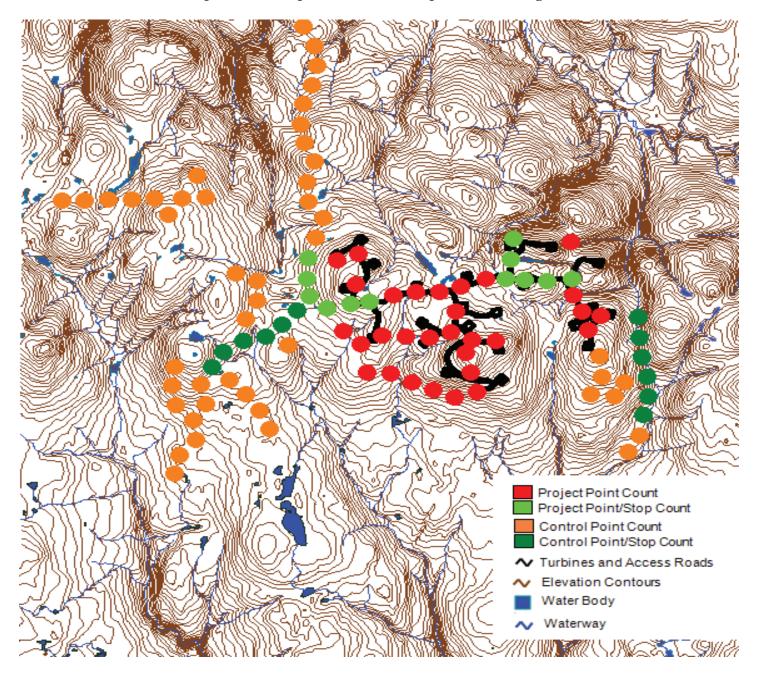
By the second week of June, spring migration is over and most birds, including the majority of neo-tropical migrants, are on their breeding territories. The analysis of the peak breeding season

in the study area is conducted for the period from 8 June through 4 July. Since most of the early breeding birds have not completed breeding activities by the beginning of June, these species are analyzed twice, once in the early breeding season and again in the peak breeding season.

The unit of analysis in the early breeding season is the stop count (conducted while walking a linear transect for surveying migrants in stop-over). In addition, an owl/woodcock survey was conducted following the guidelines of Bird Studies Canada (Takats et al. 2001).

The survey method in the peak breeding season is the point count. All birds seen or heard at a point count station during a ten-minute time period are counted and their distance from the observer is categorized as being with a radius of <50 metres, 50-100 metres, >100 metres, and flying overhead. These point counts (circular) and stop counts (linear) are roughly comparable and only in the 50-metre distance band as explained in the chapter on spring migration (Kearney 2013c).

The location of 100 point and stop count stations is presented in Figure 1. All 100 stations were



surveyed in both 2011 and 2012. Each point count station was classified into one of seven habitat categories based on the succession pattern of the local forest (Sugar Maple/Yellow Birch/American Beech) and the dominant forestry practices:

- 1: Disturbed (primarily clearcut) forest or early successional forest
- 2: Disturbed/early successional forest next to mature deciduous forest
- 3. Mixed forest with mixed aged deciduous and coniferous trees; a mid-successional forest
- 4. Coniferous forest, either naturally regenerated or a plantation
- 5. Mature deciduous; late successional Sugar Maple, Yellow Birch, and American Beech
- 6. Residential or agricultural land
- 7. Disturbed/early successional forest next to a coniferous forest

A number of parametric and non-parametric statistical tests were used to determine significant changes in species abundance in the study area and the use of habitats. These tests are the parametric tests of Analysis of Variance (ANOVA), T-test, Welch Test, Brown-Forsythe Test, Tamhane's T2 Pairwise Comparison, and the non-parametric Wilcoxon-Mann-Whitney Test.

Results

Table 1: Habitat Types of Point Counts in Project and Control Areas

		Aı	ea	
		Project	Control	
Habitat		Area	Area	Total
Disturbed Forest	Count	7 _a	6 _a	13
	% within	16.7%	10.3%	13.0%
	Area			
Mature	Count	15 _a	11 _a	26
Deciduous Next	% within	35.7%	19.0%	26.0%
to Disturbed	Area			
Mixed Forest	Count	8 _a	16 _a	24
	% within	19.0%	27.6%	24.0%
	Area			
Coniferous	Count	1_a	3_a	4
Forest	% within	2.4%	5.2%	4.0%
	Area			
Deciduous	Count	3_a	13 _b	16
Forest	% within	7.1%	22.4%	16.0%
	Area			
Mixed Forest	Count	8 _a	9 _a	17
Next to	% within	19.0%	15.5%	17.0%
Disturbed	Area			
Total	Count	42	58	100
	% within	100.0%	100.0%	100.0%
	Area			

Each subscript letter denotes a subset of Area categories whose column proportions do not differ significantly from each other at the .05 level.

Habitat

Since the spring stop counts and peak breeding point counts were randomly chosen, it is hypothesized that they comprise a representative sample of the habitat types in the study area. Using the peak breeding point counts as the unit of analysis, Table 1 shows the number of habitat types in the project and control areas. Of the six habitat types present in both areas, the number of point counts of the mature deciduous forest type is significantly lower (95% confidence level) in the project area than in the control area. Table 2 indicates that there is a significantly higher level of disturbed forest habitat in the project area than in the control area.

These results would indicate that one should find a greater abundance of bird species that

Table 2: Disturbance of Point Count Habitats in Project and Control Areas

		Ar		
		Project	Control	
Disturbance		Area	Area	Total
Disturbed	Count	30_a	26 _b	56
	% within	71.4%	44.8%	56.0%
	Area			
Undisturbed	Count	12 _a	32 _b	44
	% within	28.6%	55.2%	44.0%
	Area			
Total	Count	42	58	100
	% within	100.0%	100.0%	100.0%
	Area			

Each subscript letter denotes a subset of Area categories whose column proportions do not differ significantly from each other at the .05 level.

Table 3: Summary of Early Breeding Stop-Counts in the <50 Meters Distance Band. 2011-2012

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Species	N	Total	Mean	Frequency	Rank
American Robin	126	86	0.68	41.30%	1
Song Sparrow	150	30	0.20	14.00 %	2
Dark-eyed Junco	126	22	0.17	14.30 %	3
Hairy Woodpecker	192	7	0.04	3.10%	4
Black-capped Chickadee	126	5	0.04	4.00%	5
Ruffed Grouse	150	4	0.03	2.70%	6
Downy Woodpecker	186	4	0.02	2.00%	7
Blue Jay	126	2	0.02	1.60%	8
Northern Saw-whet Owl	198	1	0.01	0.50%	9
Gray Jay	192	1	0.01	0.50%	10
Northern Flicker	150	1	0.01	0.70%	11

prefer disturbed habitats in the project area and fewer birds of species requiring more homogenous mixed, coniferous, or deciduous forest habitat.

Early Breeding Birds

A summary of the early breeding birds observed in the study area is given in Table 3. This data is derived from 24 stop-counts, repeated on a rotating basis, on a total of 4 transects which were conducted twice a week from mid-March to the first few days of June over a two year period. Of the 11

species recorded in the <50 meter distance band, the most common is the American Robin with a total of 86 seen in 2 years. The mean number of American Robins per count was 0.68, and they were noted at 41.3% of 126 stop-counts during

the early breeding period. The other top-ranked species were Song Sparrow, seen on 14% of counts, and Dark-eyed Junco (14%). The low numbers of early breeding birds is indicative of the late arrival of spring on Nuttby Mountain. The elevation of stop-counts ranged between 230 and 320 meters above sea-level. The owl and



crepuscular species surveys in the evenings at these higher elevations yielded no bird observations. One Northern Saw-whet Owl was heard on a transect count in the early morning.

Peak Breeding Birds

Table 4 summarizes the abundance of peak breeding at all distances for point counts from the

Table 4: Summary of Peak Breeding Birds at All Distances on Point Counts, 2011-2012 (Top 40 in Rank)

Species	N		Mean	Frequency	Rank
Red-eyed Vireo	200	297	1.49	79.00%	1
White-throated Sparrow	200	240	1.20	50.00%	2
American Robin	200	226	1.13	55.00%	3
Ovenbird	200	202	1.01	52.00%	4
Black-throated Green Warbler	200	143	.72	47.00%	5
Hermit Thrush	200	112	.56	37.50%	6
Magnolia Warbler	200	95	.48	38.00%	7
American Redstart	200	90	.45	35.50%	8
Swainson's Thrush	200	81	.41	29.50%	9
Common Yellowthroat	200	70	.35	27.00%	10
Alder Flycatcher	200	64	.32	22.00%	11
Song Sparrow	200	55	.28	18.50%	12
Least Flycatcher	200	50	.25	19.50%	13
Dark-eyed Junco	200	49	.25	17.50%	14
Mourning Warbler	127	23	.18	15.00%	15
Black-and-White Warbler	200	33	.17	15.50%	16
Lincoln's Sparrow	200	30	.15	12.00%	17
Ruby-crowned Kinglet	200	29	.15	12.00%	18
Blue-headed Vireo	200	25	.13	11.50%	19
Winter Wren	200	25	.13	12.00%	20
Yellow-rumped Warbler	200	23	.12	9.00%	21
Chestnut-sided Warbler	200	20	.10	9.00%	22
European Starling	200	16	.08	0.50%	23
Purple Finch	200	14	.07	7.00%	24
American Crow	200	12	.06	4.50%	25
Hairy Woodpecker	200	11	.06	5.00%	26
Yellow-bellied Flycatcher	127	6	.05	4.70%	27
Black-capped Chickadee	200	9	.05	3.50%	28
Northern Flicker	200	8	.04	4.00%	29
Common Grackle	200	8	.04	3.00%	30
American Goldfinch	72	3	.04	4.20%	31
Northern Parula	200	6	.03	3.00%	32
Blackburnian Warbler	127	4	.03	3.10%	33
Mourning Dove	200	5	.03	2.50%	34
American Woodcock	200	4	.02	0.50%	35
Boreal Chickadee	200	4	.02	1.50%	36
Black-throated Blue Warbler	200	4	.02	2.00%	37
Yellow-bellied Sapsucker	200	3	.02	1.50%	38
Olive-sided Flycatcher	200	3	.02	1.00%	39
Common Raven	200	3	.02	1.50%	40

second week of June to the first few days of July, 2011-2012. In the peak breeding season, the Red-eyed Vireo, occurring on 79% of point counts, surpasses the American Robin (55%) as the most common breeding bird. The other top five peak breeding birds in this distance interval are Ovenbird (52%), White-throated Sparrow (50%), and Black-throated Green Warbler (47%). Other species occurring on more than 20% of point counts are Hermit Thrush, Magnolia Warbler, American Redstart, Swainson's Thrush, Common Yellowthroat, and Alder Flycatcher. These findings are consistent with bird studies other Sugar Maple/Yellow Birch/American Beech forests in Northern Nova Scotia (Kearney 2013b).

As shown in Table 5, bird counts within the 50-meter band of point counts show a similar pattern to those at all distances. However, among the top 10-ranked species, there is a decrease in ranking for the White-throated Sparrow and Hermit Thrush, and an

Table 5: Summary of Peak Breeding Birds in the <50 Meter Band on Point Counts, 2011-2012 (Top 40 in Rank)

Point Counts, 2011-2012 (10p 40 in Rank)									
Species	N	Total	Mean	Frequency	Rank				
Red-eyed Vireo	200	137	.69	51.50%	1				
American Robin	200	119	.60	41.00%	2				
Black-throated Green Warbler	200	99	.50	35.50%	3				
Ovenbird	200	90	.45	32.00%	4				
American Redstart	200	86	.43	34.00%	5				
White-throated Sparrow	200	86	.43	25.50%	6				
Magnolia Warbler	200	81	.41	33.50%	7				
Common Yellowthroat	200	56	.28	24.00%	8				
Hermit Thrush	200	46	.23	18.50%	9				
Least Flycatcher	200	34	.17	14.00%	10				
Black-and-White Warbler	200	32	.16	15.00%	11				
Swainson's Thrush	200	31	.16	12.50%	12				
Alder Flycatcher	200	29	.15	12.50%	13				
Dark-eyed Junco	200	29	.15	11.50%	14				
Blue-headed Vireo	200	20	.10	9.50%	15				
Yellow-rumped Warbler	200	20	.10	9.00%	16				
Mourning Warbler	127	13	.10	10.20%	17				
Song Sparrow	200	19	.10	8.00%	18				
Ruby-crowned Kinglet	200	16	.08	7.00%	19				
Winter Wren	200	14	.07	7.00%	20				
Lincoln's Sparrow	200	13	.07	5.00%	21				
Chestnut-sided Warbler	200	12	.06	6.00%	22				
Yellow-bellied Flycatcher	127	5	.04	3.90%	23				
Black-capped Chickadee	200	6	.03	3.00%	24				
Northern Parula	200	6	.03	3.00%	25				
Blackburnian Warbler	127	4	.03	3.10%	26				
Purple Finch	200	5	.03	2.50%	27				
American Woodcock	200	4	.02	0.50%	28				
Hairy Woodpecker	200	4	.02	2.00%	29				
Black-throated Blue Warbler	200	4	.02	2.00%	30				
Boreal Chickadee	200	3	.02	1.00%	31				
Nashville Warbler	200	3	.02	1.50%	32				
Common Grackle	200	3	.02	1.00%	33				
Ruby-throated Hummingbird	200	2	.01	1.00%	34				
Northern Flicker	200	2	.01	1.00%	35				
American Goldfinch	72	1	.01	1.40%	36				
Blue Jay	200	1	.01	0.50%	37				
American Crow	200	1	.01	0.50%	38				
Golden-crowned Kinglet	200	1	.01	0.50%	39				
YWAR	200	1	.01	0.50%	40				

increase for the American Robin, Black-throated Green Warbler, American Redstart, Common Yellowthroat, and Least Flycatcher. Both the White-throated Sparrow and the Hermit Thrush have songs which can be heard at greater distances than many other species which most likely accounts for their higher ranking in the all distances category.

The species demonstrating statistically significant habitat relationships at the 95% confidence level is presented in Table 6. Among the *Empidonax* flycatchers, the habitat niche of each species is clearly revealed. The Yellowbellied Flycatcher prefers mixed forest, the Alder Flycatcher disturbed clearings, and the Least Flycatcher the edge of mature deciduous.

The Swainson's Thrush showed preference for mixed forest and kept way from clearcuts.



Table 6: Mean Number of Birds per Habitat Category for Species Showing Significant Habitat Relationships at the 95% Confidence Level in the 50-Meter Distance Band

		Mature				
		Deciduous			Mature	Mixed
		Next to	Mixed	Coniferous	Deciduous	Next to
Species	Disturbed	Disturbed	Forest	Forest	Forest	Disturbed
Yellow-bellied Flycatcher	0.04	0.04	0.19	0.13	0.00	0.00
Alder Flycatcher	0.65	0.14	0.04	0.13	0.00	0.06
Least Flycatcher	0.15	0.29	0.15	0.00	0.18	0.06
Red-eyed Vireo	0.08	0.78	0.90	0.25	1.18	0.32
Swainson's Thrush	0.00	0.04	0.29	0.75	0.09	0.18
Chestnut-sided Warbler	0.12	0.18	0.00	0.00	0.00	0.00
Magnolia Warbler	0.31	0.29	0.42	1.00	0.06	0.82
Black-throated Green Warbler	0.15	0.35	0.60	1.25	0.61	0.53
Black-and-White Warbler	0.08	0.22	0.13	0.00	0.15	0.24
American Redstart	0.12	0.55	0.44	0.13	0.61	0.38
Ovenbird	0.00	0.41	0.38	0.13	1.15	0.35
Mourning Warbler	0.23	0.29	0.06	0.00	0.00	0.21
Common Yellowthroat	0.88	0.27	0.04	0.25	0.00	0.44
White-throated Sparrow	0.96	0.33	0.15	0.63	0.12	0.82

Key

Positive Habitat Association at 95% Confidence Level

Negative Habitat Association at 95% Confidence Level

(Darker Colour = Stronger Association)

Among the warblers, only the Common Yellowthroat had a preference for cleared areas or early successional forest. The Mourning Warbler and especially the Chestnut-sided Warbler had a significant positive relationship to disturbed areas on the edge of a deciduous forest. The Magnolia Warbler and the Black-throated Green Warbler had some preference for mixed forests. The Ovenbird had a very strong positive relationship with mature deciduous forests.

Finally the results for the White-throated Sparrow appear atypical for the Sugar Maple/Yellow Birch/American Beech forest. Normally this species shows a very strongly positive significant relationship to clearcuts and early successional habitats (Kearney 2013b). On Nuttby Mountain and



surrounding areas, the mean number of Whitethroated Sparrows is higher in these disturbed habitats but not at a statistically significant level. It did show some significantly higher numbers in disturbed areas next to mixed forests.

As noted previously and as presented in Table 1 and Table 2, the project area has significantly greater amount of disturbed habitats, significantly lower amounts of mature deciduous forest, than the forest in the control area. Thus from the above description of the habitat

relationships of species, one might expect to find significantly higher numbers of Alder Flycatchers, Least Flycatchers, Chestnut-sided Warblers, Mourning Warblers, Common Yellowthroats, and White-throated Sparrows in the project area. At the same time, one might expect lower numbers of Yellowbellied Flycatchers, Swainson's Thrushes, Magnolia Warblers, Black-throated Green Warblers, and Ovenbirds.

Table 7 shows the results of a number of statistical tests comparing the abundance of species in the project and control area in the 50 meter band and at all distances. As expected, Alder Flycatchers showed a strong increase in the project area. There was also a moderate to weak level of evidence supporting a significant increase of Mourning Warblers and Chestnut-sided Warblers in the project area. Concerning expected decreases, there were moderate to weak levels of evidence of significant decreases in Black-throated Green Warblers and Ovenbirds.

Table 7: Mean Abundance and p-Values for Significant Tests for Peak Breeding Point Counts in Project and Control Areas

	Mean A	bundance		p-values at All Distances		Mean A	p-values at <50 Meters							
	Project	Control				Brown-	Mann-Whitney	Project	Control				Brown-	Mann-Whitney
Species	Area	Area	T-Test	ANOVA	Welch	Forsythe	Wilcoxen	Area	Area	T-Test	ANOVA	Welch	Forsythe	Wilcoxen
Alder Flycatcher	0.55	0.16	0.000	0.000	0.000	0.000	0.000	0.23	0.09	0.025	0.016	0.025	0.025	0.017
Blue-headed Vireo	0.04	0.19	0.001	0.003	0.001	0.001	0.003	0.04	0.15	0.007	0.014	0.007	0.007	0.015
Common Raven	0.04	0.00	0.083	0.040	-	-	0.041	0.00	0.00	-	-	-	-	-
Winter Wren	0.05	0.18	0.003	0.007	0.003	0.003	0.007	0.04	0.09	0.084	0.107	0.084	0.084	0.107
American Robin	1.36	0.97	0.045	0.045	0.046	0.046	0.009	0.67	0.54	0.309	0.309	0.313	0.313	0.229
Chestnut-sided Warbler	0.17	0.05	0.028	0.015	0.028	0.028	0.025	0.10	0.03	0.098	0.075	0.098	0.098	0.075
Black-throated Green Warbler	0.56	0.83	0.041	0.041	0.038	0.038	0.021	0.37	0.59	0.051	0.051	0.052	0.052	0.008
Blackburnian Warbler	0.00	0.03	0.045	0.086	-	-	0.086	0.00	0.03	0.045	0.086	-	-	0.086
Black-and-White Warbler	0.11	0.21	0.065	0.080	0.065	0.065	0.105	0.10	0.21	0.035	0.048	0.035	0.035	0.061
Ovenbird	0.76	1.19	0.016	0.023	0.016	0.016	0.072	0.33	0.53	0.060	0.072	0.060	0.060	0.070
Mourning Warbler	0.31	0.19	0.109	0.103	0.109	0.109	0.003	0.23	0.10	0.032	0.022	0.032	0.032	0.029
Song Sparrow	0.44	0.16	0.005	0.002	0.005	0.005	0.002	0.12	0.08	0.417	0.417	0.419	0.419	0.233
White-throated Sparrow	0.85	1.46	0.005	0.008	0.005	0.005	0.018	0.23	0.58	0.003	0.005	0.003	0.003	0.001

Key

Higher in Project Area and Significant at 95% level - Dark to light shades of colour indicate: Lower in Project Area and Significant at 95% level - Dark to light shades of colour indicate:

strong moderate weak difference strong moderate weak difference

Other birds for which no significant habitat relationships were established in this study but for which there was weak evidence for significantly higher numbers in the project than in the control areas were Common Raven, American Robin, and Song Sparrow. This is consistent with the known habitat preferences of these species. Similarly, species for which no significant habitat relationships were established but for which there was weak evidence of significantly lower numbers in the project area were Winter Wren, Blackburnian Warbler, and Black-and-White Warbler. These three species tend to prefer a homogenous forest habitats or a mixture of homogenous next to disturbed forest.

The two anomalies in Table 7 are White-throated Sparrow and Blue-headed Vireo. For both species there was strong statistical evidence for significant declines in their numbers in the project area as compared to the control area. White-throated Sparrows in the project area were 42% lower in the all distances category and 60% lower at less than 50 meters than in the control area. Blue-headed Vireos were 79% lower in the all distances category and 73% lower at less than 50 meters. In the case of the Blue-headed Vireo, it nests and forages in a variety of coniferous and deciduous habitats in the study area. Habitat differences between the project and control areas would not appear to explain its steep decline in the project area. In the case of the White-throated Sparrow, it should have

significantly increased in the project area instead of showing a strong decrease.

A statistical analysis annual variation in the abundance of birds in the study area, both the project area and control area combined, in the two years of the study showed no significant differences between the two years relative to any of the species, the total number of species, and total numbers of birds.

Species of Conservation Concern

Table 8 provides a list of the species of conservation concern in the study area, giving their status as determined by different government agencies and an annotation on their breeding occurrence in the study area. The status rankings come from the Nova Scotia Department of Natural Resources (NSDNR), the Species at Risk Act (SARA), and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Figure 2 shows the location of the two species that are SARA and/or COSEWIC listed and observed during the breeding season in the study area in 2011 to 2012. These are the Olive-sided Flycatcher and the Eastern Wood-Pewee.

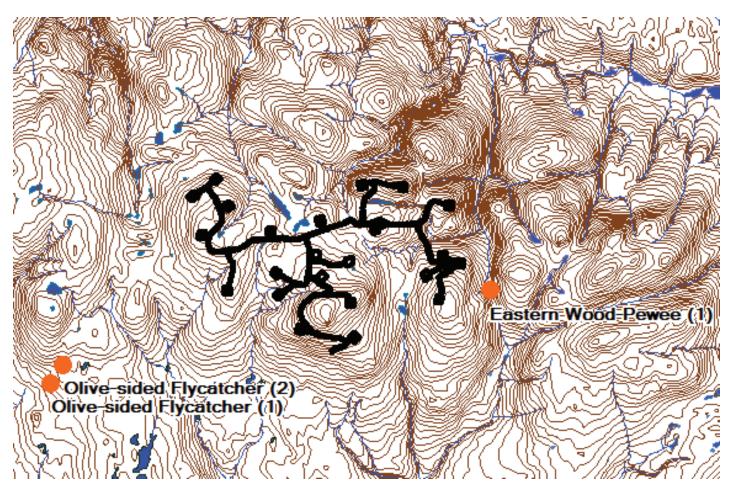
Table 8: An Annotated List of the Species of Conservation Concern in the Study Area, 2011-2012

	NSDNR	SARA	COSEWIC	COSEWIC Priority	
Species	Rank	Schedule 1	Listed	Candidates	Annotations
Belted Kingfisher				High	Seen twice in the control area, 24 June 2011 and 18 June 2012 Two to three individuals seen in control
Olive-sided Flycatcher	Threatened	Threatened	Threatened		area on 26 June 2012
Eastern Wood-Pewee	Vulnerable		Special Concern		One in control area on 21 June 2012
Yellow-bellied Flycatcher Gray Jay	Sensitive Sensitive				Total of 17 individuals over two years in project and control areas One seen in control area on 2 April 2012 One in control area on 28 Iune and 4 Iuly
Boreal Chickadee	Sensitive				One in control area on 28 June and 4 July 2011; One in project area on 4 July 2011 One in project area on 21 June 2011 and 24
Golden-crowned Kinglet	Sensitive				May 2012; one in control area on 21 May Total of 51 individuals over two years in
Ruby-crowned Kinglet	Sensitive				project and control areas
Rose-breasted Grosbeak	Sensitive				One on 24 June 2011 in control area
					Two in control area on 20 May 2011 and 18
Pine Siskin	Sensitive				April 2012; one in project area on 11 May

Discussion

The bird species composition and abundance of each species in the project area was largely as expected for a disturbed Sugar Maple, Yellow Birch, American Beech forest in northern Nova Scotia. The two major exceptions were the large decreases in the White-throated Sparrow and Blueheaded Vireo as compared to the control area. One factor that might account for these declines is the noise created by the wind turbines in the project area. In a study of the effect of the noise created by compressor stations at gas pipelines in Alberta, White-throated Sparrows were found to be one of the species in the boreal forest to be most negatively impacted (Bayne, Habib, and Boutin 2008). In

Figure 2: Location of SARA and COSEWIC Listed Species



the case of Blue-headed Vireo, studies indicate that the species is especially sensitive to clear-cutting and even partial cuts (James 1998). This appears to be an effect that is greater than simply a change of suitable habitat as Blue-headed Vireos in a partial cut had considerably less success in finding a mate over a two-year period than birds in undisturbed forest habitat. Along the same lines, female Blue-



headed Vireos readily abandon their nests after close contact with human activity (James 1998).

The cases of the White-throated Sparrow and Blue-headed Vireo point to the need for a greater understanding of all the possible anthropogenic effects of wind energy development on the bird populations of Nova Scotia.

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