Spring Nocturnal Passage and Acoustic Monitoring – 2013

Preliminary Report

Sable Wind Project

Prepared for:

The Sable Wind Project Team

By

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Abstract

Two acoustic monitoring stations at the eastern end of the Canso Peninsula recorded the night flight calls of migrating birds from early April to early June 2013. The monitoring station at 34 meters above sea level had 62% more high frequency calls than the station at sea level. The seasonal pattern, hourly distribution, and taxonomic composition of calls were similar between the two sites. A comparison of the low frequency calls at the two stations was not possible due to the ambient noise created by Spring Peepers. The data indicate that total spring night flight calls is higher in the study area than at other sites surveyed thus far in Nova Scotia and that birds may be flying consistently at a low altitude.

Introduction

Most songbirds and many other types of birds migrate at night. One way of detecting and measuring this nocturnal migration is by recording their flight calls as they fly overhead. This document reports on the acoustic monitoring of the spring nocturnal migration at the proposed Sable Wind Project. It will present the total number, seasonal and hourly variation, and taxonomic composition of night flight calls detected, and a discussion of the results.

Methods

Location of Listening Stations

The location of listening stations was chosen on the basis of their proximity to the project area, their elevation relative to sea level, and ease of access for the frequent collection of data cards and changing of batteries. One station was established at sea level in the project area along the shore of Spinney Gully. The microphone was mounted on a two-meter pole for a total elevation of about 2 meters above sea level. A second station was setup at Camp Glasgow, 30 meters above sea level. The microphone was mounted a four meter pole for a total elevation of about 34 meters above sea level. The station is located about 1 kilometer northeast of the project area. A third and backup listening station was established next to a private residence on Sterling Street in the Town of Canso. The microphone was mounted on a two meter pole on a hill 40 meters above sea level for a total elevation of 42 meters. It was also about 1 kilometer from the project area and to the northwest. Figure 1 shows the location of the listening stations.

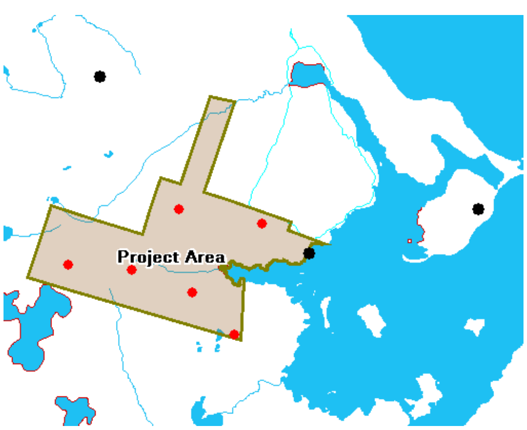


Figure 1: Location of Listening Stations (black dots) and Proposed Turbines (red dots)

Recording Equipment

At all three sites, a Song Meter SM2, made by Wildlife Acoustics, was used as a recording device. The Song Meter is powered by 2 AA and 4 D alkaline batteries. Settings were as follows:

Sampling format: 16 bit
Sampling rate: 24,000 Hz
High pass filter: 1,000 Hz
Pre-amp: 60 dB gain
Storage: 2-32GB SD cards

Wildlife Acoustics also produces a night flight call microphone, the SMX-NFC, to be used with the Song Meter. This weather-resistant microphone rests on a flat horizontal plate creating a pressure zone resulting in a 3-6 dB gain within a beam angle of 125 degrees.

The Song Meter and SMX-NFC microphone were chosen for use in this study since they were also employed by the author at five other existing or proposed wind energy facilities during the spring migration in Nova Scotia in 2012.

The Song Meter firmware was programmed to start recording at civil sunset and sunrise at the latitude and longitude of each recording device. The Song Meter setup at Spinney Gully is shown in Figure 2.

Figure 2: Song Meter and SMX-NFC Microphone at Spinney Gully with Close-up of Foam Protected Microphone on Plate

Another type of recording equipment was also used at the Camp Glasgow listening station. This was the 21c produced by Old Bird. This “bucket” unit has a microphone, preamp, and AC power connector. It thus requires an external power source and recorder (in this case a laptop computer). The settings were as follows:

Sampling format: 16 bit
Sampling rate: 22,000 Hz
High pass filter: 1,000 Hz
Pre-amp: Unknown gain
Storage: Hard disk drive

The 21c also requires recording software to be used on the recording device. The i-Sound WMA MP3 Recorder Professional was used to record .wav files on the laptop computer. This software was manually set to record between civil sunset and civil sunrise for one-week blocks of time.

Figure 3 shows the 21c microphone on pole.

Figure 3: 21c Microphone at Camp Glasgow

Detection and Analysis Software

The detection of night flight calls in the .wav files, and their organization and identification to bird species was conducted using the Raven Pro sound analysis software produced by the Cornell Lab of Ornithology.

The detection parameters for high frequency calls (sparrows and warblers) and low frequency calls (thrushes, flycatchers, and tanagers) are shown in Table 1.

Table 1: Detection Parameters

	High Frequency	Low Frequency
Minimum Frequency	6000 Hz	2250 Hz
Maximum Frequency	11000 Hz	3750 Hz
Minimum Duration	29 ms	29 ms
Maximum Duration	400 ms	330 ms
Minimum Separation	104 ms	52 ms
Signal to Noise Ratio Parameters		
Minimum Occupancy	25.0	20.0
Threshold	3.5	4.0
Noise Power Estimation Parameters		
Block Size	5000 ms	1000 ms
Hop Size	250 ms	250 ms
Percentile	50.0	50.0

The review panel of Raven Pro allows for a standardized process to classify, identify, and store night flight calls.

During periods of wind and/or rain, detection software can produce tens of thousands of false positives. This effect is more severe in the low frequency range. When such weather conditions occurred, all positive detections were reviewed for 10 minutes of each hour in the high frequency range and 5 minutes of each hour in the low frequency range. If a true positive was found during those periods, the 20-minutes before and after the true positive was also reviewed.

The presence of Spring Peepers (*Pseudacris crucifer*) can also result in tens of thousands of false detections. When the ambient noise from peepers is mild to moderate, many of the false positives can be eliminated using an exclusion band. In this study, an exclusion band of 2400-2600 Hz would eliminate a large number of peeper detections but very few birds. When peeper noise was heavy, a wider exclusion band of 2400-3000 Hz was required, resulting in the loss of more birds. If a bird call was detected while using this wider exclusion band, the detections for 20 minutes before and after the detection were reviewed. When peeper noise was severe, low frequency analysis became impossible as the lower parts of the spectrograms become totally blackened with peeper calls.

Results

Recordings were analyzed from the Wildlife Acoustic SMX-NFC microphones and Song Meters at two listening stations, Camp Glasgow and Spinney Gully. Since these two stations yielded a complete season of recordings, the files from the back-up unit at Sterling Street were not analyzed. Recordings produced from the 21c microphone were analyzed for the two nights for which the highest counts were produced by the SMX-NFC microphones.

Camp Glasgow – SMX-NFC Microphone and Song Meter Recording Configuration

Files were obtained for every night from 5 April to 12 June. A total of 751 night flight calls were detected. This number does not include local breeding birds that fly at night such as gulls, Willet and Spotted Sandpiper. As shown in Table 2, no flight calls were detected on 23 or 33% of nights while 28% of the flight calls were detected on 3 or 4% of nights.

Table 2: Number of Night Flight Calls per Night at Camp Glasgow

Calls/Night	Number of Nights	% of Total
0	23	0.00%
1-25	37	33.42%
26-50	7	38.22%
>50	3	28.36%

On a seasonal basis, the highest counts were recorded from 30 April to 1 June. Nightly counts of flight calls are shown in Figure 4. By taking the mean of the total night flight calls per night over 10-day periods, the seasonal pattern of calls is more apparent. This is presented in Figure 5.

Figure 4: Night Flight Calls by Date at Camp Glasgow

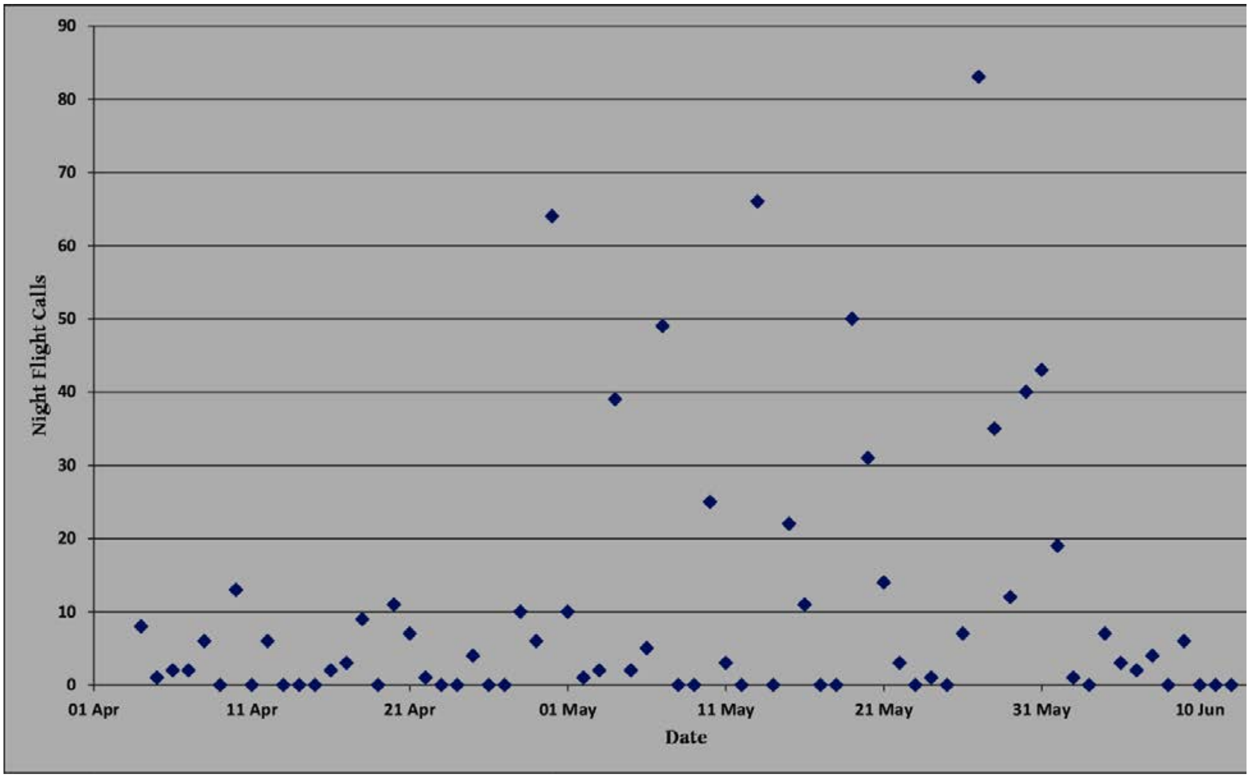
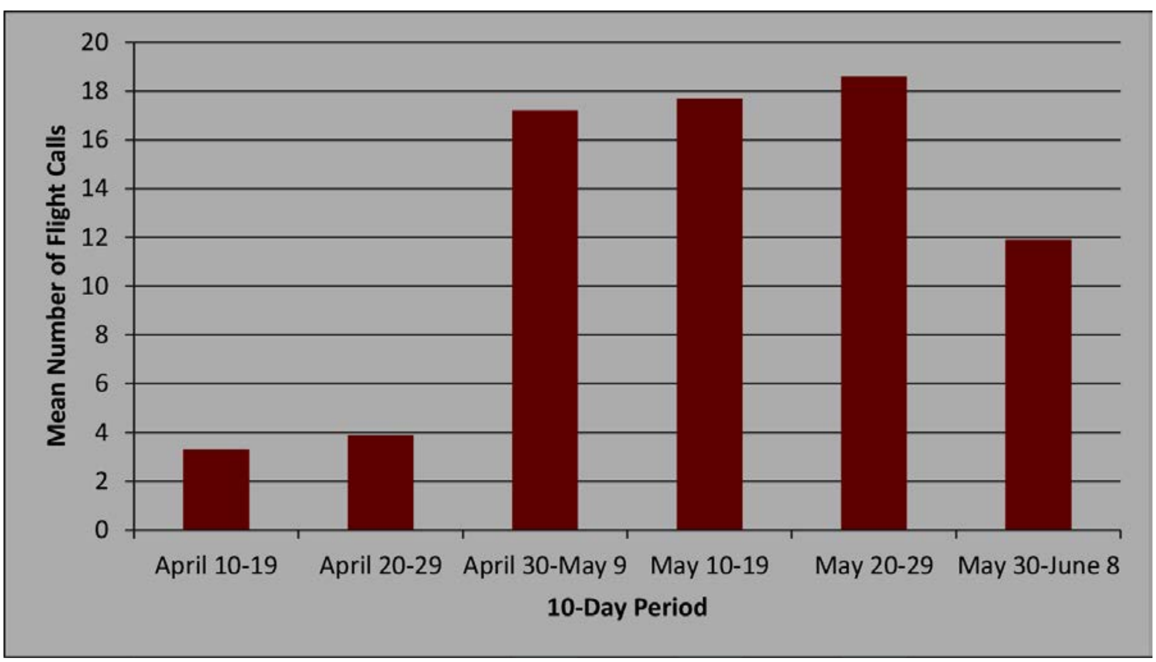
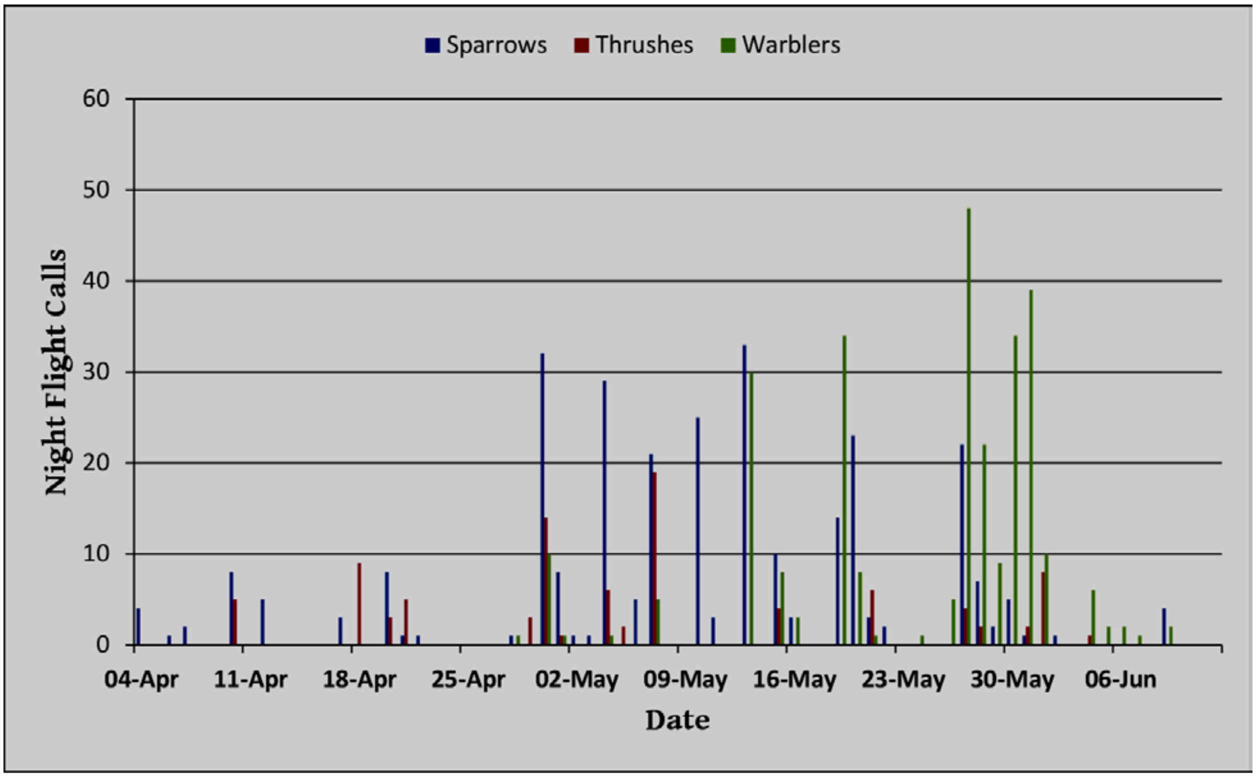


Figure 5: Mean Number of Night Flight Calls per Night by 10-Day Periods at Camp Glasgow



The detections of flight calls in the high frequency range consisted largely of sparrows (Family Emberizidae) and warblers (Family Parulidae). The low frequency detections were primarily thrushes (Family Turdidae). The number of flight calls by date from birds of these three families is shown in Figure 6. Sparrows and thrushes peaked in late April to mid-May and warblers in mid to late May.

Figure 6: Night Flight Calls by Family and by Date at Camp Glasgow



The most common call detected to the species level was that of the White-throated Sparrow (163 night flight calls). The most common warbler call was the Yellow Warbler/Blackpoll Warbler complex (87 calls). The most common thrush call was the Hermit Thrush (60 calls). Further classification of night flight calls by taxon is given in Annex 1.

The calls of only one species listed as endangered, threatened, or of special concern by the Species at Risk Act or by the Committee on the Status of Endangered Wildlife in Canada were detected. This was two calls of the Canada Warbler on 31 May.

The number of recording hours each night (from civil sunset to civil sunrise) varied from 10.0 hours on 4 April and 7.13 hours on 12 June. Table 3 presents the number of night flight calls by hours after civil sunset for the spring season. Calls were fairly evenly distributed throughout the night up to six hours after civil sunset with the exception of the 1-2 hour bin. The number of calls detected in the 7-9 hour bins was smaller due to shorter nights as the season progressed.

Table 3: Night Flight Calls by Hours after Civil Sunset at Camp Glasgow

Hour Bin	Number	%
<1	94	12.53%
1	47	6.27%
2	86	11.47%
3	74	9.87%
4	98	13.07%
5	108	14.40%
6	103	13.73%
7	73	9.73%
8	53	7.07%
9	14	1.87%

Camp Glasgow – 21c Microphone and Laptop Computer

Recordings produced by the 21c microphone at Camp Glasgow were analyzed for the two peak nights of flight calls as indicated by the SMX-NFC/Song Meter configuration in the same location. Only the high frequency calls from the 21c were analyzed. Table 4 compares the number of high frequency night flight calls detected by the two monitoring units on 13 May and 27 May. The 21c detected 217% and 441% more flight calls than the SMX-NFC at the same location (about 30 meters apart) on those two nights.

Table 4: High Frequency Calls Detected on Two Nights by the 21c and SMX-NFC Microphones

Date	21c	SMX-NFC	Ratio
13-May	139	64	2.17
27-May	309	70	4.41

No endangered, threatened, or special concern species were detected on these two nights by the 21c microphone.

Spinney Gully – SMX-NFC Microphone and Song Meter Recording Configuration

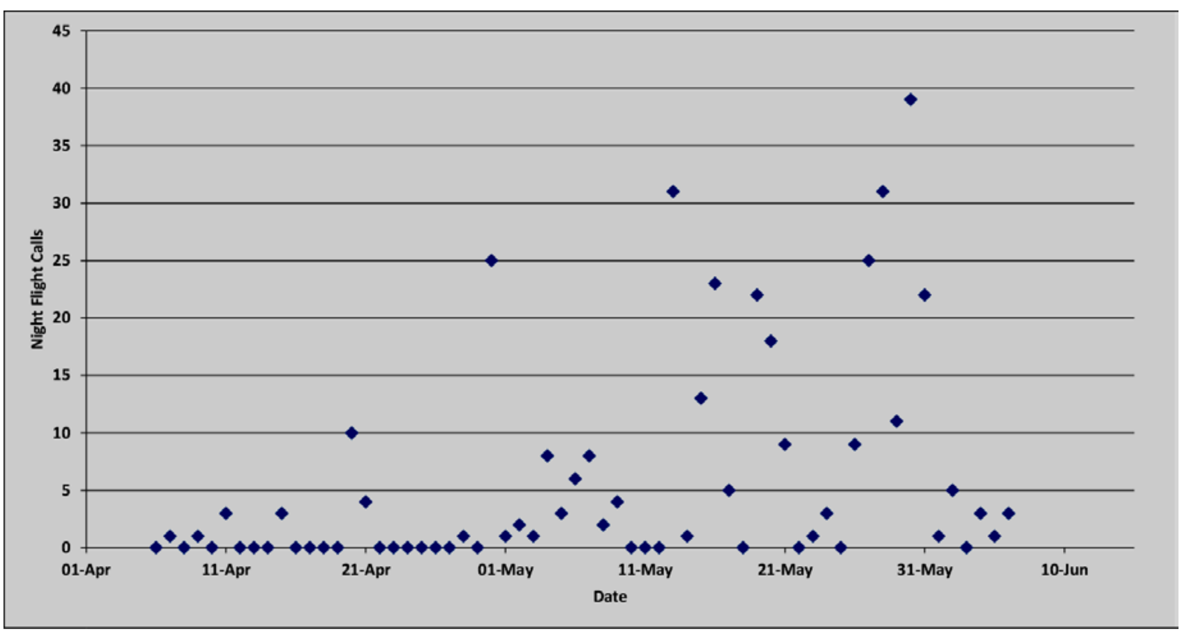
Sound files were obtained for every night from 6 April to 6 June. Since the listening station is on low ground at sea level, there was an abundance of vernal ponds plus a year-round pond in the vicinity. The level of ambient noise from Spring Peepers was at the severe level and the detection of night flight calls in the low frequency range was not possible. However, Spring Peepers do not affect the detection of calls in the high frequency range.

The total number of high frequency calls detected at the Spinney Gully station for the entire spring period was 360. This compares with 582 high frequency calls (62% greater) at Camp Glasgow using the same equipment. As shown in Table 5, the number of night flight followed a similar pattern of many nights of no calls or very low numbers of calls and large numbers (26-50 in this case) on 3 or 5% of nights. The number of night flight call by date is plotted in Figure 7.

Table 5: Number of Night Flight Calls per Night at Spinney Gully

Calls/Night	Number of Nights	% of Total
0	24	0.00%
1-25	35	71.67%
26-50	3	28.06%
>50	0	0.00%

Figure 7: Night Flight Calls by Date at Spinney Gully



The seasonal pattern of calls as well as well as their taxonomic composition was similar in Spinney Gully to Camp Glasgow. This was true also for the hourly distribution as seen in Table 6. Thus all patterns appear the same except that Spinney Gully had 38% less high frequency calls.

Table 6: Night Flight Calls by Hours after Civil Sunset at Spinney Gully

Hour Bin	Number	%
<1	37	10.28%
1	44	12.22%
2	43	11.94%
3	47	13.06%
4	52	14.44%
5	51	14.17%
6	35	9.72%
7	32	8.89%
8	7	1.94%
9	12	3.33%

No flight calls of endangered, threatened, or special concern species were detected at Spinney Gully. The flight call of one rare species, the White-crowned Sparrow, was recorded on 1 June.

Discussion

Research suggests that birds use flight calls to maintain flocks, stimulate migration, minimize collisions with obstacles, reduce dispersion, and detect changes in wind direction (Hüppop and Hilgerloh 2012). The number of flights calls detected does not necessarily represent the intensity of migration at a given time but can also indicate changes in the conditions of flight. According to a literature review by Farnsworth (2005), flight calls may increase with:

1) Increasing cloud cover or lowering ceiling,
2) The approach of weather boundaries involving precipitation, fog, and wind,
3) Falling temperatures in the autumn and rising temperatures in the spring, and
4) Topographic features that concentrate birds.

Despite this variability, flight calls data over a season or years can represent consistent biological patterns (Farnsworth 2005).

One can begin to understand the pattern of night flight calls on the Canso Peninsula by comparing the data with other locations in Nova Scotia. Table 7 compares the spring flight call data at the two listening stations in this study with an acoustic study of five other existing or proposed wind farm sites in Nova Scotia (Cornell Laboratory of Ornithology and John F. Kearney & Associates 2013). Due to the problem at all sites with Spring Peepers in the spring, only high frequency calls are presented. This comparison indicates that the Camp Glasgow station had 44% more flight calls than the highest count at any site in the previous study while the Spinney Gully station was on a par with the other sites.

Table 7: Total High Frequency Flight Calls Detected during the Spring Migration in Nova Scotia

Site	County	Year	Distance from Coast (KM)	Elevation (M)	Flight Calls
1	Antigonish	2012	6.5	230	352
2	Pictou	2012	14.2	210	404
3	Pictou	2012	14.9	200	355
4	Colchester	2012	19.9	250	263
5	Digby	2012	2.1	100	321
Camp Glasgow	Guysborough	2013	0.11	30	582
Spinney Gully	Guysborough	2013	0.01	0	360

Given the similarity in the seasonal, hourly, and taxonomic patterns at the Camp Glasgow and Spinney Gully, the difference in call counts between them might be attributable to the 32 meter difference in their height above sea level. Farnsworth's (2005) review of the literature indicated that the skyward reach of acoustic monitoring is at most 500 meters for larger birds such as thrushes and a maximum of 200-300 meters for smaller birds such as warblers and sparrows. An additional 32 meters would thus put the Camp Glasgow stations closer to migrants. It also indicates that birds are flying quite low if 32 meters results in a 62% increase in flight calls detected.

The relatively even hourly distribution of flight calls at both stations provides further evidence that migrants over this part of the Canso Peninsula may be flying quite low throughout the night. Research indicates that other locations are often characterized by a concentration of calls at specific intervals during the night resulting from weather patterns or during periods of ascent (early evening) or descent (before dawn) (Farnsworth 2005).

Conclusion

The data from this study indicate that total spring night flight calls is higher at the Camp Glasgow station than at other sites surveyed thus far in Nova Scotia and that birds may be flying consistently at a low altitude.

References

Cornell Laboratory of Ornithology, and John F. Kearney & Associates. 2013. Database of Night Flight Calls from Nova Scotia Wind Farms, 2011-2012.

Farnsworth, Andrew. 2005. "Flight Calls and Their Value for Future Ornithological Studies and Conservation Research." *The Auk* no. 122 (3):733-746.

Hüppop, Ommo, and Gudrun Hilgerloh. 2012. "Flight Call Rates of Migrating Thrushes: Effects of Wind Conditions, Humidity and Time of Day at an Illuminated Offshore Platform." *Journal of Avian Biology* no. 43 (1):85-90. doi: 10.1111/j.1600-048X.2011.05443.x.

Annex 1: Total Number of Night Flight Calls by Taxon for Camp Glasgow and Spinney Gully Using SMX-NFC Microphone

American Redstart	**17**	**Lincoln's/Swamp Sparrow**	**21**
American Robin	**18**	**Nashville Warbler**	**8**
Black-and White Warbler	**27**	**Northern Parula**	**8**
Bay-breasted Warbler	**1**	**Northern Waterthrush**	**12**
Black-capped Chickadee	**9**	**Ovenbird**	**18**
Blackpoll/Yellow Warbler	**144**	**Warbler unspecified**	**22**
Boreal Chickadee	**1**	**Songbird unspecified**	**27**
Black-throated Green Warble	**11**	**Palm Warbler**	**28**
Canada Goose	**3**	**Savannah Sparrow**	**57**
Canada Warbler	**2**	**Scarlet Tanager**	**2**
Chipping Sparrow	**2**	**Genus Setophaga (warbler)**	**35**
Cape May Warbler	**6**	**Song Sparrow**	**38**
Common Yellowthroate	**31**	**Swainson's Thrush**	**16**
Dark-eyed Junco	**8**	**Tennessee Warbler**	**3**
Sparrow unspecified	**55**	**Unknown**	**21**
Fox Sparrow	**4**	**Veery**	**1**
Greater Yellowlegs	**42**	**White-crowned Sparrow**	**1**
Hermit Thrush	**60**	**Wilson's Warbler**	**8**
Least Sandpiper	**19**	**White-throated Sparrow**	**255**
Magnolia Warbler	**50**	**Yellow-rumped Warbler**	**32**