AVIAN STUDY
AULD'S COVE

March 2, 2016

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Mr. Glenn Goudey
NS Power Inc.
1223 Lower Water Street
Halifax, NS B3J 3S8

Dear Mr. Goudey,

Re: Avian Study, Auld's Cove, NS

Attached is the Avian Study Assessment prepared for Auld's Cove, NS.

We trust this report to be satisfactory at this time. Once you have had an opportunity to review this correspondence, please contact us to address any questions you may have.

Thank you,

Shawn Duncan, BSc.
Vice President
sduncan@strum.com

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LIST OF ACRONYMS

ACCDC	Atlantic Canada Conservation Data Centre
AVPLIC	Avian Power Line Committee
CI	Confidence Interval
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
dB	Decibel
EA	Environmental Assessment
EC	Environment Canada
kV	Kilovolt
MSBP	Migratory Soaring Bird Project
NSDNR	Nova Scotia Department of Natural Resources
NSESA	Nova Scotia Endangered Species Act
NSPI	Nova Scotia Power Inc.
OHGW	Overhead Ground Wire
P	p-value
SARA	Species at Risk Act
SOCI	Species of Conservation Interest

1.0 INTRODUCTION

Strum Consulting completed an avian study (the study) in the vicinity of existing transmission line infrastructure at Auld's Cove, NS which is situated approximately 1.6 km northwest of the Canso Causeway. The Auld's Cove crossing extends across the Strait of Canso, from Highway 104 on the Nova Scotia peninsula to Highway 19 on Cape Breton Island (Drawing 1, Appendix A).

Nova Scotia Power Inc. (NSPI) is planning an expansion to the existing power line infrastructure at Auld's Cove, in order to accommodate additional power generation from the Maritime Link. It has been determined that the proposed activity requires the completion of a provincial Environmental Assessment (EA).

The purpose of the study was to accurately characterize the bird community at Auld's Cove and adjacent areas, in support of the EA process.

2.0 STUDY OBJECTIVE

The primary objective of the study was to accurately characterize avian composition and behaviour at the location of proposed new power line infrastructure at Auld's Cove, NS. An evaluation of trends and utilization of the site by birds at this location will enable an evaluation of potential impacts and/or risk to the avian community as a result of the proposed activity to be made.

In order to support the study, additional information related to the avian population was also collected at the Canso Causeway.

In order to achieve the objective of the study, the following key parameters were evaluated through the completion of multiple field survey programs throughout 2015.

- Species composition and abundance at each site throughout various seasons, time of day/night, and varying weather conditions;
- Behavioural activities (*i.e.* migration, feeding, breeding) of birds both on land, and within the Strait of Canso at each site location; and
- Interaction and behavioural responses of birds and existing power line infrastructure at Auld's Cove and the Canso Causeway.

Surveys completed to collect the necessary data required to meet the objective, are further discussed in Section 5.

3.0 SITE DETAILS

3.1 Auld's Cove

The Auld's Cove study area is located northwest of the Canso Causeway. The existing NSPI infrastructure consists of a double circuit overhead transmission crossing of the Strait of Canso; a body of water between the mainland of Nova Scotia and Cape Breton Island (Drawing 1, Appendix A). This consists of two double circuit suspension towers, six anchor structures and associated foundations (three on each side of the crossing); along with high strength self-dampening conductor. The two circuits (six conductors) which share the existing double circuit tower consist of a 345kV line and a 230kV line. The span over the Strait of Canso is approximately 1.4 km with additional spans of 1.0 km and 0.7 km to the anchor towers on the adjacent hills. These spans are designed for minimum clearance above navigable waters of 50 m at a conductor temperature of 50°C, and are built with a Special Type 41 single conductor. The existing crossing contains navigation lighting and aircraft markers.

Berms on either side of the Strait allow for the existence of coastal ponds along the shorelines. On the eastern side, the berm was originally created for the railway infrastructure, and the resulting pond is known as Long Pond. On the western side, the berm comprises the NSPI transmission tower, and the Cove Motel and Restaurant. The resulting coastal pond on this side of the Strait is known as Archie's Pond. Coastal Ponds typically provide favourable conditions for roosting, foraging, and breeding activities and were therefore included in the study.

The Auld's Cove study area refers to the general zone to which surveys were completed (Drawing 2, Appendix A). In general, the study area comprises the air space adjacent to the existing power line infrastructure, shoreline pond habitats, and the forested shoreline which extends and inclines on the Cape Breton and mainland side of the Strait of Canso, where existing NSPI transmission lines span to the anchor towers (Drawing 3, Appendix A). Habitat mapping (NSDNR 2014) suggests that the majority of terrestrial habitat features adjacent to the transmission line corridor consist of mixedwood and hardwood forest on the mainland side and predominantly softwood and mixedwood forest on the Cape Breton side (Drawing 3, Appendix A). Site observations indicate that this habitat mapping is accurate. Forest habitats are for the most part middle aged to mature, and in some cases, over mature mixedwood habitat that in some areas has suffered blowdown. The corridor underneath the existing Auld's Cove power lines provides for stands of regenerating hardwood and softwood. The topography is steep, but there are small isolated pockets of wetland habitat in areas of topographical relief.

3.2 Canso Causeway

The Canso Causeway is a rock-fill Causeway which crosses the Strait of Canso, connecting Cape Breton and Mainland Nova Scotia (Drawing 1, 2, and 3 Appendix A). The Causeway is approximately 1,372 m in length across the water with a surface width of 24.3 m. A 93.9 m swing bridge allows vessels to pass through the Strait. The Causeway has been in operation since 1955.

The Causeway contains a set of two paired transmission towers separated by a distance of approximately 330 m (Drawing 4, Appendix A). The southwestern towers connect to an additional tower located approximately 450 m to the southwest, which is located on the face of a steep topographical incline. The northeastern towers connect to an additional tower located approximately 480 m to the northeast, and is off-set approximately 85 m from the Causeway itself. The Cape Breton and Central Nova Scotia Railway runs along the Causeway, parallel to the Trans-Canada Highway to its southeast.

Existing electrical infrastructure consists of two 230kV circuits (6 conductors total), sharing a set of towers on the northern side of the causeway and one 138kV circuit (3 conductors total) which crosses the Canso Causeway on the southern side of Highway 104.

Habitat mapping (NSDNR 2014) suggests that the majority of habitat features adjacent to the transmission line corridor consist of a gravel pit and mixedwood forest on the mainland side, and is predominantly urban developed areas with small isolated stands of softwood forest on the Cape Breton side (Drawing 3, Appendix A). Again, site observations confirm that this habitat mapping is accurate for this area.

The Canso Causeway study area comprises the air space immediately adjacent to the existing infrastructure, and in the waters on the north and south side of the Causeway itself (Drawing 4, Appendix A).

4.0 BACKGROUND

Prior to the completion of the 2015 study at the project location of Auld's Cove as well as the general area including the Canso Causeway, information related to the avian population at the Canso Causeway site, and adjacent habitat has been collected via the completion of a focused bird interaction study completed by Strum in 2014 and focused carcass monitoring programs completed by NS Department of Natural Resources (NSDNR),

The 2014 Strum bird interaction study was completed at the Canso Causeway to assess the bird community (abundance and species composition), and to gauge bird behavioural responses to, and interaction with, NSPI infrastructure. Other potential mortality factors, including vehicular traffic, were also assessed.

The scope of the study included two main field components: active observations; and carcass searches which consisted of bi-weekly surveys within two, six-week periods (late spring and fall) when birds traditionally congregate in the area. The surveys were performed over two consecutive days.

The following relevant key findings were identified during the 2014 surveys:

- Over 70 species were observed during the spring and fall component of the study. The most common species observed were Double-crested Cormorant *(Phalacrocorax auritus*), Herring Gull (*Larus argentatus*), Great Black-backed Gull (*Larus marinus*), Common Tern (*Sterna hirundo*), and Bonaparte's Gull (*Chroicocephalus philadelphia*).
- Terns were commonly observed carrying food from the south side of the Causeway and then heading north, suggesting that a possible nesting colony exists north of the Causeway.
- Foraging activities appeared concentrated in two areas. Gulls were commonly foraging along the north side of the Causeway extending to Auld's Cove, whereas cormorants foraged further north of the Causeway throughout the northern extent of the Straight of Canso.
- Flight path adjustments in response to NSPI infrastructure included backtracking and completing several circles to achieve the sufficient height needed to pass safely over the power lines; hesitation before flying through the power lines; and increased apprehensiveness on windy days, especially with lighter species, such as terns.
- The area where birds most frequently crossed the Causeway appeared to be near the tower installed on Balache Point, where the lines are higher. Balache Point is a small point in the Straight of Canso located immediately to the west of the Canso Causeway Canal, just before the Canso Causeway reaches Cape Breton Island.
- Several injuries and/or deaths were observed when species attempted to fly between the power lines as opposed to under or over.
- A larger number of close calls were observed during the fall surveys in comparison to spring. The majority of collisions observed during September and October were a result of large flocks of birds, especially Double-crested Cormorants, passing back and forth through the Causeway.
- A total of 69 carcasses were identified during the spring and fall carcass searches. Most common carcasses observed were Double-crested Cormorant and Herring Gull.

4.1 Regional Bird Migration

The Strait of Canso provides a migratory pathway for bird species, specifically those following coastal routes to winter in areas south of Nova Scotia. Cormorants, terns, and gulls tend to nest in coastal colonies often amidst one another, where access to an abundant fish supply is present (NSDNR 2013). Each year Atlantic Saury (a.k.a. billfish, needlefish, skipjack) migrate from the Gulf of St. Lawrence to the eastern seaboard of the United States in late fall/early winter (Chaput and Hurlbut 2010). This annual influx of fish-stocks tends to attract a large abundance of birds to the area. Historically the Strait of Canso provided a passageway for the fall migration; however the construction of the Causeway created a barrier for fish passage resulting in dense aggregations of Atlantic Saury along the northern portion of the Causeway (Canadian Heritage Information Network 1998). Species diversity is typically higher in the fall migration period than in the spring, with large numbers of a variety of gull, seabird, waterfowl, gannets, and Bald Eagles congregate here for several weeks while the Atlantic Saury are migrating. Comparatively during the spring migration period, species diversity is restricted to a few species of gulls, cormorants, and waterfowl, with the

diversity of seabirds notably absent (Strum 2014). While no surveys were conducted during the winter months in 2014 or 2015, bird numbers and diversity is expected to be low as the Straight of Canso typically freezes during the winter.

5.0 METHODOLOGY

A variety of survey protocols were implemented to collect the data required to comprehensively evaluate the avian community within the study areas. Targeted survey programs completed for the study included passerine migration surveys, diurnal movement surveys, seabird and shorebird nesting and breeding surveys, nocturnal activity surveys, an acoustic monitoring study, and infrastructure interaction surveys. Methods employed in these surveys are described below.

Passerine Migration Surveys

Passerine migration surveys employed the Standardized Area Search Methodology (EC 2007). Three surveys were conducted in May and June, 2015. The purpose of these surveys was to identify any critical breeding habitat in areas that may be impacted by the proposed new power lines at Auld's Cove, and to survey the diversity and abundance of migrating passerines. All birds observed within a 10 minute period were recorded for each point-count location. Twelve (12) point-count locations were assessed during each survey at the Auld's Cove Crossing. Six (6) point-count locations occurred along the extension of the right of way (ROW) on both the east (Cape Breton) side and west (Mainland) side of the Strait of Canso. The locations were spaced approximately 300 m apart, and were 40 to 60 m south of the existing Auld's Cove power lines (Drawing 3, Appendix A). The surveys were completed within a 4 hour period after sunrise.

Diurnal Movement Surveys

These surveys employed the Watch Count Methodology (EC 2007). A total of 50 surveys were completed at the Auld's Cove location from early April to late October 2015. An additional thirty-two (32) diurnal movement surveys were completed at the Canso Causeway location from early July to late October, 2015. The purpose of these surveys was to collect data on the daily movement patterns of birds in the area throughout the season from spring to fall, and to assess how birds interact with NSPI infrastructure. Additionally, the objective was to track how these birds interact with the NSPI's existing infrastructure in the areas. The Diurnal survey locations are indicated on Drawing 3 (Appendix A). Surveys were split equally between morning and evening surveys consisting of 25 morning surveys and 25 evening surveys at the Auld's Cove location and 16 morning and 16 evening surveys at the Canso Causeway location. Morning surveys began at sunrise and ran for a 4-hour duration at a vantage point that provided full view of the respective study area. Likewise, evening surveys began 4 hours before dusk at the same locations. Data on avian species abundance and composition, movement patterns, behavior, and interactions (including collisions and mortalities) was collected during these surveys. Weather and tidal conditions were also recorded for each survey. Data was recorded on field sheets which were then digitized and analyzed for patterns, trends, and correlations. Example data sheets are provided in Appendix B.

Seabird and Shorebird Nesting and Breeding Surveys

Seabird and Shorebird surveys also employed the Watch Count Methodology (EC 2007). A total of ten (10) surveys were conducted from early July to mid-September. The purpose of these surveys was to assess the diversity and abundance of seabirds and shorebirds utilizing habitat features in the area during their breeding season. Surveys lasted for 6 hours each, and were split between two locations (3 hours at each location). Surveys were conducted at locations that provided full view of two coastal ponds, Long Pond and Archie's Pond, situated alongside the eastern and western shoreline of the Strait of Canso, respectively (Drawing 2, Appendix A). All birds observed during the survey period were noted along with observations on behaviour (*i.e.* flying from roost to feeding areas, etc.). These surveys were conducted during a variety of weather and tidal conditions.

Nocturnal Activity Surveys

These surveys utilized an adapted version of the Watch Count Methodology (EC 2007). A total of 6 (six) Nocturnal Activity Surveys were conducted at Auld's Cove throughout October (Drawing 3, Appendix A). The purpose of these surveys was to assess the nocturnal movement activity of birds in the area during the fall migration period when nocturnal movements are believed to be at their highest. Surveys were split between post-dusk periods (3) and pre-dawn periods (3). Post-dusk surveys were conducted for 4 hours beginning after dusk. Pre-dawn surveys were conducted 4 hours before dawn. Auditory observations of bird flight calls were made by an expert birder, and visual observations of roosting and flying birds were established using a TIM-14 Thermal Imaging Monocular purchased from the General Starlight Company. Information on bird species composition (where possible), movements, behaviour, and interactions with existing NSPI infrastructure was recorded.

Acoustic Monitoring Study

Two acoustic monitors were placed within the Auld's Cove study area, and one monitor was placed within the Canso Causeway study area (Drawing 3, Appendix A) to assess avian acoustic patterns at night throughout various seasons. The purpose of this study was to gather data on avian nocturnal activity throughout the seasons studied. Acoustic monitors consisted of SM3 acoustic monitors purchased from Wildlife Acoustics Inc. Night flight call microphones (also purchased from Wildlife Acoustic Inc.) were erected on towers 4 m above the ground. These microphones consist of an omnidirectional microphone mounted on an acrylic plate, and are designed to provide a 3 dB gain in flight calls emitted from above the microphone, while reducing background noise from below the microphone. Monitors were deployed from early June to late October 2015 and were set to record for 10 minutes every hour from 10:00 pm until 5:00 am, a total of 80 minutes per night. Three nights each week were randomly selected for an analysis of general activity levels during night-time hours. Further analysis was completed on alternating weeks' to identify species composition (where possible) present, and call type.

Infrastructure Interaction Surveys

These surveys were conducted at the Auld's Cove location (Drawing 3, Appendix A) to assess potential avian interactions with existing NSPI infrastructure. The existing power lines at Auld's

Cove were monitored for 6-8 hours a day, 3 days per week from early August to late October 2015 (a total of 286 hours of monitoring time). Observations on interactions, including mortalities, collisions, and near misses were recorded. Surveys took place in a variety of weather conditions, including wind storms, rain storms, and fog cover.

Table 1 below provides a summary of the methodology employed during each survey program and the data collected.

Table 1. Survey Program Methodology

Survey Type	Survey Methodology	Data
Passerine Migration	• Employed the Standardized Area Search Methodology. • Three surveys conducted throughout May and June 2015. • 36 standardized area searches conducted at 12 locations (split 6 x 6 on either side of Strait of Canso at Auld's Cove location). • Surveys were conducted within 4 hours after sunrise.	• Species composition and abundance. • Behavioral activities, breeding evidence.
Diurnal Movement	• Employed the Watch Count Methodology. • 50 surveys conducted at Auld's Cove from April-October 2015. • 32 surveys conducted at the Canso Causeway from July-October 2015. • Surveys split evenly between morning and evening. • Completed at suitable vantage points for each location.	• Species composition and abundance. • Behavioral activities and diurnal movement patterns. • Interactions and responses to NSPI infrastructure.
Seabird and Shorebird Nesting and Breeding	• Employed the Watch Count Methodology. • 10 surveys in total (6 hour durations) conducted from early July to mid-September. • Survey areas consisted of Long Pond and Archie's Pond.	• Species composition and abundance. • Behavioural activities including nesting and breeding.
Nocturnal Activity	• Employed modified version of the Watch Count Methodology. • Auditory observations recoded by expert birder and Visual observations made using thermal imaging monocular. • 6 surveys conducted throughout October (3 post-dusk surveys and 3 pre-dawn surveys). • Completed at Auld's Cove location only.	• Species composition (where possible). • Species behaviour. • Interactions and responses to NSPI infrastructure.

Survey Type	Survey Methodology	Data
Acoustic Monitoring	• Monitors placed at three locations within the Auld's Cove crossing and Canso Causeway study areas. • 10 minute recordings from every hour between 10:00 pm and 5:00 am daily (80 minutes per night). • Activity levels assessed for three randomly selected nights per week from early June to late October. • Species composition and flight call classification conducted for three randomly selected nights every second week from June to late October.	• Avian acoustic activity level. • Species composition (where possible). • Call type classification.
Infrastructure Interaction	• Watch Count (August-October 2015). • Three days per week, 6-8 hours per day (286 hours of monitoring time total). • Suitable vantage point at Auld's Cove location.	• Avian interactions with NSPI infrastructure.

5.1 Important Definitions and Analytical Approach

5.1.1 Seasons

Field observations and results were compared throughout various seasons. For the purpose of this study, seasons correspond to the following survey periods:

Spring: April 16 – June 23
Summer: July 2 – September 11
Fall: September 17 – October 29

5.1.2 Species of Conservation Interest (SOCI)

Species of Conservation Interest (SOCI) are those species considered to be at risk or sensitive to extirpation or extinction. For the purposes of this study, SOCI include those species listed as:

- "Endangered", "Threatened", or "Special Concern" under *SARA;* and
- "Endangered", "Threatened "or "Vulnerable" under the NS *ESA*.
- Ranked as "1 – At Risk", "2 – May Be At Risk", "3 - Sensitive" or "5 - Undetermined" under the NSDNR General Status Ranks of Wild Species in Nova Scotia;
- Listed "Endangered", "Threatened", or "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); and
- Ranked as "S1", "S2" or "S3" under the ACCDC provincial conservation status rank.

Behavioral activities (*i.e.* migration, feeding, and breeding) and interactions with NSPI infrastructure for each SOCI will be discussed in Section 6.6.

5.1.3 Guilds

For the purposes of this study, the analytical approach to evaluating avian activity and behaviour will be via the concept of *Guilds, i.e.* the classification and grouping of bird species by taxonomy and behavioral trend characteristics. For the most part, guilds are defined by taxonomical relation [*i.e.* American Black Ducks (*Anas rubripes*) and Common Mergansers (*Mergus merganser*) are both in the *Anatidae* family, and are thus grouped together in the Sea ducks and Waterfowl guild]. However, in some cases, species were observed to display unique behaviours, or were especially abundant. In these cases, species were then assigned their own guild, which were analyzed separately. An example of this are the Double-Crested cormorants, which could have been assigned to the Seabird guild, but because they were so abundant and exhibited unique behaviours, they were assigned their own guild and analyzed separately. Guild constituents are listed in Appendix C.

For the purpose of this analysis, guilds will be defined as groups of birds that may be loosely taxonomically related and/or share behavioural commonalities and can therefore be analyzed as a unit.

5.1.4 Interactions and High Risk Interactions

During bird survey events, specific efforts were made to track interactions with the existing NSPI infrastructure at Auld's Cove and the Canso Causeway. The term *Interactions* will be used throughout this report to describe any observations made by the expert birders in which the bird(s) appeared to have altered their behaviour as a result of the presence of existing infrastructure. For example, when flying from south to north, Herring Gulls were commonly observed to strafe back and forth across the Strait of Canso in the Auld's Cove study area until they achieved the altitude to cross over the power lines. This behaviour is a direct result of the presence of the Auld's Cove power lines.

High risk interactions are interactions in which the bird(s) was observed to have interacted with the powerlines, and observed to have passed particularly close (within approximately 10 m) to NSPI infrastructure (recorded as having passed 'just below', 'through', or 'just above' the power lines).

6.0 RESULTS AND DISCUSSION

The following sections summarize the results of the survey programs outlined in Section 5.0.

6.1 Passerine Surveys

A total of 53 species, comprising 488 individual birds, were observed during the passerine surveys completed in May/June 2015 (Tables 1 and 2, Appendix D). Black-and-white Warbler (*Mniotilta varia*), Ovenbird (*Seiurus aurocapilla*), and Red-eyed Vireo (*Vireo olivaceus*) were the most

frequently observed, while American Redstart (*Setophaga ruticilla*), American Robin (*Turdus migratorius*), and Ovenbird were the most abundant species.

Passerines were also observed during the other survey programs completed at Auld's Cove and Canso Causeway. A total of 67 species of passerines were identified during the entire study (Table 3, Appendix D). The majority of these species, 53, were observed during the passerine surveys. During diurnal surveys, 18 species were observed at Auld's Cove and 15 species at Canso Causeway. There were 25 species identified from nocturnal acoustic monitoring recordings. American Goldfinch (*Spinus tristis*) and Amercian Robin were the most frequently observed and most abundant species observed in more than one survey.

Passerine SOCI observed during the study are presented below in Table 2. The corresponding survey the species was observed in is also provided.

Table 2. Passerine SOCI Identified in All Bird Surveys.

Common Name	Scientific Name	SARA Status	NSESA Status	NSDNR Status	COSEWIC Status	S-Rank	Surveys Observed In [1]
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	P
Chimney Swift	*Chaetura pelagica*	Threatened	Endangered	At Risk	Threatened	S2S3B	A
Eastern Kingbird	*Tyrannus tyrannus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	C
Golden-crowned Kinglet	*Regulus satrapa*	Not Listed	Not Listed	Sensitive	Not Listed	S4	P
Killdeer	*Charadrius vociferus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	N
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	At Risk	Threatened	S3B	P
Pine Siskin	*Spinus pinus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B, S5N	P
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	P
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Endangered	May Be At Risk	Special Concern	S2S3B	P
Savannah Sparrow	*Passerculus sandwichensis*	Not Listed	Not Listed	Secure	Not Listed	S4M,S2N	N,C, A
Tree Swallow	*Tachycineta bicolor*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	P, A, C

[1] P – Passerine Survey
A – Auld's Cove Diurnal Survey and Tern/Shorebird Survey
C – Canso Causeway Diurnal Survey
N – Nocturnal Surveys and Acoustic Monitoring

A discussion of the above noted SOCI is provided in Section 6.6.

Habitat identified during the breeding bird surveys was primarily limited to middle aged to mature mixed wood forest stands, as well as regenerating hardwood and softwood in the areas under the existing Auld's Cove powerline corridor. While these habitats can provide breeding habitat for a

variety of bird species, no areas of critical habitat (critical nesting habitat for SOCI or habitat that may be utilized for nesting by a particular diversity of birds) were identified.

6.1.1 Auld's Cove

A total of 1490 passerine birds, made up of 67 different species were observed within the Auld's Cove study area throughout all surveys completed. The most abundant species were American Crow (*Corvus brachyrhynchos*), Song Sparrow (*Melospiza melodia*), Blue Jay (*Cyanocitta cristata*), American Robin, Belted Kingfisher (*Megaceryle alcyon*), and American Redstart.

6.1.2 Canso Causeway

A total of 441 passerine birds, made up of 24 different species were observed within the Canso Causeway study area throughout all surveys completed. The most abundant species were American Robin, American Goldfinch, American Crow, American Redstart, Belted Kingfisher, and European Starling (*Sturnus vulgaris*).

6.2 Diurnal Surveys

Surveys were completed within the Auld's Cove study area and the Canso Causeway study area to discern bird species composition and abundance, in addition to their activity relative to existing infrastructure. Special consideration was afforded to observe flight direction, height at crossing, and position within the Strait at power line infrastructure locations.

6.2.1 Auld's Cove

A total of 14,613 birds were observed during the Diurnal Surveys at Auld's Cove; 2,077 birds during the spring, 3,829 during the summer, and 8,435 birds in the fall. Of these birds, 5,299 were observed during evening surveys and 9,042 were observed during morning surveys. While no surveys were conducted during the winter months, abundance and diversity of birds is expected to be low as the Straight of Canso is typically ice covered, reducing foraging opportunities for birds in the area.

6.2.1.1 Species Composition

A total of 60 species were observed at the Auld's Cove crossing during Diurnal Surveys. Some of which were unidentifiable to the species level as they were beyond the range of effective visual observation. In this instance birds were identified to family or genus level. The most frequently observed species was the Double-crested Cormorant, composing 37% of the total number of birds observed (Table 3) (Figure E1, Appendix E). The second most frequent species were Bonaparte's Gulls (20%) and Common Terns (15%). Although not common during the spring or fall, the Northern Gannet (*Morus bassanus*) composed 14% of the total number of birds observed during the summer.

Table 3. Commonly Observed Birds during Diurnal Surveys at Auld's Cove

Common Name	Scientific Name	Guild	Total Birds Observed	
			Number	Percentage
Double-crested Cormorant	*Phalacrocorax auritus*	Cormorants	5448	37%
Bonaparte's Gull	*Chroicocephalus philadelphia*	Sea Gulls	2869	20%
Common Tern	*Sterna hirundo*	Terns	2196	15%
Herring Gull	*Larus argentatus*	Sea Gulls	925	6%
Northern Gannet	*Morus bassanus*	Northern Gannet	641	4%
Great Black-backed Gull	*Larus marinus*	Sea Gulls	557	4%
Gull sp.	*Laridae sp.*	Sea Gulls	550	4%
Common Merganser	*Mergus merganser*	Sea Ducks and Waterfowl	294	2%
Red-breasted Merganser	*Mergus serrator*	Sea Ducks and Waterfowl	183	1%
American Black Duck	*Anas rubripes*	Sea Ducks and Waterfowl	142	1%

The most commonly observed guilds were Cormorants (37% of total observed, 1 species), followed by Gulls (35%, 8 species) and Terns (15%, 4 species) (Table 4). Although there were 18 species of Passerines/Raptors observed, they only comprised 2% of the total number of observed birds. The 15 species of Sea Ducks and Waterfowl comprised 6% of the total number of birds observed, and the 10 species of Shorebirds observed comprised 1% of the total number of birds observed.

Table 4. Total Number of Observed Birds by Guild at Auld's Cove

Guild	Total Number Observed	Percentage	Number of Species
Cormorants	5448	37 %	1
Gulls	5044	35%	8
Terns	2199	15%	4
Sea Ducks and Waterfowl	805	6%	15
Northern Gannet	641	4%	1
Passerines/Raptors	352	2%	18
Shorebirds	116	1%	10
Seabirds	8	<1%	3

6.2.1.2 Diurnal Movement Patterns

Movement patterns were documented for all birds, whether flocking of flying individually, as they passed across existing power lines infrastructure during the diurnal surveys at Auld's Cove. The data collected included the direction of flight, area of crossing, and height at crossing and if the birds interacted with the power lines.

Figure 1 indicates the direction of flight taken by birds as they crossed the Auld's Cove power lines. Note that the direction of flight was simplified to 'north to south' or 'south to north', when in reality, the birds observed may have been travelling in a variety of different directions (i.e. northwest to southeast, or southwest to northeast). The simplified direction of flight metric is intended to describe

whether birds were generally traveling towards or away from the Auld's Cove / Port Hastings area as they crossed the Auld's Cove powerlines.

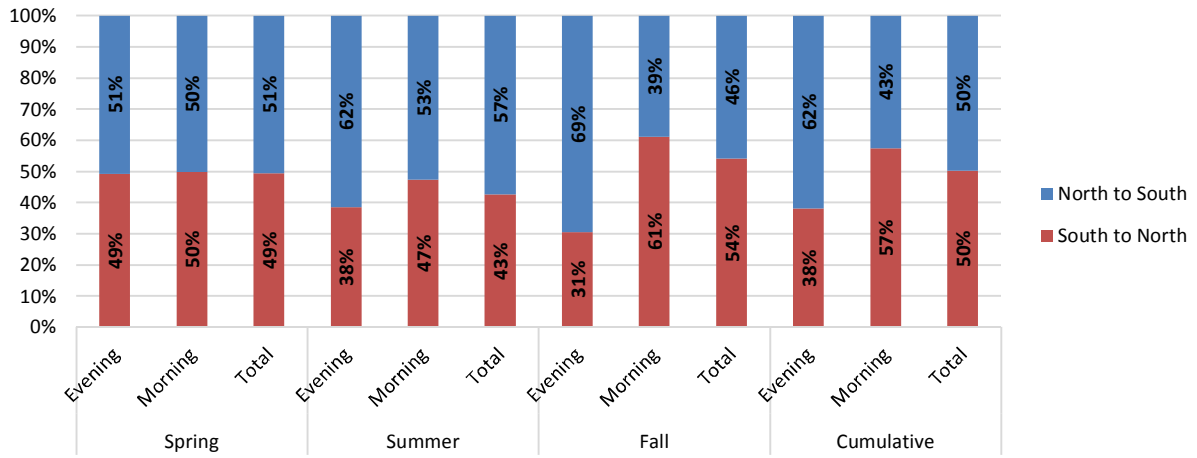

Figure 1. Direction of observed bird flight at Auld's Cove

Direction of flight varied based on season and time of day. During the spring, flight direction was, for the most part, evenly distributed between north to south and south to north. However, during the summer, 57% of the observed birds flew north to south and during the fall, 54% flew south to north. This discrepancy, while small, could indicate a larger abundance of birds migrating through the area during these periods.

Cumulatively, a greater percentage of birds flew from north to south in the evening and from south to north in the morning. This phenomenon is particularly exaggerated in the fall, and is believed to be the result of birds (namely Double-crested cormorants, discussed further in section 6.5) nesting or roosting in the south traveling to feeding grounds in the north. Overall, an equal percentage flew in both directions.

Figure 2 shows the height at crossing as birds crossed the Auld's Cove power lines throughout each season and cumulative totals. The height of crossing was divided into the following categories relative to existing NSPI infrastructure:

- skimming the water;
- well below lines;
- just below lines;
- through lines;
- just above lines; and
- well above lines.

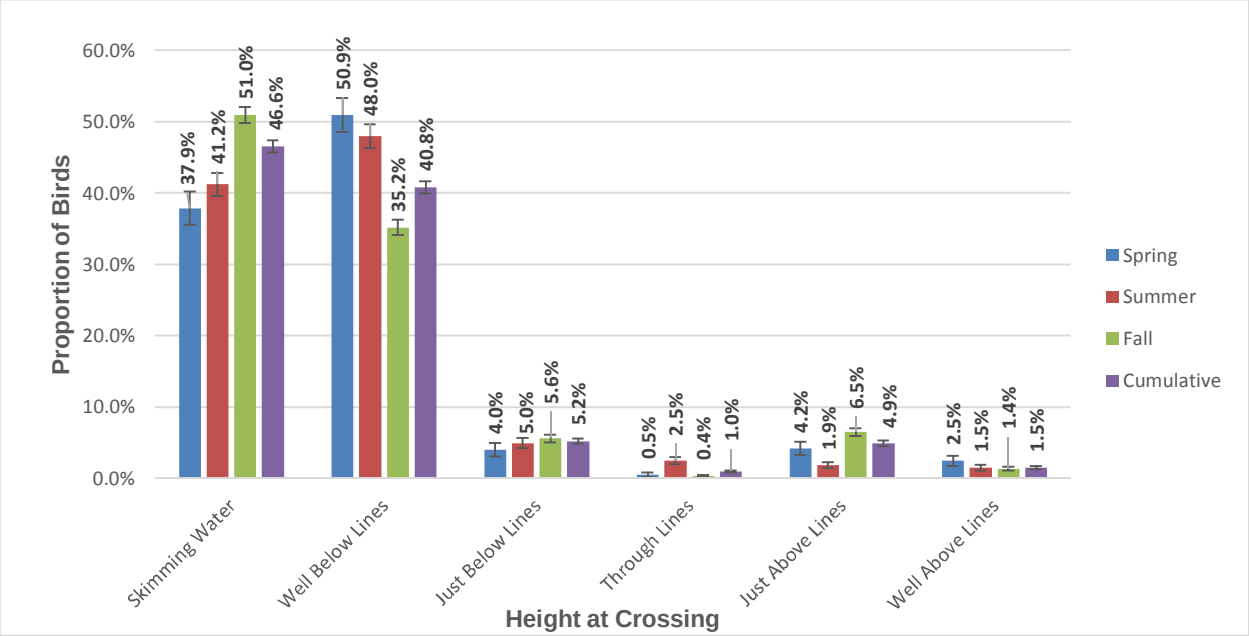

Figure 2. Height at crossing at the Auld's Cove power lines with 95% confidence intervals

The trends in the height at which birds crossed the Auld's Cove power lines was for the most part consistent from season to season. The vast majority (87.4% ± 0.9%, 95% CI) of birds fly either well below the lines or skim the water. Another 5.2% (± 0.4%, 95% CI) of birds cross just below the lines and 4.9% (± 0.4%, 95% CI) of birds cross just above the lines. Only 1.5% (± 0.2%, 95% CI) and 1.0% (± 0.2%, 95% CI) cross well above the lines, or through the lines.

The numbers of birds skimming the water as they cross beneath the lines is almost exclusively due to the species specific behaviour of Double-crested cormorants, which were by far the most abundant species observed at Auld's Cove (37% of all birds observed). 75% (75% ± 1%, 95% CI) of the Double-crested Cormorants observed crossing beneath the power lines were skimming the water as they did so.

Throughout the year, birds that crossed just below, through, or just above the power lines were most consistently larger gull species (e.g. Herring Gulls and Great Black-backed Gulls, discussed further in Section 6.5.). These birds crossed the power lines for the most part in solitude, or in small groups of usually no more than 4 to 5 individuals. During the spring and fall migratory periods, Double-crested Cormorants traveled in flocks of usually between 10-20 individuals. These flocks, for the most part, skimmed the water as they crossed the power lines, but they would occasionally fly at a height where they had to manoeuver to go just under, through, or over the power lines. These instances occurred rarely and typically during high wind conditions, or when the Strait of Canso was ice covered.

Figure 3 indicates the areas where birds crossed the Auld's Cove power lines, throughout each season and cumulatively. Seven areas of crossing were evenly distributed across the Strait of Canso in the vicinity of NSPI infrastructure. Drawing 4 (Appendix A) illustrates the approximate delineations of each crossing location relative to the Auld's Cove diurnal surveys.

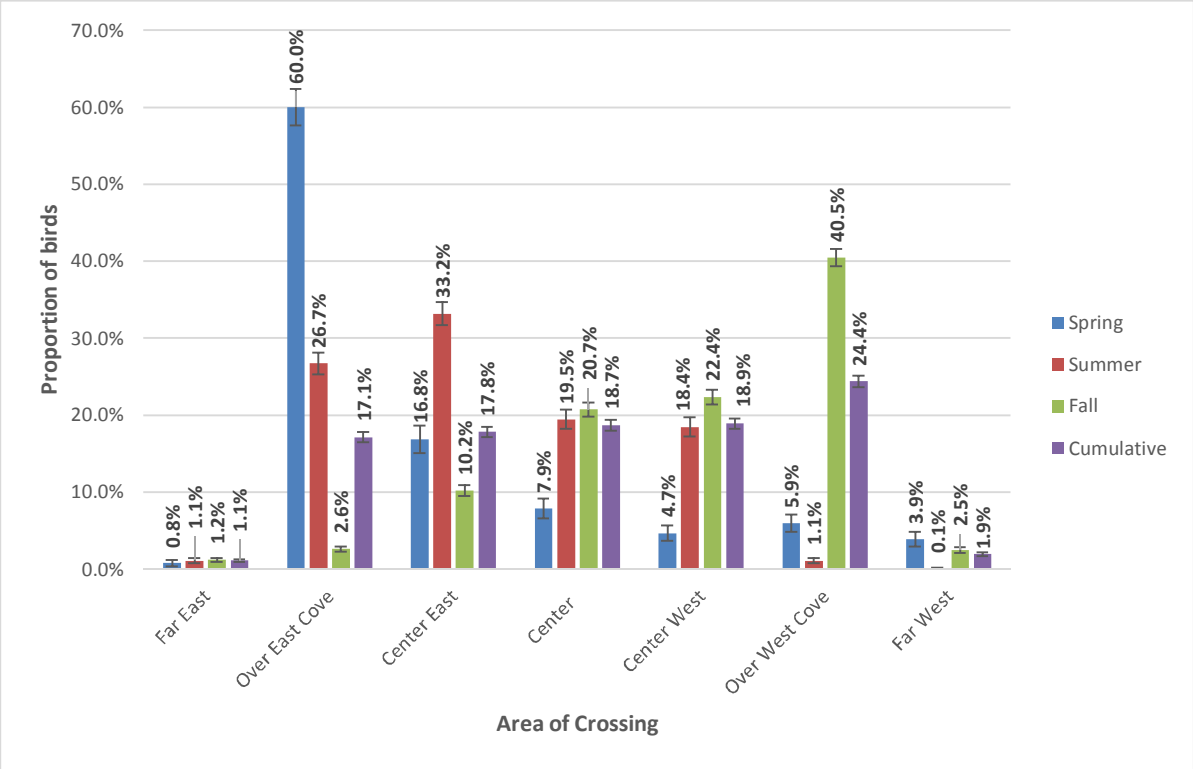

Figure 3. Area of Crossing at the Auld's Cove power lines with 95% confidence intervals

Cumulatively, a relatively equal portion of birds crossed the Auld's Cove power lines over Long Pond (east cove), and over the three areas of the Strait of Canso itself (center east, center, and center west). These trends varied seasonally as a result of the presence of different bird species foraging in varied areas of the Strait. For example, more birds were observed to cross the power lines over Long Pond (east cove) in the spring and summer than in the fall. This corresponded to the nesting period of the colony of Common Terns on a small island in Long Pond, discussed further in Section 6.5. These birds then moved out of the area before the end of the summer period.

Very few birds were observed to have crossed the Auld's Cove power lines overland on either side of the Strait (far east or far west). These areas are likely somewhat under-represented as making visual observations of flying birds is more difficult against a forested terrain backdrop, especially at long range.

The cumulative data suggest that the majority of crossings occurred over Archie Pond (West Cove), however, the seasonal data shows that this is heavily skewed by the numbers of crossings observed in the fall period in that location. This trend is due to the species specific behaviour of Double-crested Cormorants and Bonaparte's Gulls (which cumulatively were the two most abundant species in the area, accounting for 57% of all birds observed during the diurnal watch surveys). Large flocks of several hundred birds were observed to forage on stocks of bait fish shoaling within Long Pond (east cove) during the fall period. These flocks crossed under the power lines several times per hour during the morning hours in fall. The same trend was not observed in the evening however, suggesting that the trend is possibly related to tide and/or fish presence. The birds comprising these flocks were either skimming the water or flying well below the Auld's Cove power lines. There were no observable interactions between these foraging bird flocks and NSPI infrastructure.

6.2.2 Canso Causeway

A total of 12,715 birds were observed during the Diurnal Surveys conducted from the beginning of July to the end of October at the Canso Causeway study area (note that diurnal watch surveys did not begin until July 2nd); 4,869 birds during the summer, and 7,846 during the fall. Of these birds, 5,596 were observed in the evening and 7,119 birds were observed in the morning.

When compared to the same periods (summer and fall), at the Auld's Cove study area, approximately the same number of birds were observed to have crossed the power lines during these periods combined (12,264 at Auld's Cove and 12,715 at the Canso Causeway). However, when distinguished by the season, there were 27% more birds observed to have crossed the power lines at the Canso Causeway during the summer, and 7.5% more birds observed to have crossed the power lines at the Auld's Cove location in the fall. The discrepancies between the numbers of crossings observed at these two locations can likely be attributed to changes in food sources throughout the season. During the summer, the Canso Causeway appeared to be a lucrative feeding ground, but during the fall, areas adjacent to Auld's Cove (particularly within Archie's Pond) appeared to host shoals of bait fish, attracting birds away from the Causeway.

6.2.2.1 Species Composition

A total of 55 species were observed at the Canso Causeway study area during Diurnal Surveys. The most frequently observed species was the Double-crested Cormorant, composing 73% of the total number of birds observed (Table 5) (Figure E2, Appendix E). The next most frequent species were Common Terns (6%), Herring Gulls (5%) and Great Black-backed Gulls (4%). Although not frequently observed during the summer, during the fall, Bonaparte's Gulls consisted of 4% of the total number of birds observed during the fall.

Table 5. Most Commonly Observed Birds during Diurnal Surveys at the Canso Causeway

Common Name	Scientific Name	Guild	Total Birds Observed	
			Number	Percentage
Double-crested Cormorant	*Phalacrocorax auritus*	Cormorants	9254	73%
Common Tern	*Sterna hirundo*	Terns	700	6%
Herring Gull	*Larus argentatus*	Sea Gulls	571	5%
Great Black-backed Gull	*Larus marinus*	Sea Gulls	529	4%
Gull sp.	*Larus sp.*	Sea Gulls	340	3%
Bonaparte's Gull	*Chroicocephalus philadelphia*	Sea Gulls	328	3%
Northern Gannet	*Morus bassanus*	Northern Gannet	198	2%
Common Eider	*Somateria mollissima*	Sea Ducks and Waterfowl	135	1%
American Robin	*Turdus migratorius*	Passerine/Raptors	100	1%
Bald Eagle	*Haliaeetus leucocephalus*	Passerine/Raptors	93	1%

The most commonly observed guilds were Cormorants (73% of total observed, 1 species), followed by Gulls (14%, 6 species) and Terns (6%, 1 species) (Table 6). When compared to the Auld's Cove location, the most abundantly observed species (Double-crested cormorants, Common terns Bonepart's gulls, and Herring gulls) were consistent. In addition, the number of species observed was consistent between the locations, with 55 species being observed to cross the Canso Causeway power lines and 60 being observed to cross the Auld's Cove power lines.

Table 6. Total Number of Observed Birds by Guild at the Canso Causeway

Guild	Total Number Observed	Percentage	Number of Species
Cormorants	9254	73%	1
Gulls	1795	14%	6
Terns	700	6%	1
Passerines/Raptors	344	3%	21
Sea Ducks and Waterfowl	288	2%	12
Northern Gannet	198	2%	1
Shorebirds	108	<1%	8
Seabirds	17	<1%	4

6.2.2.2 Diurnal Movement Patterns

Movement patterns were documented as each bird passed across the power lines during the diurnal surveys at Canso Causeway. Patterns recorded included the direction of flight, area of crossing, and height at crossing.

Figure 4 indicates the direction of flight of the birds and flocks of birds observed as they passed across the power lines during the diurnal watch surveys at the Canso Causeway. As previously discussed, direction of flight (*i.e.* north to south) was used as simple metric to describe if the birds

were traveling away from, or towards, the Port Hawkesbury / Point Tupper area as they crossed the power lines.

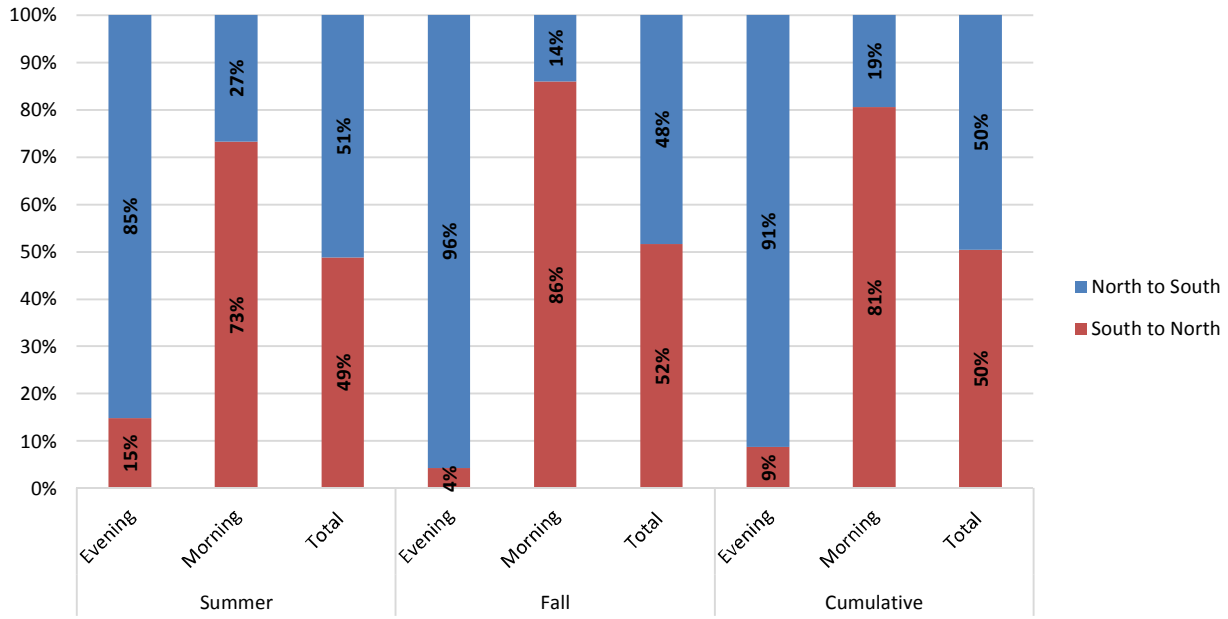

Figure 4. Direction of bird flight at the Canso Causeway power lines

Direction of flight appears to vary based on time of day at the Canso Causeway. Irrespective of the season, a greater percentage of observed bird crossings in the evening were from the north to the south, and in the morning the opposite flight direction was observed. Flight direction was evenly distributed when results from morning and evening surveys are combined. These data indicate that large numbers of birds tend to move from nesting or roosting areas in the south to forage north of the Canso Causeway during the day, and return to the south in the evening. The main species responsible for this phenomenon is the Double-crested Cormorant, which move en-mass from roosting areas in the south to forage in the Auld's Cove area. A trend that is particularly exaggerated in the fall when thousands of Cormorants have been observed in the area (Strum 2014). A similar, yet less exaggerated trend was observed at the Auld's Cove location during the summer and fall as well. The likely explanation for the increased exaggeration in this trend at the Canso Causeway than at Auld's Cove is because there are a greater number of birds in the area of the Canso Causeway, most likely attributable to lucrative foraging areas for seabirds like cormorants and gulls.

Figure 5 shows the height at which birds crossed the Canso Causeway power lines. Apart from "skimming the water" the height of crossing was divided into the same categories as those used for Auld's Cove. Due to the presence of the causeway, skimming the water was not an option for birds

at this location. As discussed in Section 5.1, instances in which the bird was observed to have passed 'just below', 'through', or 'just above' the power lines are considered high risk interactions.

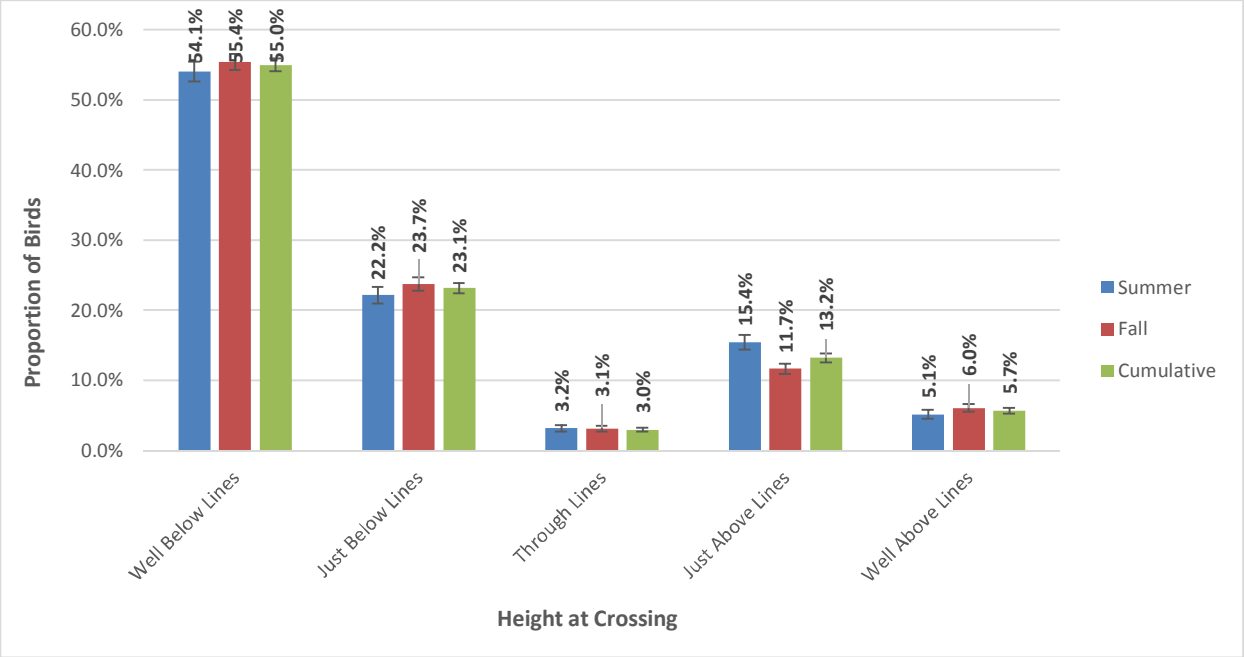

Figure 5. Height of birds at crossing of power lines at Canso Causeway with 95% confidence intervals

The majority of birds (55.0% ± 0.9%, 95% CI) observed crossing the Canso Causeway power lines crossed well below them. Another 23.1% (± 0.8%, 95% CI) of birds crossed just below, and 13.2% (± 0.6%, 95% CI) crossed just above. 3.0% (± 0.3%, 95% CI) of birds crossed through the power lines, and 5.7% (± 0.4%, 95% CI) crossed well above. These trends hold more or less throughout each season.

Like at Auld's Cove, the majority of birds passed below the power lines, but proportionately, more birds passed 'just below' (23.1% at the Canso Causeway compared to 5.2% at Auld's Cove) 'through' (3% compared to 1%), 'just above' (13.2% compared to 4.9%) or well above' (5.7% compared to 1.5%) the power lines than at Auld's Cove. In each case there is approximately a 3-4 fold increase in the number of birds taking higher flight paths relative to the power lines at the Canso Causeway than at Auld's Cove. This trend is likely due to the lower height of the Canso Causeway power lines. The lower hanging power lines were observed to be more intrusive to the birds passing through the area, than at the Auld's Cove location.

Figure 6 indicates the locations where birds crossed the Canso Causeway power lines, throughout each season and cumulatively. Five areas of crossing were evenly distributed across the Canso

Causeway in the vicinity of NSPI infrastructure. Drawing 4 (Appendix A) illustrates the approximate delineations of each crossing location relative to the Canso Causeway diurnal surveys.

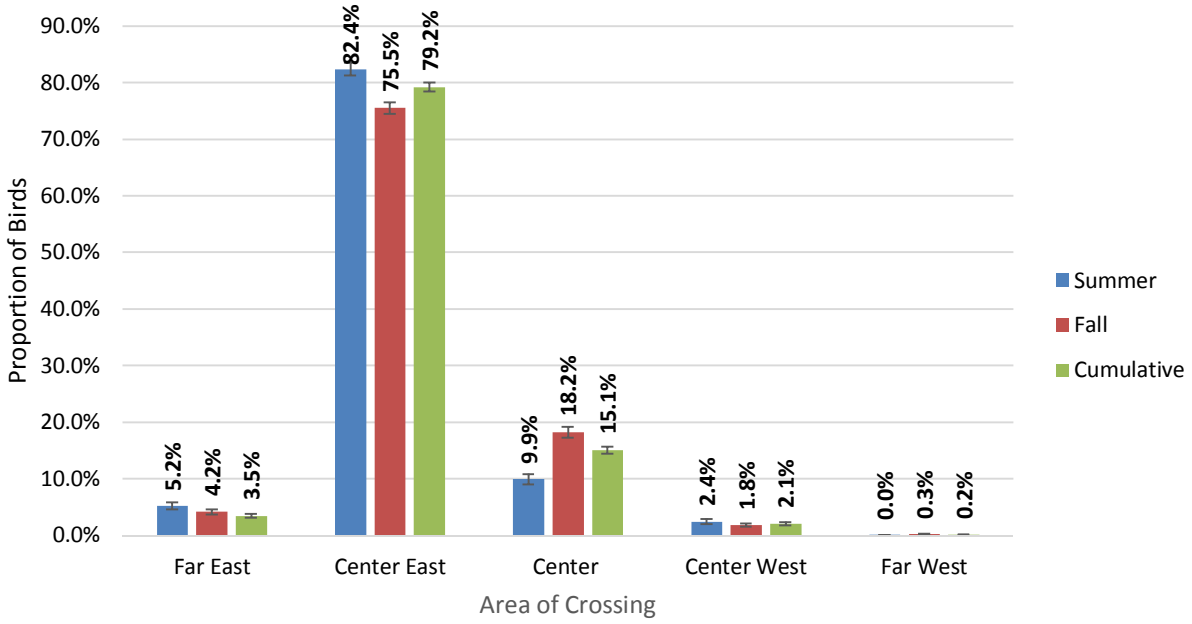

Figure 6. Area of crossing at Canso Causeway with 95% confidence intervals

The vast majority (79.2% ± 0.8%, 95% CI) of birds were observed to cross the Canso Causeway power lines in the center east, and for the most part channel to the immediate southwest of the tower installed on Balache Point, where the powerlines are highest. Another 15.1% (± 0.7%, 95% CI) crossed in the center, and significantly fewer at other areas of the power lines. This is likely because the power lines are higher in the center east of the Causeway, creating a funnel where birds can pass through at a relatively safe distance from the power lines above, and the Causeway's vehicle traffic below. The same trend was observed during the 2014 surveys at the Canso Causeway (Strum 2014).

6.3 Seabird and Shorebird Nesting and Breeding Surveys

Key coastal habitats in the Strait of Canso area were surveyed to characterize the seabird and shorebird community, with consideration afforded to the effects of the tidal cycle on roosting and foraging behaviour. Survey areas focused on two coastal ponds, Long Pond and Archie's Pond, situated alongside the eastern and western shoreline of the Strait of Canso, respectively.

6.3.1 Terns

An active Common Tern colony was observed on an island in the middle of Long Pond. July surveys revealed the nesting period had already begun, with an estimated 20-30 pairs of terns observed, and approximately 60-80 adult terns in colony. In July, tern activity in Long Pond was high, with terns commonly observed dispersing from the island to forage and returning to the colony,

presumably feeding their young. Several juveniles were noted emerging from the tall grass. Many terns were observed roosting on exposed gravel bars just north of the island and feeding by the bridge situated at the mouth of Long Pond. Numbers of juveniles increased into August, several of which were observed on exposed rocks and gravel bars surrounding Long Pond. An Arctic Tern (*Sterna paradisaea*) was observed near the colony on several occasions in July and August. Tern activity diminished into September, with 20-25 terns recorded on September 3, half of which were juveniles, and no terns were observed during the September 24 survey.

While the majority of tern activity occurred in the vicinity of Long Pond, a few were noted, on occasion, feeding in Archie's Pond and roosting on rocks just outside of the pond. Several juveniles were present perched on exposed rocks outside of Archie's Pond in July.

6.3.2 Shorebirds

6.3.2.1 Archie's Pond

A total of 24 bird species were observed in the vicinity of Archie's Pond during the seabird and shorebird surveys. Spotted Sandpipers (*Actitis macularius*) and Willets (*Tringa semipalmata*) were observed at Archie's Pond from early July, but neither were confirmed as breeding. Several other species were observed roosting on the rock bar surrounding the pond or feeding in the pond including Killdeer (*Charadrius vociferus*), Least Sandpiper (*Calidris minutilla*), Semipalmated Sandpiper (*Calidris pusilla*), Greater Yellowlegs (*Tringa melanoleuca*), and Semipalmated Plover (*Charadrius semipalmatus*). Up to 30 Semipalmated Plovers were observed roosting on the rock bar. Other birds of interest using the area include Belted Kingfishers, Bonaparte's Gulls, and fledged young Red-breasted Mergansers (*Mergus serrator*), which are an uncommon breeding bird in Nova Scotia (Chris Pepper, personal communication).

A significant increase in Bonaparte's Gulls was noted in mid-September, with hundreds recorded roosting on gravel bars exposed by low tide in September/October.

SOCI observed in the vicinity of Archie's Pond included the following:

- Greater Yellowlegs;
- Killdeer;
- Savannah Sparrow (*Passerculus sandwichensis)*;
- Semipalmated Sandpiper;
- Spotted Sandpiper;
- Tree Swallow (*Tachycineta bicolor)*;
- Whimbrel (*Numenius phaeopus*); and
- Willet.

A discussion of the above noted SOCI is provided in Section 6.6.

6.3.2.2 Long Pond

A total of 32 bird species were observed in the vicinity of Long Pond during the seabird and shorebird surveys. Spotted Sandpipers were confirmed as breeding at Long Pond (observed with fledged young). Willets displayed behaviour indicating they attempted to nest (agitated, consistently dive bombing) but no nests or fledged young birds were observed, suggesting the nest was possibly predated. Long Pond appears to offer ample feeding opportunities during low tide and an area to roost at all tide levels. A larger variety of shorebird species were observed here including Semipalmated Sandpiper, Semipalmated Plover, Least Sandpiper, Lesser Yellowlegs (*Tringa flavipes*), Greater Yellowlegs, Short-billed Dowitcher (*Limnodromus griseus*), Ruddy Turnstone (*Arenaria interpres*), Baird's Sandpiper (*Calidris bairdii*) [uncommon in NS (Chris Pepper, personal communication)], and Red Knot (*Calidris canutus*). Other species of interest observed utilizing Long Pond include Belted Kingfishers, Red-breasted Mergansers, and Bonaparte's Gulls. A single Chimney Swift (*Chaetura pelagica*) was observed flying low over the pond in rough weather in late August. Chimney Swifts are listed as endangered in NS and vulnerable in Canada.

A significant increase in Double-crested Cormorants and Bonaparte's Gulls were noted in mid-September, with hundreds recorded in Long Pond.

SOCI observed in the vicinity of Long Pond included the following:

- Arctic Tern;
- Chimney Swift;
- Greater Yellowlegs;
- Red Knot;
- Savannah Sparrow;
- Semipalmated Sandpiper;
- Spotted Sandpiper;
- Tree Swallow; and
- Willet.

A discussion of the above noted SOCI is provided in Section 6.6.

6.4 Nocturnal Activity

Nocturnal surveys consisting of acoustic monitoring and visual surveys were completed to characterize nighttime bird activity and potential infrastructure interactions at Auld's Cove and the Canso Causeway.

6.4.1 Acoustic Survey Results

Acoustic monitors were placed at three key locations within the Auld's Cove and the Canso Causeway study areas, with 10 minute recordings every hour between 10:00 pm and 5:00 am from June 11, 2015 until October 31, 2015 were obtained. Monitoring locations are provided on Drawing 3 (Appendix A).

6.4.1.1 Activity

Three nights of recordings were randomly selected from each week to be analyzed for bird activity. Each ten minute segment was rated as having either none, low, moderate, or high bird activity and afforded a corresponding score from 0 to 3 (Table 7). Nightly scores were tallied to provide a weekly activity score.

Table 7: Bird Activity Scoring

Activity Level	Activity Score	Activity Description
None	0	No bird activity
Low	1	One or two birds heard during the 10 minute recording
Moderate	2	3 to 7 birds during the 10 minute recording, moderately active throughout the recording
High	3	Greater than 7 birds, active through the recording

Monthly average activity levels indicate seasonal variation in peak activity hours (Figure 7). During the months of June and July, activity levels are highest at 5 am and lowest between 11 pm and 3 am. This is likely due to the presence of breeding passerines calling continuously during the morning chorus. During the month of August, activity levels were relatively consistent throughout the night, varying slightly, with a peak activity level at 11 pm. During September, peak activity levels were at 11 pm and 12 am, although still high at 2 am and 5 am. This may be due in part to increased nocturnal activity levels as birds migrate through the area. During October, activity levels were consistently low throughout the night.

June and July had the highest average activity levels, recorded at 5 am, again likely due to the morning chorus of breeding songbirds.

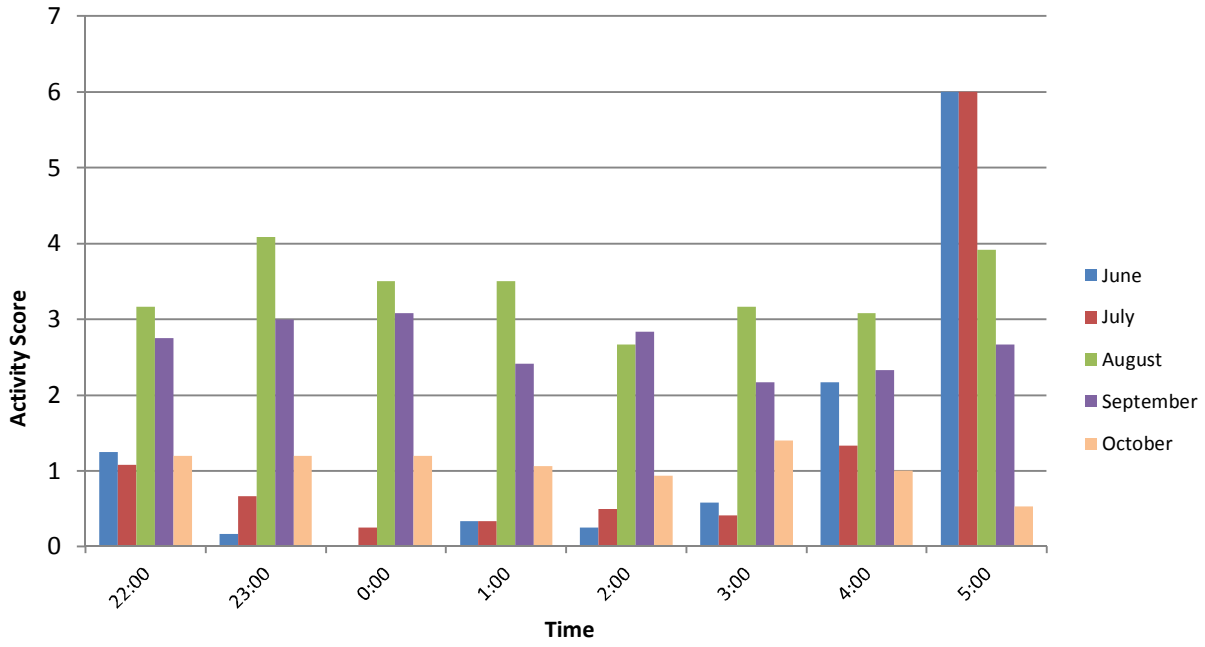

Figure 7. Weekly average of hourly total activity for all sound monitors.

The highest weekly activity levels were observed throughout August, followed closely by September (Figure 8). Comparatively, activity levels throughout June, July, and October were lower. The higher nocturnal activity levels throughout August and September may correspond to migrant birds passing through the area at this time. The high confidence intervals in the weekly averages calculated throughout August and September indicate a high degree of variability in activity levels, which may correspond to migratory waves of birds passing through the area.

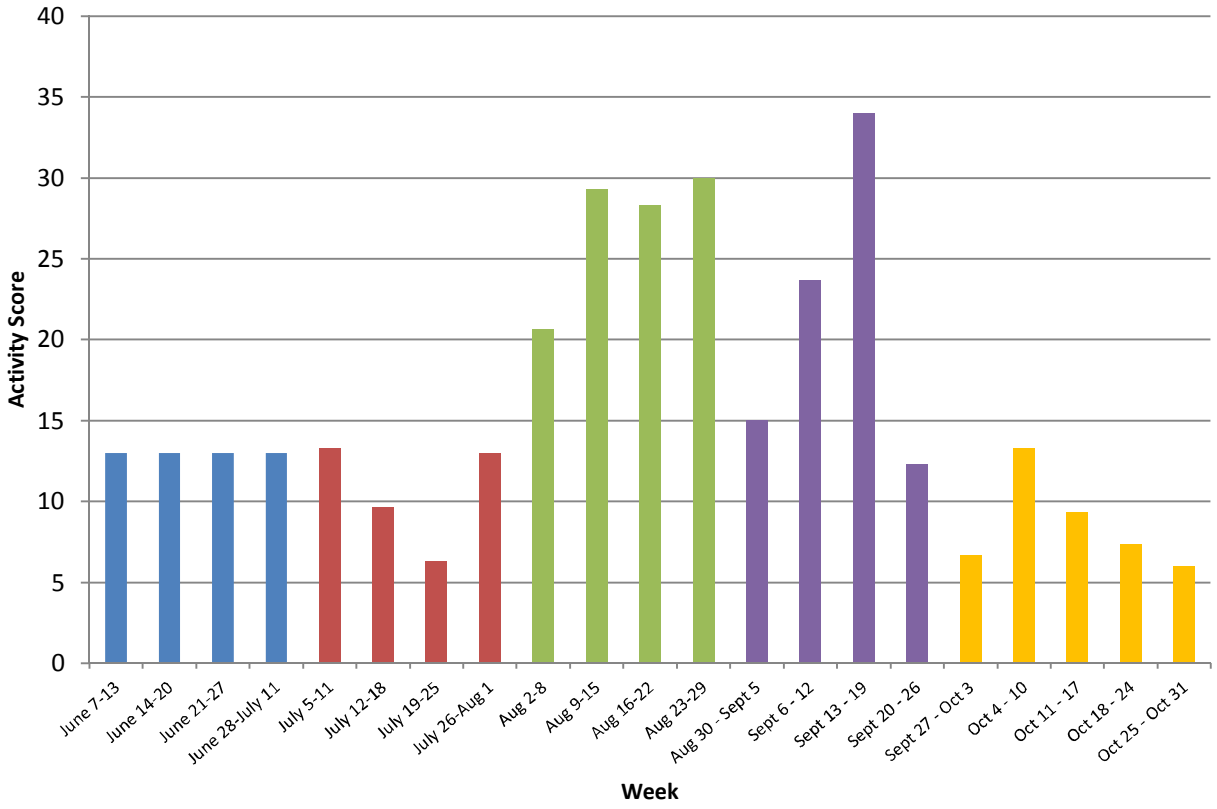

Figure 8. Average weekly total activity for all sounds monitors

6.4.1.2 Species Composition

Species specific identification was also determined during alternate weeks of the monitoring period. A total of 99 hours, spanning 22 weeks of acoustic recordings were analyzed and 46 bird species were identified (Figure 9). Diversity of species present was at its highest during July and June, and decreased progressively into the late summer and fall. The reason for this is likely due in part to the diversity of species in the area decreasing as they begin to migrate to their wintering grounds. Additionally, it becomes more difficult to determine species diversity using acoustic data as the season progresses, as song bird's pair up and stop singing. Therefore, the true diversity is likely somewhat under-represented in the late summer and fall months.

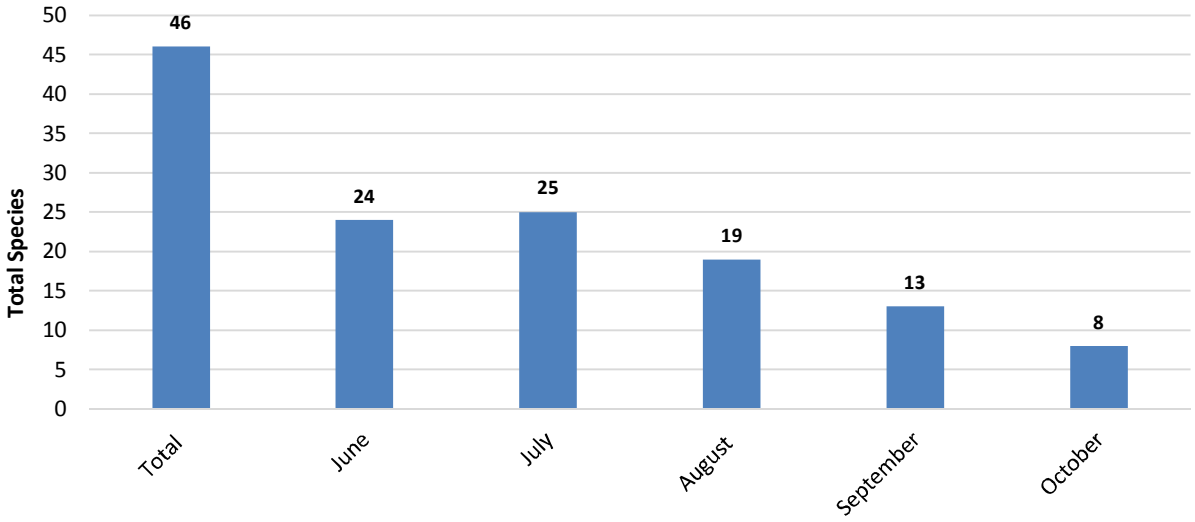

Figure 9. Total bird species per month recorded on all monitors

Throughout the night, the highest number of bird species identified was at 5:00 am (34 species) due to a typical trend of birds being most active immediately after sunrise (Figure 10). The diversity levels observed during the preceding nighttime hours (10:00 PM to 4:00 AM) were comparatively low as activity levels are generally lower at night.

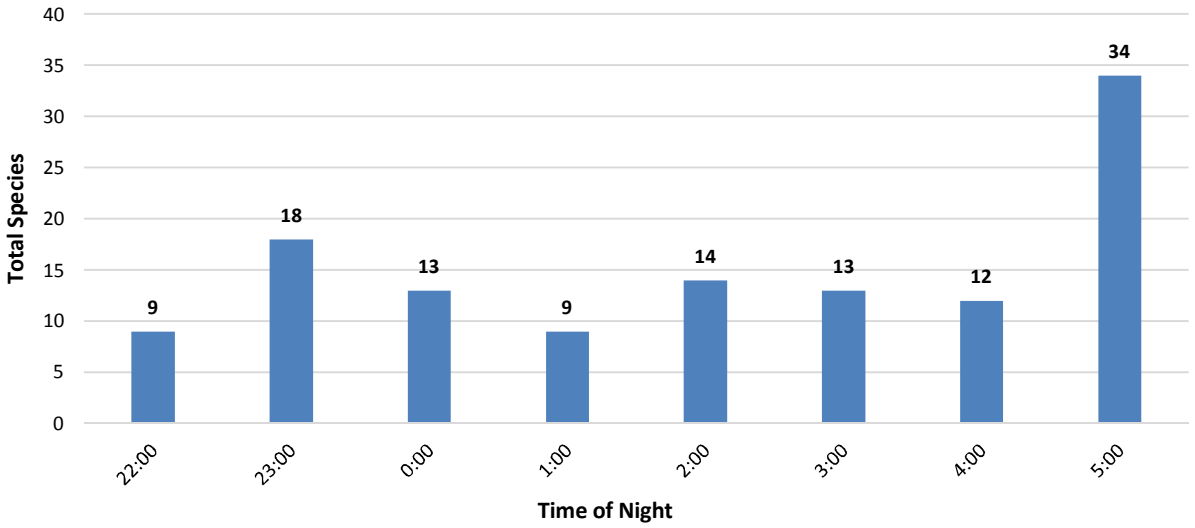

Figure 10. Total bird species per time of night on all monitors

A total of 1349 birds were identified throughout the monitoring period by species composition analysis (Figure 11). The highest numbers of birds were recorded in August, many of which were passerine species (Figure 1a, Appendix F) which may be due to large flocks of passerines migrating

throughout the night. These data support the results of the weekly activity level analysis (displayed in Figure 8).

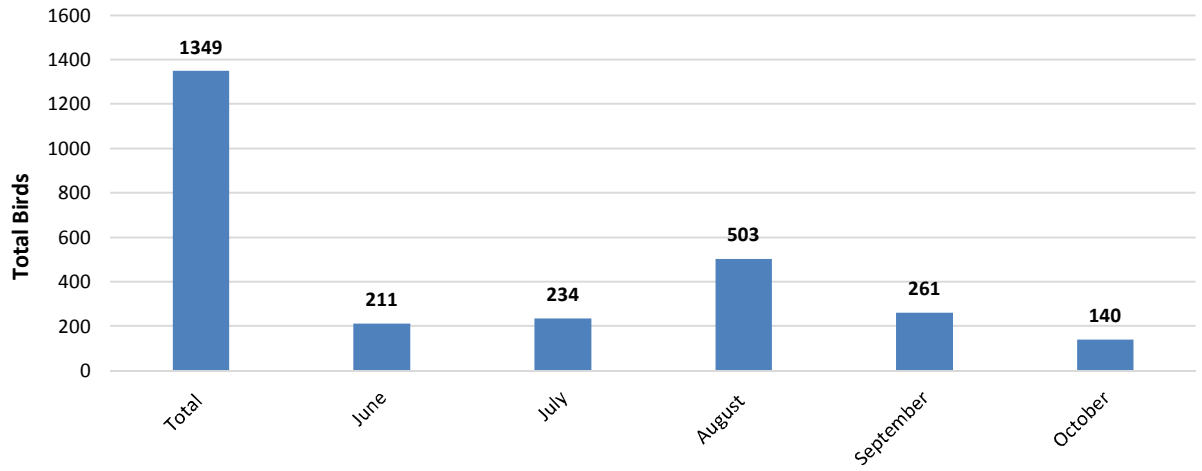

Figure 11. Total birds identified per month on all monitor

Similar to the species count, the highest numbers of birds throughout the monitoring period were identified during the 5:00 am recording period (Figure 12), and the numbers identified over the nighttime hours were comparatively low

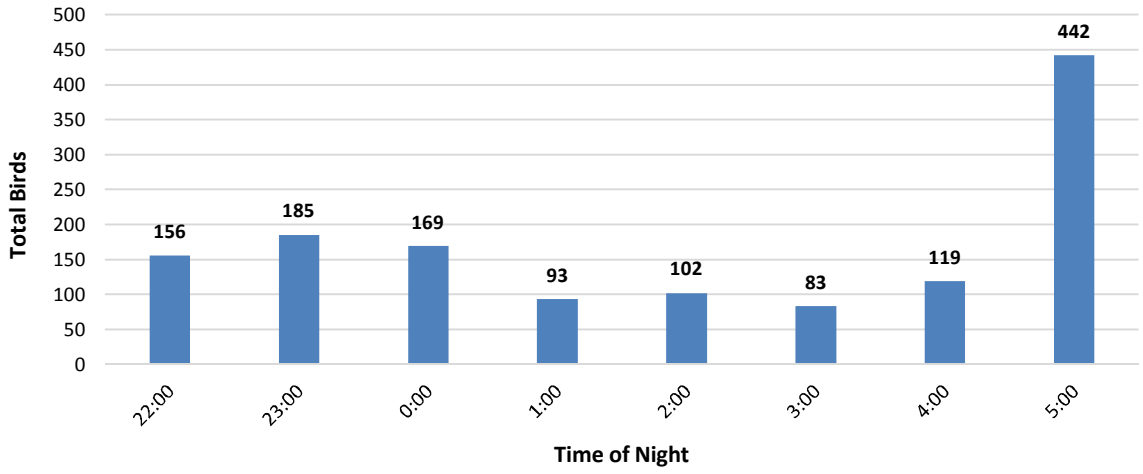

Figure 12. Total birds identified during the night on all monitors

The most frequent type of auditory cue identified on the recordings was "flight calls" totalling 723 (Figure 13). This is followed by call types categorized as 'other' which are all vocalizations that are not flight calls or songs, rather warning calls and begging calls. Passerine species accounted for the

highest number of flight calls, and the Common tern accounted for the highest number of other calls (Figure 1b, Appendix F).

Flight calls were most abundant during the month of August which coincides with the start of the fall migration period. Passerine songs were most abundant during the breeding season in June and July, and were not recorded at all during September and October, as summering passerine species began to migrate away from the area.

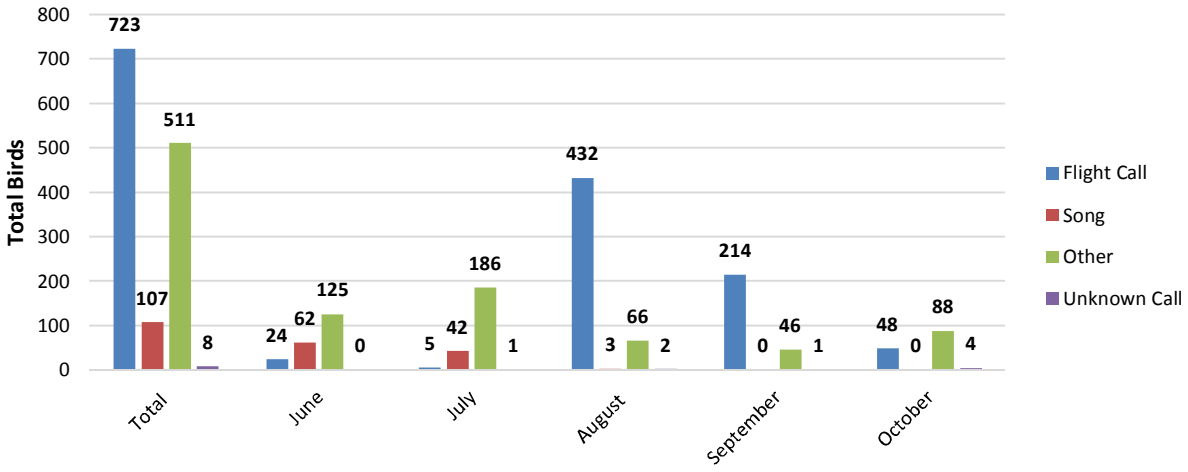

Figure 13. Total call types identified on all monitors

Flight calls were more abundant during the early hours of the night, between 10:00 pm and 12:00 am, suggesting that this is when most nighttime migration occurs (Figure 14). Passerine songs and other calls were most abundant at 5:00 am, coinciding with early morning activity.

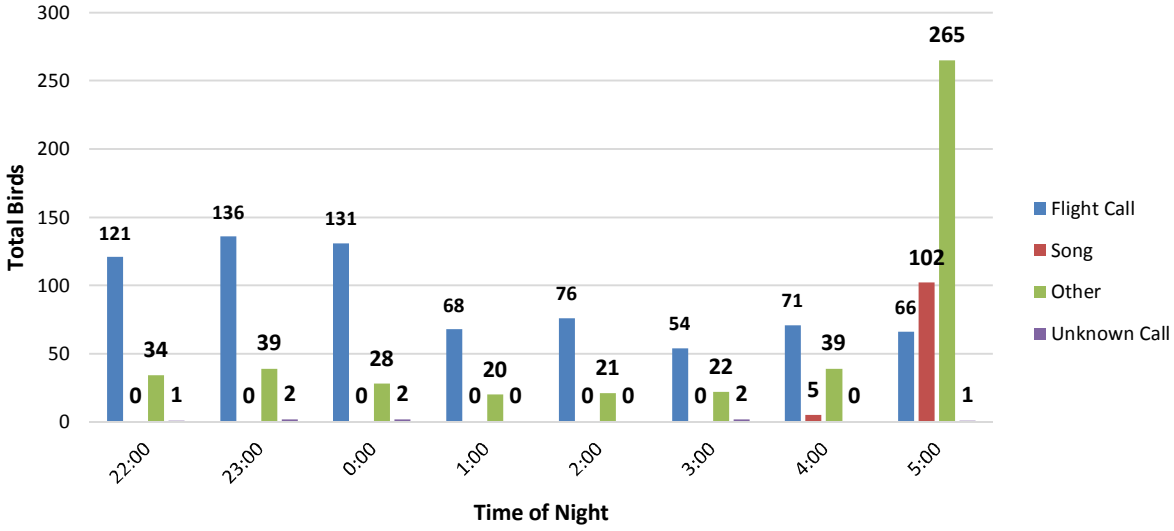

Figure 14. Total call types identified throughout the night on all monitors

6.4.2 Nocturnal Auditory and Visual Bird Survey Results

Nocturnal surveys were completed at the Auld's Cove study area in October, 2015 and consisted of six surveys: three post dusk surveys between 7:30 pm and 11:30 pm and three pre-dawn surveys between 3:00 am and 7:00 am. Each survey consisted of an auditory identification component and a visual observation component using a thermal imaging monocular.

6.4.2.1 Auditory Results

A total of 44 birds composed of 15 species were identified during the nocturnal auditory surveys (Table 8). Identified birds consisted of passerines, sea ducks, and waterfowl and seabirds.

Table 8. Nocturnal auditory and visual observation survey results

Bird Species	Guild	Number of Birds Identified (Auditory)	Number of Birds Identified (Visual)
American Black Duck	Sea Duck and Waterfowl	11	0
Duck sp.	Sea Duck and Waterfowl	0	5
Great Black backed Gull	Gull	2	0
Great Blue Heron	Sea Duck and Waterfowl	2	0
Hermit Thrush	Passerine/Raptors	2	0
Gull Sp.	Gull	2	51
Herring Gull	Gull	1	0
Northern Gannet	Northern Gannet	0	5
Passerine Sp.	Passerine/Raptors	4	0
Rock Pigeon	Passerine/Raptors	1	0
Savannah Sparrow	Passerine/Raptors	1	0
Semipalmated Plover	Seabird	2	0
Song Sparrow	Passerine/Raptors	2	0
Sparrow Sp.	Passerine/Raptors	9	0
Unknown sp.	Unknown	3	15
Warbler Sp.	Passerine/Raptors	1	0
Yellow-rumped Warbler	Passerine/Raptors	1	0
Total Birds		**44**	**76**

6.4.2.2 Nocturnal visual observation survey results

A total of 76 birds were observed during nocturnal surveys, of which many were unidentifiable to species level (Table 8). The most abundantly observed were gulls, followed by unidentified species. Most of the observed birds crossed the lines at center east or center (Figure 15 and Drawing 4, Appendix A) just beneath the lines, or just above the lines hence categorizing them as high risk interactions (Figure 16).

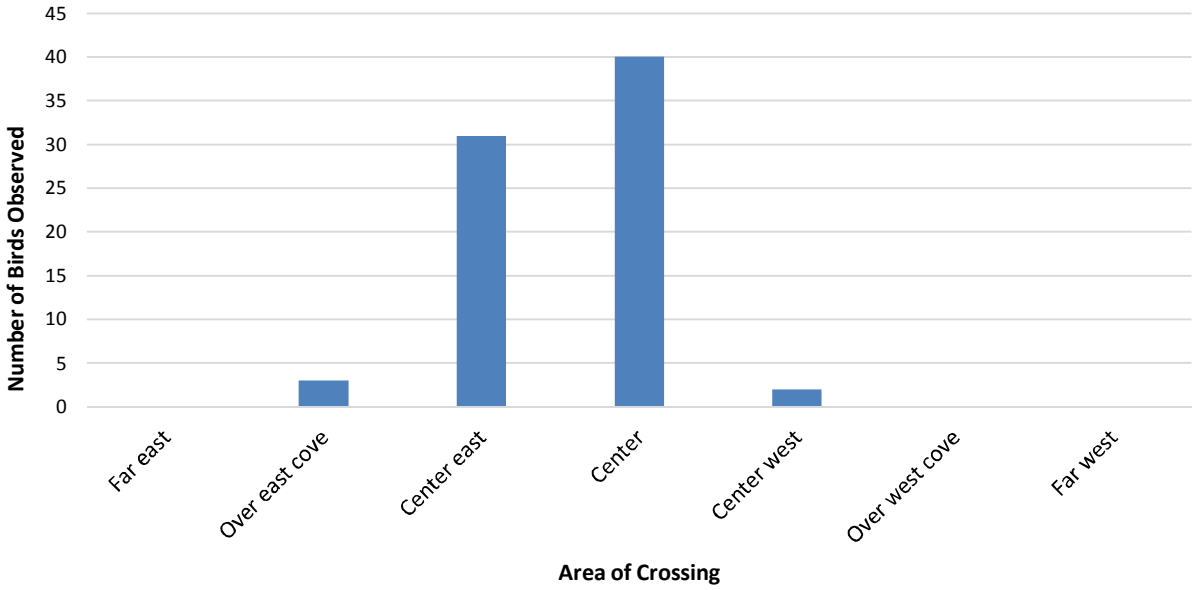

Figure 15. Area of crossing of birds observed during nocturnal surveys at Auld's Cove

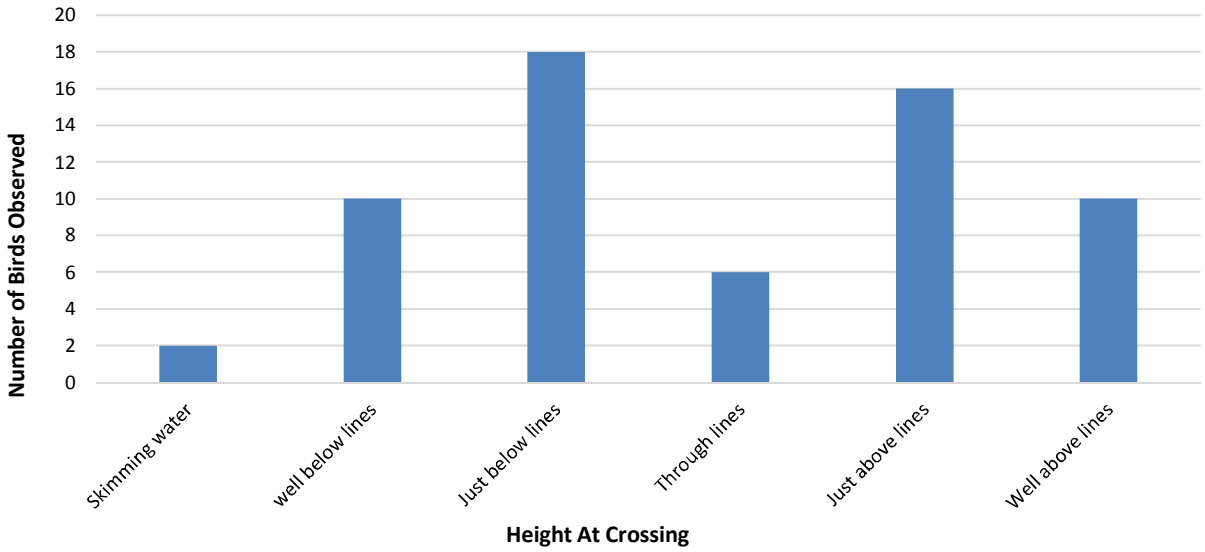

Figure 16. Height at crossing of birds observed during nocturnal surveys at Auld's Cove

46 % (±11%, 95% CI) of the total birds observed during nocturnal surveys interacted with the power lines at Auld's Cove (Figure 17). This indicates that on average, nocturnal interaction rates appear to be higher than diurnal interaction rates. However, it should also be noted that visual limitations of the scope did not allow for a full viewscape as experienced during the day and, therefore, nocturnal observations may be biased towards those birds directly in line with the scope which was oriented at the lines. It is possible that birds skimming the water or flying well above the lines were not captured with the scope and the results are thus skewed towards a higher proportion of interactions. Additionally, the number of nocturnal visual observations is limited by a small sample size (only 76 individual birds observed). Caution is urged in relying on the nocturnal visual survey data as confidence in it is somewhat low, and the nocturnal visual survey approach is inherent with limitations. No collisions or mortalities were observed during the nocturnal surveys.

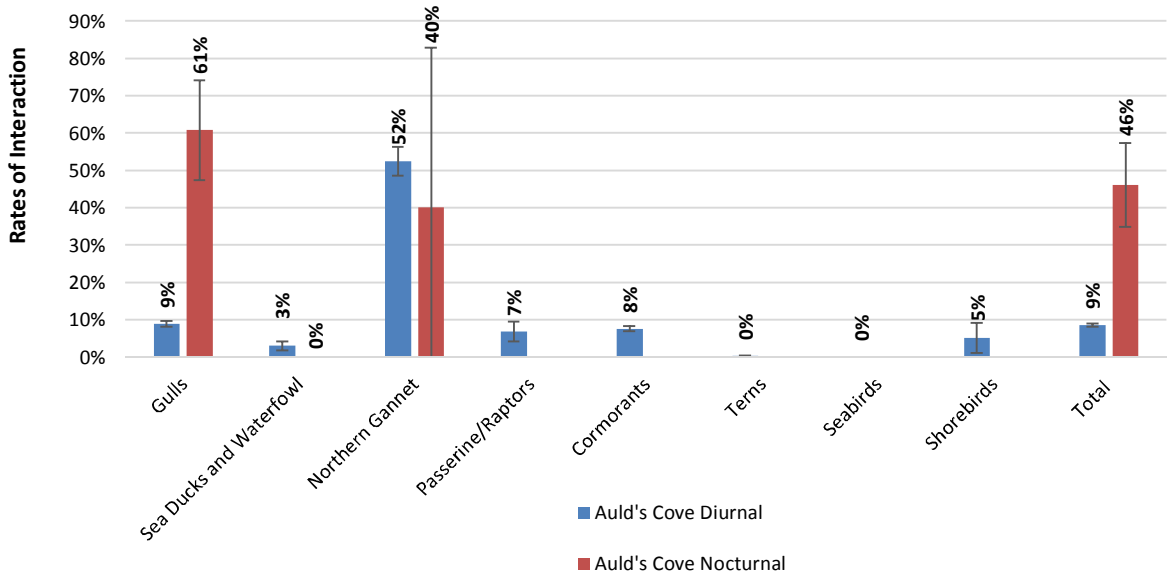

Figure 17. Rates of interaction per guild for diurnal and nocturnal surveys at Auld's Cove with 95% confidence intervals

The nocturnal surveys did show that there is significantly lower bird activity at night than there is during the day. Inclusive of the nocturnal visual surveys, and the nocturnal auditory surveys, there was an average of 6 birds observed per hour (120 birds observed per 18 hours of survey effort at Auld's Cove). Comparatively, based on the data collected during the diurnal surveys, there was an average of 76 birds observed per hour (14,613 birds observed in 200 hours of survey effort at Auld's Cove). This indicates that despite the potentially higher interaction rates at night, there are significantly fewer birds moving though the Auld's Cove area at night than there are during the day, so instances of collision of mortality are likely to be uncommon at night.

In addition to the quantifiable data provided by the nocturnal visual surveys, there were some anecdotes collected by the surveyors that have some relevance. Of the birds observed flying near the powerlines (the majority [80%] were gulls), effectively all of them exhibited some sort of avoidance behaviour around the power lines. That is, the birds were observed to alter their flight pattern to avoid the power lines by diving, under them or circling until they had the altitude to pass over them. This indicates that despite the low light conditions at night, the birds observed (primarily gulls) appeared to have the ability to perceive the powerlines and avoid them, just as they typically would do during the day. While it should not be considered more than an anecdote, this observed trend does indicate that instances of collisions or mortality at night may be rare.

6.5 Infrastructure Interaction Study

Interaction and behavioural responses of birds and existing power line infrastructure at Auld's Cove and the Canso Causeway were recorded during all surveys completed for the Study. In addition, targeted watch count surveys were conducted at the Auld's Cove power lines from August to October 2015. Watch count surveys consisted of a morning and afternoon watch period accounting for a total of 6 to 8 hours per day, completed three days a week. A suitable vantage point at Auld's Cove location was selected providing an unobstructed view of the existing NSPI infrastructure.

Observations related to bird behaviour and interactions for each guild/species is discussed for the Auld's Cove and Canso Causeway study areas. Overall results specific to the watch count surveys and diurnal surveys are discussed independently in section 6.5.1, whereas species specific commentary is included for the entire study within sections 6.5.1.1-6.5.1.8.

6.5.1 Auld's Cove

Watch Count Surveys

A total of 29 targeted watch count surveys (198 total survey hours) were completed at the Auld's Cove location from August 24 until October 30. During these surveys, one near miss was observed on October 23 as a seagull travelling north to south crossing near the centre of the power lines came in close contact with the lower power line. Weather conditions may have been a contributing factor for this incident, with the presence of heavy fog/cloud cover occurring. No additional interactions were observed.

Seagulls and cormorants were the most commonly observed flocks passing the Auld's Cove lines during the targeted watch count surveys. Avian activity appeared greatest during the morning surveys, immediately following sunrise, with overall activity increasing in September and furthermore into October.

The majority of birds recorded were travelling south to north, centre west, either skimming the water or flying well below the lines.

Diurnal Surveys

During Diurnal Watch Surveys, 1253 birds and 18 species were observed to interact with the Auld's Cove power lines (Figure 18). As stated in section 5.1.4, an interaction is described as any bird whose behaviour changed due to the presence of the power lines and could include turning around or hesitating before crossing the lines. High Risk Interactions were viewed as interactions where the bird crossed just below the lines, through the lines or just above the lines as the risk for collision increased. High risk interactions accounted for 75.4% (±2.4%, 95% CI) of interactions observed, for a total of 945 high risk interactions out of 1253 total interactions.

Figure 18 shows the number of interactions observed during diurnal surveys at the Auld's Cove power lines.

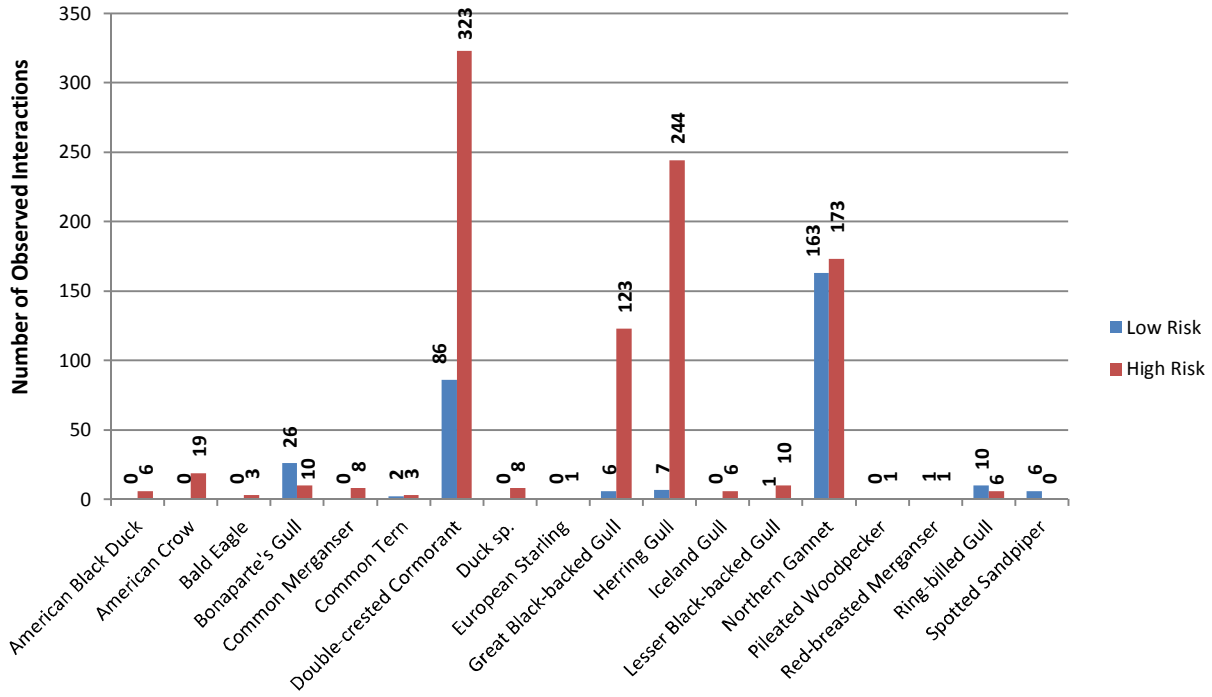

Figure 18. Observed interactions at Auld's Cove during Diurnal Bird Surveys

A total of 18 species were observed to interact with the Auld's Cove power lines during the Diurnal Movement Surveys at Auld's Cove. Northern Gannets had the highest rate of interaction of any of the guilds at 52.4% (± 3.9%, 95% CI) (Figure 19). Gulls had the next highest rate of interaction, with 8.9% (± 0.8%, 95% CI) of gulls who crossed the line interacting with it. Seabirds did not interact with the lines at all and only 0.2% (±0.2%, 95% CI) of terns interacted. The vast majority of interactions fell under the category of high risk interaction (the bird or flock of birds passed 'just below', 'through' or 'just above' the power lines).

Figure 19 (below) shows the rates as a percentage at which each guild interacted with the Auld's Cove powerlines. The rate of interaction metric represents the proportion of birds in each guild that were observed to interact with the Auld's Cove power lines as they crossed them.

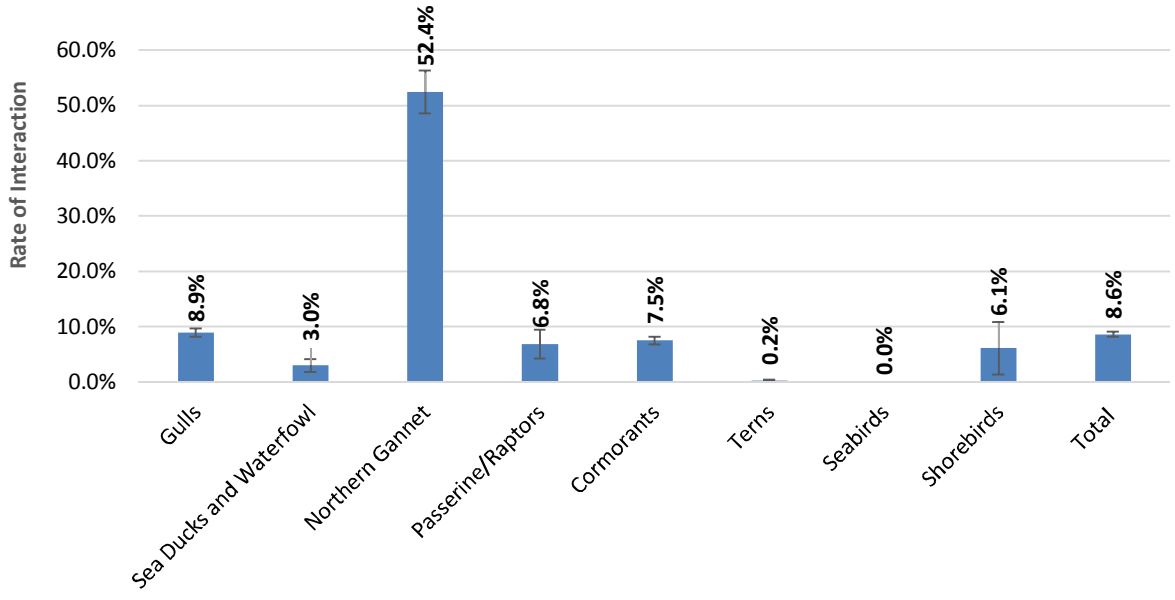

Figure 19. Rates of interaction for each guild with the Auld's Cove power lines with 95% confidence intervals

Northern gannets had the highest rate of interaction with the Auld's Cove power lines. Gulls, passerines, and cormorants each had interaction rates similar to the total rate of interaction, while sea ducks and waterfowl, terns, seabirds, and shorebirds had rates below the total rate of interaction. The likely reason for the higher rates of interactions amongst Northern Gannets is due to the species specific behavior of its flight height tendencies. The Northern Gannet prefers to fly at approximately the same height as the Auld's Cove power lines, notably during periods when they forage for fish in the Strait of Canso. With the exception of the Gulls, the rest of the guilds typically interacted with the power lines during the spring and fall migration periods. Gulls were observed to interact with the power lines at relatively equal rates through the year.

Guild specific behaviors and trends are discussed in more detail in their corresponding sections below.

6.5.1.1 Terns

Four species of terns were observed at Auld's Cove during the Diurnal Movement Surveys and accounted for 2199 individual birds. Arctic terns, Bridled terns (*Onychoprion anaethetus*), and Caspian terns (*Hydroprogne caspia*) were only observed during the spring migratory period, indicating they were only passing through the area. Common terns, however, were ubiquitous throughout spring and summer due to the presence of a colony nesting on an island in Long Pond. This colony

was all but vacated during the fall period, however. The majority of instances where terns crossed the Auld's Cove power lines occurred over the eastern cove (Long Pond) (Figure 20), due to the existence of the above mentioned island to which Common terns were nesting upon throughout the summer. Only one tern species, (Common Tern) had an observed interaction with the power lines (Figure 19).

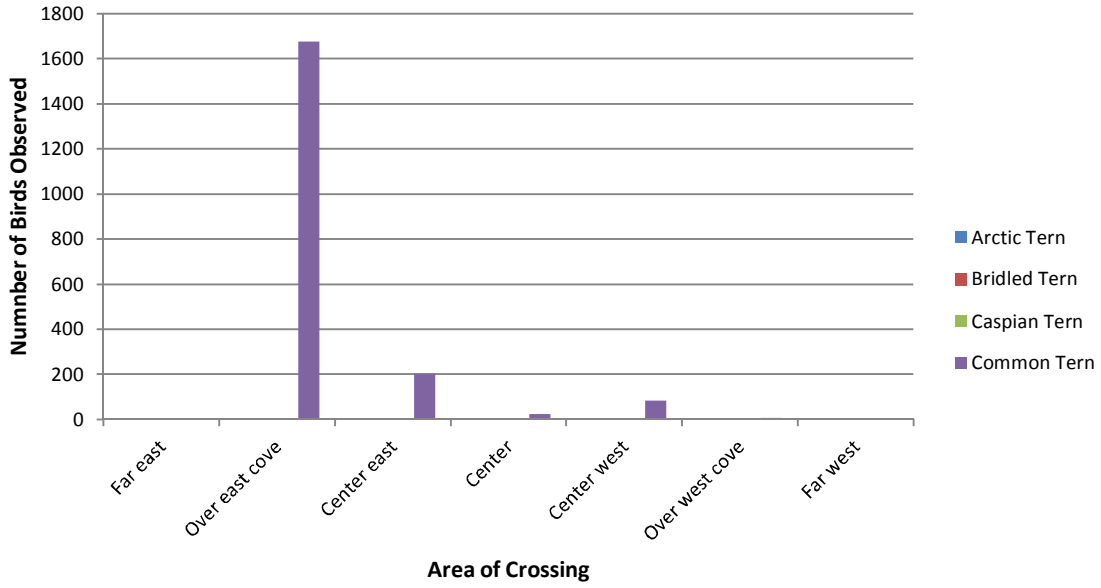

Figure 20. Area of crossing of terns observed at Auld's Cove during Diurnal Bird Surveys

Despite being one of the more commonly observed species during spring and summer at Auld's Cove, the Common Tern was observed to have interacted only five times with the Auld's Cove power lines, three of which were considered high risk. While these birds did cross under the power lines frequently on feeding sorties, they typically flew well below the power lines, or were skimming the water (Figure 21).

Despite their abundance in the area, terns do not behave in a way that puts them at risk of interacting with the existing Auld's Cove power lines.

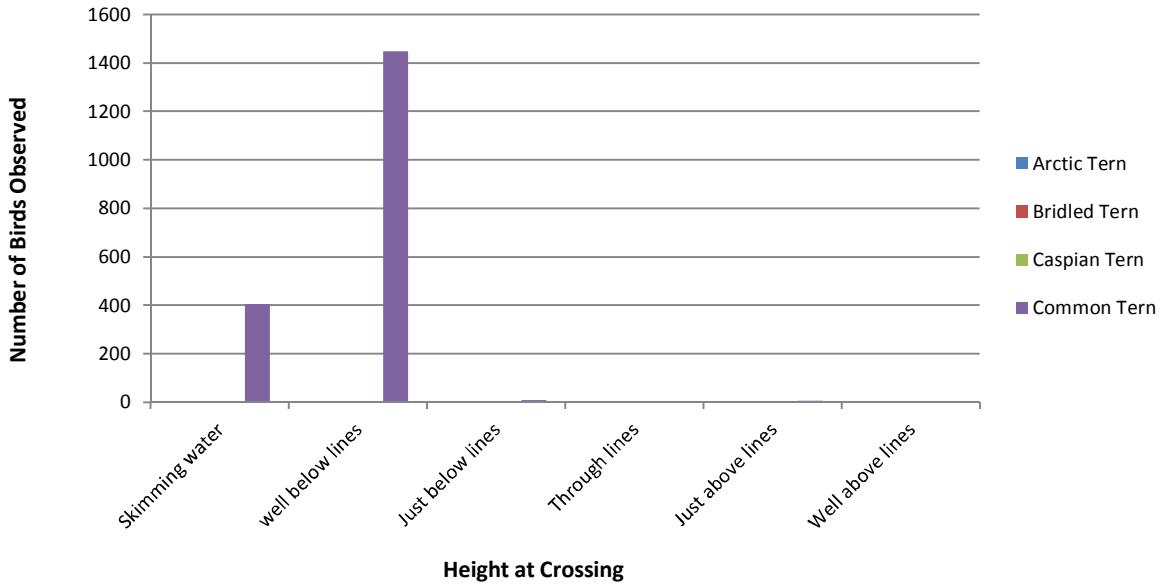

Figure 21. Height at crossing of terns observed at Auld's Cove during Diurnal Bird Surveys

6.5.1.2 Cormorants

The Double-crested cormorant was the only species of cormorant observed at Auld's Cove during the surveys, but the Great cormorant (*Phalacrocorax carbo*) had previously been observed in small numbers at the Canso Causeway (Strum 2014).

There were 409 observed interactions between Double-crested cormorants and the Auld's Cove power lines, 323 (78.9%) of which were high risk interactions (Figure 18).

Most cormorants were observed crossing the lines between center east and over west cove (Figure 22). During spring and summer, Cormorants tend to use the center east of the Strait of Canso as a corridor when moving through the area. In the fall, shoals of bait fish attracted large flocks of several hundred birds to move within the center west of the causeway, and within the west cove (Archie's Pond), which accounts for the increased amount of movement at these locations.

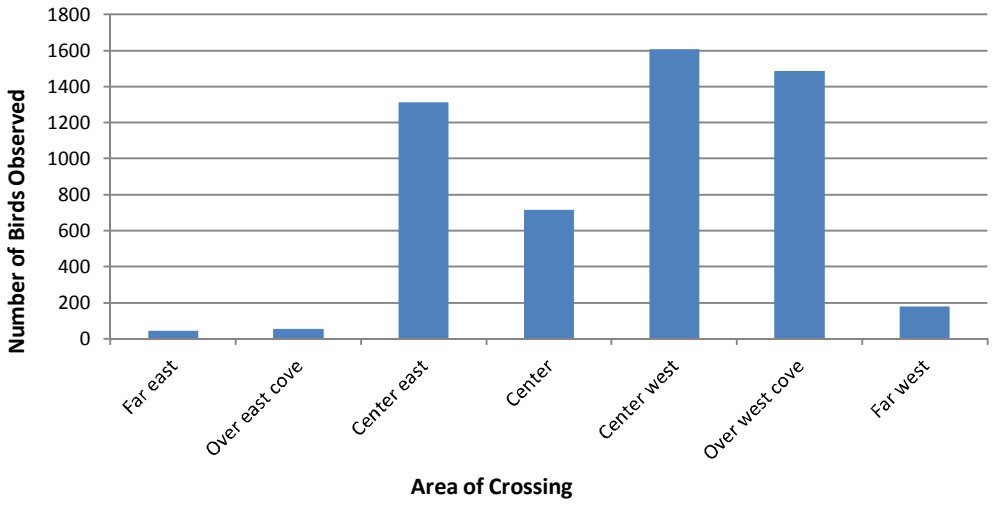

Figure 22. The Area of crossing of cormorants at Auld's Cove during Diurnal Bird Surveys

Most cormorants were observed to be skimming the water as they crossed the Auld's Cove power lines (Figure 23). Just over 400 cormorants were observed to cross the Auld's Cove power lines in high risk areas (just below, through, or just above the power lines). Instances in which cormorants were flying higher than just a few metres above the water level (skimming the water) tended to correlate to weather events, in which the water was rough as a result of high winds, or when the Strait of Canso was ice covered.

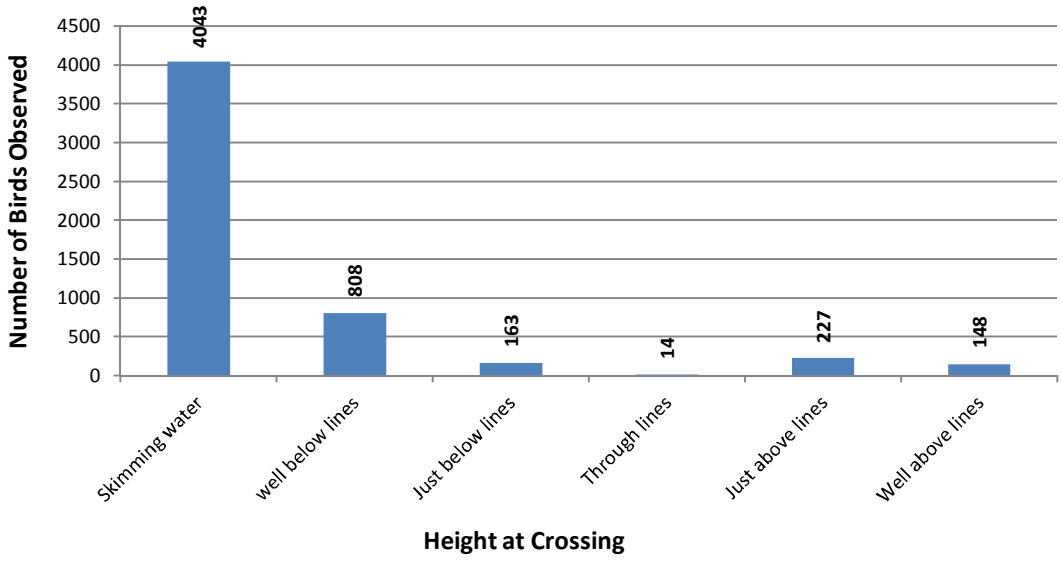

Figure 23. Height at crossing of cormorants at Auld's Cove during Diurnal Bird Surveys

As a guild, Cormorants had the second highest number of interactions with the Auld's Cove power lines (second, yet only narrowly to gulls), yet only 7.5% of all of the Cormorants who crossed the power lines interacted with them (Figure 19), and there were no collisions or mortality events. Further to that, Cormorants appear to be very aware of the presence of the Auld's Cove power lines, and could be seen adapting their flight path several hundred metres away from the lines as they approached them.

For the most part, Cormorants behave in a way that does not put them at great risk of interacting with NSPI infrastructure at Auld's Cove, despite their abundance in the area. However, while not observed to be a common occurrence, Cormorants do exhibit behaviors in which they fly at altitudes that bring them close to the height of the Auld's Cove power lines, resulting in manoeuvering around the infrastructure. These instances seem to be most common in the fall and spring, and appear to be influenced by the weather and the presence of ice in the Straight of Canso.

6.5.1.3 Sea Ducks and Waterfowl

A total of 15 species of sea ducks and waterfowl were observed at Auld's Cove during Diurnal Bird Surveys accounting for 805 of the birds. Sea ducks and waterfowl interacted with the lines 3.0% (±1.2%, 95% CI) of the time, or 24 times total. Of that, 13 (54% of all interactions) were considered high risk interactions (Figure 18).

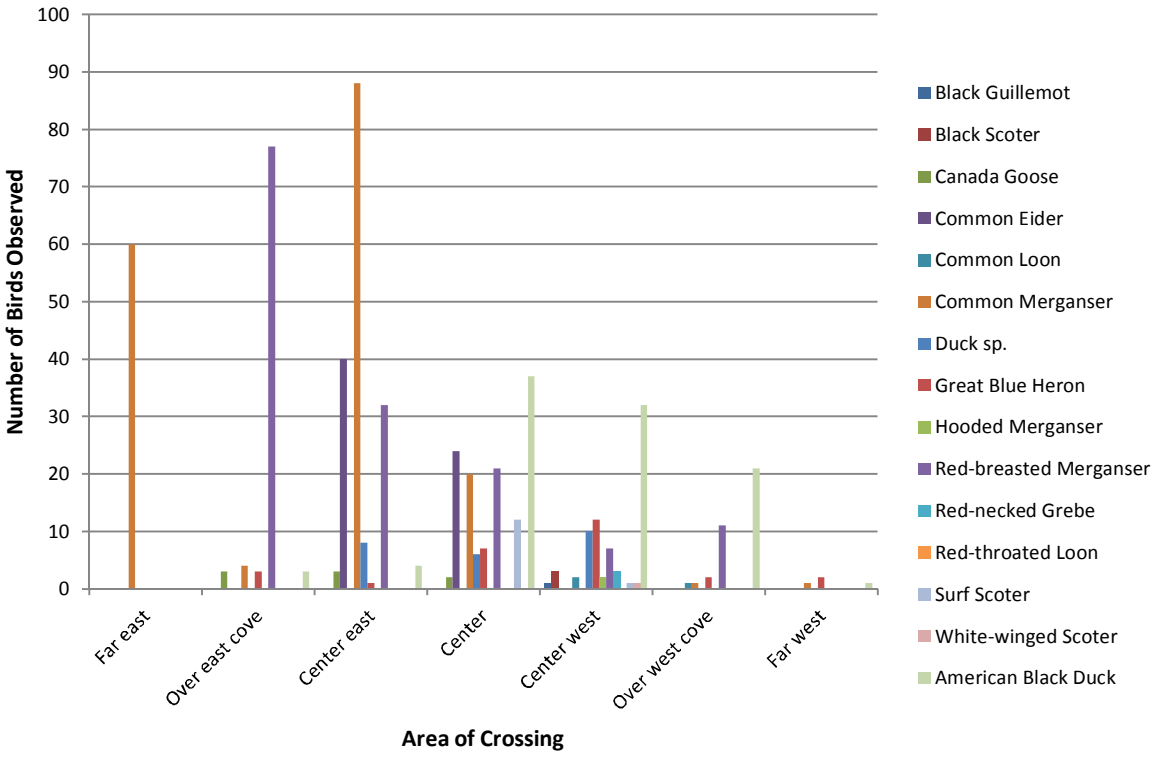

Figure 24. Area of crossing of sea ducks and waterfowl observed at Auld's Cove during Diurnal Bird Surveys

The two most commonly observed species in the spring and summer were the Common Merganser and Red-breasted Merganser. The Common Merganser and Red-breasted Merganser predominantly crossed the lines east of center (far east, over east cove and center east) (Figure 24). In the latter part of the summer and into the fall, American black ducks became more abundant in the area, likely as a result of vacating lacustrine environments where they summered, to come to the sea coast. These ducks were commonly observed foraging in the western cove, but would occasionally cross the Auld's Cove power lines in the Strait of Canso. The remaining sea ducks and waterfowl species tended to cross between center east and center west (Figure 24).

Most of the observed birds in this guild crossed well below the lines, however there were a number of instances where they crossed at heights that were relatively close to the power lines, contributing to their interaction rates (Figure 25). These instances generally occurred in the late summer and fall, as birds flew in small flocks across the lines, possibly while migrating through the area.

Generally, Seaducks and Waterfowl species exhibit behaviours that do not put them at risk of interacting with existing NSPI infrastructure at Auld's Cove. Furthermore, while they were present in some diversity throughout all seasons, they were not observed to frequent the area in any significant abundance.

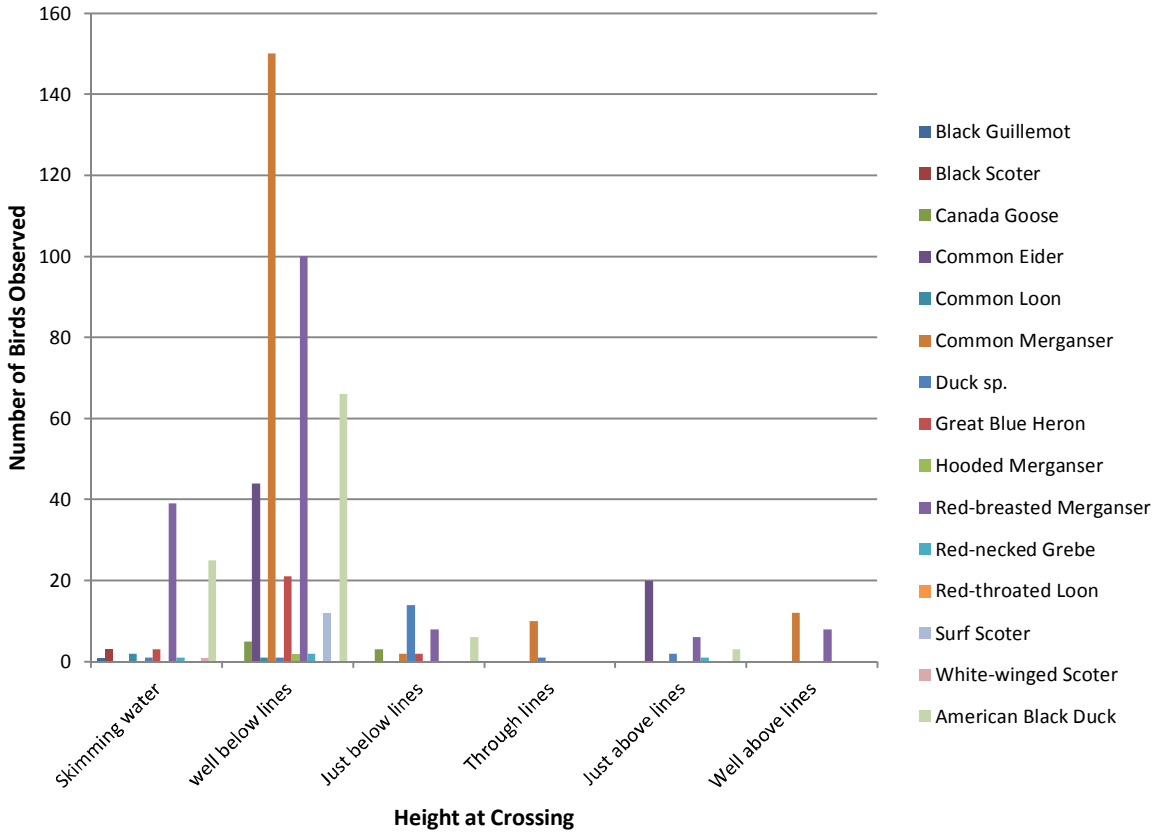

Figure 25. Height at Crossing of sea ducks and waterfowl observed at Auld's Cove during Diurnal Bird Survey

6.5.1.4 Gulls

Seven species of gulls were observed at Auld's Cove, accounting for 5044 individual birds observed at this location. Six of these species interacted with the lines, for a total of 449 interactions. Of these interactions, 399 (88.9%) were high risk interactions (Figure 18).

The majority of the gulls, except for the Bonaparte's Gull, crossed between center east and center west (Figure 26). Most Bonaparte's Gulls crossed the lines over west cove or over center. These trends reflect the foraging grounds of Bonaparte's gulls. This species, for the most part, crossed well under the Auld's Cove power lines as they flew throughout the general area. Most gulls were observed skimming water or flying well below the lines as they crossed (Figure 27).

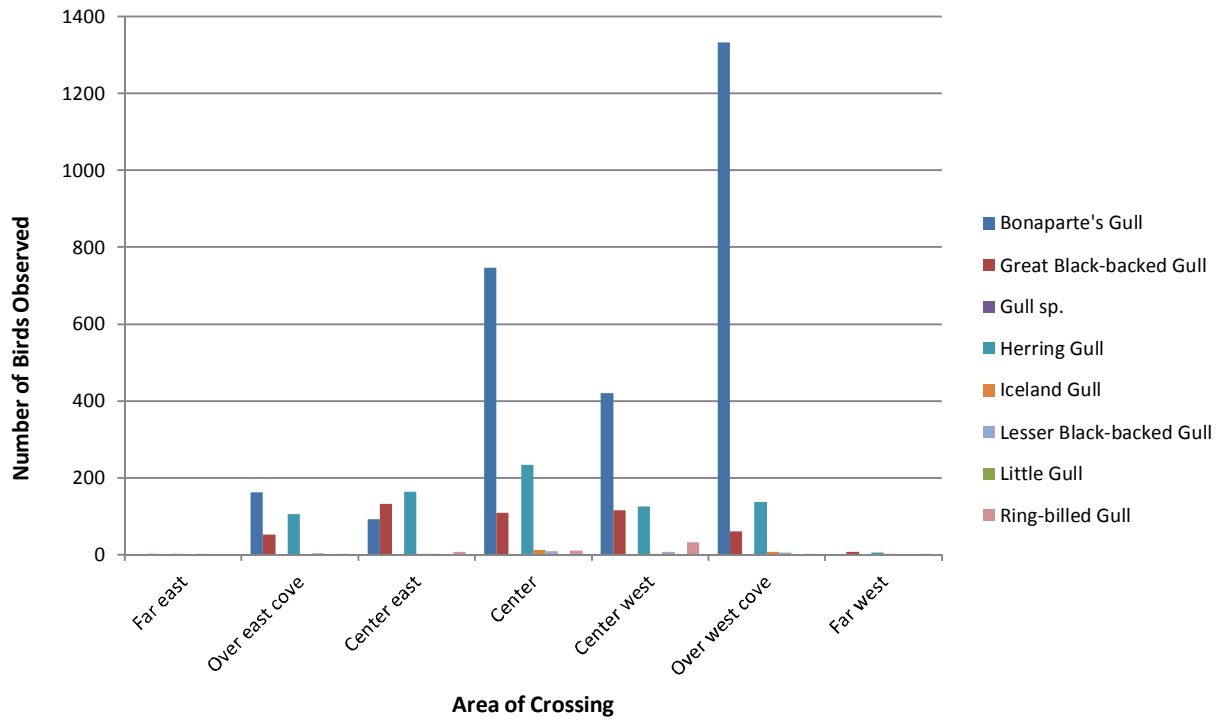

Figure 26. Area of crossing of gulls observed at Auld's Cove during Diurnal Bird Surveys

Herring gulls and Great Black-backed gulls were the next two most commonly observed species at Auld's Cove. It was these species that accounted for the majority of interactions within this guild. These species often flew at heights parallel to the power lines, and strafed back and forth across the Strait of Canso before eventually crossing just over, or just under the power lines. This trend occurred throughout the year amongst these species, and was most commonly observed during the morning diurnal watch surveys as the birds flew from south to north.

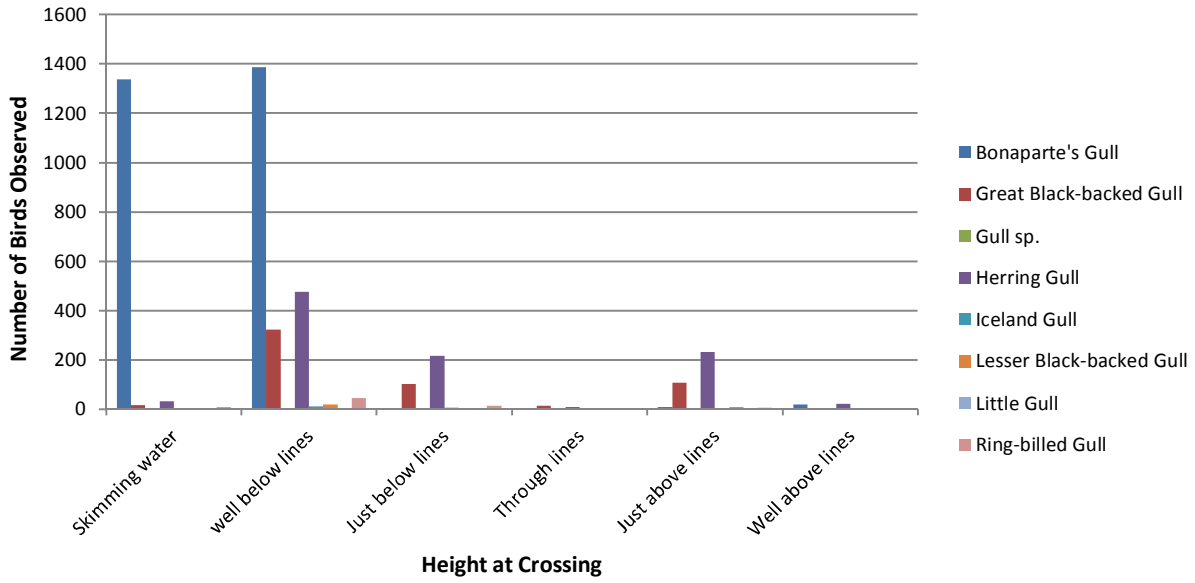

Figure 27. Height at crossing of gulls observed at Auld's Cove during Diurnal Bird Surveys

Like Cormorants, gulls appeared to have good awareness of the power lines, and while they did frequently fly close to them, they appeared to avoid them comfortably. This behaviour, for the most part, is not considered to accentuate risk for gulls, however potential risk of interaction is likely to increase during specific weather conditions, such as high winds or poor visibility.

6.5.1.5 Northern Gannets

Only one species of gannet was observed at Auld's Cove, the Northern gannet, which was observed to cross the Auld's Cove power lines 641 times. Northern gannets had the highest rate of interaction (Figure 19). They were observed to interact with the power lines on 52.4% (± 3.9%, 95% CI) of the observed crossings,336 times in total, 173 (51.5%) of which were considered high risk (Figure 18).

The high rate of interaction between Northern gannets and the Auld's Cove power lines can be attributed to their foraging behaviour. Northern gannets typically soar at heights comparable to the height of the Auld's Cove power lines as they scan the waters below for fish shoals prior to diving into the water to capture fish from several hundred feet. This behavior was observed several times at Auld's Cove, particularly in early July, but was persistent to a lesser extent throughout the summer. Feeding typically occurred in the middle of the Strait of Canso, most often to the north of the Auld's Cove power lines. Northern gannets were also present in the area throughout the fall, albeit in smaller numbers.

Northern gannets were most frequently observed in the center of the Strait (Figure 28). When they did cross the power lines, they were aware of the infrastructure and typically maintained a safe

distance from it, usually passing well below the power lines. The majority of high risk interactions occur as birds pass just beneath the power lines, in addition to through the power lines (an uncommon crossing method of which they were one of only a few guilds to perform) (Figure 29).

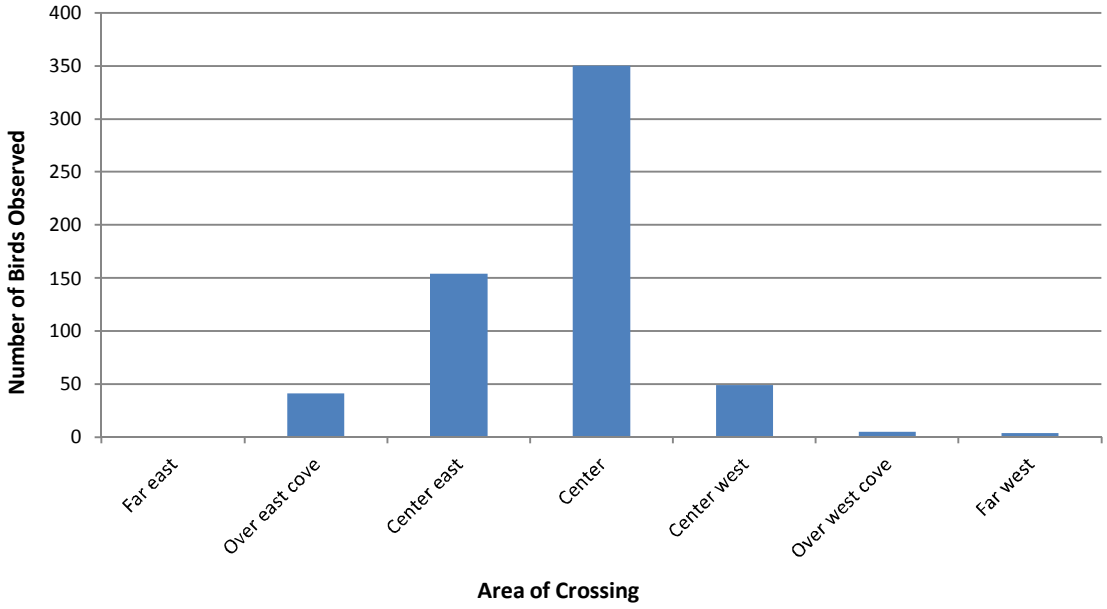

Figure 28. Area of crossing of Northern Gannets observed at Auld's Cove during Diurnal Bird Surveys

Northern Gannets exhibit behavior that puts them at risk of interacting with the Auld's Cove power lines. These birds, however, do appear to exhibit good awareness and avoidance behavior of the power lines, but certain weather conditions, such as high winds or poor visibility, are likely to increase their risk of collisions.

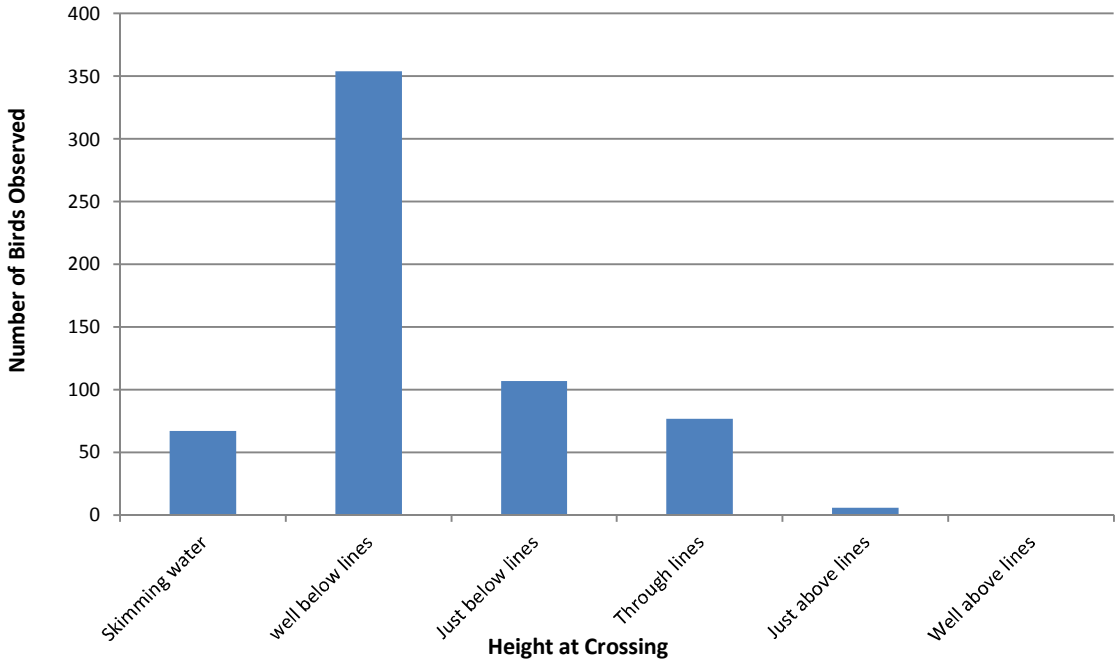

Figure 29. Height at crossing of Northern Gannets observed at Auld's Cove during Diurnal Bird Surveys

6.5.1.6 Seabirds

Eight birds composed of three different species were observed at Auld's Cove during the Diurnal Bird Surveys. No seabirds were observed interacting with the power lines (Figure 19).

All seabirds were observed crossing the lines at center east or center west (Figure 30), and flying well below the power lines or skimming water (Figure 31). These birds were only observed in the area during the fall, and in very small numbers.

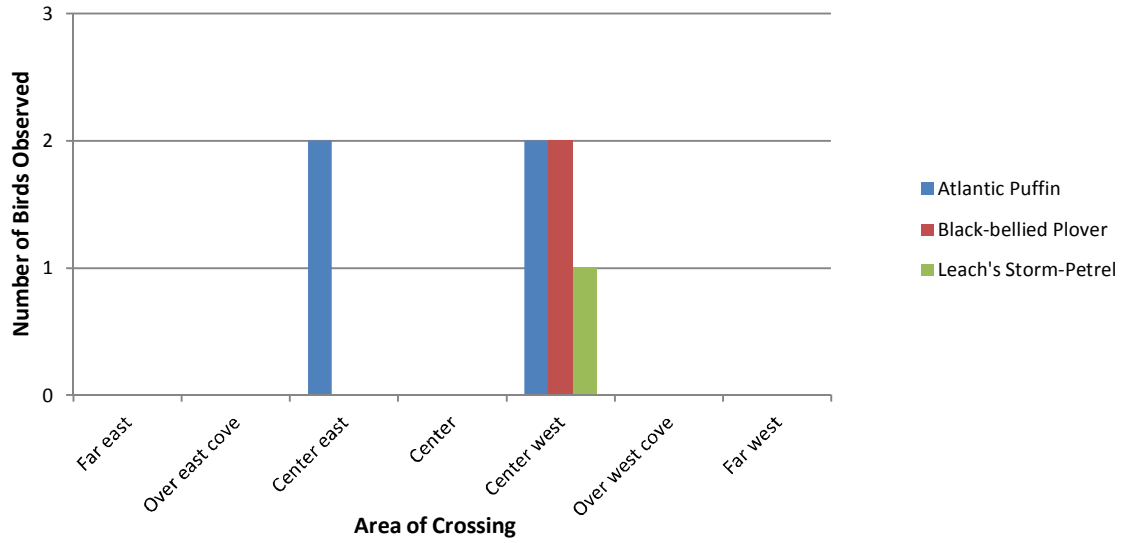

Figure 30. Area of crossing of seabirds observed at Auld's Cove during Diurnal Bird Surveys

While observations of these birds were too scarce to draw any meaningful trends, study observations suggest that they do not behave in a manner that puts them at risk of interacting with NSPI infrastructure at Auld's Cove.

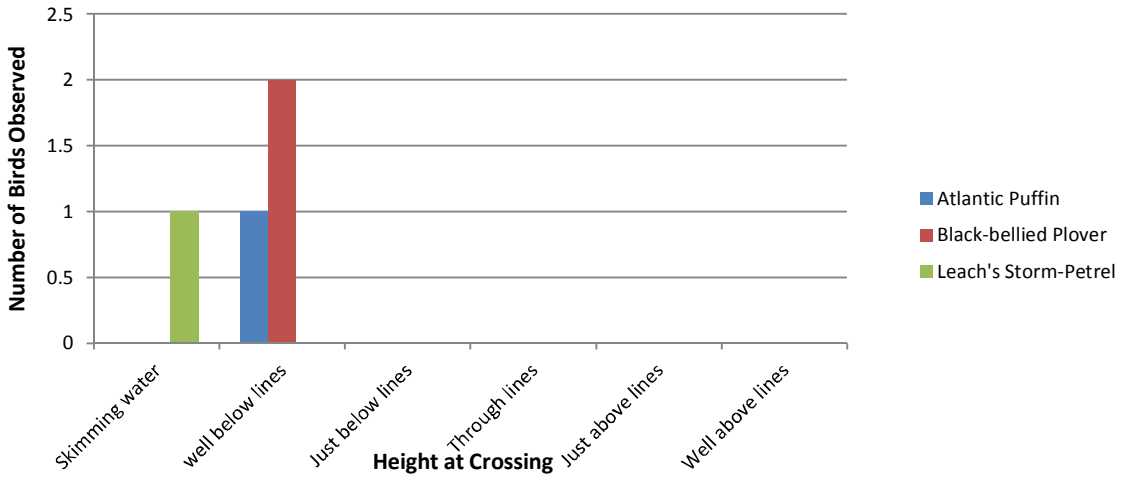

Figure 31. Height at crossing of seabirds observed at Auld's Cove during Diurnal Bird Surveys

6.5.1.7 Shorebirds

Ten species of shorebirds were observed at Auld's Cove during Diurnal Bird Surveys accounting for 116 of the birds observed to cross the power lines. Of these birds, only one species interacted with the lines, the Spotted Sandpiper, which interacted with the power lines six times, none of which were considered high risk (Figure 18).

Shorebirds appeared to predominantly cross the power lines between over east cove and center east (Figure 32). Most shorebirds, including the Spotted Sandpiper, were observed skimming the water or flying well below the power lines (Figure 33).

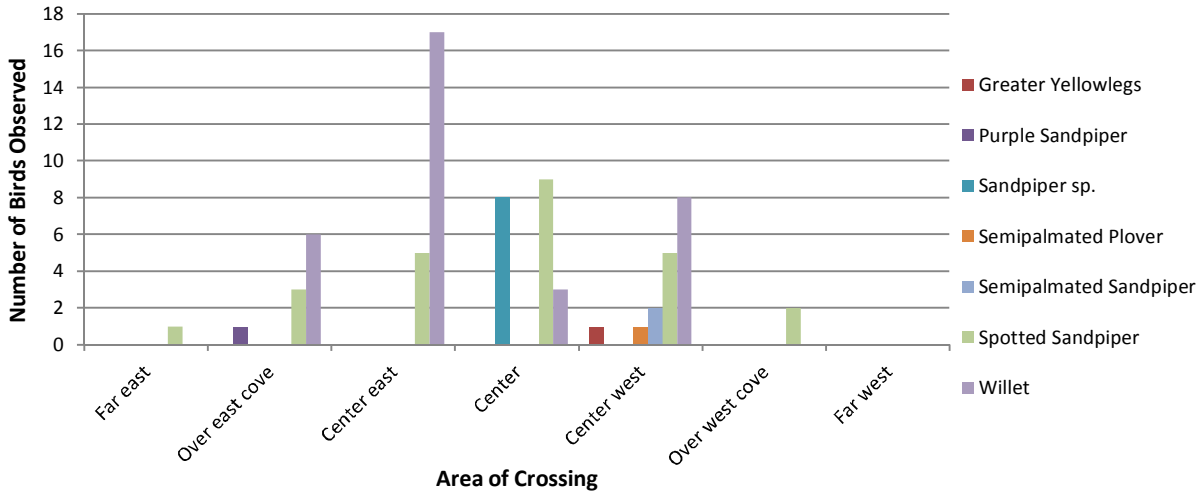

Figure 32. Area of crossing of shorebirds observed at Auld's Cove during Diurnal Bird Surveys

Shorebirds as a guild do not generally exhibit behaviour that puts them at risk of interacting with NSPI infrastructure at Auld's Cove.

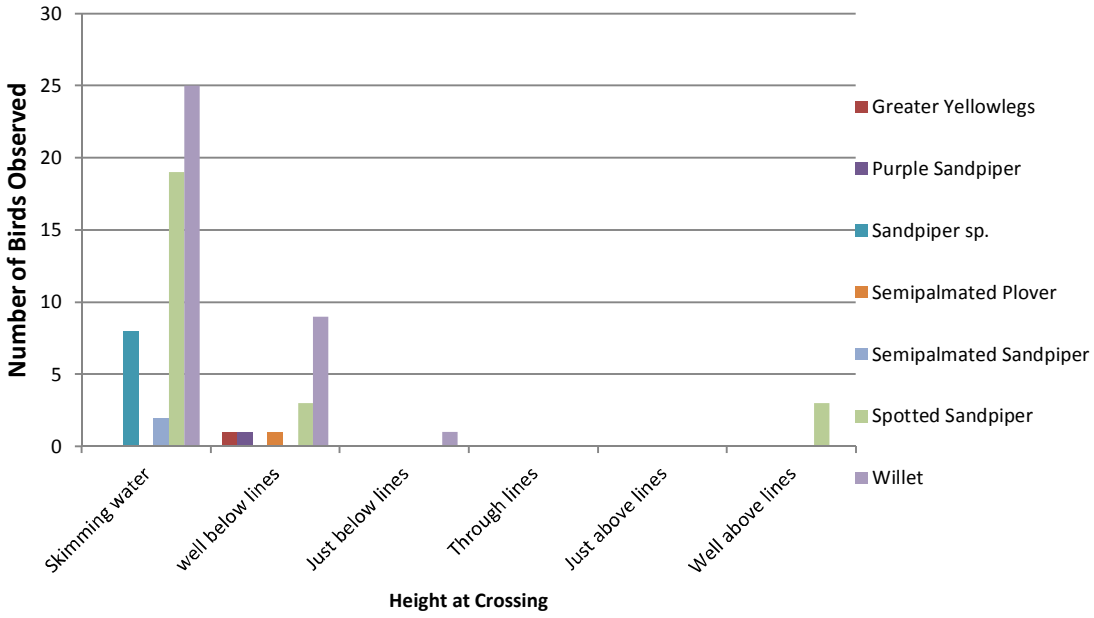

Figure 33. Height at crossing of shorebirds observed at Auld's Cove during Diurnal Bird Survey

6.5.1.8 Other Species (Passerines/Raptors)

A total of 17 species of passerines and raptors were observed at Auld's Cove which account for 234 individual birds. Of these observations, there were only four interactions, three of which were considered high risk (Figure 18).

Bald eagles (*Haliaeetus leucocephalus*) were observed on two occasions to interact with the lines. In both cases, the birds flew with confidence in close proximity to the power lines. These birds have good depth perception, and usually demonstrate territorial fidelity, suggesting the birds that interacted with the power lines were aware and avoided them. One Pileated woodpecker (*Hylatomus pileatus*) and one European starling were also observed to interact with the power lines.

Most passerine/raptors were observed crossing the lines over west cove or over the far west (Figure 34), and were observed flying well below the lines when crossing (Figure 35). The most commonly observed passerine / raptor species was the Blue jay.

It should be noted that passerines are likely an under represented group, as many species (*i.e.* Warblers) are small and difficult to observe over large distances. The behaviour of passerine and raptor species that were observed, for the most part does not indicate any behaviour that would put this guild at risk of interacting with the Auld's Cove power lines.

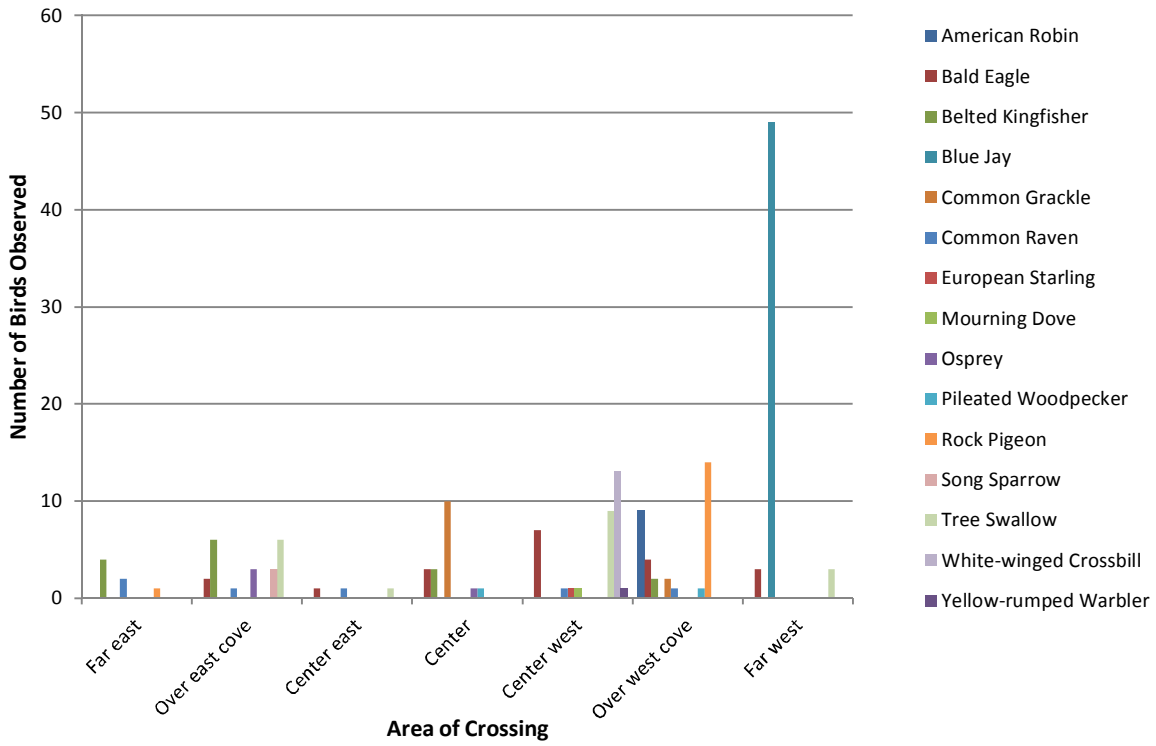

Figure 34. Area of Crossing for passerines and raptors observed at Auld's Cove during Diurnal Bird Surveys.

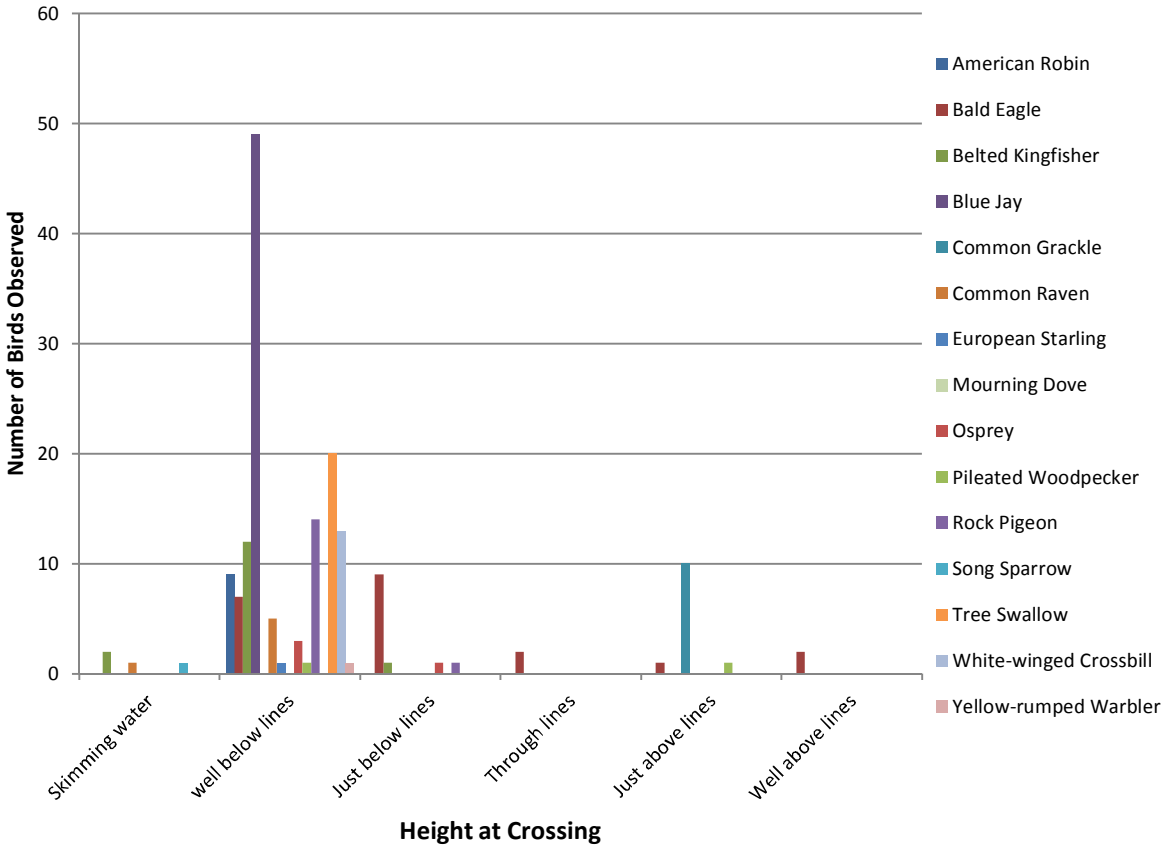

Figure 35. Height at crossing of passerines and raptors observed at Auld's Cove during Diurnal Bird Surveys.

6.5.2 Canso Causeway

Bird behaviour and interaction with existing infrastructure at the Canso Causeway location was achieved during all surveys that were completed within that study area throughout 2015. Diurnal surveys are discussed independently below, followed by species specific commentary in sections 6.5.2.1 to 6.5.2.8.

Diurnal Surveys

Diurnal watch surveys were conducted at the Canso Causeway from the beginning of July until the end of October. During these surveys, avian activity was monitored for general movements and interactions with NSPI infrastructure which includes two individual sets of power lines; a large set of power lines located on the north side of the Causeway, and a small set of power lines, located on the south side. A total of 1937 birds, constituting 26 species, were observed interacting with either the large or small power lines (Figure 36).

Figure 36 shows the number of interactions observed between birds and the Canso Causeway power lines.

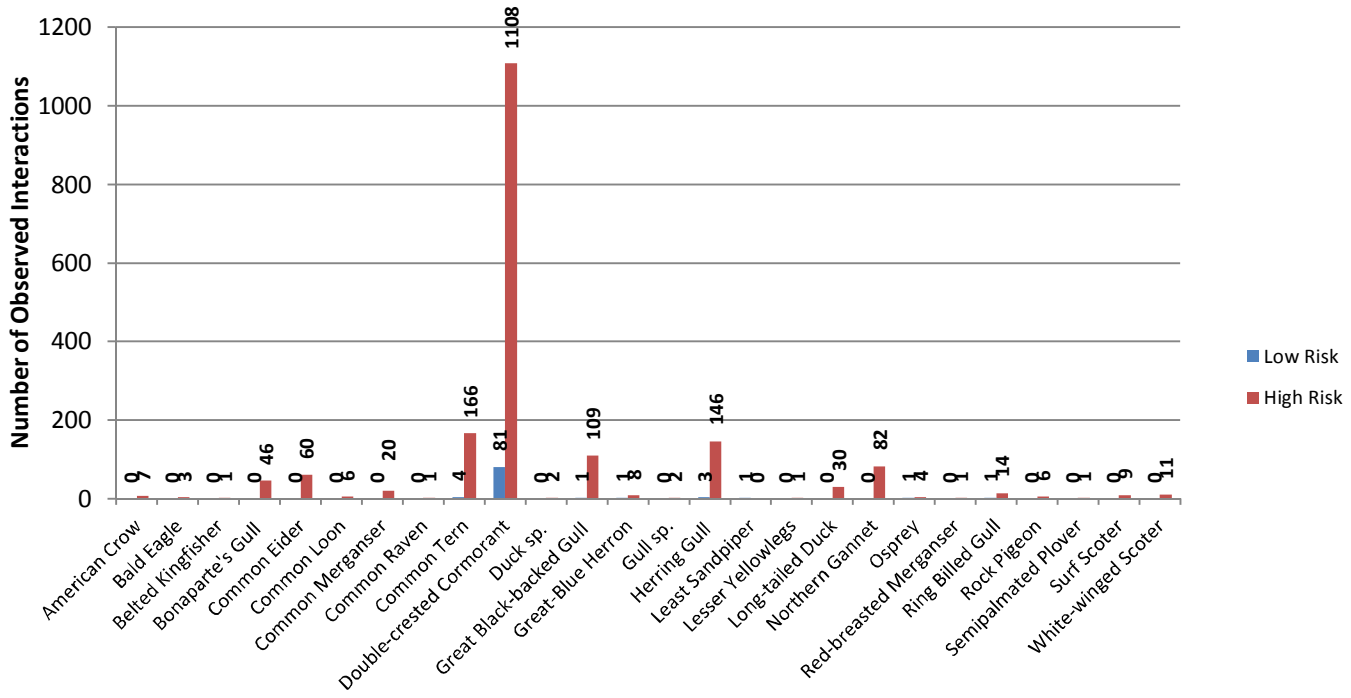

Figure 36. Observed interactions at Canso Causeway during Diurnal Bird Surveys

A total of 26 species interacted with the Canso Causeway power lines. Sea ducks, waterfowl, and Northern Gannets had a higher rate of interaction than any other guild (Figure 37). Of all the sea ducks and waterfowl observed, 49.2% (± 5.6%, 95% CI) interacted with the lines, closely followed by Northern Gannets where 41.4% (± 6.9%, 95% CI) interacted with the power lines. This is significantly greater than the total rate of interactions of 15.2% (± 0.6%, 95% CI). Apart from seabirds which were not observed interacting with the lines at all, shorebirds and passerines/raptors had the lowest rates of interaction with the power lines. Only 3.3% (± 3.2%, 95% CI) of shorebirds and 6.3% (± 2.5%, 95% CI) of passerine/raptors interacted with the lines. Guild specific behaviours and trends are discussed in more detail in their corresponding sections below. Almost every guild had at least a 2 to 3 fold increase in interaction rates at the Canso Causeway power lines when compared to the Auld's Cove power lines.

Figure 37 shows the rates as a percentage at which each guild interacted with the Canso Causeway power lines. The rate of interaction metric represents the proportion of birds in each guild that were observed to interact with the Canso Causeway power lines as they crossed them.

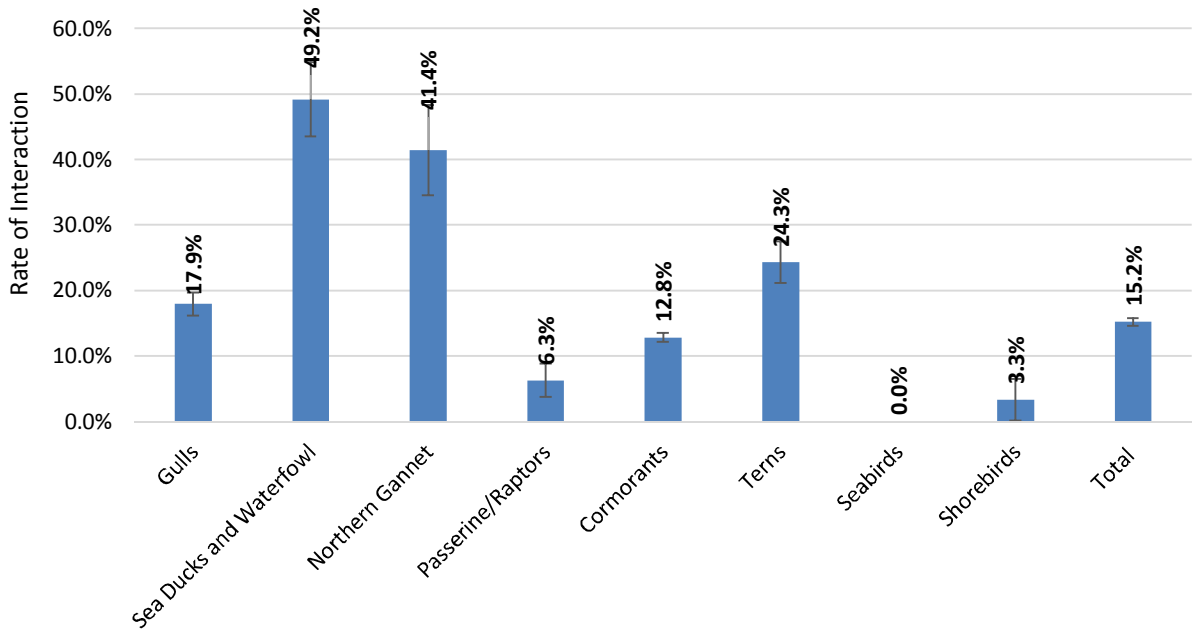

Figure 37. Rate of interactions for each guild at Canso Causeway with 95% confidence intervals

Sea ducks and waterfowl and Northern gannets had the highest rates of interaction with the Canso Causeway power lines. Terns, gulls, and cormorants each interacted at around the total rate of interaction, while passerine/raptors, shorebirds and seabirds had rates lower than the total rate of interactions with the Canso Causeway power lines. Similar to Auld's Cove, Northern Gannets had a high rate of interaction with the Canso Causeway power lines. One Northern gannet was observed to collide with the large power lines at the Canso Causeway, but the bird recovered, and continued its flight path.

6.5.2.1 Terns

One species of tern, the Common Tern, totalling 700 individuals was observed to cross the Canso Causeway power lines throughout the study. The Common Tern had a total of 170 interactions, 166 (97.6% ± 2.3%, 95% CI) of which were considered high risk (Figure 36). Terns had a rate of interaction of 24.3% (± 3.2%, 95% CI) with the Canso Causeway power lines (Figure 37), which was higher than at Auld's Cove.

Terns predominately crossed the Canso Causeway lines in the center east, usually immediately southwest of the tower installed on Balache Point where the power lines are highest, with many birds also traveling over center (Figure 38). Terns were observed flying at various heights, but most traveled either well below the lines or just above the lines (Figure 39).

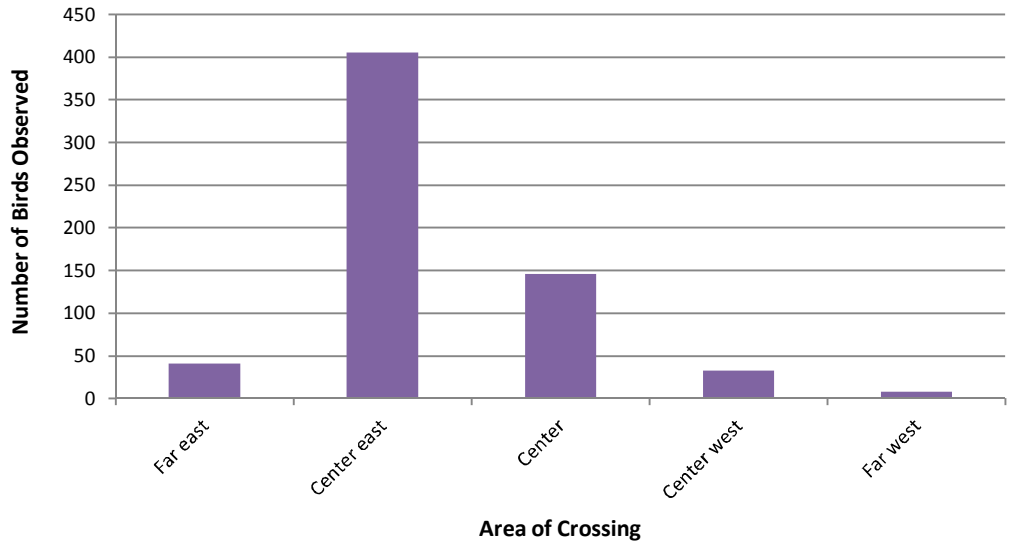

Figure 38. Area of crossing of Common Terns observed at the Canso Causeway during Diurnal Bird Surveys

The explanation for differences in the way that Terns behave around the Canso Causeway power lines when compared to the Auld's Cove power lines is likely due to the infrastructure arrangement at the Canso Causeway itself; specifically the lower height of the power lines. Terns typically fly low (not more than 10 m above the water) as they forage for food. Observations of Tern flight path behaviour during the surveys suggest that as they approach the Causeway, they adjusted their height to avoid the causeway structure, as well as vehicular traffic. In most instances, the adjustment veered their flight path in close proximity to the power lines. Depending on a variety of factors, including wind speed and direction, direction of flight, etc., success in navigation through the power lines varied. Generally, Terns appear able to navigate through the obstacles within the area effectively; however specific weather conditions, namely high winds and low visibility, appeared to increase their risk of interaction. No instances of Tern collision were observed during the 2015 study.

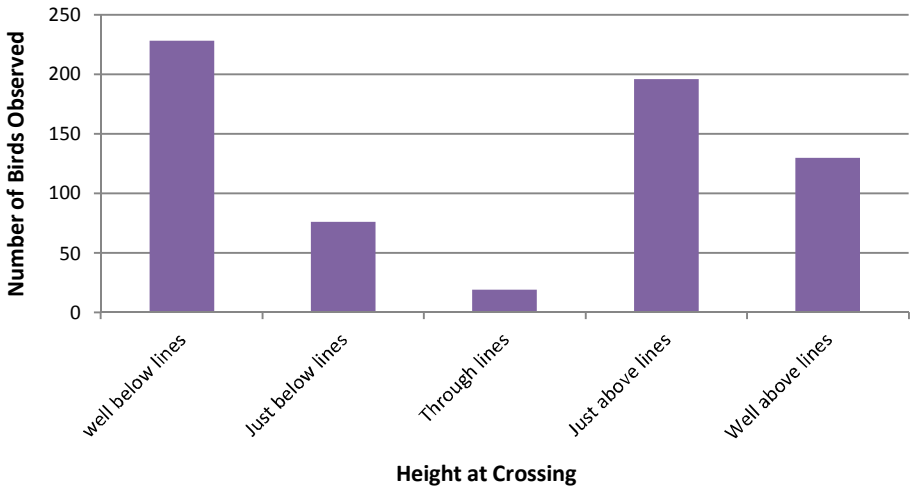

Figure 39. Height at crossing of Common Terns observed at the Canso Causeway during Diurnal Bird Surveys

6.5.2.2 Cormorants

One species of cormorant was observed at the Canso Causeway, the Double-crested Cormorant. A total 9254 Cormorants were observed to cross the Canso Causeway power lines. Cormorants interacted with the lines 1189 times, 1106 of which were considered high risk (93.2% ± 1.4%, 95% CI) (Figure 37).

Most cormorants were observed crossing the lines at center east, with approximately 1000 crossing at center (Figure 40). These areas appear to be a favoured passageway for birds as the lines near the northeastern most tower are higher. The southwestern portion of the Causeway appeared more difficult for individuals to cross due to slack (and hence lower) power lines.

The majority of cormorants were observed flying well below the lines as they crossed the Canso Causeway; however, in excess of 2500 cormorants were flying just below the lines (Figure 41).

Cormorants had the fifth highest rate of interaction with the Canso Causeway power lines, with 12.8% (± 0.7%, 95% CI) of all of the Cormorants who crossed the power lines having interacted with them (Figure 37). Two collisions were observed resulting in one confirmed mortality. In both cases, Cormorants were travelling just above the lines, crossing near the center. One Cormorant struck the smaller 138 kV power lines at the Causeway and died. The other collision occurred as a flock of 14 Cormorants were crossing, several close calls occurred, and one collision leaving the Cormorant injured.

Cormorants were by far the most abundant species observed at the Canso Causeway, and were observed to move en masse across the power lines during every survey. This trend was most pronounced in the fall when flocks of Cormorants, hundreds strong, would move from roosting areas in the south, towards Auld's Cove (north) to forage for the day. For the most part the Cormorants were able to navigate through the existing NSPI infrastructure without incident; however, there were a large number of high risk interactions, including two collisions. This trend suggests that when compared to the infrastructure at Auld's Cove, the Canso Causeway power lines tend to create higher rates of interaction for this guild.

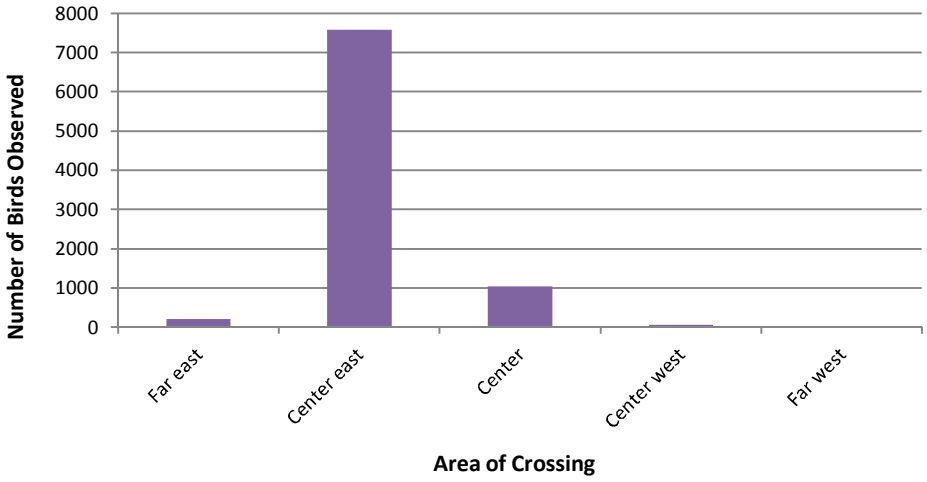

Figure 40. Area of Crossing of Double-crested Cormorants observed at the Canso Causeway during Diurnal Bird Surveys

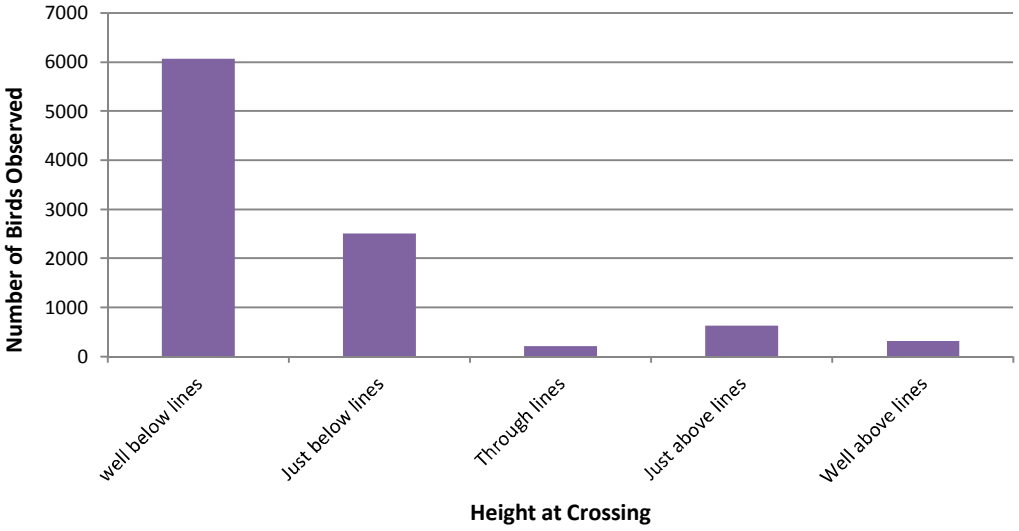

Figure 41. Height at Crossing of Double-crested Cormorants observed at the Canso Causeway during Diurnal Bird Surveys

6.5.2.3 Sea Ducks and Waterfowl

A total of 13 species of sea ducks and waterfowl were observed at the Canso Causeway during Diurnal watch surveys at this location, accounting for 301 individual bird crossings. Sea ducks and waterfowl interacted with the lines 49.2% (± 5.6%, 95% CI) of the time, or 148 times total. 147 (99.3% ± 1.3% of all interactions, 95% CI) were considered high risk (Figure 37).

The most commonly observed species was the Common Eider, which predominantly crossed the lines at the center east; just below the lines (Figures 42 and 43).

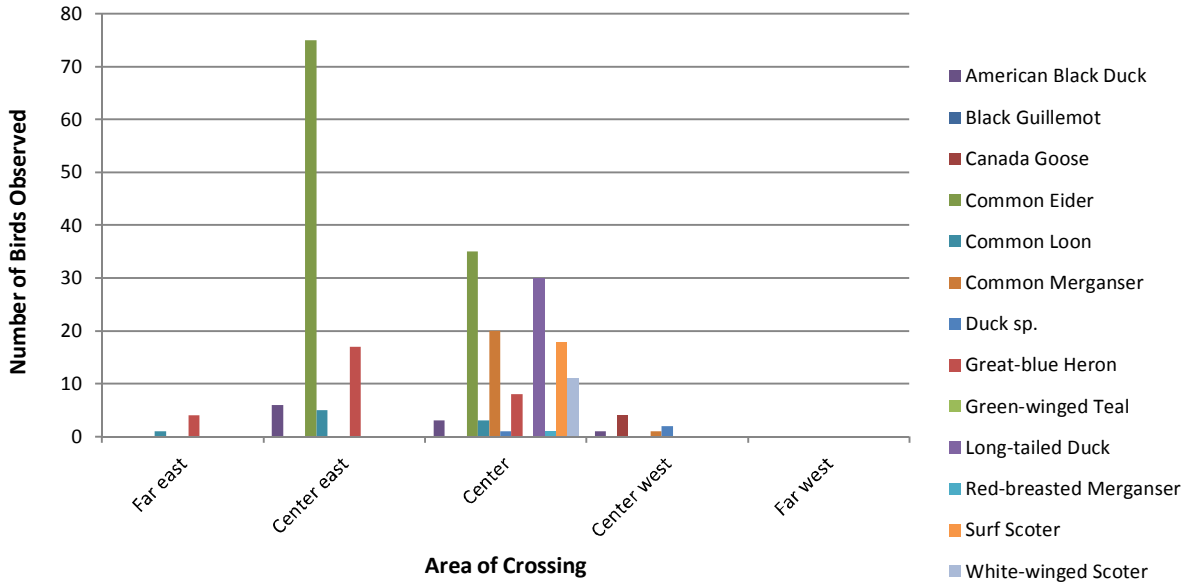

Figure 42. Area of crossing for sea ducks and waterfowl observed at the Canso Causeway during Diurnal Bird Surveys.

The remainder of observed birds in this guild crossed the lines at the center (Figure 42). In contrast to the Common Eider, most sea ducks and waterfowl were flying just above the power lines when crossing the causeway (Figure 43).

As a guild, sea ducks and waterfowl had the highest rate of interaction with the Canso Causeway power lines, with 49.2% (± 5.6%, 95% CI) of all of sea ducks and waterfowl observed experiencing an interaction (Figure 37). Species in this guild are especially vulnerable to interactions as they typically fly low over the water, which at this location they cannot due to the causeway structure. While there were no collisions or mortalities observed for this guild during surveys, there is a distinctly higher rate of interaction with NSPI infrastructure at the Canso Causeway than at Auld's Cove due to the infrastructure arrangement

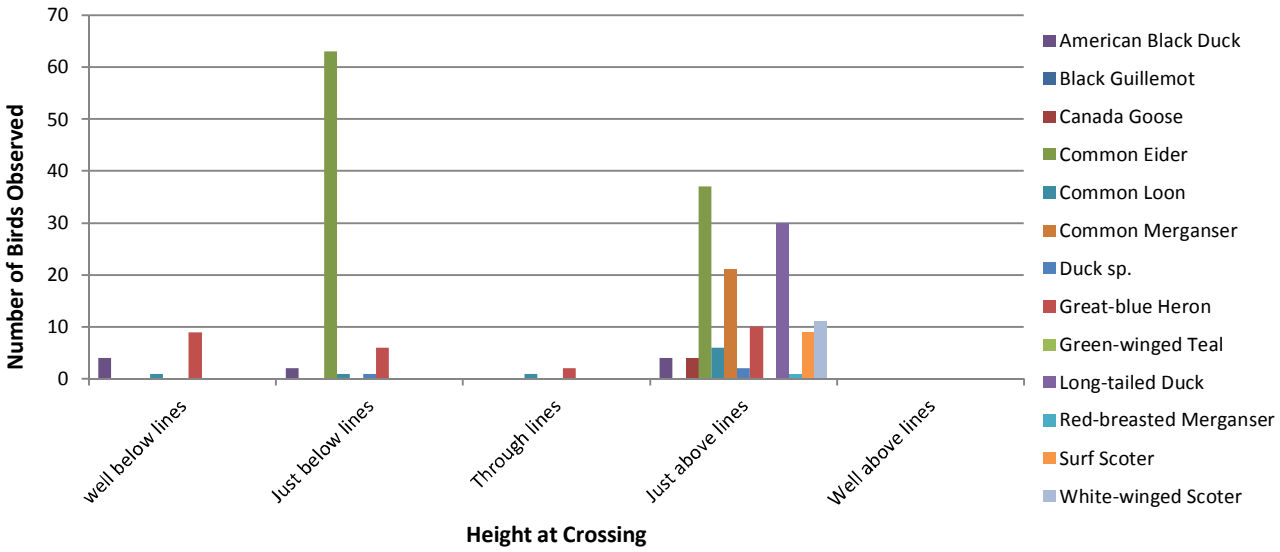

Figure 43. Height at crossing for sea ducks and waterfowl observed at the Canso Causeway during Diurnal Bird Surveys

6.5.2.4 Gulls

Five species of gull were observed at the Canso Causeway during Diurnal watch surveys accounting for 1795 individual birds that crossed the power lines. Species in this guild interacted with the lines 17.9% (± 1.8%, 95% CI) of the time, or 322 times total. A total of 317 (98.4% ± 1.4% of all interactions, 95% CI) were considered high risk (Figure 37).

Herring Gull and Great black-backed Gull were the two most commonly observed species in the summer. A significant increase of Bonaparte's Gull occurred in the fall presumably due to increased bait fish stocks in the area.

The majority of the Gulls crossed the lines at either center east or center (Figure 44). Most gulls were flying either just above the lines or well below the lines during the crossing (Figure 45). The common frequency of birds crossing just above the lines accounts for the contributing factor for the high proportion of high risk interactions.

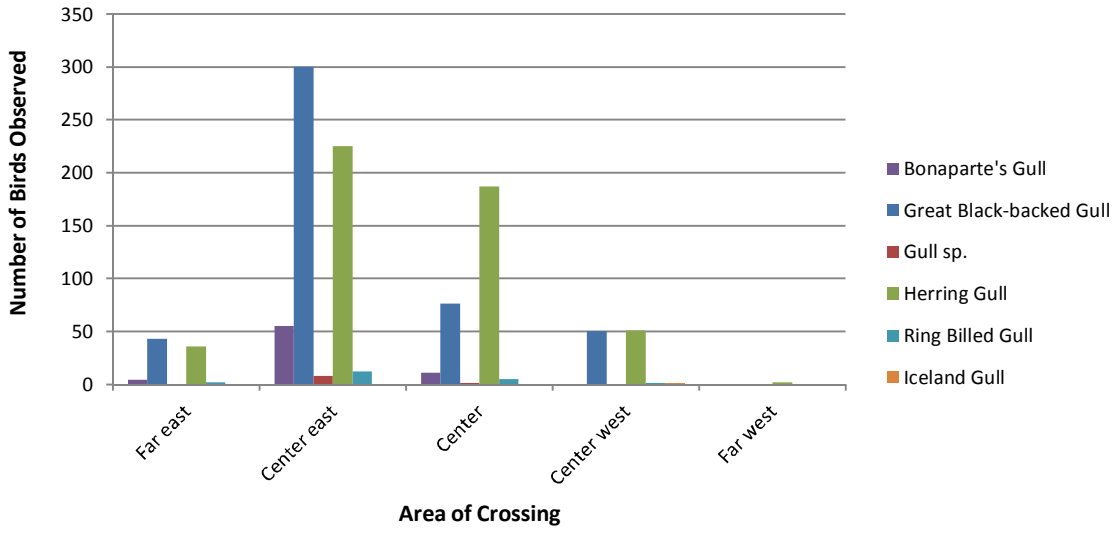

Figure 44. Area of crossing for gulls observed at the Canso Causeway during Diurnal Bird Surveys

As a guild, Gulls interacted with the Canso Causeway power lines the fourth most frequently, with 17.9% (± 1.8%, 95% CI) of all of the gulls who crossed the power lines interacting with them (Figure 37). One mortality event was observed when a Great Black-backed Gull struck the power lines and fell into the water.

Despite this incidence, gulls were observed to exhibit a good deal of confidence when navigating around obstacles in this area. Instances of high risk interactions or collisions are likely increased in high winds or low visibility conditions. Again, data demonstrates that this guild has a higher rate of interaction with NSPI infrastructure at the Canso Causeway than that installed at Auld's Cove.

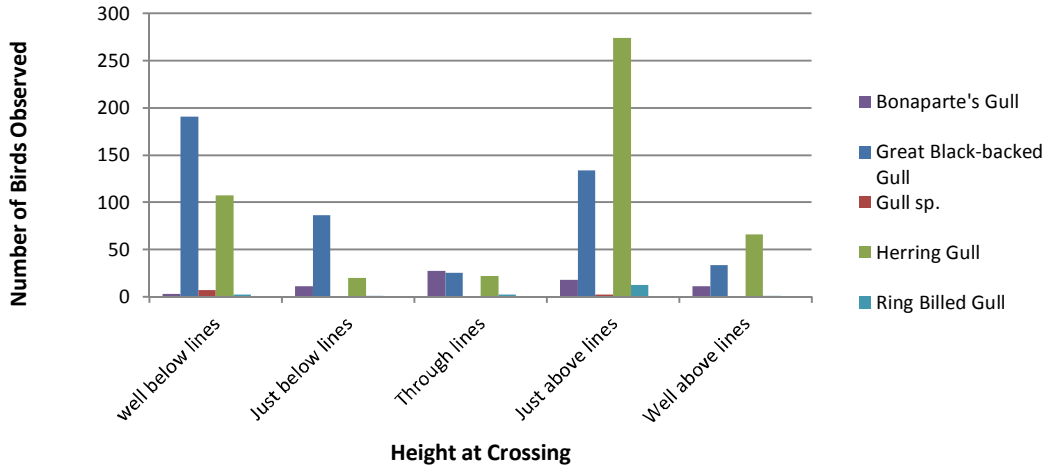

Figure 45. Height at crossing for gulls observed at the Canso Causeway during Diurnal Bird Survey

6.5.2.5 Northern Gannets

Only one species of gannet, the Northern Gannet, was observed at the Canso Causeway accounting for 198 individual birds. Northern Gannets interacted with the lines 41.4% (± 6.9%, 95% CI) of the time, or 82 times in total, all of which were considered high risk (Figure 37).

Most Northern Gannets were observed crossing the lines at either center or center east (Figure 46). Northern Gannets predominantly flew just above the lines when crossing, which may account for the high proportion of high risk interactions (Figure 47).

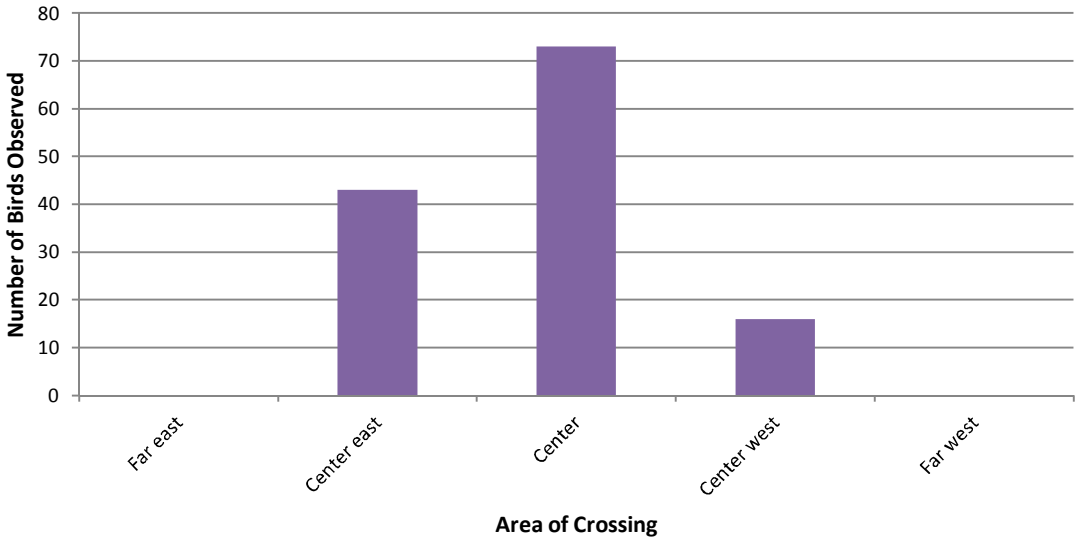

Figure 46. Area of crossing of Northern Gannets observed at the Canso Causeway during Diurnal Bird Surveys

The Northern Gannet interacted with the Canso Causeway power lines the second most frequently, with 41.4% (± 6.9%, 95% CI) of all of gannets who crossed the power lines interacting with them (Figure 37). One collision event was observed in which a Northern Gannet who was carrying a fish just above the lines, near the center struck the line, but continued to fly. Weather conditions are thought to have played a factor in this collision, as a heavy fog was present at the time.

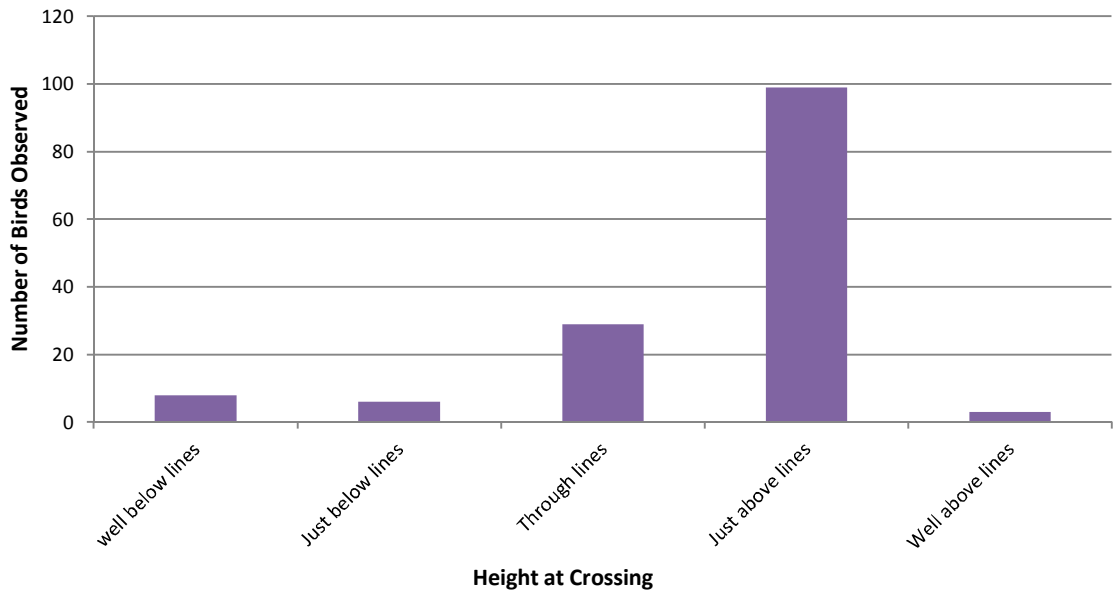

Figure 47. Height at crossing of Northern Gannets observed at the Canso Causeway during Diurnal Bird Surveys

6.5.2.6 Seabirds

A total of 17 seabirds composed of four different species were observed at the Canso Causeway during Diurnal Bird Surveys. No seabird was observed interacting with or crossing the lines (Figure 25).

6.5.2.7 Shorebirds

Nine species of shorebirds were observed at the Canso Causeway during Diurnal Bird Surveys accounting for 111 individual total birds. Shorebirds interacted with the lines 3.3% (± 3.2%, 95% CI) of the time, or three times total, two of which were considered high risk interactions (Figure 37).

The Semipalmated plover was the most commonly observed shorebird species, which crossed center east and just above the lines on all occasions (Figures 48 and 49). Almost all shorebirds crossed the lines at center west except for the Semipalmated Sandpiper which crossed at center east (Figure 48). Similarly, most shorebirds were flying just above the lines when crossing the lines except for the Semipalmated Sandpiper which flew just below the lines (Figure 49). No collisions or mortalities were observed for shorebirds.

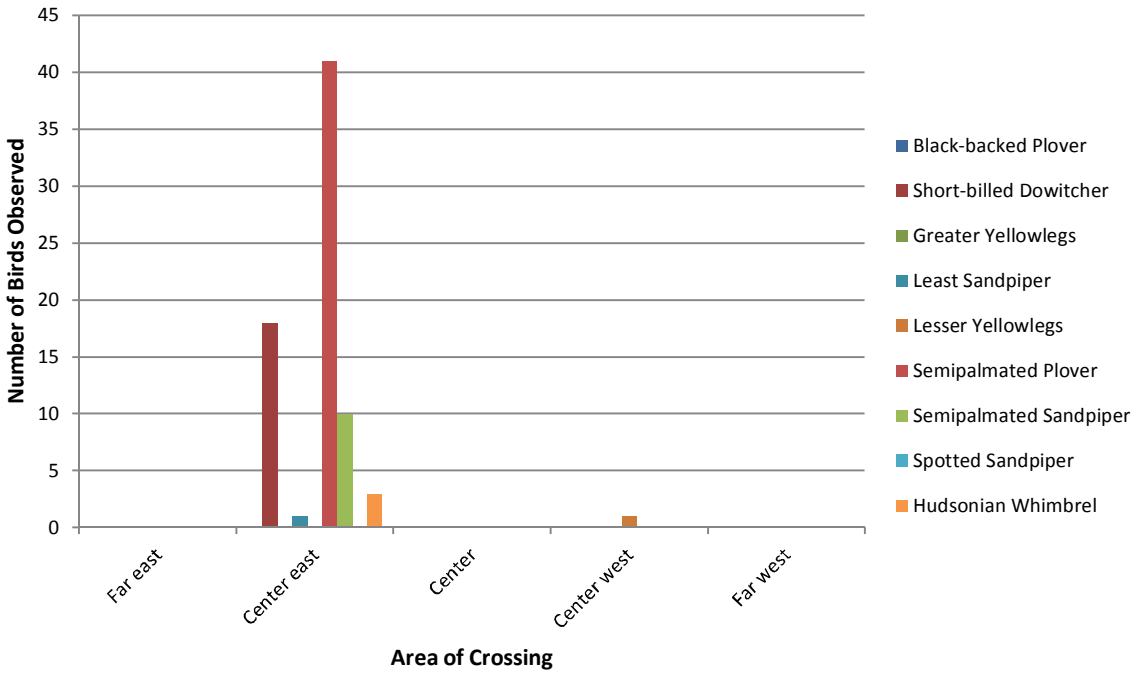

Figure 48. Area of crossing of shorebirds observed at the Canso Causeway during Diurnal Bird Surveys

There is very little suitable habitat for this guild in the area of the Canso Causeway. The majority of the birds in the guild are found within the Auld's Cove study area. As such, these birds were not present in the Causeway study area in abundance.

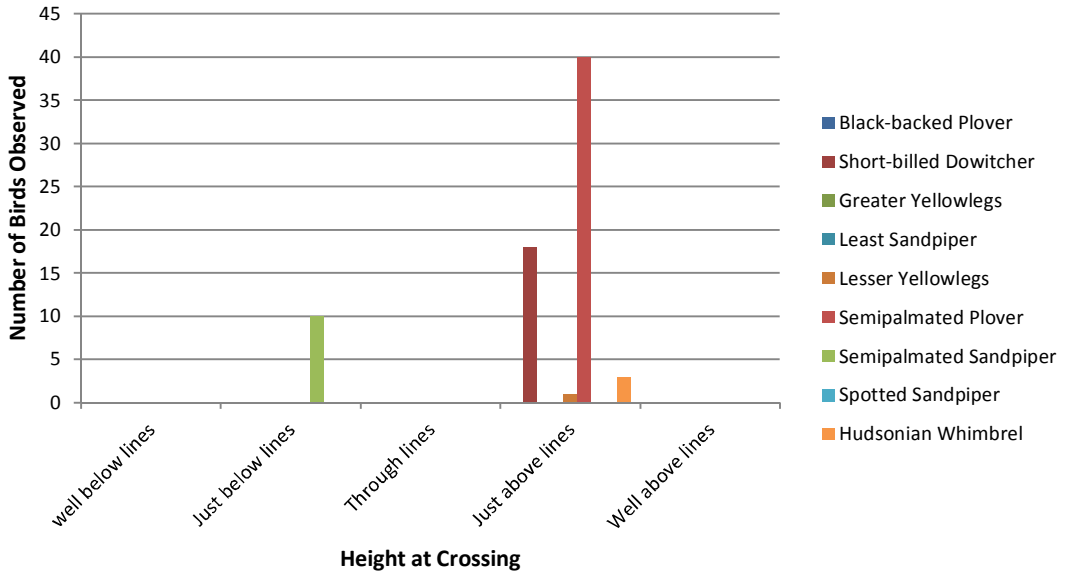

Figure 49. Height at crossing of shorebirds observed at the Canso Causeway during Diurnal Bird Surveys

6.5.2.8 Other Species (Passerines/Raptors)

A total of 21 species of passerines and raptors were observed at the Canso Causeway during Diurnal Bird Surveys, accounting for 344 individual birds. There were 22 observed interactions, 21 of which of which were high risk (95.5% ± 8.7%, 95% CI). The following species were identified during surveys (Figure 37):

- American Crow;
- Bald Eagle;
- Common Raven;
- Osprey; and
- Rock Pigeon.

The most commonly observed passerines/raptor species was the American Robin. A large flock of 100 American Robins crossed the power lines near the center, flying well above the lines. No interactions were observed.

The remainder of species in this guild crossed the lines between far-east and center east (Figure 50). In terms of height of crossing, these species predominantly crossed just above or well below the lines (Figure 51).

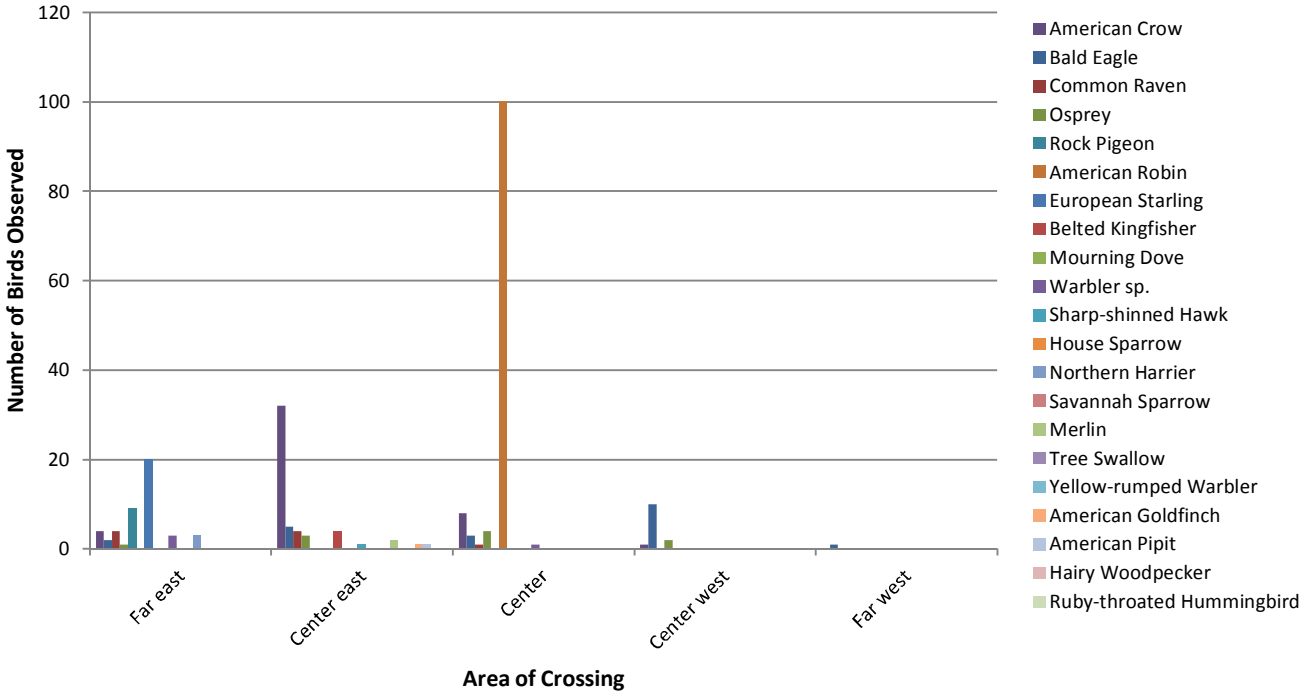

Figure 50. Area of crossing of passerines and raptors observed at the Canso Causeway during Diurnal Bird Surveys

There is a large degree of variability in the behavior of the species that comprise this guild and the sample size observed is small. The data does show that the interaction rates at both locations (6.3% ± 2.5% at the Canso Causeway and 6.8% ± 2.6% at Auld's Cove, 95% CI; Figures 19 and 37) are approximately equal.

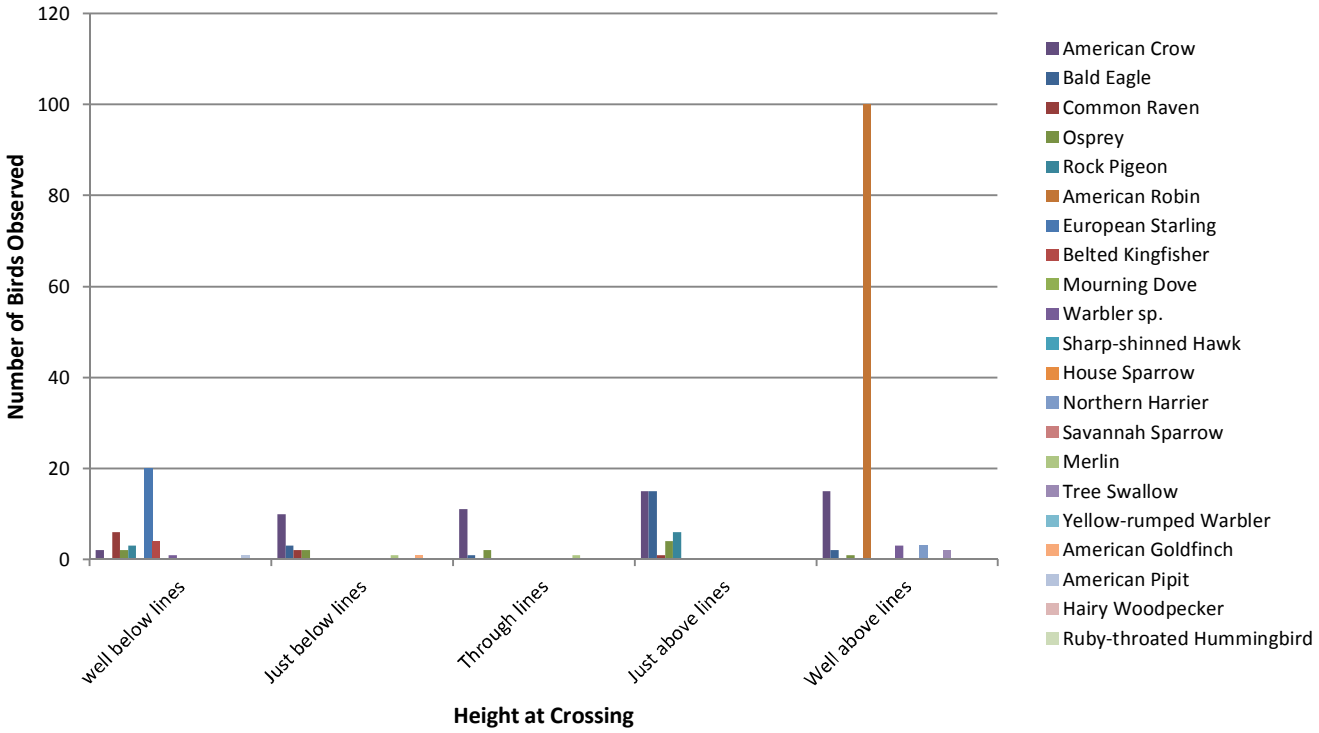

Figure 51. Height at crossing of passerines and raptors observed at the Canso Causeway during Diurnal Bird Surveys

6.6 Effects of Tide and Weather

6.6.1 Effects of Tide and Weather Conditions on Interactions at Auld's Cove

Off all birds observed during various wind speeds, those observed when wind speeds were between 0-9 km/hr had the highest rate of interaction (10.7% ± 1.6%, 95% CI), followed by birds observed when wind speeds were between 40-49 km/hr (10.2% ± 1.1%, 95% CI). The lowest rate of interaction was observed during wind speeds greater than 50 km/hr (7.5% ± 1.8%, 95% CI).

Figure 52 shows the rate of interactions for birds observed at different wind speeds.

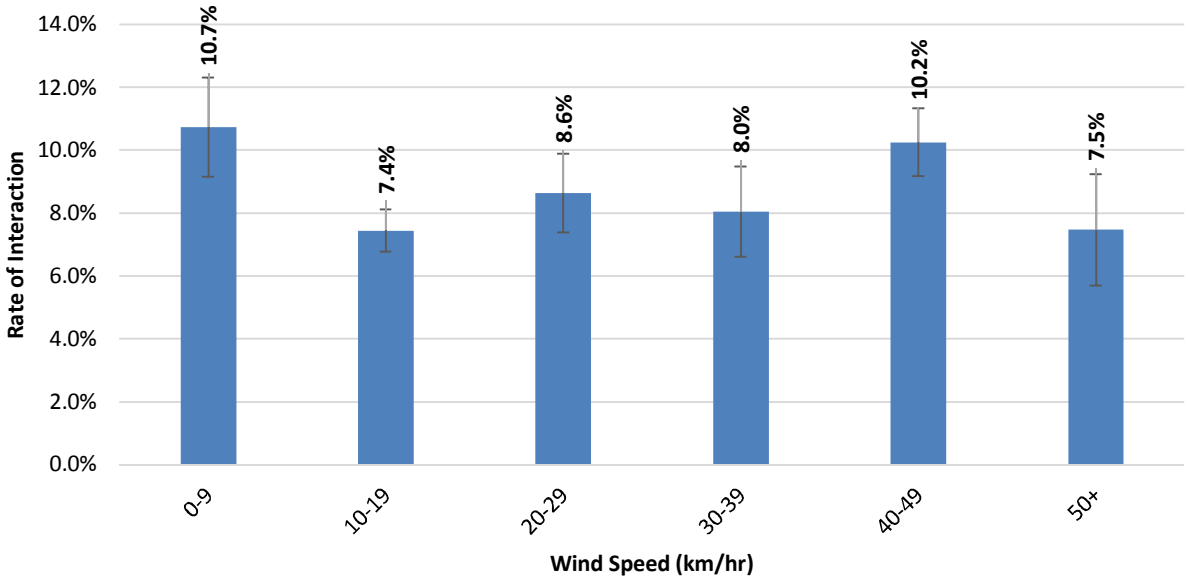

Figure 52. Effects of Wind Speed on rates of interaction at Auld's Cove with 95% confidence intervals

While anecdotal observations indicated that increased wind speeds increase the risk of birds interacting with the Auld's Cove power lines, the trend is not reflected in the data. For the most part, interaction rates were relatively consistent across all wind speeds. This is likely skewed by the relatively low number of surveys that occurred during high wind events (although efforts were made to target high wind events during surveys). Additionally, bird activity was generally lower in high wind events, which is also likely reflected in the data. Figure 53 indicates how wind direction affects the rates of interaction between birds and the Auld's Cove power lines.

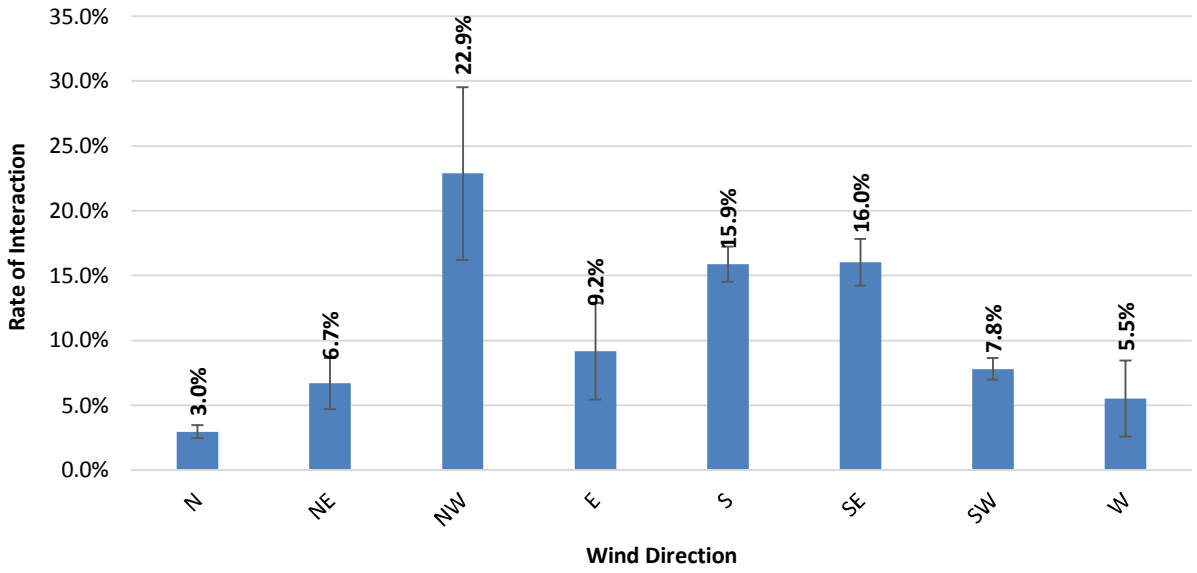

Figure 53. Effects of Wind Direction on the rates of interaction at Auld's Cove with 95% confidence intervals

For the most part, northwesterly winds resulted in more interactions between birds and the Auld's Cove power lines. This is believed to be a result of birds being blown into the area from St. George's Bay. Additionally, southerly and southeasterly winds resulted in relatively high rates of interactions. As previously discussed, results are dependent on the wind conditions prevalent during actual surveys, hence with the sampling events being somewhat limited (*i.e.* typically extending over two days throughout every week), a true correlation between effects of wind are hard to ascertain with any certainty.

Figure 54 shows how sky conditions affect the rates of interaction between birds and the Auld's Cove power lines.

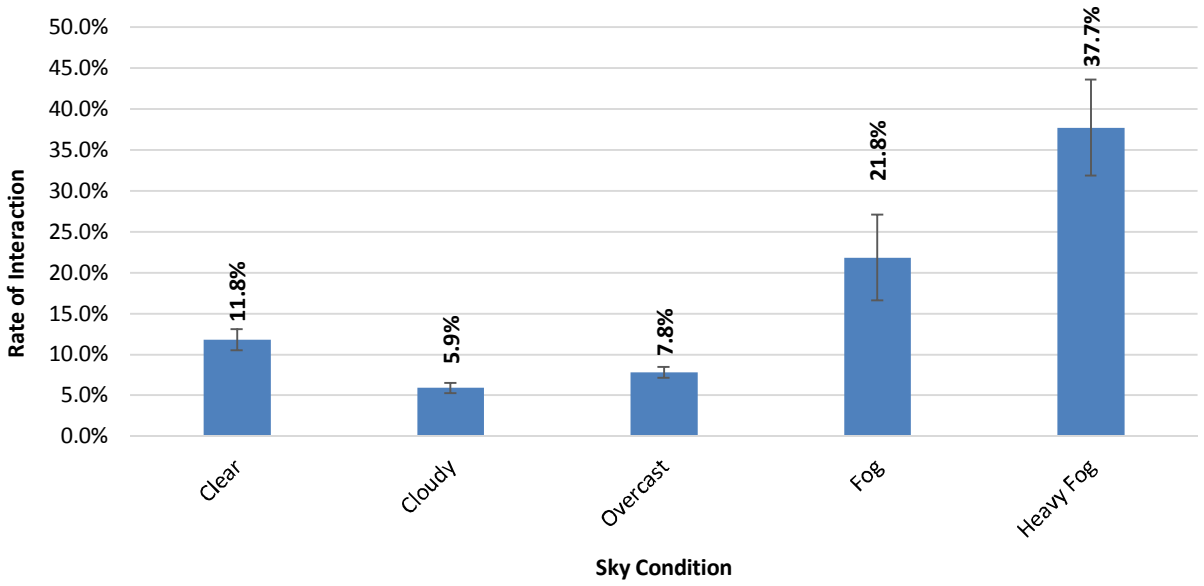

Figure 54. Effects of Sky Conditions on the rates of interaction at Auld's Cove with 95% confidence intervals

Sky conditions that resulted in low visibility (e.g. fog and heavy fog) resulted in higher rates of interaction (21.8% ± 5.2% in 'fog' conditions and 37.7% ± 5.8% in 'heavy fog' conditions). It should be noted that that survey ability is impaired in the low visibility conditions.

Two of the four diurnal watch surveys took place in 'fog' conditions, in which visibility was roughly 1 to 2 km, and two surveys took place in 'heavy fog' conditions, in which visibility was less than 1 km. As the number of birds observed in 'fog' and 'heavy fog' conditions is somewhat low (238 birds and 265 birds respectively) confidence in this data is low to moderate, as indicated by the somewhat wide range in interaction rate confidence intervals (5.2% and 5.8%, see above).

The average number of birds observed per hour during 'fog' and 'heavy fog' days is somewhat low at 30 and 33 bird observations per hour respectively under these conditions, which are less than half the average across all diurnal watch surveys of 73 bird observations per hour. While this is likely due in part to limitations in survey ability during the low visibility conditions, it may also indicate that there is less bird movement in the Auld's Cove area in foggy conditions. This suggests that the higher interaction rates in foggy conditions may be partially offset by lower levels of bird activity under these conditions when considering the risk that the Auld's Cove infrastructure poses to birds.

We calculated the average number of interactions per hour observed at Auld's Cove under 'fog' and 'heavy fog' conditions from the diurnal survey data to serve as a rough estimate of the number of birds expected to interact with the powerlines per hour in foggy conditions, which was 9.5 interactions per hour (the fog interaction coefficient). Compared to the average number of interactions per hour across all surveys (6.3 interactions per hour), the hourly interaction numbers in foggy conditions is approximately 50% higher than average.

While specific efforts were made to target foggy days in the diurnal watch surveys, only 4 of the 50 diurnal watch surveys took place in foggy conditions as the spring, summer and fall of 2015 had relatively few fog days. Because of this, we made an effort to quantify the average number of fog days based on archived weather data for the area. Weather data was accessed from Environment Canada's Climate Data Online Database (EC 2016). Data recorded at the nearby Port Hawkesbury weather station was analyzed to determine the average number of foggy days in the spring, summer, and fall (a season) back to 2011 (5 years) when this information first began to be recorded. This analysis revealed an average of 32 'fog' days per occurred season for the last 5 years, with 19 occurring in the spring (April, May, and June), 9 occurring in the summer (July, August and the first half of September), and 4 occurring in the fall (the second half of September and October). From this information, we extrapolated to estimate the number of birds likely to interact with the powerlines under foggy conditions in each season on an average year based on the fog interaction coefficient described above. We estimate that on an average year, approximately 2166 birds are likely to interact with the powerlines in foggy conditions the spring, 1026 in the summer, and 456 in the fall, for a total of 3648 interactions under foggy conditions in one season (assuming that birds are active for an average of 12 per day).

There was a calculated average of 6.3 interactions per hour across the whole season in 2015 based on the diurnal survey data. When extrapolated, 16,088 interactions are estimated to have occurred within the 2015 season (based on a 214 day season from April to October and assuming an average of 12 hours of bird activity per day). Assuming this figure represents the average number of interactions per season, we can deduce that on average 22.6% of interactions that occur within a season occurred under foggy conditions.

Figure 55 indicates how tidal conditions affect the rates of interaction at Auld's Cove.

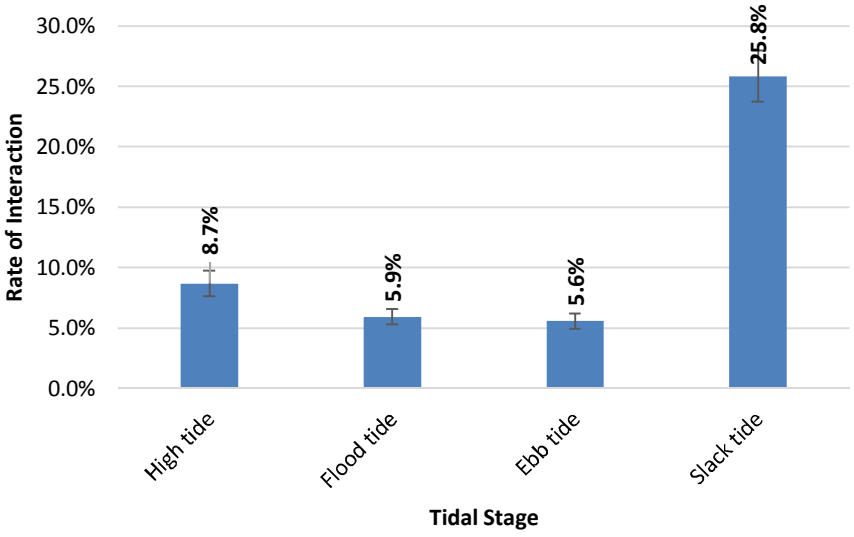

Figure 55. Effects of Tidal Conditions on the rates of interaction at Auld's Cove with 95% confidence intervals

Observed interaction rates were higher during surveys that occurred during slack tide. The reason for this is not clear, but it is likely due the influence that tides have on habitat in the Auld's Cove area. Auld's Cove hosts rock bars and mud flats frequented by a variety of seabirds and shorebirds. These habitats are exposed at slack tide, which may be is the influencing factor in attracting birds to that location during this period, resulting in higher interaction rates.

6.6.2 Effects of Tide and Weather Conditions on Interactions at the Canso Causeway

Figure 56 shows how wind speed affects the rates of interaction between birds and the Canso Causeway power lines.

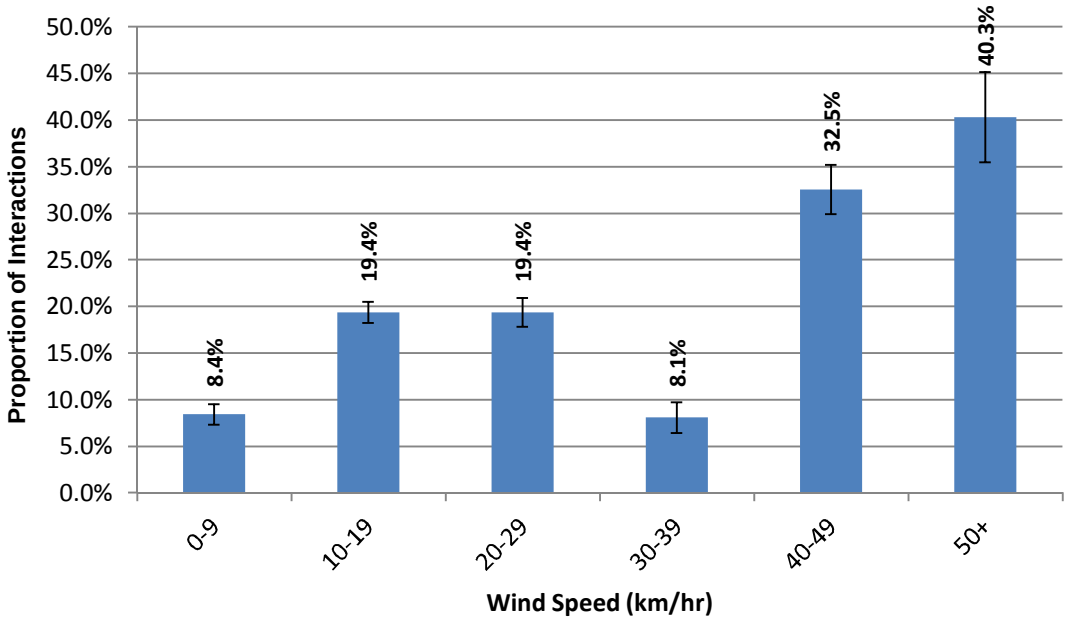

Figure 56. Effects of wind speed on rates of interaction at the Canso Causeway with 95% confidence intervals

At the Canso Causeway, there was a general correlation between wind speeds and interaction rates. With a few exceptions, the higher the wind speed, the higher the rate of interaction with the power lines became. Results are likely skewed slightly by the lack of equal survey effort at different wind speeds.

This correlation between wind speeds and rates of interaction was not observed at Auld's Cove.

Figure 57 shows how wind direction affects the rates of interaction between birds and the Canso Causeway power lines.

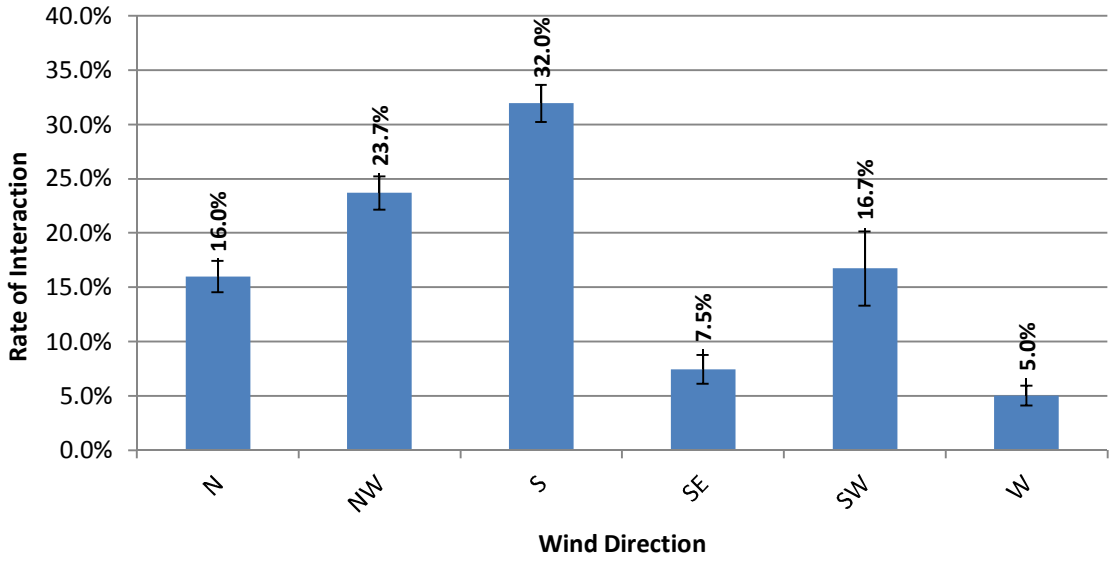

Figure 57. Effects of wind direction on the rates of interaction at the Canso Causeway with 95% confidence intervals

Southerly winds result in the highest rates of interaction at the Canso Causeway. This trend was observed to a lesser extent at Auld's Cove. The reason for this is not entirely clear, but it could be due to birds being blown up from the southern section of the Strait of Canso and the Chedabucto Bay. The second highest rate of interaction as a result of wind conditions was observed with Northwesterly winds. This trend was also observed at Auld's Cove, and is believed to be as a result of birds being blown into the area from the St. George's Bay area. Northwesterly and southerly winds produce higher rates of interaction at both the Canso Causeway and Auld's Cove power lines.

Figure 58 shows how sky conditions affects the rates of interaction between birds and the Canso Causeway power lines.

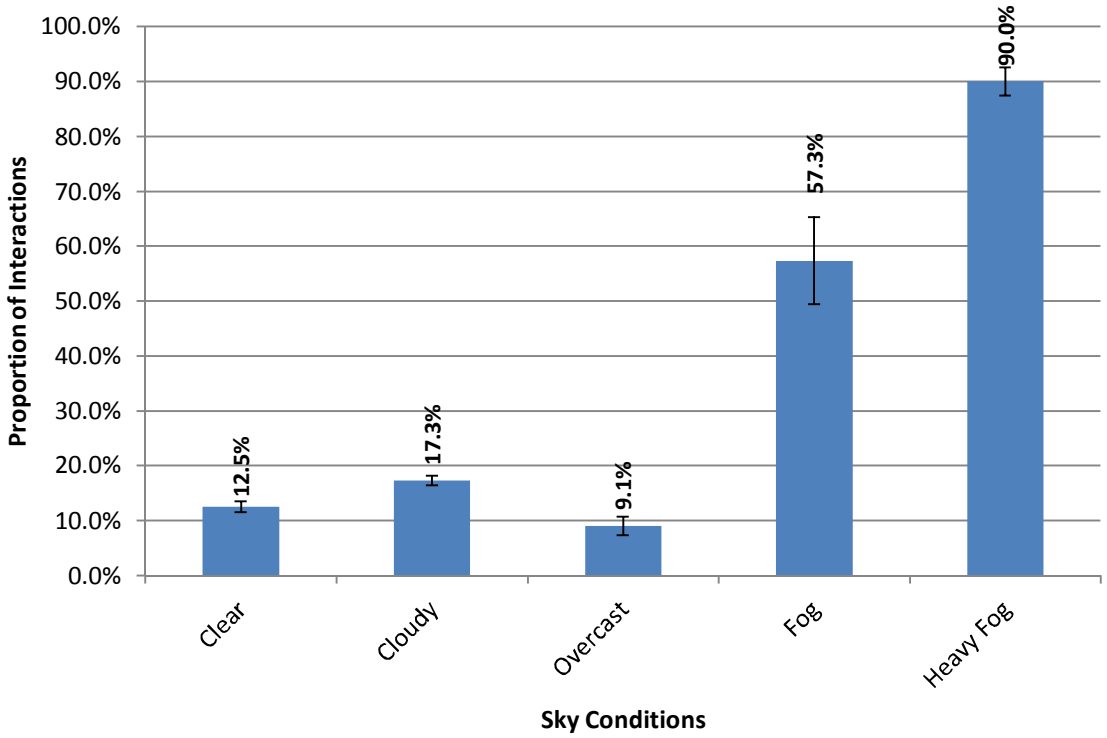

Figure 58. Effects of Sky Conditions on the Proportion of Interactions at the Canso Causeway with 95% confidence intervals

Similarly to the observations at Auld's Cove, sky conditions that result in low visibility (e.g. fog and heavy fog) result in higher rates of interactions.

Figure 59 shows how tidal conditions affects the rates of interaction at the Canso Causeway power lines.

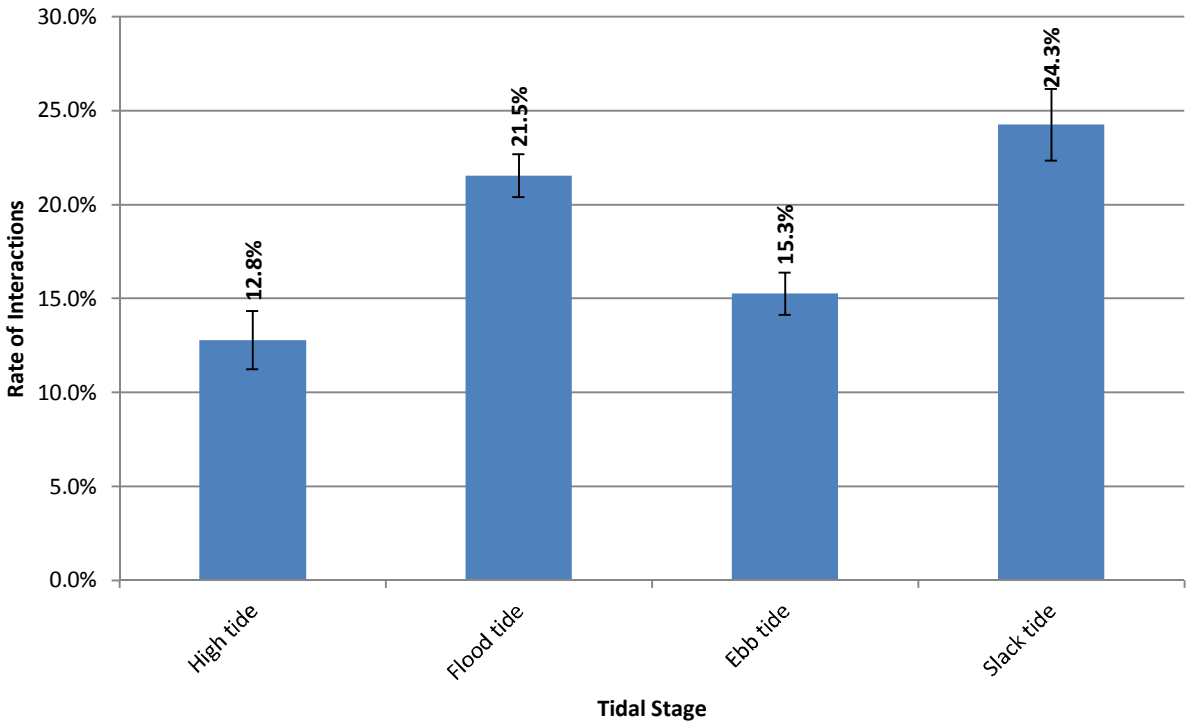

Figure 59. Effects of Tidal Conditions on the rate of interactions at the Canso Causeway with 95% confidence intervals

Tides did not appear to exert a discernable trend in the rate of interactions at the Canso Causeway like they did at Auld's Cove. Slack tide did result in the highest rate of interaction, as is consistent with Auld's Cove, but only by less than 3%. The difference in the effect that tide played in interaction rates between the two locations is likely a result of surrounding habitat. Auld's Cove hosts rock bars and mud flats frequented by a variety of seabirds and shorebirds. These habitats are exposed at slack tide, which may be the attraction of birds to that location. The Canso Causeway is not surrounded by habitat features that are influenced by the tide hence reducing its impact on interactions.

6.7 Species of Conservation Interest

Overall, there were 21 SOCI identified during all surveys (Table 9).

Table 9. Bird SOCI identified at or Near the Study Area

Common Name	Scientific Name	SARA Status[1]	NSESA Status[2]	COSEWIC Status[3]	NSDNR Status[4]	NS S-Rank[5]
Arctic Tern	Sterna paradisaea	Not Listed	Not Listed	Not Listed	May Be At Risk	S3B
Atlantic Puffin	Fratercula arctica	Not Listed	Not Listed	Not Listed	Sensitive	S1B,S4S5N
Bay-breasted Warbler	Dendroica castanea	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B
Chimney Swift	Chaetura pelagica	Threatened	Endangered	Threatened	At Risk	S2S3B
Common Loon	Gavia immer	Not Listed	Not Listed	Not at Risk	May Be At Risk	S3B,S4N
Common Tern	Sterna hirundo	Not Listed	Not Listed	Not at Risk	Sensitive	S3B
Golden-crowned Kinglet	Regulus satrapa	Not Listed	Not Listed	Not Listed	Sensitive	S4
Greater Yellowlegs	Tringa melanoleuca	Not Listed	Not Listed	Not Listed	Sensitive	S3B,S5M
Killdeer	Charadrius vociferus	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B
Olive-sided Flycatcher	Contopus cooperi	Threatened	Threatened	Threatened	At Risk	S3B
Pine Siskin	Spinus pinus	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B, S5N
Purple Sandpiper	Calidris maritima	Not Listed	Not Listed	Not Listed	Sensitive	S3N
Red Knot rufa ssp	Calidris canutus rufa	Endangered	Endangered	Endangered	At Risk	S2S3M
Ruby-crowned Kinglet	Regulus calendula	Not Listed	Not Listed	Not Listed	Sensitive	S4B
Rusty Blackbird	Euphagus carolinus	Special Concern	Endangered	Special Concern	May Be At Risk	S2S3B
Savannah Sparrow	Passerculus sandwichensis	Special Concern	Not Listed	Special Concern	Secure	S4B
Semipalmated Sandpiper	Calidris pusilla	Not Listed	Not Listed	Not Listed	Sensitive	S3M
Spotted Sandpiper	Actitis macularius	Not Listed	Not Listed	Not Listed	Sensitive	S3S4B
Tree Swallow	Tachycineta bicolor	Not Listed	Not Listed	Not Listed	Sensitive	S4B
Whimbrel	Numenius phaeopus	Not Listed	Not Listed	Not Listed	Sensitive	SNA
Willet	Tringa semipalmata	Not Listed	Not Listed	Not Listed	May Be At Risk	S2S3B

[1]Government of Canada 2012; [2]NS ESA 2013; [3]COSEWIC 2012a; [4]NSDNR 2010; [5]ACCDC 2015

Of the SOCI listed in Table 9, the following five species are listed under either *SARA* or NS *ESA*:

- Chimney Swift;
- Olive-sided Flycatcher;
- Red Knot;
- Rusty Blackbird; and
- Savannah Sparrow.

An evaluation of trends and utilization of the site by the SOCI listed above is provided below.

Chimney Swift (*Chaetura pelagica*)

- One bird was observed during a shorebird watch count flying over Long Pond from north to south on August 27, 2015. This bird was likely migrating through the area on its southerly migration to its overwintering grounds in the Tropics. It is also possible that the bird may have been feeding on insects present near Long pond. Given the time of year and habitat in which it was observed, it was more likely that it was migrating through the area rather than roosting or nesting nearby.

Olive-sided Flycatcher (*Contopus cooperi*)

- One Olive-sided Flycatcher was observed during a passerine survey on June 16, 2015 in a forested area beneath the existing Auld's Cove power lines, on the western (mainland) side. It was heard over a distance of 100 m from the point count location. This species is frequently observed at forest edges near open areas, including clear-cuts. The observed song suggested it came from an un-paired breeding male. It is possible that this species breeds in the forested areas on either side of the Strait of Canso but this could not be determined during this study.

Red Knot (*Calidris canutus*)

- One Red Knot was observed foraging on the rock bar that contains Long Pond on the east side of the Strait of Canso on September 2, 2015. This species is known to pass through Nova Scotia during migration. Given that it was not observed during any previous or subsequent shorebird surveys, it is likely that this individual was passing through the area on its southerly migration to its wintering grounds in South America.

Rusty Blackbird (*Euphagus carolinus*)

- A group of four Rusty Blackbirds were observed on May 15, 2015 during one of the passerine surveys. The birds were flying through the clearing under the eastern tower of the existing Auld's Cove power lines. While suitable breeding habitat exists on the forested slopes on either side of the Strait of Canso, these birds were not observed during any

subsequent passerine surveys. Therefore it is likely that they were just passing through on their northerly migration flight path.

Savannah Sparrow (*Passerculus sandwichensis*)

- The Savannah sparrow was observed throughout all survey types conducted throughout the season, and were consistently observed in the area from April to late October. Flight calls and songs were also identified during the Nocturnal surveys conducted at Auld's Cove, and in the acoustic monitoring program. It is the 'Ipswich' sub population of Savannah sparrow, which is endemic to Sable Island, which is listed as 'Special Concern; by SARA and COSEWIC. The more common mainland population of these birds is considered secure. The Ipswich population is visually distinctive from the main Savannah sparrow population. None of the Savannah sparrows that were visually observed during any of the surveys were Ipswich Savannah sparrows. It is very difficult to distinguish between the vocalizations of Ipswich Savannah sparrows and common Savannah sparrows, so it is possible that any auditory observations of these birds, including those made as part of the nocturnal surveys or the acoustic monitoring program, came from Ipswich Savannah Sparrows. This however is unlikely as visual observations could not confirm the presence of Ipswich Savannas Sparrows.

7.0 INFRASTRUCTURE INTERACTION ANALYSIS

7.1 Existing Infrastructure

Based on the guild specific trends outlined in Section 6.5.1 and 6.5.2, an overall review of interactions between birds and existing infrastructure at each study area is provided and in the following sections.

7.1.1 Auld's Cove Interaction Tracking Results

Table 10 summarizes the risk of collision posed to each guild by the Auld's Cove power lines. Each guild is assigned a score of 'low', 'medium' or 'high' based on the justification provided. The risk scores correspond to the following:

- **Low** – It is very unlikely that a member of this guild will collide with the power lines at any time under any conditions.
- **Medium** – It is unlikely that a member of this guild will collide with the power lines, unless under specific conditions (such as during bad weather or during the migration season).
- **High** – It is likely that a member of this guild may collide with the power lines at any time under any conditions.

Table 10. Risk of Interaction by Guild at Auld's Cove

Guild	Risk of Collision with Existing Auld's Cove Power Lines	Risk Score Justification
Terns	Low	Although abundant in the area, Terns did not exhibit behaviors that put them at risk of colliding with the power lines.
Cormorants	Moderate	Cormorants are present in abundance throughout the season, particularly in the fall, but they only seldom (during migration and during high winds) behaved in a way that put them at risk of colliding with the Auld's Cove power lines.
Sea Ducks and Waterfowl	Low	Sea ducks and waterfowl were not present in high abundance at any point during the year, and they did not exhibit behaviors that put them at risk of colliding with the power lines.
Gulls	Moderate	While Gulls have a relatively high rate of interaction, they consistently exhibit a good deal of confidence when maneuvering around the power lines. Gulls are only likely to collide with the power lines during high wind or low visibility conditions.
Northern Gannets	Moderate	While Northern gannets exhibit behaviors that may put them at risk of interaction with the power lines, they were not present in high abundance at any point during the season, and they consistently exhibited good avoidance behavior. They are only likely to collide with the power lines during high wind or low visibility conditions.
Seabirds	Low	Seabirds were not present in high abundance at any point during the year, and did not exhibit behaviors that put them at risk of colliding with the power lines.
Shorebirds	Low	Shorebirds were not present in any abundance at any point during the year, and they did not exhibit behaviors that put them at risk of colliding with the power lines.
Other Species (Passerines/ Raptors)	Low	Passerines and raptors were not present in any significant numbers at any point during the year, and for the most part did not exhibit behaviors that put them at risk of colliding with the power lines.

For the most part, the risk posed by the Auld's Cove power lines is 'Low'. For Cormorants, Gulls, and Northern Gannets where the risk of collisions was determined to be 'Moderate', the risk is largely due to species specific behaviours and how they are likely to be confounded by factors such as weather conditions. It should be noted that that this analysis gave little weight to the results of the nocturnal surveys conducted at Auld's Cove. While the nocturnal survey results indicated that the risk of the Auld's Cove power lines to birds is higher at night, the small data set available for analysis limits the ability for definitive conclusions to be made about the nocturnal behavior of birds.

7.1.2 Canso Causeway Interaction Tracking Results

Table 11 summarizes the risk of collision posed to each guild by the Canso Causeway power lines. Again, each guild is assigned a score of 'low', 'medium' or 'high' based on the justification provided. The risk scores correspond to the following:

- **Low** – It is very unlikely that a member of this guild will collide with the power lines at any time under any conditions.
- **Medium** – It is unlikely that a member of this guild will collide with the power lines, unless under specific conditions (such as during bad weather or during the migration season).
- **High** – It is likely that a member of this guild may collide with the power lines at any time under any conditions.

Table 11. Risk of Interaction by Guild at Canso Causeway

Guild	Risk of Collision with Existing Auld's Cove Power Lines	Risk Score Justification
Terns	High	Terns were abundant in the area and exhibited behaviors that put them at risk of colliding with the power lines.
Cormorants	High	Cormorants were abundant in the area and exhibited behaviors that put them at risk of colliding with the power lines.
Sea Ducks and Waterfowl	High	While not overly abundant in the area, Sea Ducks and Waterfowl consistently exhibited behaviors that put them at risk of colliding with the power lines.
Gulls	High	Gulls were abundant in the area and exhibited behaviors that put them at risk of colliding with the power lines.
Northern Gannets	High	While not overly abundant in the area Northern gannets exhibited behaviors that put them at risk of colliding with the power lines.
Seabirds	Un-determined	Few sea birds were present in the area, and none of them were observed crossing the power lines.
Shorebirds	Low	Shorebirds were not present in any abundance at any point during the year, and they did not exhibit behaviors that put them at risk of colliding with the power lines.
Other Species (Passerines/ Raptors)	Low	Passerines and raptors were not present in any significant numbers at any point during the year, and for the most part did not exhibit behaviors that put them at risk of colliding with the power lines.

The risk posed by the Canso Causeway power lines is for the most part high, with the exception of Shorebirds and Passerine / Raptors. These guilds do not appear to behave in a manner that puts them at risk with the Canso Causeway infrastructure. No seabird species were observed to cross the Canso Causeway power lines, therefore no analysis was possible for this guild.

The data show evidence that birds behave differently in response to the Auld's Cove power lines when compared to the Canso Causeway power lines. Explanations for this trend are dependent on the following variables:

- species specific behavioural characteristics which are unique to each guild (e.g. flight height and seasonal activity characteristics)
- habitat resource for feeding and foraging between the two locations (e.g. provision of fish as a food source).
- Differences in the infrastructure arrangement at each location (e.g. height of the power lines and the obstructions posed by other features such as the Canso Causeway and its towers).

Study results suggest that generally, the existing Canso Causeway power lines pose a greater risk of collision to birds than those existing at Auld's Cove. While there are some exceptions (e.g. Northern Gannets and Passerines and Raptors), there is an approximate 2-3 fold increase in interaction rates at the Canso Causeway power lines when compared to the Auld's Cove power lines. Furthermore, there were four observed collisions at the Canso Causeway, compared to none at Auld's Cove location despite the completion of approximately 500 hours of surveying at the Auld's Cove location.

7.2 Proposed Infrastructure

According to the Migratory Soaring Bird Project, the biggest impacts to migrating birds across flyways for medium to high voltage power lines are believed to be:

- Displacement/Barriers: along migration routes or to suitable habitats/feeding grounds
- Habitat impacts: fragmentation of habitats at landscape level
- Electrocution: risk associated with medium voltage distribution power lines
- Collision: risk associated with high voltage transmission power lines

(Source: MSBP, 2015)

The data obtained from the 2015 surveys has been reviewed, and avian trends and behaviour has been utilized to predict the potential impacts (listed above) to the avian community as a result of the proposed infrastructure arrangement at Auld's Cove. The following sections provide an account of each potential impact, and outline to what degree the planned infrastructure at Auld's Cove contributes to it.

7.2.1 Displacement/Barriers

Survey results suggest that during periods of migration, birds utilize the Strait of Canso (inclusive of the Auld's Cove and Canso Causeway locations) as a flyway, but the existing infrastructure does not appear to obstruct or alter migrating bird behaviour to any significant extent (Section 6.5). Feeding and foraging habitat is provided by the shoreline waterbodies of Archie's Pond and Long Pond (Section 6.3 and Drawing 3, Appendix A), however, expansion of the existing infrastructure is not likely to have a significant impact to this habitat.

Although the existing infrastructure creates a physical interruption in the flyway of birds, 2015 field evidence suggests that the vast majority of birds (87.3% ± 0.9%, 95% CI) fly well beneath the existing power lines, and instances of altered flight path behaviour is relatively uncommon. Therefore, the erection of additional power lines at Auld's Cove is not likely to act as an additional migratory barrier.

7.2.2 Habitat Impacts

As discussed in Section 3.1, terrestrial habitat adjacent to the Auld's Cove location comprises a mixture of middle aged to mature mixedwood forest, which in some cases has experienced blowdown. Although final infrastructure design has not been completed, it is anticipated that the proposed new tower at the southern extent, will be situated adjacent to the existing the tower located on the coastal berm separating Archie's Pond and the Strait of Canso. Habitat features on the berm is limited to a gravel/rock surface along the rocky shoreline, therefore impacts to existing avian habitat is not expected. The forested northern extent will experience small scale vegetation clearing within the right of way for tower and power line installation which extends to the north; however none of the existing habitat has been identified as significant to habitat requirements of any species identified during the 2015 surveys. Therefore, there is no anticipated impact to habitat as a result of physical construction activities expected during tower erection and power line installation.

7.2.3 Electrocution

In a report entitled *"Protecting Birds from Power lines"*, D. Haas *et al* note that casualties due to electrocution almost exclusively occur to species that perch and/or roost on badly designed medium voltage power poles. The spacing between energized wires and lack of protective insulators increases electrocution risk on such structures. The existing structures at Auld's Cove are high voltage towers, and comprise downwardly hanging, insulated high strength self-dampening conductors, hence significantly reducing the risk of electrocution. Field surveys during 2015 confirm that there was no evidence of nesting/roosting birds on the Auld' s Cove towers, and no bird carcasses indicating the potential for electrocution, were observed beneath the structures. Therefore, the expansion of the infrastructure using similar tower design is not thought to increase the potential of electrocution.

7.2.4 Collision

In 2012, the Avian Power Line Committee (APLIC) stated in their publication *Reducing Avian Collisions with Power Lines: The State of the Art,* that bird collision rates are largely dependent on the following variables:

- Biological Characteristics: the susceptibility for a species to be affected by power line collision based on the functions of the species characteristics i.e. body size, weight, wing shape, flight behaviour and nesting habits;
- Environmental Conditions: land uses, weather conditions and visibility and sudden disturbances; and
- Engineering Aspects: relating to infrastructure design *i.e.* diameter of lines, line placement, line orientation, line configuration, structure type, and lighting (constant or blinking).

For the purposes of this section's analysis, susceptibility to avian collision as a result of the proposed project is based on the engineering aspects of the new infrastructure. Specific commentary related to biological characteristics of birds, as well as correlations between the risk to birds and environmental conditions, such as weather and tides, are provided in Section 6 and 7.

In a workshop completed in 2011 for the Renewable Grid Initiative, Dr. Markus Nipkow states that migrants flying at heights between 20 m and 50 m are at considerable risk of collision, and higher losses occur at flyways and/or migration pathways (Nipkow. M, 2011). Furthermore the APLIC Report as well as D. Hass *et al* agree that death by collision with the cables is by far the largest peril posed by high-voltage power lines. Highest risk is posed by those power lines, where the conductor cables are arranged at different heights (multi-level arrangements) and/or with neutral cables (over-head ground wire) high above the conductor cables (Haas *et al*, 2005).

The current infrastructure at Auld's Cove consists of two towers to which three sets of two parallel power lines are arranged vertically. The lowest set of lines is designed for minimum clearance of 50 m above the Strait, extending to 115.5 m where the highest set of paired wires attaches to the towers. In addition, no overhead ground wire (OHGW) exists on the current infrastructure, nor is there one planned for the new expanded infrastructure.

According to the publications referenced above, it is apparent that the current infrastructure at Auld's Cove falls within the parameters of an arrangement that could increase collision potential, or that to which may cause impact to avian behaviour and population *i.e.* power lines within the 20 m – 50 m height range, located within a migration flyway, and consisting of a multi-level power line arrangement. It should be noted however, that the lack of an OHGW reduces collision risk dramatically, and the 2015 field surveys suggest that existing infrastructure at Auld's Cove is not adversely affecting bird behaviour in this regard, nor is it precipitating avian collision or mortality events.

Many hundreds of bird species typically migrate at night, and it is well known that artificial lights attract birds during migration, particularly when the sky is cloudy and the ceiling is low (Gauthreaux Jr. S and Belser. C 2006). This publication goes on to note that exposure to a light field at night causes alteration of a straight flight path (e.g. hovering, slowing down, shifting direction, or circling). Furthermore, studies completed to ascertain the influence of varying lighting types to bird behaviour suggest that red lights appear to disrupt the magnetic compass used by birds during migration, and that this could be a factor contributing to the aberrant flight behaviour of migrating birds near towers with red warning light arrays (Gauthreaux Jr. S and Belser. C 2006). The existing lighting set-up at Auld's Cove includes vertically aligned, flashing white lighting, which will be replicated on the new infrastructure, hence no additional affects to birds are expected.

The data collected during 2015 surveys indicates that the existing NSPI infrastructure installed at Auld's Cove does not generally have a direct effect on bird movement through the area, and does not appear to cause bird mortality. The addition of the new infrastructure, which will expand on the current infrastructure and possess a similar power line arrangement, should not substantially

increase the cross-sectional profile of the existing transmission infrastructure. Therefore, it is not expected to cause additional risk to birds moving through the area. Additionally, the footprint of the new infrastructure will not impact important bird habitat in the area. Appropriate mitigation methods associated with construction of the new infrastructure are provided in Section 7.3.

7.3 Mitigation

Typically the first means of mitigating potential avian interactions with regards to a new powerline project is initiated during the planning phases. The APLIC report recommends the completion of spatial analysis, field assessments, and avian risk assessments in order to assess potential avian/powerline interactions. Such studies would provide planners with detailed ornithological information such that powerline corridors could be routed and designed to minimize potential avian interactions.

In this case however, mitigation techniques should incorporate the existing infrastructure, as well as the new infrastructure. As discussed in Section 7.2, the similarities in tower and powerline design between the proposed arrangement, and existing structures acts as the primary means of mitigation. The following mitigation methods are common to all power line infrastructures and could be considered, however, site specific methods are also provided below.

Common Mitigative Measures

- Tower Design: Include visual and acoustic scaring methods to reduce collision with towers as well as nesting, perching, and roosting activities. If electrocution is an issue, reducing the risk by installing safe nesting and perching platforms a minimum of 70 cm above energized components. Space conductors at least 140 cm apart (MSBP 2015)

- Line Height and Arrangement: Minimizing the vertical spread of power lines. Having lines in a horizontal plane reduces collision risk.

- Removing the Overhead Ground Wire: Greater collision risk is associated with infrastructure which includes a thinner OHGW, therefore removing the thin wire, or where this is not possible, marking the line to make it more can reduce the risk. The existing, and new infrastructure will not include an OHGW.

- Visibility of Lines: The APLIC report states that there are three general types of line marking devices: aerial marker spheres, spirals, and suspended devices (swinging, flapping, and fixed). In addition, large diameter wire, though not a marking device, may also improve line visibility and has been used with line marking devices to reduce risk of electrocutions and collisions. Jenkins et al. (2010) concluded that any sufficiently large line marking device that thickens the appearance of the line for at least 20 cm (7.8 in) in length and is placed with at least 5 to 10 m(16.4 to 32.8 ft) spacing, is likely to lower collision rates by 50% to 80% (APLIC 2012).

Site Specific Mitigative Measures

- Timing of construction and maintenance activities: Construction of the new infrastructure will be timed to coincide with lower bird activity (i.e. January through February). This will limit potential disturbance to local winter residents utilizing shoreline habitat and ponds, as well as diurnal movements of birds in the area. Maintenance activities to be completed at similar periods of the year. Clearing of vegetation and construction within forested areas will take place outside of critical bird nesting periods (i.e. March 31 to August 31).

- Protection of adjacent habitat: The adjacent shoreline pond (Archie's Pond and Long Pond) in addition to the forested area surrounding the northern tower and right of way will be unaffected by construction activities. A Project Environmental Protection Plan should be developed to note site specific mitigation options while working in close proximity to these habitats (e.g. sediment and erosion control).

- Deterring nuisance wildlife: Measures will be taken to deter nuisance wildlife during construction and once the towers are complete. Good housekeeping practices will be maintained during construction limiting the attraction of invasive species such as Rock pigeons and European starlings. Additionally, care will be taken to prevent potential nesting cavities for these species, and bird spikes could be considered to prevent them from loitering on the towers adjacent to nesting and foraging habitats of migratory seabirds and shorebirds.

- Lighting: Maintain flashing white lighting to mirror existing infrastructure.

- Post Construction Monitoring Studies: Completion of a post construction monitoring study to identify potential effects of new infrastructure, and address site specific mitigation (if necessary).

8.0 DISCUSSION

The following key findings have been identified:

- Throughout the survey program, a total of 112 species were observed, distributed between the following guilds; Cormorants (<1% of species abundance), Northern gannet (<1%), Passerines/raptors (60%), Sea gulls (5%), Seabirds (3%), Seaducks and waterfowl (14%), Shorebirds (13%) and Terns (4%).
- The most abundantly observed species during the survey program were Double-crested cormorants, Common terns, Bonaparte's gulls, and Herring gulls.
- Twenty one (21) SOCI were identified during all surveys, five of which are listed under either *SARA* or NS *ESA* (Chimney Swift, Olive-sided Flycatcher, Red Knot, Rusty Blackbird, and Savannah Sparrow)
- A total of 67 species of passerines were identified during the entire study, the majority of which (53) were observed during the passerine surveys.
- Number of species observed at both locations during the diurnal surveys was consistent, with 55 species observed to cross the Canso Causeway power lines and 60 species observed to cross the Auld's Cove power lines.
- From a seasonal standpoint, 27% more birds were observed crossing the power lines at the Canso Causeway during the summer, and 7.5% more birds observed to have crossed the power lines at the Auld's Cove location in the fall.
- During the summer, the Canso Causeway appeared to be a lucrative feeding area, but during the fall, areas around Auld's Cove (particularly within Archie's Pond) appeared to host shoals of bait fish, attracting birds away from the Causeway.
- Birds tended to move from nesting or roosting areas in the south to forage north of the Canso Causeway during the day, and return to the south in the evening. A similar, yet less exaggerated trend was observed at the Auld's Cove location during the summer and fall as well.
- An active Common Tern colony was observed on an island in the middle of Long Pond with high activity noted in July and August, then diminishing into September.
- A larger variety of shorebird species were observed at Long Pond (32 species) than Archie's Pond (24 species), possibly due to the ample feeding opportunities during low tide and an area to roost at all tide levels.
- A significant increase in Bonaparte's Gulls was noted in mid-September at both Archie's Pond and Long Pond, with hundreds recorded at each location.
- Observations of flight paths during the study revealed the majority (87%) of birds crossing the Auld's Cove NSPI infrastructure fly either well below the lines or skim the water, while proportionately more birds passed 'just below', 'through', 'just above' or well above' the Canso Causeway power lines than at Auld's Cove. Likely due to the height of the power lines themselves, with the Canso Causeway wires being constructed at a lower height that is more intrusive to the birds passing through the area than the Auld's Cove power lines.

- Vast majority (79.2%) of birds were observed to cross the Canso Causeway power lines in the center east, likely because the power lines are higher in the center east of the Causeway.
- Equal portion of birds crossed the Auld's Cove power lines over Long Pond (East Cove), and over the three areas of the Strait of Canso itself (Center East, Center and Center West).
- Interactions with NSPI infrastructure among various guilds were examined at both locations revealing Northern Gannets had the highest rate of interaction at the Auld's Cove lines, whereas Seaducks and waterfowl and Northern Gannets had higher rates of interactions at the Canso Causeway.
- Four collisions were observed at the Canso Causeway (2 Double-crested Cormorants, 1 Northern Gannet, and 1 Great Black-backed Gull) and none at Auld's Cove.
- Interactions throughout varying weather conditions were compared; indicating higher wind speeds at the Canso Causeway produce a higher rate of interaction with the power lines, however no correlation between wind speeds and interactions were evident at Auld's Cove.
- Northwesterly and southerly winds produced a higher rate of interactions at both the Canso Causeway and Auld's Cove power lines.
- Sky conditions resulting in low visibility (e.g. fog and heavy fog) resulted in a higher rate of interaction at both the Canso Causeway and Auld's Cove power lines. Additional analysis indicates that on an average year, 22.6% of interactions occur in foggy conditions, and the majority of these are likely to occur in the spring.
- Acoustic analysis of recordings collected at night indicate that detectable bird diversity and activity levels increase from spring to late summer, and then taper into the fall.
- Nocturnal surveys conducted with thermal imagery indicate that bird interaction rates with the Auld's Cove power lines are five-fold higher at night than during the day, but these results are confounded by a small sample size and methodological limitations.
- Interaction rates were highest during surveys that occurred during slack tide at Auld's Cove and to a much lesser extent at Canso Causeway. Habitat features frequented by a variety of seabirds and shorebirds are exposed at Auld's Cove during slack tide whereas Canso Causeway is not surrounded by such tidal influenced habitat features.
- Evidence suggests that birds behave differently in response to the Auld's Cove power lines when compared to the Canso Causeway power lines, predominately related to differences in behavior, especially feeding and foraging behavior differences between the two areas (e.g. birds being attracted to shoals of fish that move around the area during different parts of the season).
- Powerline design between the two locations (e.g. Height of the power lines and the obstructions posed by other features such as the Canso Causeway itself) also modulates the behavioral responses that bird in each guilds have to the infrastructure.
- Analysis reveals that the existing power lines installed at the Canso Causeway pose a much larger risk to birds than those installed at Auld's Cove. While there are some exceptions (e.g. Northern Gannets, Passerines and Raptors), there is a 2-3 fold increase in interaction rates at the Canso Causeway power lines when compared to the Auld's Cove power lines. Furthermore, there were four observed collisions at the Canso Causeway, and none at Auld's Cove despite over 500 hours of surveys being done at that location.

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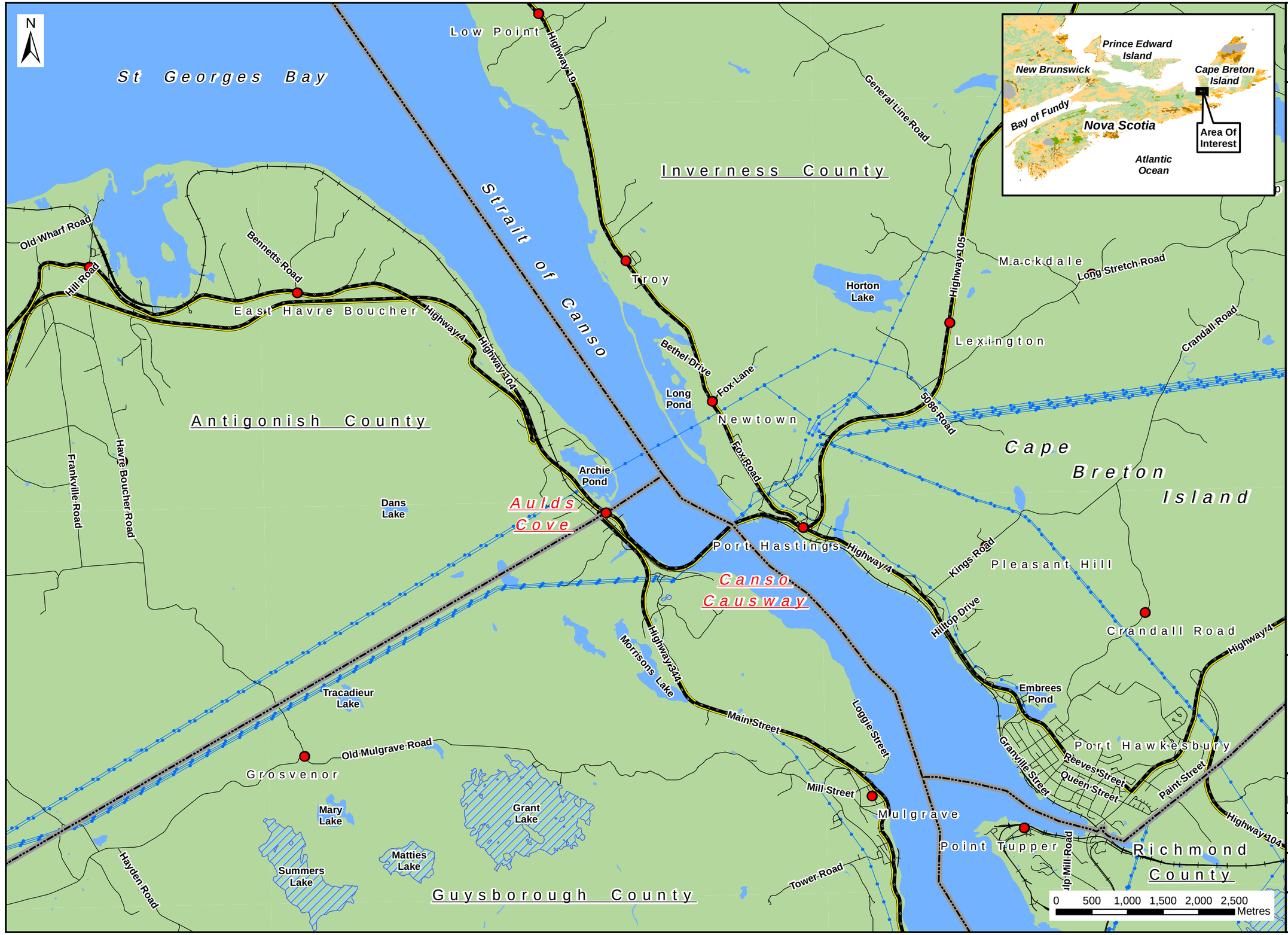
APPENDIX A
DRAWINGS



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

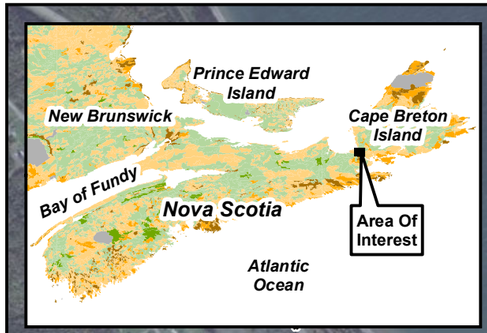
- County Boundary
- Active Railroad
- Public Roads
- Major Roads and Highways
- Existing Transmission Lines
- Water Bodies
- Mapped Reservoir

Site Location

Strum Consulting — 20 Years Taking Charge

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: Novermber 2015	Project #: 15-5354
Scale: 1:50,000	Drawing #: 1
Drawn By: H. Serhan	
Checked By: M. Henley	



N

Inverness County

Strait of Canso

Long Pond

Ceilidh Coastal Trail-Port Hastings-Inverness

Highway 19

Bethel Dr

Fox Lane

Highway 4

Powers Rd

Normas Lane

Tower Rd

Far West

West Cove

Centre West

Centre

Centre East

East Cove

Far East

Archie Pond

Mildreds Lane

Port Hastings

Ceilidh Coastal Trail-Troy-Inverness

Cemetery Rd

William St

Old Victoria Rd

Saddler St

Lovers Lane

Highway 105

Highway 4

Canso Causeway

Auld's Cove

OBrien Rd

FAIR RD

Lower Quarry Rd E

Antigonish County

Guysborough County

0 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Bing Satellite Imagery.

Legend:

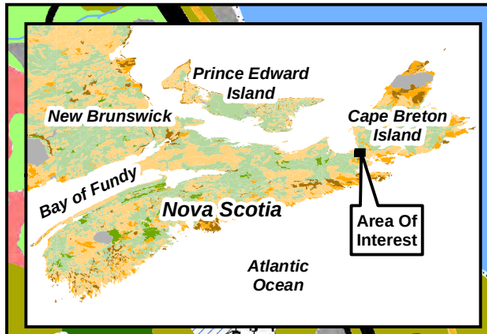
- Study Area
- County Boundary
- Existing Transmission Lines

Area of Crossing - Aulds Cove

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date:	Project #:
Novermber 2015	15-5354
Scale: 1:15,000	Drawing #: 2
Drawn By: H. Serhan	
Checked By: M. Henley	



N

Strait of Canso

Inverness County

Antigonish County

Guysborough County

Long Pond

Archie Pond

AM1

AM2

AM3

Port Hastings

Auld's Cove

Canso Causeway

0 200 400 600 800 1,000 Metres

Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre. Forestry Inventory Database by Nova Scotia Department of Natural Resources (ND DNR).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

Survey Locations (Type)
- Acoustic
- Nocturnal / Infrastructure Interaction / Diurnal
- Passerine
- Tern / Shorebird

County Boundary
Existing Transmission Lines
Mapped Stream
Mapped Indefinite Stream
Water Bodies
Water Bodies

Forested Land (Type)
- Softwood
- Mixedwood
- Hardwood

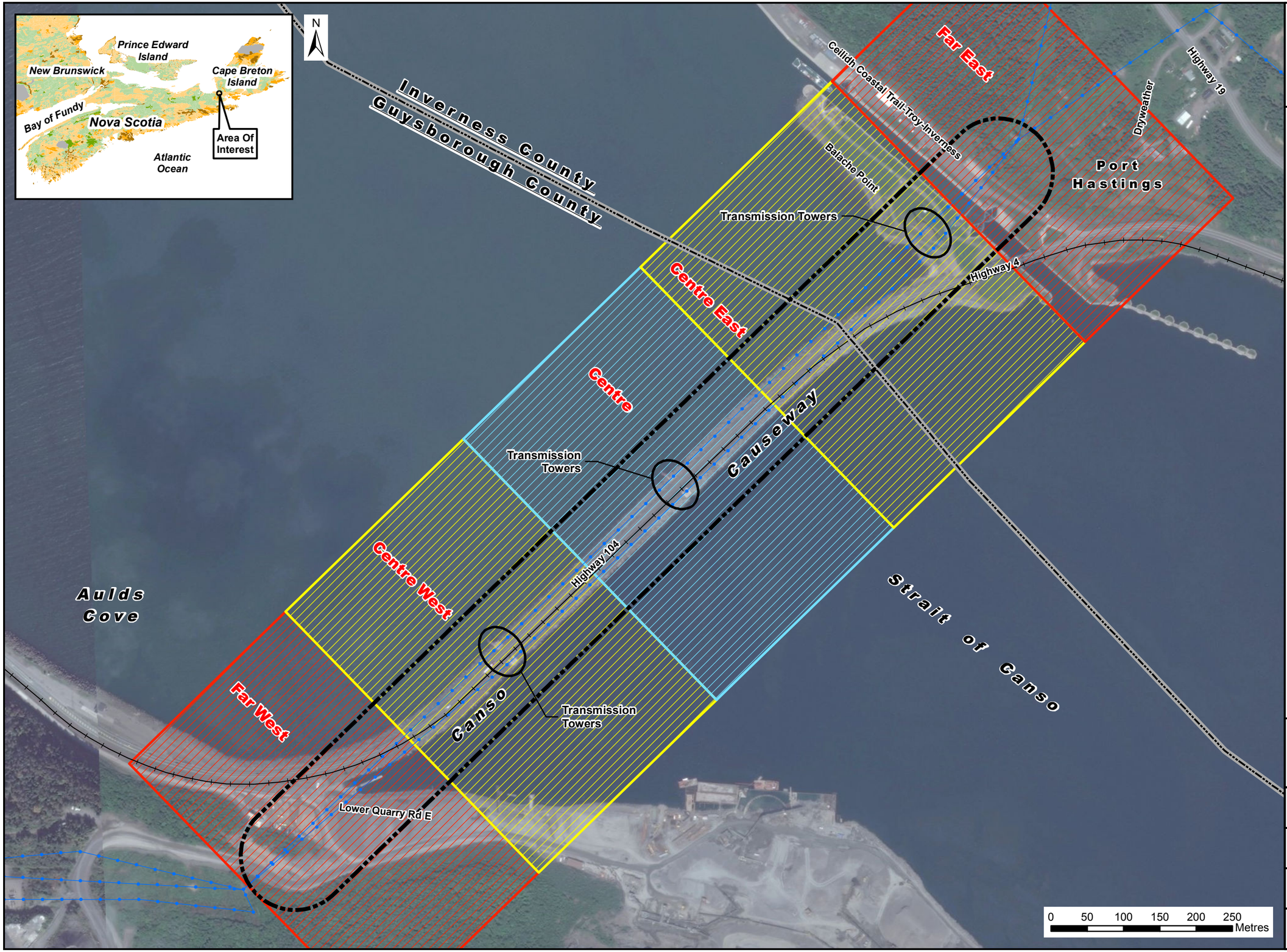
Non-Forested Land (Type)
- Untreated Natural Stand
- Treated Stand
- Old Field
- Dead Stand
- Plantation
- Brush
- Alders <75% Cover
- Alders >75% Cover
- Clear Cut
- Partial Depletion
- General Wetlands
- Beaver Flowage
- Open Bogs
- Treed Bogs
- Coastal Habitat
- Lake/River Wetland
- Cliffs, Dunes, Coastal Rock
- Open Water
- Barren
- Agriculture
- Urban and Miscellanious
- Beach
- Gravel Pit
- Powerline Corridor
- Road Corridor
- Rail Corridor

Habitat Cover

Strum 20 YEARS Taking Charge CONSULTING

*Engineering * Surveying * Environmental*
*Bedford * Antigonish * Moncton * Deer Lake*

Date: Novermber 2015	Project #: 15-5354
Scale: 1:15,000	Drawing #: 3
Drawn By: H. Serhan	
Checked By: M. Henley	



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. Bing Satellite Imagery.

Legend:

- Study Area
- County Boundary
- Active Railroad
- Existing Transmission Lines

Area of Crossing - Canso Causeway

Strum CONSULTING

Date: November 2015	Project #: 15-5354
Scale: 1:5,000	Drawing #: 4
Drawn By: H. Serhan	
Checked By: M. Henley	

APPENDIX B
DATA SHEET EXAMPLES

Aulds Cove Diurnal Watch Data Sheet

Date: July 2 2015 Personnel: SD Sky: Seaward Cloud mostly clear Temp: 24°C Wind: 30-40 km SW

Time	Species	Number	Flight		Area of Crossing							Height						Interaction with lines		Notes
			S to N	N to S	Far east	Over east cove	Center east	Center	Center west	Over west cove	Far west	Skimming water	well below lines	Just below lines	Through lines	Just above lines	Well above lines	Yes	No	
6:00	Tern	9	1			1							1						1	
	Tern	25		1		1							1						1	
	Double-Crested Cormorant	1						1					1						1	
	Red-Breasted Merganser	1		1			1						1						1	
	Northern Gannet	22	1					1					1					1		22 birds soaring over straight just north of wires occasionally they try to cross but hesitate and turn back, feeding activity seems more just north of lines suggesting they are nervous to cross lines, though they may just be following fish below lines
	Double-Crested Cormorant	1		1			1						1						1	
	Tern	1				1									1			1		Struggled against wind to get away, strong wind blew him through wires
6:25	Tern	35	1										1						1	
	Tern	20	1			1							1						1	
	Herring Gull	2				1							1						1	
	Tern	1	1			1							1						1	
	Tern	2		1			1						1						1	
	Caspian Tern		1				1						1						1	
6:40	Tern	43	1			1							1						1	
	Tern	54		1		1							1						1	
	Double-Crested Cormorant	1		1		1						1							1	
	Red-Breasted Merganser	2	1							1			1						1	
7:00	Northern Gannet	10		1		1									1			1		Did not cross lines, feeding moves out sat close and turned back
	Double-Crested Cormorant	1	1					1								1		1		Circled at same altitude to cross lines
	Northern Gannet	1		1				1						1				1		
7:20	Northern Gannet	1	1					1					1						1	
	Northern Gannet	2		1			1						1					1		Hesitated
	Double-Crested Cormorant	1		1				1					1						1	
	Northern Gannet	1	1						1				1						1	
7:35	Tern	14	1			1							1						1	
	Tern	26		1		1							1						1	
	Black-backed Gull	1		1		1							1						1	
	Double-Crested Cormorant	1		1				1				1							1	
	Northern Gannet	2						1					1					1		
	Red-Breasted Merganser	4	1			1							1						1	4 Males Turned over west cove then west

Canso Causeway Diurnal Watch Data Sheet

Date: July 13 2015 Personnel: CP Sky: Few clouds Wind: 25-35 km/h NW

Time	Species	Number	Flight		Area of Crossing										Interaction with lines		Interaction with smaller lines		Notes
			S to N	N to S	Far east	Center east	Center	Center west	Far west	well below lines	Just below lines	Through lines	Just above lines	Well above lines	Yes	No	Yes	No	
5:30	Double-Crested Cormorant	2		1		1					1					1		1	
	Tern	2																	Fishing on North side of causeway
5:45	Great Black-Backed Gull	1		1			1						1		1			1	Took long time to cross lines
	Double-Crested Cormorant	1		1		1				1						1		1	
6:00	Tern	1	1			1							1		1			1	
	Tern	1		1		1							1		1			1	Close to contacting lines
	Great Black-Backed Gull	1		1		1						1			1			1	
	Double-Crested Cormorant	1		1		1				1						1		1	
6:30	Great Black-Backed Gull	1		1		1													
	Great Black-Backed Gull	1		1		1						1			1			1	
	Tern	1		1		1							1		1			1	Took at least 30-45 seconds before crossing line
	Double-Crested Cormorant	1		1		1					1					1		1	
	Double-Crested Cormorant	1		1		1					1					1		1	
	Herring Gull	1	1			1				1						1		1	
	Herring Gull	1		1		1								1		1		1	
	Great Black-Backed Gull	1		1		1				1						1		1	
	Tern	1	1			1				1						1		1	
6:45	Tern	2		1		1							1		1			1	
	Double-Crested Cormorant	1	1			1					1				1		1		
	Double-Crested Cormorant	1		1		1					1					1		1	
	Great Black-Backed Gull	1		1		1					1					1		1	
	Herring Gull	1		1			1						1		1			1	
	Herring Gull	1		1		1							1		1			1	
	Double-Crested Cormorant	1		1		1				1						1		1	
7:00-7:10	Great Black-Backed Gull	2	1				1						1		1			1	
	Great Black-Backed Gull	1		1		1					1		1		1		1		Under large lines, over small lines
	Double-Crested Cormorant	1		1		1					1				1		1		
	Double-Crested Cormorant	1		1		1					1					1		1	
	Northern Gannet	10	1				1					1	1		1			1	A couple birds had minor troubles fairly close to making contact
	Great Black-Backed Gull	1		1			1						1		1			1	

APPENDIX C
GUILD CONSTITUENTS

Guild	Constituents	
	Species Name	**Scientific Name**
CORMORANTS	Double-crested Cormorant	*Phalacrocorax auritus*
NORTHERN GANNET	Northern Gannet	*Morus bassanus*
PASSERINE/RAPTORS	American Crow	*Corvus brachyrhynchos*
	American Goldfinch	*Spinus tristis*
	American Pipit	*Anthus rubescens*
	American Robin	*Turdus migratorius*
	Bald Eagle	*Haliaeetus leucocephalus*
	Belted Kingfisher	*Megaceryle alcyon*
	Black-capped Chickadee	*Poecile atricapillus*
	Blue Jay	*Cyanocitta cristata*
	Common Grackle	*Quiscalus quiscula*
	Common Raven	*Corvus corax*
	European Starling	*Sturnus vulgaris*
	Hairy Woodpecker	*Picoides villosus*
	House Sparrow	*Passer domesticus*
	Merlin	*Falco columbarius*
	Mourning Dove	*Zenaida macroura*
	Northern Harrier	*Circus cyaneus*
	Osprey	*Pandion haliaetus*
	Pileated Woodpecker	*Dryocopus pileatus*
	Rock Pigeon	*Columba livia*
	Ruby-throated Hummingbird	*Archilochus colubris*
	Ruffed Grouse	*Bonasa umbellus*
	Savannah Sparrow	*Passerculus sandwichensis*
	Sharp-shinned Hawk	*Accipiter striatus*
	Song Sparrow	*Melospiza melodia*
	Tree Swallow	*Tachycineta bicolor*
	White-winged Crossbill	*Loxia leucoptera*
	Yellow-rumped Warbler	*Dendroica coronata*
SEA GULLS	Lesser Black-backed Gull	*Larus fuscus*
	Bonaparte's Gull	*Chroicocephalus philadelphia*
	Great Black-backed Gull	*Larus marinus*
	Herring Gull	*Larus argentatus*
	Iceland Gull	*Larus glaucoides*
	Lesser Black-backed Gull	*Larus fuscus*
	Little Gull	*Hydrocoloeus minutus*
	Ring-billed Gull	*Larus delawarensis*
SEABIRDS	Puffin sp.	*Alcid sp.*
	Atlantic Puffin	*Fratercula arctica*
	Black-bellied Plover	*Pluvialis squatarola*
	Jaeger	*Stercorarius sp.*
	Leach's Storm-Petrel	*Oceanodroma leucorhoa*
SEADUCKS AND WATERFOWL	American Black Duck	*Anas rubripes*
	Black Guillemot	*Cepphus grylle*
	Black Scoter	*Melanitta nigra*
	Canada Goose	*Branta canadensis*
	Common Eider	*Somateria mollissima*
	Common Loon	*Gavia immer*
	Common Merganser	*Mergus merganser*
	Great Blue Heron	*Ardea herodias*
	Green-winged Teal	*Anas crecca*
	Hooded Merganser	*Lophodytes cucullatus*
	Long-tailed Duck	*Clangula hyemalis*
	Red-breasted Merganser	*Mergus serrator*
	Red-necked Grebe	*Podiceps grisegena*
	Red-throated Loon	*Gavia stellata*
	Surf Scoter	*Melanitta perspicillata*
	White-winged Scoter	*Melanitta fusca*

Guild	Constituents	
	Species Name	**Scientific Name**
SHOREBIRDS	Black-bellied Plover	*Pluvialis squatarola*
	Long-billed Dowitcher	*Limnodromus scolopaceus*
	Greater Yellowlegs	*Tringa melanoleuca*
	Killdeer	*Charadrius vociferus*
	Least Sandpiper	*Calidris minutilla*
	Lesser Yellowlegs	*Tringa flavipes*
	Purple Sandpiper	*Calidris maritima*
	Semipalmated Plover	*Charadrius semipalmatus*
	Semipalmated Sandpiper	*Calidris pusilla*
	Spotted Sandpiper	*Actitis macularius*
	Whimbrel	*Numenius phaeopus*
	Willet	*Tringa semipalmata*
TERNS	Arctic Tern	*Sterna paradisaea*
	Bridled Tern	*Onychoprion anaethetus*
	Caspian Tern	*Hydroprogne caspia*
	Common Tern	*Sterna hirundo*

APPENDIX D
PASSERINE SURVEY RESULTS

Date	Location	Coordinates (UTM NAD83)	Habitat	Conditions				Time	Common Name	Number Observed	Distance (m)	Pairs
				Wind	Temperature	Sky	Precipitation					
15-May-15	Aulds Cove	623378, 5057549	Roadside, scrub/regen with some mature conifer/mix nearby.	calm	3	Clear	None	05:20:00	American Robin	1	0-50	
…	…	…	…	…	…	…	…	…	American Robin	3	100+	
…	…	…	…	…	…	…	…	…	Northern Flicker	1	50-100	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	2	50-100	
…	…	…	…	…	…	…	…	…	American Crow	1	0-50	
…	…	…	…	…	…	…	…	…	American Crow	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	50-100	
15-May-15	Aulds Cove	623614, 5057755	Roadside, scrub/regen with some mature conifer/mix nearby.	calm		Clear	None	05:37:00	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	American Robin	2	100+	
…	…	…	…	…	…	…	…	…	American Crow	3	50-100	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Flicker	1	100+	
…	…	…	…	…	…	…	…	…	American Goldfinch	3	50-100	
…	…	…	…	…	…	…	…	…	Common Raven	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	50-100	
15-May-15	Aulds Cove	623858, 5057937	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor. Some recent tree harvesting nearby.	calm		Clear	None	05:51:00	Song Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	2	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	American Crow	1	100+	
…	…	…	…	…	…	…	…	…	American Crow	3	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Ruby-crowned Kinglet	1	50-100	
…	…	…	…	…	…	…	…	…	American Robin	2	100+	
…	…	…	…	…	…	…	…	…	Northern Flicker	1	100+	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Evening Grosbeak	2	50-100	
15-May-15	Aulds Cove	624109, 5058112	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	06:06:00	Purple Finch	1	50-100	
…	…	…	…	…	…	…	…	…	American Goldfinch	2	50-100	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	2	50-100	
…	…	…	…	…	…	…	…	…	Pine Siskin	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	2	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Ruffed Grouse	1	50-100	
15-May-15	Aulds Cove	624381, 5058241	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	06:21:00	American Robin	2	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	2	0-50	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Ruby-crowned Kinglet	1	50-100	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	2	50-100	
…	…	…	…	…	…	…	…	…	American Goldfinch	2	50-100	
…	…	…	…	…	…	…	…	…	Dark-eyed Junco	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	50-100	
15-May-15	Aulds Cove	623053, 5057469	Roadside, under tower. Scrub/regen, Med age deciduous on either side of corridor.	calm		Clear	None	06:55:00	Hermit Thrush	1	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Purple Finch	1	50-100	
…	…	…	…	…	…	…	…	…	Canada Goose	1	0-50	
…	…	…	…	…	…	…	…	…	Blue Jay	4	50-100	
…	…	…	…	…	…	…	…	…	Common Tern	2	100+	
…	…	…	…	…	…	…	…	…	Rusty Blackbird	4	0-50	
15-May-15	Aulds Cove	621187, 5056461	Near train tracks. Med/mature deciduous/mix	calm		Clear	None	07:29:00	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	50-100	
15-May-15	Aulds Cove	620899, 5056371	Mature Decid/mix near stream. Scrub/regen nearby.	calm		Clear	None	7:51	Song Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Golden-crowned Kinglet	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	50-100	
…	…	…	…	…	…	…	…	…	Ruffed Grouse	1	50-100	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Parula	1	100+	
…	…	…	…	…	…	…	…	…	Black-throated Blue Warbler	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
15-May-15	Aulds Cove	620647, 5056207	Med/mature decid/mix near power corridor	calm		Clear	None	08:12:00	Blue-headed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Ruby-crowned Kinglet	1	100+	
…	…	…	…	…	…	…	…	…	Pileated Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Ruffed Grouse	1	50-100	
…	…	…	…	…	…	…	…	…	Hermit Thrush	1	50-100	
…	…	…	…	…	…	…	…	…	Hairy Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Northern Flicker	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Pine Siskin	2	50-100	
…	…	…	…	…	…	…	…	…	Sharp-shinned Hawk	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Common Raven	1	50-100	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	

Date	Location	Coordinates (UTM NAD83)	Habitat	Conditions				Time	Common Name	Number Observed	Distance (m)	Pairs
				Wind	Temperature	Sky	Precipitation					
15-May-15	Aulds Cove	620381, 5056056	Med/mature decid/mix near power corridor	10-20km/hr north		Clear	None	08:31:00	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Ruby-crowned Kinglet	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	100+	
15-May-15	Aulds Cove	620117, 5055866	Med/mature decid/mix near power corridor	calm		Clear	None	08:48:00	American Goldfinch	1	0-50	
…	…	…	…	…	…	…	…	…	Golden-crowned Kinglet	1	0-50	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	0-50	
…	…	…	…	…	…	…	…	…	Pileated Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Pine Siskin	2	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Common Raven	1	0-50	
15-May-15	Aulds Cove	619834, 5055725	Swampy area in power corridor. Med/mature decid/mix on either side of corridor.	calm		Clear	None	09:04:00	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Downy Woodpecker	1	0-50	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow-rumped Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
16-Jun-15	Aulds Cove	623378, 5057549	Roadside, scrub/regen with some mature conifer/mix nearby.	calm	8	Clear	None	05:06:00	Ruby-crowned Kinglet	1	50-100	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	American Redstart	3	0-50	
…	…	…	…	…	…	…	…	…	American Redstart	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	100+	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	1	0-50	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	0-50	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	0-50	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Common Grackle	1	100+	
…	…	…	…	…	…	…	…	…	Tree Swallow	1	0-50	
…	…	…	…	…	…	…	…	…	Common Raven	2	100+	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	0-50	
16-Jun-15	Aulds Cove	623614, 5057755	Roadside, scrub/regen with some mature conifer/mix nearby.	calm		Clear	None	05:21:00	Mourning Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Tree Swallow	1	50-100	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Common Raven	4	0-50	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	100+	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
16-Jun-15	Aulds Cove	623858, 5057937	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor. Some recent tree harvesting nearby.			Clear	None	05:37:00	Mourning Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Hairy Woodpecker	1	50-100	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	2	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	2	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Pileated Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	100+	
…	…	…	…	…	…	…	…	…	American Crow	2	100+	
…	…	…	…	…	…	…	…	…	American Robin	2	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Common Raven	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	2	100+	
…	…	…	…	…	…	…	…	…	American Redstart	1	100+	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	8	50-100	
…	…	…	…	…	…	…	…	…	Downy Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Lincoln's Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
…	…	…	…	…	…	…	…	…	Olive-sided Flycatcher	1	100+	
16-Jun-15	Aulds Cove	624109, 5058112	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	05:52:00	Blackburnian Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	American Crow	2	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	100+	
…	…	…	…	…	…	…	…	…	Blue Jay	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Mourning Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Mourning Warbler	1	100+	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	1	50-100	
…	…	…	…	…	…	…	…	…	Hairy Woodpecker	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
16-Jun-15	Aulds Cove	624381, 5058241	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	06:06:00	Chestnut-sided Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	2	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	3	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
…	…	…	…	…	…	…	…	…	Least Flycatcher	2	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Red-tailed Hawk	1	100+	

Date	Location	Coordinates (UTM NAD83)	Habitat	Conditions				Time	Common Name	Number Observed	Distance (m)	Pairs
				Wind	Temperature	Sky	Precipitation					
16-Jun-15	Aulds Cove	623053, 5057469	Roadside, under tower. Scrub/regen, Med age deciduous on either side of corridor.	5-10km/hr n		Clear	None	06:43:00	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	American Redstart	1	0-50	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Belted Kingfisher	1	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
16-Jun-15	Aulds Cove	621187, 5056461	Near train tracks. Med/mature deciduous/mix	20-30km/hr n		Clear	None	07:11:00	Swainson's Thrush	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	100+	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
16-Jun-15	Aulds Cove	620899, 5056371	Mature Decid/mix near stream. Scrub/regen nearby.	20-30km/hr n		Clear	None	07:30:00	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Blue Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	100+	
16-Jun-15	Aulds Cove	620647, 5056207	Med/mature decid/mix near power corridor	20-30km/hr n		Clear	None	07:51:00	Magnolia Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	0-50	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
16-Jun-15	Aulds Cove	620381, 5056056	Med/mature decid/mix near power corridor	20-30km/hr n		Clear	None	08:11:00	American Redstart	1	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	1	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	50-100	
16-Jun-15	Aulds Cove	620117, 5055866	med/mature decid/mix near power corridor	20-30km/hr n		Clear	None	08:29:00	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Northern Parula	1	0-50	
…	…	…	…	…	…	…	…	…	American Robin	2	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Evening Grosbeak	1	100+	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	American Redstart	2	0-50	
16-Jun-15	Aulds Cove	619834, 5055725	2	20-30km/hr n		Clear	None	08:47:00	Least Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	2	100+	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	0-50	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	100+	
23-Jun-15	Aulds Cove	623378, 5057549	Roadside, scrub/regen with some mature conifer/mix nearby.	calm	6	Clear	None	05:18:00	Mourning Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	American Redstart	2	0-50	
…	…	…	…	…	…	…	…	…	American Redstart	3	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	0-50	
…	…	…	…	…	…	…	…	…	Common Raven	2	100+	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	3	0-50	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	100+	
23-Jun-15	Aulds Cove	623614, 5057755	Roadside, scrub/regen with some mature conifer/mix nearby.	calm		Clear	None	05:32:00	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Yellow Warbler	2	50-100	
…	…	…	…	…	…	…	…	…	Common Raven	4	0-50	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	American Robin	1	0-50	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	100+	
…	…	…	…	…	…	…	…	…	Mourning Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Blue Jay	1	100+	
23-Jun-15	Aulds Cove	623858, 5057937	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor. Some recent tree harvesting nearby.	calm		Clear	None	05:48:00	Cedar Waxwing	4	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	2	0-50	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Flicker	1	100+	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	American Robin	1	50-100	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Lincoln's Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	Mourning Warbler	2	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	American Kestrel	1	100+	

Date	Location	Coordinates (UTM NAD83)	Habitat	Conditions				Time	Common Name	Number Observed	Distance (m)	Pairs
				Wind	Temperature	Sky	Precipitation					
23-Jun-15	Aulds Cove	624109, 5058112	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	06:08:00	American Redstart	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	2	50-100	
…	…	…	…	…	…	…	…	…	Blackburnian Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	0-50	
…	…	…	…	…	…	…	…	…	Hairy Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	American Crow	1	100+	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	0-50	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
…	…	…	…	…	…	…	…	…	Pileated Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Mourning Warbler	1	100+	
23-Jun-15	Aulds Cove	624381, 5058241	Deciduous scrub/regen on ATV path. Med/mature woods on either side of power corridor.	calm		Clear	None	06:24:00	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	0-50	
…	…	…	…	…	…	…	…	…	American Redstart	1	0-50	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	50-100	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	Yellow-bellied Sapsucker	1	0-50	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Pileated Woodpecker	1	100+	
…	…	…	…	…	…	…	…	…	Evening Grosbeak	1	100+	
…	…	…	…	…	…	…	…	…	Yellow Warbler	1	0-50	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	American Robin	1	100+	
23-Jun-15	Aulds Cove	623053, 5057469	Roadside, under tower. Scrub/regen, Med age deciduous on either side of corridor.	5-10km/hr		Clear	None	06:56:00	Blackburnian Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	0-50	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	1	0-50	
…	…	…	…	…	…	…	…	…	Belted Kingfisher	1	100+	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	0-50	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Blue Jay	1	100+	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	0-50	
23-Jun-15	Aulds Cove	621187, 5056461	Near train tracks. Med/mature deciduous/mix	10-20km/hr north		variable cloud	None	07:43:00	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	50-100	
…	…	…	…	…	…	…	…	…	American Goldfinch	2	0-50	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	0-50	
23-Jun-15	Aulds Cove	620899, 5056371	Mature Decid/mix near stream. Scrub/regen nearby.	10-20km/hr north		variable cloud	None	08:01:00	Common Raven	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	American Crow	1	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100	
23-Jun-15	Aulds Cove	620647, 5056207	Med/mature decid/mix near power corridor	10-20km/hr north		variable cloud	None	08:20:00	Bay-breasted Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Swainson's Thrush	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	Red-breasted Nuthatch	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	100+	
23-Jun-15	Aulds Cove	620381, 5056056	Med/mature decid/mix near power corridor	10-20km/hr north		variable cloud	None	08:44:00	Ovenbird	1	50-100	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	100+	
…	…	…	…	…	…	…	…	…	Black-and-white Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Black-capped Chickadee	1	100+	
…	…	…	…	…	…	…	…	…	American Redstart	1	50-100	
…	…	…	…	…	…	…	…	…	White-throated Sparrow	1	100+	
…	…	…	…	…	…	…	…	…	American Goldfinch	1	0-50	
…	…	…	…	…	…	…	…	…	Purple Finch	1	100+	
…	…	…	…	…	…	…	…	…	Black-throated Green Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
…	…	…	…	…	…	…	…	…	Magnolia Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	1	100+	
…	…	…	…	…	…	…	…	…	Red-eyed Vireo	1	50-100	
23-Jun-15	Aulds Cove	620117, 5055866	med/mature decid/mix near power corridor	10-20km/hr north		variable cloud	None	9:01	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Mourning Warbler	1	100+	
…	…	…	…	…	…	…	…	…	Northern Parula	1	50-100	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	0-50	
…	…	…	…	…	…	…	…	…	Common Yellowthroat	1	50-100	
…	…	…	…	…	…	…	…	…	Chestnut-sided Warbler	1	50-100	
…	…	…	…	…	…	…	…	…	Ovenbird	1	0-50	
…	…	…	…	…	…	…	…	…	Song Sparrow	1	50-100	
…	…	…	…	…	…	…	…	…	American Redstart	1	50-100	
23-Jun-15	Aulds Cove	619834, 5055725	Swampy area in power corridor. Med/mature decid/mix on either side of corridor.	10-20km/hr north		variable cloud	None	09:15:00	Alder Flycatcher	1	0-50	
…	…	…	…	…	…	…	…	…	Common Raven	1	100+	
…	…	…	…	…	…	…	…	…	Ovenbird	2	50-100	
…	…	…	…	…	…	…	…	…	Least Flycatcher	1	50-100	
…	…	…	…	…	…	…	…	…	Cedar Waxwing	1	50-100	
…	…	…	…	…	…	…	…	…	Blue-headed Vireo	1	100+	

Common Name	Scientific Name	SARA Status	NSESA Status	NSDNR Status	COSEWIC Status	S-Rank	Number of Times Observed	Number of Individuals Observed
Alder Flycatcher	*Empidonax alnorum*	Not Listed	Not Listed	Secure	Not Listed	S5B	18	19
American Crow	*Corvus brachyrhynchos*	Not Listed	Not Listed	Secure	Not Listed	S5	9	15
American Goldfinch	*Spinus tristis*	Not Listed	Not Listed	Secure	Not Listed	S5	16	23
American Kestrel	*Falco sparverius*	Not Listed	Not Listed	Secure	Not Listed	S5B	1	1
American Redstart	*Setophaga ruticilla*	Not Listed	Not Listed	Secure	Not Listed	S5B	19	25
American Robin	*Turdus migratorius*	Not Listed	Not Listed	Secure	Not Listed	S5B	15	24
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	1	1
Belted Kingfisher	*Megaceryle alcyon*	Not Listed	Not Listed	Secure	Not Listed	S5B	2	2
Black-and-white Warbler	*Mniotilta varia*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	20	20
Blackburnian Warbler	*Dendroica fusca*	Not Listed	Not Listed	Secure	Not Listed	S4B	10	10
Black-capped Chickadee	*Poecile atricapillus*	Not Listed	Not Listed	Secure	Not Listed	S5	8	11
Black-throated Blue Warbler	*Dendroica caerulescens*	Not Listed	Not Listed	Secure	Not Listed	S5B	2	2
Black-throated Green Warbler	*Dendroica virens*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	16	16
Blue Jay	*Cyanocitta cristata*	Not Listed	Not Listed	Secure	Not Listed	S5	4	7
Blue-headed Vireo	*Vireo solitarius*	Not Listed	Not Listed	Secure	Not Listed	S5B	13	14
Canada Goose	*Branta canadensis*	Not Listed	Not Listed	Secure	Not Listed	SNAB,S4N	1	1
Cedar Waxwing	*Bombycilla cedrorum*	Not Listed	Not Listed	Secure	Not Listed	S5B	8	22
Chestnut-sided Warbler	*Dendroica pensylvanica*	Not Listed	Not Listed	Secure	Not Listed	S5B	10	11
Common Grackle	*Quiscalus quiscula*	Not Listed	Not Listed	Secure	Not Listed	S5B	1	1
Common Raven	*Corvus corax*	Not Listed	Not Listed	Secure	Not Listed	S5	10	18
Common Tern	*Sterna hirundo*	Not Listed	Not Listed	Sensitive	Not at Risk	S3B	1	2
Common Yellowthroat	*Geothlypis trichas*	Not Listed	Not Listed	Secure	Not Listed	S5B	15	16
Dark-eyed Junco	*Junco hyemalis*	Not Listed	Not Listed	Secure	Not Listed	S4S5	1	1
Downy Woodpecker	*Picoides pubescens*	Not Listed	Not Listed	Secure	Not Listed	S5	2	2
Evening Grosbeak	*Coccothraustes vespertinus*	Not Listed	Not Listed	Secure	Not Listed	S4B,S5N	3	4
Golden-crowned Kinglet	*Regulus satrapa*	Not Listed	Not Listed	Sensitive	Not Listed	S4	2	2
Hairy Woodpecker	*Picoides villosus*	Not Listed	Not Listed	Secure	Not Listed	S5	4	4
Hermit Thrush	*Catharus guttatus*	Not Listed	Not Listed	Secure	Not Listed	S5B	2	2
Least Flycatcher	*Empidonax minimus*	Not Listed	Not Listed	Secure	Not Listed	S4B	13	14
Lincoln's Sparrow	*Melospiza lincolnii*	Not Listed	Not Listed	Secure	Not Listed	S4B	2	2
Magnolia Warbler	*Dendroica magnolia*	Not Listed	Not Listed	Secure	Not Listed	S5B	17	19
Mourning Warbler	*Oporornis philadelphia*	Not Listed	Not Listed	Secure	Not Listed	S4B	9	10
Northern Flicker	*Colaptes auratus*	Not Listed	Not Listed	Secure	Not Listed	S5B	3	5
Northern Parula	*Parula americana*	Not Listed	Not Listed	Secure	Not Listed	S5B	12	12
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	At Risk	Threatened	S3B	1	1
Ovenbird	*Seiurus aurocapilla*	Not Listed	Not Listed	Secure	Not Listed	S5B	22	25
Pileated Woodpecker	*Dryocopus pileatus*	Not Listed	Not Listed	Secure	Not Listed	S5	5	5
Pine Siskin	*Spinus pinus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B, S5N	3	5
Purple Finch	*Carpodacus purpureus*	Not Listed	Not Listed	Secure	Not Listed	S4S5	10	12
Red-breasted Nuthatch	*Sitta canadensis*	Not Listed	Not Listed	Secure	Not Listed	S4S5	1	1
Red-eyed Vireo	*Vireo olivaceus*	Not Listed	Not Listed	Secure	Not Listed	S5B	21	22
Red-tailed Hawk	*Buteo jamaicensis*	Not Listed	Not Listed	Secure	Not at Risk	S5	1	1
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	4	5
Ruffed Grouse	*Bonasa umbellus*	Not Listed	Not Listed	Secure	Not Listed	S4S5	3	3
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Endangered	May Be At Risk	Special Concern	S2S3B	1	4
Sharp-shinned Hawk	*Accipiter striatus*	Not Listed	Not Listed	Secure	Not at Risk	S4S5B	1	1
Song Sparrow	*Melospiza melodia*	Not Listed	Not Listed	Secure	Not Listed	S5B	11	14
Swainson's Thrush	*Catharus ustulatus*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	8	9
Tree Swallow	*Tachycineta bicolor*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	2	2
White-throated Sparrow	*Zonotrichia albicollis*	Not Listed	Not Listed	Secure	Not Listed	S5B	15	21
Yellow Warbler	*Dendroica petechia*	Not Listed	Not Listed	Secure	Not Listed	S5B	10	11
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	1	1
Yellow-rumped Warbler	*Dendroica coronata*	Not Listed	Not Listed	Secure	Not Listed	S5B	5	7

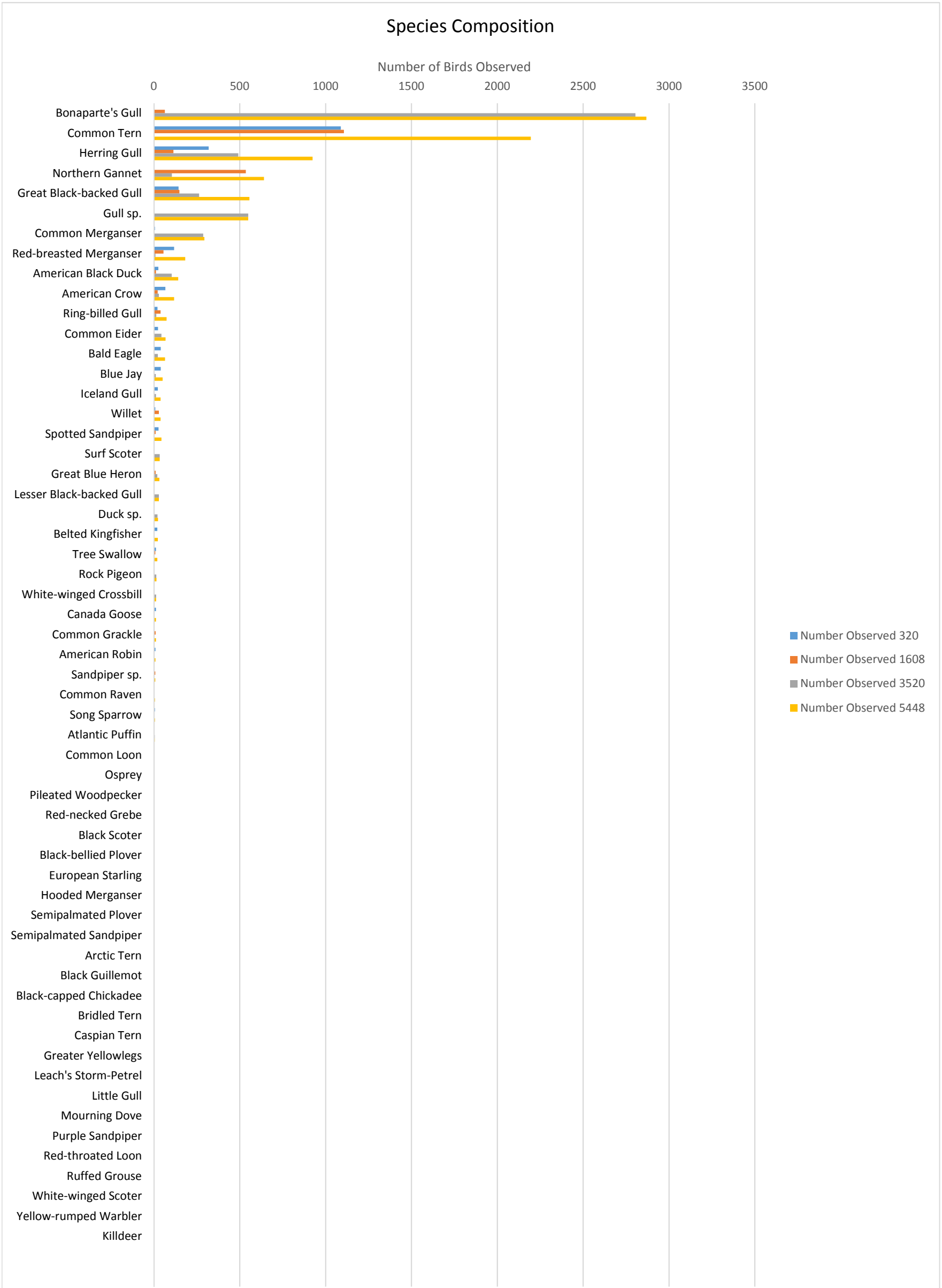
Common Name[1]	Scientific Name	SARA Status	NSESA Status	NSDNR Status	COSEWIC Status	S-Rank	Surveys Observed In [2]
Alder Flycatcher	*Empidonax alnorum*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
American Crow	*Corvus brachyrhynchos*	Not Listed	Not Listed	Secure	Not Listed	S5	P, A, C, N
American Goldfinch	*Spinus tristis*	Not Listed	Not Listed	Secure	Not Listed	S5	P, C, N
American Kestrel	*Falco sparverius*	Not Listed	Not Listed	Secure	Not Listed	S5B	P
American Pipit	*Anthus rubescens*	Not Listed	Not Listed	Secure	Not Listed	S4	A, S, C
American Redstart	*Setophaga ruticilla*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
American Robin	*Turdus migratorius*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, A, C, N
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	P
Belted Kingfisher	*Megaceryle alcyon*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, A, S, C, N
Black-and-white Warbler	*Mniotilta varia*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	P
Blackburnian Warbler	*Dendroica fusca*	Not Listed	Not Listed	Secure	Not Listed	S4B	P
Black-capped Chickadee	*Poecile atricapillus*	Not Listed	Not Listed	Secure	Not Listed	S5	P, A, N
Black-throated Blue Warbler	*Dendroica caerulescens*	Not Listed	Not Listed	Secure	Not Listed	S5B	P
Black-throated Green Warbler	*Dendroica virens*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	P
Blue Jay	*Cyanocitta cristata*	Not Listed	Not Listed	Secure	Not Listed	S5	P, A, N
Blue-headed Vireo	*Vireo solitarius*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Cedar Waxwing	*Bombycilla cedrorum*	Not Listed	Not Listed	Secure	Not Listed	S5B	P
Chestnut-sided Warbler	*Dendroica pensylvanica*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Chimney Swift	*Chaetura pelagica*	Threatened	Endangered	At Risk	Threatened	S2S3B	A
Clay-colored Sparrow	*Spizella pallida*	Not Listed	Not Listed	Accidental	Not Listed	SNA	A
Common Grackle	*Quiscalus quiscula*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, A, N
Common Raven	*Corvus corax*	Not Listed	Not Listed	Secure	Not Listed	S5	P, A, C
Common Yellowthroat	*Geothlypis trichas*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Dark-eyed Junco	*Junco hyemalis*	Not Listed	Not Listed	Secure	Not Listed	S4S5	P, N
Downy Woodpecker	*Picoides pubescens*	Not Listed	Not Listed	Secure	Not Listed	S5	P
Pileated Woodpecker	*Dryocopus pileatus*	Not Listed	Not Listed	Secure	Not Listed	S5	A
Eastern Kingbird	*Tyrannus tyrannus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	C
European Starling	*Sturnus vulgaris*	Not Listed	Not Listed	Exotic	Not Listed	SNA	A, C
Evening Grosbeak	*Coccothraustes vespertinus*	Not Listed	Not Listed	Secure	Not Listed	S4B,S5N	P
Golden-crowned Kinglet	*Regulus satrapa*	Not Listed	Not Listed	Sensitive	Not Listed	S4	P

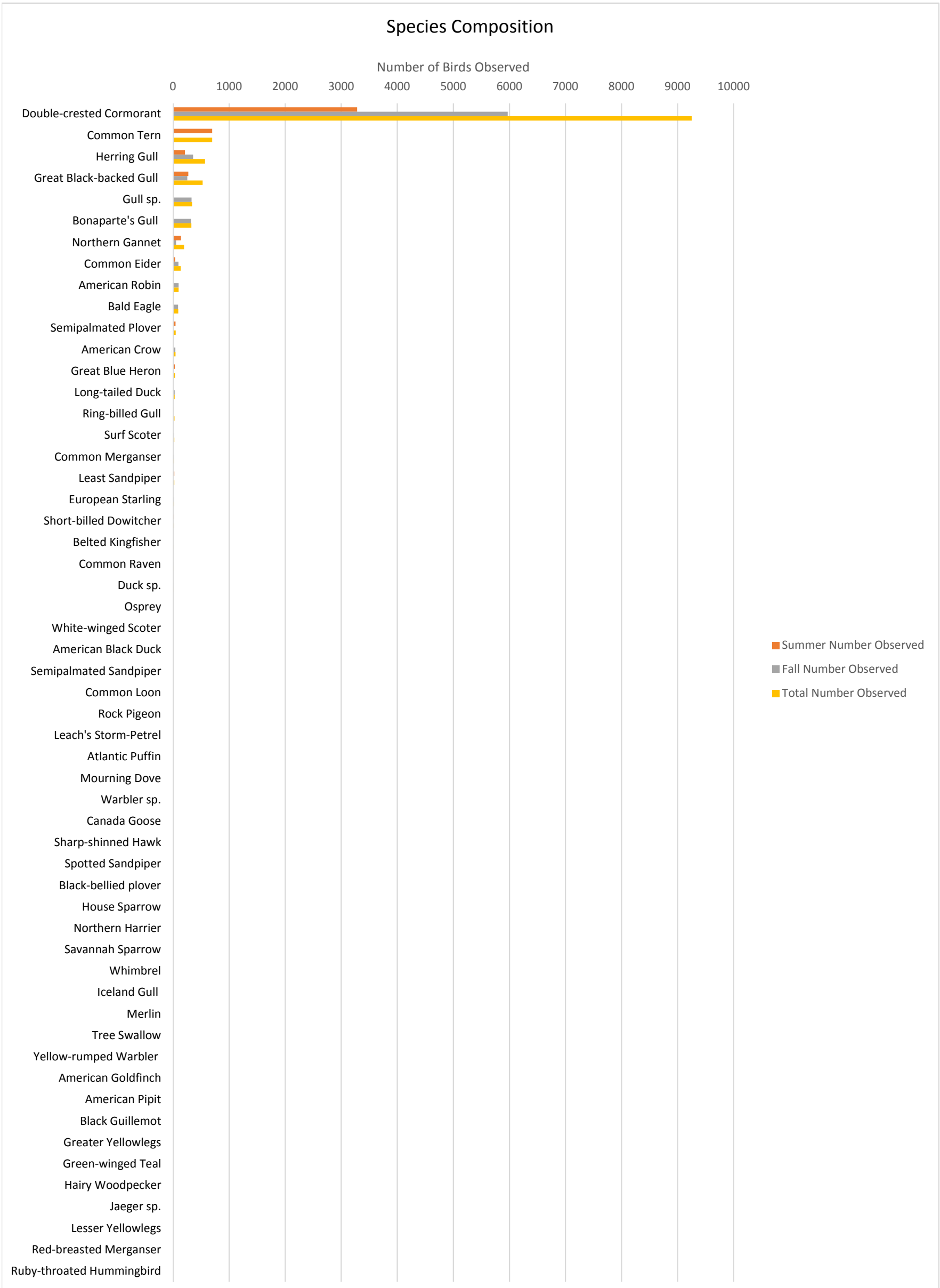
Common Name[1]	Scientific Name	SARA Status	NSESA Status	NSDNR Status	COSEWIC Status	S-Rank	Surveys Observed In [2]
Hairy Woodpecker	*Picoides villosus*	Not Listed	Not Listed	Secure	Not Listed	S5	P, C
Hermit Thrush	*Catharus guttatus*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
House Sparrow	*Passer domesticus*	Not Listed	Not Listed	Exotic	Not Listed	SNA	C
Killdeer	*Charadrius vociferus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B	N
Least Flycatcher	*Empidonax minimus*	Not Listed	Not Listed	Secure	Not Listed	S4B	P
Lincoln's Sparrow	*Melospiza lincolnii*	Not Listed	Not Listed	Secure	Not Listed	S4B	P
Magnolia Warbler	*Dendroica magnolia*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Mourning Warbler	*Oporornis philadelphia*	Not Listed	Not Listed	Secure	Not Listed	S4B	P
Northern Flicker	*Colaptes auratus*	Not Listed	Not Listed	Secure	Not Listed	S5B	P
Northern Parula	*Parula americana*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Olive-sided Flycatcher	*Contopus cooperi*	Threatened	Threatened	At Risk	Threatened	S3B	P
Ovenbird	*Seiurus aurocapilla*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Pileated Woodpecker	*Dryocopus pileatus*	Not Listed	Not Listed	Secure	Not Listed	S5	P, A
Pine Siskin	*Spinus pinus*	Not Listed	Not Listed	Sensitive	Not Listed	S3S4B, S5N	P
Purple Finch	*Carpodacus purpureus*	Not Listed	Not Listed	Secure	Not Listed	S4S5	P
Red-breasted Nuthatch	*Sitta canadensis*	Not Listed	Not Listed	Secure	Not Listed	S4S5	P, N
Red-eyed Vireo	*Vireo olivaceus*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Red-tailed Hawk	*Buteo jamaicensis*	Not Listed	Not Listed	Secure	Not at Risk	S5	P
Rock Pigeon	*Columba livia*	Not Listed	Not Listed	Exotic	Not Listed	SNA	A, C, N
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	P
Ruby-throated Hummingbird	*Archilochus colubris*	Not Listed	Not Listed	Secure	Not Listed	S5B	C
Ruffed Grouse	*Bonasa umbellus*	Not Listed	Not Listed	Secure	Not Listed	S4S5	P, A
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Endangered	May Be At Risk	Special Concern	S2S3B	P
Sharp-shinned Hawk	*Accipiter striatus*	Not Listed	Not Listed	Secure	Not at Risk	S4S5B	P, N
Savannah Sparrow	*Passerculus sandwichensis*	Not Listed	Not Listed	Secure	Not Listed	S4M,S2N	C, A, N
Song Sparrow	*Melospiza melodia*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, A, N
Swainson's Thrush	*Catharus ustulatus*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	P, N
Tree Swallow	*Tachycineta bicolor*	Not Listed	Not Listed	Sensitive	Not Listed	S4B	P, A, C
White-throated Sparrow	*Zonotrichia albicollis*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
White-winged	*Loxia leucoptera*	Not Listed	Not Listed	Secure	Not Listed	S4S5	A

Common Name[1]	Scientific Name	SARA Status	NSESA Status	NSDNR Status	COSEWIC Status	S-Rank	Surveys Observed In [2]
Crossbill							
Yellow Warbler	*Dendroica petechia*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, N
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Not Listed	Not Listed	Secure	Not Listed	S4S5B	P
Yellow-rumped Warbler	*Dendroica coronata*	Not Listed	Not Listed	Secure	Not Listed	S5B	P, A, C, N

[1] Bolded text indicates species observed in more than one survey.
[2] P – Passerine Survey
A – Auld's Cove Diurnal Survey and Tern/Shorebird Survey
C – Canso Causeway Diurnal Survey
N – Nocturnal Surveys and Acoustic Monitoring

APPENDIX E
DIURNAL SURVEY RESULTS


Species Composition
Number of Birds Observed
0
500
1000
1500
2000
2500
3000
3500
Bonaparte's Gull
Common Tern
Herring Gull
Northern Gannet
Great Black-backed Gull
Gull sp.
Common Merganser
Red-breasted Merganser
American Black Duck
American Crow
Ring-billed Gull
Common Eider
Bald Eagle
Blue Jay
Iceland Gull
Willet
Spotted Sandpiper
Surf Scoter
Great Blue Heron
Lesser Black-backed Gull
Duck sp.
Belted Kingfisher
Tree Swallow
Rock Pigeon
White-winged Crossbill
Canada Goose
Common Grackle
American Robin
Sandpiper sp.
Common Raven
Song Sparrow
Atlantic Puffin
Common Loon
Osprey
Pileated Woodpecker
Red-necked Grebe
Black Scoter
Black-bellied Plover
European Starling
Hooded Merganser
Semipalmated Plover
Semipalmated Sandpiper
Arctic Tern
Black Guillemot
Black-capped Chickadee
Bridled Tern
Caspian Tern
Greater Yellowlegs
Leach's Storm-Petrel
Little Gull
Mourning Dove
Purple Sandpiper
Red-throated Loon
Ruffed Grouse
White-winged Scoter
Yellow-rumped Warbler
Killdeer
Number Observed 320
Number Observed 1608
Number Observed 3520
Number Observed 5448


Species Composition
Number of Birds Observed
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Double-crested Cormorant
Common Tern
Herring Gull
Great Black-backed Gull
Gull sp.
Bonaparte's Gull
Northern Gannet
Common Eider
American Robin
Bald Eagle
Semipalmated Plover
American Crow
Great Blue Heron
Long-tailed Duck
Ring-billed Gull
Surf Scoter
Common Merganser
Least Sandpiper
European Starling
Short-billed Dowitcher
Belted Kingfisher
Common Raven
Duck sp.
Osprey
White-winged Scoter
American Black Duck
Semipalmated Sandpiper
Common Loon
Rock Pigeon
Leach's Storm-Petrel
Atlantic Puffin
Mourning Dove
Warbler sp.
Canada Goose
Sharp-shinned Hawk
Spotted Sandpiper
Black-bellied plover
House Sparrow
Northern Harrier
Savannah Sparrow
Whimbrel
Iceland Gull
Merlin
Tree Swallow
Yellow-rumped Warbler
American Goldfinch
American Pipit
Black Guillemot
Greater Yellowlegs
Green-winged Teal
Hairy Woodpecker
Jaeger sp.
Lesser Yellowlegs
Red-breasted Merganser
Ruby-throated Hummingbird
Summer Number Observed
Fall Number Observed
Total Number Observed

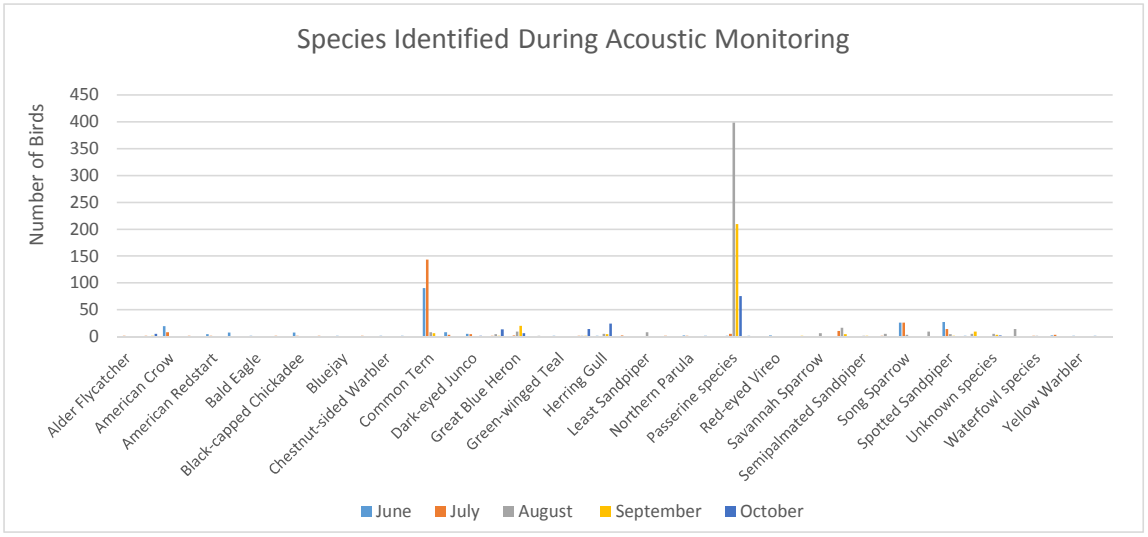
APPENDIX F
NOCTURNAL SURVEY RESULTS

Table F1: Auld's Cove Avian Study - Species Identified in Acoustic Analysis *Project # 15-5354*

Species	Guild	Total	Month					Call Type				
			June	July	August	September	October	Flight Call	Song	Other	Unknown
Alder Flycatcher	Passerine/Raptor	1	0	1	0	0	0	0	1	0	0
American Black Duck	Seaducks and Waterfowl	7	0	1	0	1	5	0	0	0	0
American Crow	Passerine/Raptor	27	19	8	0	0	0	2	0	25	0
American Goldfinch	Passerine/Raptor	1	0	1	0	0	0	0	1	0	0
American Redstart	Passerine/Raptor	5	4	1	0	0	0	0	5	0	0
American Robin	Passerine/Raptor	7	7	0	0	0	0	0	6	1	0
Bald Eagle	Passerine/Raptor	1	1	0	0	0	0	0	0	0	0
Belted Kingfisher	Passerine/Raptor	1	0	1	0	0	0	0	0	0	0
Black-capped Chickadee	Passerine/Raptor	8	7	1	0	0	0	0	7	1	0
Blue Headed Vireo	Passerine/Raptor	1	0	1	0	0	0	0	1	0	0
Bluejay	Passerine/Raptor	1	1	0	0	0	0	0	0	1	0
Canada Goose	Seaducks and Waterfowl	1	0	1	0	0	0	0	0	0	0
Chestnut-sided Warbler	Passerine/Raptor	1	1	0	0	0	0	0	1	0	0
Common Grackle	Passerine/Raptor	1	1	0	0	0	0	0	0	1	0
Common Tern	Tern	247	90	143	8	6	0	0	0	227	0
Common Yellowthroat	Passerine/Raptor	11	8	3	0	0	0	0	11	0	0
Dark-eyed Junco	Passerine/Raptor	10	5	4	0	0	1	0	9	1	0
Great Black-backed Gull	Gull	19	0	1	4	1	13	0	0	19	0
Great Blue Heron	Seaducks and Waterfowl	37	0	2	9	20	6	0	0	0	0
Greater Yellowlegs	Shorebird	1	0	0	1	0	0	0	0	1	0
Green-winged Teal	Seaducks and Waterfowl	1	1	0	0	0	0	0	0	0	0
Herring Gull	Gull	34	1	0	5	4	24	1	0	33	0
Killdeer	Passerine/Raptor	2	0	2	0	0	0	0	0	0	0
Least Sandpiper	Shorebird	8	0	0	8	0	0	8	0	0	0
Magnolia Warbler	Passerine/Raptor	1	0	1	0	0	0	0	1	0	0
Northern Parula	Passerine/Raptor	3	2	1	0	0	0	0	3	0	0
Ovenbird	Passerine/Raptor	1	1	0	0	0	0	0	1	0	0
Red-breasted Nuthatch	Passerine/Raptor	1	1	0	0	0	0	0	0	1	0
Red-eyed Vireo	Passerine/Raptor	2	2	0	0	0	0	0	2	0	0
Ring Billed Gull	Gull	1	0	0	0	1	0	0	0	1	0
Savannah Sparrow	Passerine/Raptor	6	0	0	6	0	0	6	0	0	0
Semipalmated Plover	Shorebird	30	0	10	16	4	0	1	0	29	0
Semipalmated Sandpiper	Shorebird	2	0	0	1	1	0	2	0	0	0
Shorebird species	Shorebird	6	0	1	5	0	0	1	0	5	0
Song Sparrow	Passerine/Raptor	55	26	26	3	0	0	0	50	5	0
Spotted Sandpiper	Shorebird	46	27	14	4	1	0	0	0	46	0
Swainson's Thrush	Passerine/Raptor	15	1	0	5	9	0	14	1	0	0
White-throated Sparrow	Passerine/Raptor	5	2	3	0	0	0	0	5	0	0
Yellow Warbler	Passerine/Raptor	1	1	0	0	0	0	0	1	0	0
Yellow-rumped Warbler	Passerine/Raptor	1	1	0	0	0	0	0	1	0	0
Gull species*	Gull	17	0	1	1	1	14	0	0	16	1
Passerine species*	Passerine/Raptor	688	1	5	398	209	75	644	0	43	1
Sparrow species*	Passerine/Raptor	9	0	0	9	0	0	9	0	0	0
Unknown species*	Unknown	10	0	0	5	3	2	0	0	0	5
Warbler species*	Passerine/Raptor	14	0	0	14	0	0	13	0	1	0
Waterfowl species*	Seaducks and Waterfowl	2	0	1	1	0	0	0	0	0	1
Total Birds		1349	211	234	503	261	140	701	107	457	8
Total Species		40*	24	25	19	13	8	11	18	19	4

* Six groups of birds were not identifiable to the species level.

Appendix F, Figure 1a: Number of Birds Identified during Acoustic Monitoring per Species for Each Month Project # 15-5354



Appendix F, Figure 1b: Number of Birds Identified during Acoustic Monitoring per Species for Each Call Type Project # 15-5354