Appendix D2

Bat Baseline Study

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List of Acronyms and Abbreviations

Abbreviations	**Definitions**
BCI	Bat Conservation International
AC CDC	Atlantic Canada Conservation Data Centre
CO2	Carbon Dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ECCC	Environment and Climate Change Canada
ELC	Ecological Land Classification
NL ESA	Endangered Species Act
GIS	Geographic Information Systems
GPS	Global Positioning System
ID	Identification
SAR IMMP	Species at Risk Impacts Mitigation and Monitoring Plan
IUCN	International Union for Conservation of Nature
KHz	Kilahertz
LP	Limited Partnership
NCC	Nature Conservancy Canada
NL	Newfoundland and Labrador

PCMP	Post Construction Monitoring Plan
POA	Port of Argentia
SAR	Species at Risk
SARA	Species at Risk Act
UTM	Universal Transverse Mercator
NL WD	Newfoundland and Labrador Wildlife Division
WNS	White Nose Syndrome

1.0 Introduction

The Bat Baseline Study has been developed by Argentia Renewables Wind LP (Argentia Renewables), an affiliate of Pattern Energy Group LP (Pattern Energy) for the Argentia Renewables Project (the Project), which entails the development, construction, operation and maintenance, and eventual decommissioning and rehabilitation of an onshore wind energy generation facility (Argentia Wind Facility) and a green hydrogen and ammonia production, storage, and export facility (Argentia Green Fuels Facility). The wind energy facility (i.e., wind turbine farm) will be mostly located on what is known as the Argentia Backlands, a largely uninhabited, forested area with scattered relic military sites and variable habitat types. The Argentia Green Fuels Facility will be located on the Argentia Peninsula, a brownfield industrial complex. The Port of Argentia (POA) owns both the Argentia Backlands property and property on the Argentia Peninsula. The two, along with a Project Interconnect Line, comprise the Argentia Renewables Project Area. This baseline study focuses on the presence/absence (and, based on acoustic detections, a weak inference of relative abundance) of bat species in the Project Area, including a broad-scale assessment of habitat use.

Baseline bat surveys and desktop reviews were carried out in 2022 and 2023. Initial studies in the fall of 2022 detected three bat species in the Project Area, including the migratory silver-haired bat (*Lasionycteris noctivagans*). Longer-duration surveys (i.e., spring to fall) were conducted in 2023 to determine the species type, abundance of calls, and timeline for the detection of bats in the Project Area. Four species of bats were observed from calls in the Project Area in 2023. The little brown myotis (*Myotis lucifugus*) is relatively common in Newfoundland and was expected to be present within the Project Area. This species, along with Northern myotis (*Myotis septentrionalis*) are highly susceptible to White-nose Syndrome (WNS), a fungal disease that causes bats to arise early from hibernation and die from starvation and freezing (COSEWIC, 2013). Due to this threat, both species were emergency-listed as Endangered in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2013 (COSEWIC, 2013), and on the federal **Species at Risk Act** (SARA) in 2014. The little brown myotis was listed as Endangered by the International Union for Conservation of Nature (IUCN) in 2018, and Northern myotis was listed as Near Threatened (Solari, 2018a; Solari, 2018b). WNS was discovered in Newfoundland in 2018 (NL Fisheries and Land Resources, 2018), and both species were listed as Endangered under the Newfoundland and Labrador **Endangered Species Act** (NL ESA) in 2021. The other two bat species were unexpected for the Project Area, the hoary bat (*Lasiurus cinereus*) and the silver-haired bat. These species are migratory and spend the summer months in southern Canada before returning further south to overwinter (COSEWIC, 2023). These bats are not susceptible to WNS; however, they are at an increased risk of windmill collisions during migration (COSEWIC, 2023; Frick *et al.,* 2017; Allison *et al.,* 2019; Kunz *et al.,* 2007; Lawson, 2013). Resident bats and migratory bats may each interact with the Project in different ways, according to migratory strategy (e.g., migratory bats may typically occupy higher airspace than the resident species that primarily forage in the airspace just above wetlands/waterbodies, or within the forest). Each are described briefly below.

1.1 Resident Bats

Little brown myotis are found in almost every province and territory across Canada (Nature Conservancy Canada [NCC], 2024). These bats typically weigh between 7-9 grams (NCC, 2024). Little brown myotis are insectivores, and while they feed on a large range of insects, they are preferential to aquatic insects (Bat Conservation International [BCI], 2020). Like almost all bat species, little brown myotis are nocturnal, and hibernate in the winter (NCC, 2024). Northern myotis (i.e., Northern long-eared bat), like little brown myotis, are nocturnal and feed exclusively on insects (BCI, 2024a). They are common in central-eastern Canada (COSEWIC, 2012), and typically weigh between 5-8 grams (BCI, 2024a). They have longer ears than other myotis species, which grants them an advantage in hunting moths (BCI, 2024a). Northern myotis tend to forage in forested areas, preying on moths, spiders, and a variety of other insects (Broders *et al.,* 2010). They can be difficult to visually distinguish from little brown myotis, as the two species are very similar and often share hibernacula in the winter (COSEWIC, 2012).

1.2 Migratory Bats

Silver-haired bats are a migratory species that can be found across Canada during the summer and fall (COSEWIC, 2023). Most silver-haired bats overwinter south of Canada (COSEWIC, 2023). They are insectivorous and eat a wide variety of insects, although they tend to prefer smaller, softer insects (BCI, 2024b). Silver-haired bats have dark fur with silver or grey tips, and are larger than local bats, typically weighing between 8-11 grams (Kunz, 1982). Hoary bats are a migratory species found across Canada (COSEWIC, 2023), and are the most widespread bat species across the Americas (BCI, 2017). They migrate north during the summer, where they prefer to roost in mature deciduous and coniferous trees (BCI, 2017). These insectivorous bats prefer to eat moths, though they will feed on other insects (BCI, 2024c). They are the largest of the bat species discovered in the Project Area, weighing between 20-35 grams (BCI, 2024c).

2.0 Methods

2.1 Desktop Review

A thorough desktop investigation and literature review were conducted to compile existing information on bats for the Project Area (and region) and to facilitate the determination of potential interactions between bats and the Project. The research focused on the bat species known to the area and their specific interactions with wind turbine developments. In addition, an Atlantic Canada Conservation Data Centre

(AC CDC) request was made for a 5 km radius of the Project Area; however, no records of bats were included in the results, ostensibly due to a lack of survey effort reported in the area.

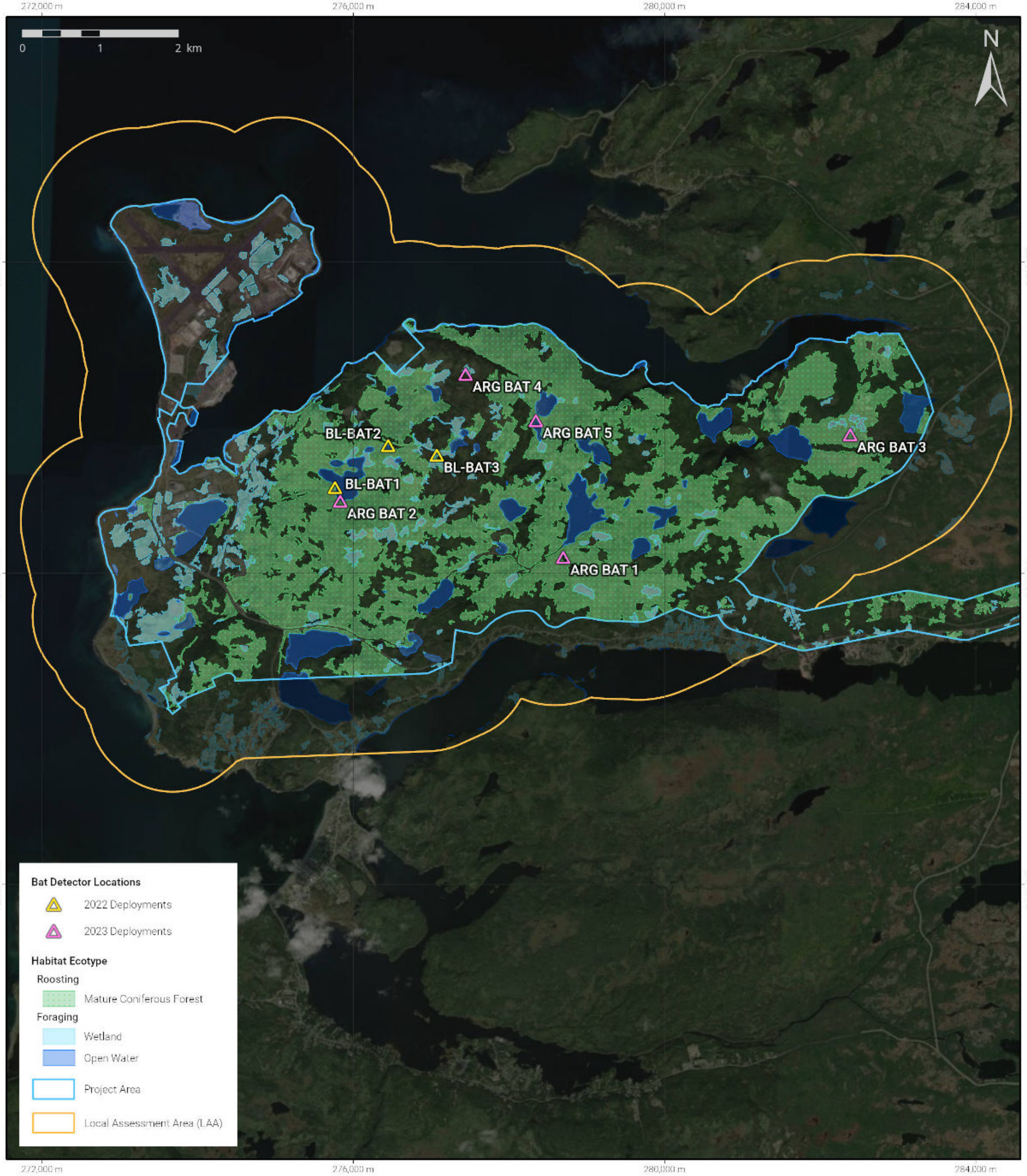
2.2 Habitat Suitability Mapping

The Ecological Land Classification (ELC) study (Appendix D3) was used to inform the bat baseline study in identifying suitable bat habitat throughout the Project Area. The ELC study consisted of a desktop review and numerous surveys throughout the Project Area. An intensive GIS and public database review was undertaken to gain an understanding of the ecotypes associated with the Project Area and their potential for bat use. Of the ten ecotypes found within the Project Area, three ecotypes present characteristics that are ideal for bat habitat. The Wetland and Open Water ecotypes were considered suitable foraging habitat while Mature Coniferous Forest was considered suitable roosting habitat. During field surveys for the ELC, observations of sites that displayed high potential to support roosting bats (e.g., rocky outcrops with shale rock, mature forest with roosting trees, or abandoned military bunkers that were moderately enclosed/protected) were recorded. The habitat suitability study informed the acoustic monitoring work undertaken, illustrated where turbine locations would impede highly suitable bat habitat, and informed the potential bat mortality estimates post-Construction Phase.

2.3 Acoustic Monitoring

Acoustic data acquisition was carried out using Titley Scientific Anabat Swift™ full spectrum passive bat detectors; three in 2022, and five in 2023 (Figure D2-2.3-1). Bat detectors collect ultrasonic bat calls with a transducer/microphone and store the sound files on SD cards for analysis. Acoustic detectors such as Anabat are used to detect calls from bats and are a relatively effective tool for identifying the species present in an area, but do not provide a clear picture of abundance (e.g., a single bat may heavily utilize an area or a group of bats may pass through an area, resulting in substantially similar detections). Regular visits were conducted to each site to collect data and batteries were monitored and changed as needed (Anabat Swift detectors are weather-proof and hold enough battery power to sustain operation for two months). As recommended by the manufacturer, the units were set to a sensitivity level of 16, and the recording format was set to full spectrum.

Detectors were mounted approximately 3 m high on trees adjacent to waterbodies, and GPS locations were recorded. Data was collected from September 9 to October 3, 2022, and from April 18 to November 16, 2023. The detectors were set to record throughout the period from a half hour before sunset to a half hour after sunrise, thereby encompassing the daily temporal window of activity. The Project Area was assessed to find locations spatially effective at detecting different bat species. Once these areas were identified using aerial imagery, ground surveys were conducted to determine precise locations where the detectors would be most effective. These areas comprised wetlands with high water tables, wetlands with open water, and water bodies where flying insects are abundant.



Pattern | Argentia Renewables	FIGURE NUMBER: D2 - 2.3 - 1	COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 22N	PREPARED BY: C. Burke	DATE: 5/17/2024
	FIGURE TITLE: Bat Detector Locations for Baseline Studies	NOTES:	REVIEWED BY:	
			APPROVED BY:	
	PROJECT TITLE: Argentia Renewables		sem	

SEM MAP ID: 238-005-GIS-108-Rev0

The detectors are small and compact, which allows for them to be mounted directly onto trees with bungee cords. They were mounted to be easily accessed for maintenance as batteries and SD cards were regularly replaced. Microphones were attached to the detectors directly or via extendable cords to ensure optimal positioning. The microphones were placed anywhere from 2.5 – 3.5 m above ground, either on the face of the detector or on tree branches that extended outward over a potential foraging area for bats. When microphones were attached to tree branches, they were pitched slightly upward. This orientation ensured that the microphone could record bats in flight above the selected area.

Detectors were deployed strategically to encompass the entire active season for bats (Figure D2-2.3-1). The myotis genus bats emerge from their hibernaculum in early spring (COSEWIC, 2013; Koch *et al.*, 2023). Females form maternity colonies and raise their young in the early summer (COSEWIC, 2013). Swarming/breeding season occurs in the fall, after which time bats return to hibernacula (Sunga *et al.*, 2022). Bats regularly forage and move about their habitats during the entire active season.

Bat call identification was conducted using Anabat Insight™ 1.8.6. (Titley Electronics, Ballina, NSW, Australia) and Kaleidoscope software. The software was used to classify the bats into species based on spectrograms (i.e., visualizations of vocal calls) and frequency ranges which are species-specific. Spectrograms display the sound frequency and time on the X and Y-axis respectively while also recording the intensity of the sound with color. For each call, the slope, maximum frequency (i.e., the highest frequency), minimum frequency (i.e., the lowest frequency), and duration were noted to determine species. Each variable was then compared with a library of reference calls collected from individual bats that had been identified to the species level. A bat call (call) was defined as a single, recognizable vocalization from one bat. A bat pass (pass) was defined as one or more sequential calls, representing calls from a single bat, recorded in one Anabat digital file. Little brown myotis have a peak call power (Fc) within the frequency range of 35-40 KHz, and Northern myotis have an Fc of 35-45KHz (McBurney & Segers, 2021). The migratory bats occupy a lower frequency range, with an Fc of 15-30KHz for hoary bats and an Fc of 25-30KHz for silver-haired bats (McBurney & Segers, 2021). The calls were categorized into three separate types (McBurney & Segers, 2021):

1) Search Calls (looking for prey);
2) Approach Calls (homing in on detected prey); and
3) Feeding Buzz (fine-tuning before capture of prey).

Each detector was equipped with a microphone capable of detecting bat calls between 10 kHz and 250 kHz, which encompasses all possible bat species' frequency ranges. Bat pass monitoring was designed based on the protocols described in Bats and Wind Turbines: Pre-siting and Pre-construction Protocols (Lausen *et al.*, 2010). Bat species calls are usually distinguishable based on the characteristics of the geometry of the frequency/time graphs. However, call recordings sometimes lack sufficient detail to allow species-level identification due to factors such as background noise, distance from the detector, weather, and other environmental factors. Any partial or fragmented calls that could not be identified to species were classified as unidentified bats (i.e., records were identified as bat calls, but species could not be determined).

An additional acoustic detection study is taking place in 2024, following the same methodology as described for previous years and in consultation with regulatory authorities. The 2024 study will involve the deployment of nine bat detectors. Further information will be provided after the study is complete.

2.3.1 Detector Locations 2022

During the baseline studies in 2022, three bat detectors were placed at the locations listed in Table D2-2.3.1-1. These locations represented foraging sites selected via aerial imagery and following site habitat review during baseline surveys for the Ecological Land Classification (ELC) (Appendix D3).

Table D2-2.3.1-1 Bat Detector Locations, Project Area, Argentia Backlands, 2022.

Detector ID	Coordinates (UTM, Zone 22T)		Habitat Type	Deployment Date	End Date	Detector Nights
BL-BAT1	275763 E	5241109 N	Pond - Wetland	Sept 9	Oct 3	24
BL-BAT2	276447 E	5241650 N	Pond - Wetland	Sept 9	Oct 3	24
BL-BAT3	277072 E	5241526 N	Wetland	Sept 9	Oct 3	24

BL-BAT 1 was placed on a tree overlooking Argentia Pond facing northeast where a riparian meadow/wetland complex exits the pond over a spillway. This area consists of wetland, stream, and pond habitats. These wetlands and waterways attract insects for bats to forage on.

BL-BAT 2 was placed in a tree facing south over a small pond which was part of a large wetland waterbody complex running along a large, flat, wet valley. The still-water in this pond combined with the diverse wetland habitat surrounding the pond provided suitable foraging habitat.

BL-BAT 3 was placed in a tree facing northeast over a small pond in the northeastern portion of the wetland complex where detector BL-BAT 2 was also located. This area represents a continuous wetland habitat that includes one of the larger waterbodies of the Project Area. Two detectors were placed here to provide ample coverage of this highly suitable foraging habitat.

2.3.2 Detector Locations 2023

During the baseline studies in 2023, five bat detectors were placed in the Project Area. To encompass a broad range of suitable bat habitats, detector locations were selected for effective spatial distribution, highly suitable habitat, and potential flight pathways. The 2022 surveys allowed for the identification of specific, highly suitable habitats where detectors would be deployed. The locations of bat detectors in 2023 and their habitat descriptions are listed below (Table D2-2.3.2-1).

Table D2-2.3.2-1 Bat Detector Locations, Project Area, Argentia Backlands, 2023.

Detector ID	Coordinates (UTM, Zone 22T)		Habitat Type	Deployment Date	End Date	Detector Nights
ARG BAT 1	278696.71 E	5240209.97 N	Stream Pool - Wetland	Apr 18	Nov 16	212
ARG BAT 2*	275831.09 E	5240934.08 N	Pond	Aug 9	Nov 16	99
ARG BAT 3	282385.42 E	5241787.64 N	Wetland - Bog	Apr 18	Nov 16	212
ARG BAT 4	277441.53 E	5242563.84 N	Pond - Wetland - Bog	Jun 27	Nov 16	142
ARG BAT 5	278344.89 E	5241968.77 N	Pond - Wetland	Jun 27	Nov 16	142
*The original detector in this location was stolen, so the deployment of a new detector occurred later than the others.						

ARG BAT 1 was placed on a tree standing alone over a small pond created in the meander of a small stream from the spillway dyke of Gull Pond (Figure D2-2.3.2-1). At ARG BAT 1 the water slows and deepens, with abundant aquatic vegetation growing at the periphery of the central flow of water. The slow movement and depth of the waters, surrounded by forested habitat and wetlands, creates an area of highly suitable flying insect habitat. The microphone was placed three or four feet higher than the detector and slanted slightly upward to get better coverage for detection. The detector's microphone was facing southwest to encompass the entire small pond and the wetland (Fen) which extended southwest beyond the pond.

Figure D2-2.3.2-1 ARG BAT 1 Detector location – Small Pond / Wetland.

ARG BAT 2 was deployed in a slightly altered location to BL BAT 1 on Argentia Pond. Detector placement was based on results from the 2022 baseline studies. ARG BAT 2 was placed east, across the stream from the previous location, in a tree overlooking a small cove in the southeast corner of the pond. This updated position reduced wind interference in the microphone. The detector microphone was extended up the tree and attached facing slightly upward and northeast across a vegetated section of the pond.

ARG BAT 3 was placed on the opposite side of the Argentia Backlands in a large wetland in the northernmost portion of the Project Area (Figure D2-2.3.2-2). This location represented one of the larger and more segregated wetland complexes in the Argentia Backlands. This region of the Project Area is heavily forested with coniferous trees and has a high variation in elevation. The detector was placed facing north over a wetland (Bog-Fen) with a high-water table but no standing waterbodies.

Figure D2-2.3.2-2 ARG BAT 3 Detector Location, Wetland.

ARG BAT 4 was deployed in a central location in the Project Area in a highly suitable habitat including a basin bog wetland with two small, still-water ponds. These bog ponds are likely to produce large numbers of flying insects and hence serve as a highly suitable forage site for bats. The detector's microphone was extended along a large protruding branch of a tree facing northeast over the bog and still-water ponds.

ARG BAT 5 was placed in a central, inland location in the Argentia Backlands where runoff from surrounding slopes creates a valley with two moderate-sized ponds. These ponds are connected by a small stream and riparian wetland. The bat detector was placed in the riparian zone of the southern pond at the northwest corner where the stream exits the pond, in a treed wetland (Figure D2-2.3.2-3). The detector was mounted in a tree facing southeast.

Figure D2-2.3.2-3 ARG BAT 5 Detector Location, Pond Riparian.

3.0 Results

3.1 Desktop Review

3.1.1 Resident Bats

The desktop investigation and literature review confirmed that the resident little brown myotis and Northern myotis were likely the most abundant bat species within the Project Area. Both species have been greatly affected by WNS in eastern North America (COSEWIC, 2013). A study by Cheng *et al*. (2021) found a population decline of more than 90% in little brown myotis, Northern myotis, and tricolored bats (*Perimyotis subflavus*) since the emergence of WNS. Both little brown myotis and Northern myotis are slow to reproduce, which increases the vulnerability of their populations (COSEWIC, 2018). It is unknown whether WNS has affected bats in the Project Area, but it is known that WNS is present in Newfoundland (NL Fisheries and Land Resources, 2018).

3.1.2 Migratory Bats

The hoary bat was observed in Gros Morne via bat detectors (Washinger *et al.*, 2020), and the NL WD advised that two occurrences of silver-haired bats have been confirmed in Newfoundland (NL WD, personal communication, 2022). Based on this information, it was considered possible that these species could visit the Project Area during migration. However, they were generally unexpected to be observed in the Project Area, given the limited reports of migratory bat species' presence in Newfoundland. Neither of these two species was listed under any conservation status when studies commenced in 2022; however, in 2023, COSEWIC listed them as Endangered (COSEWIC, 2023).

3.1.3 AC CDC Results

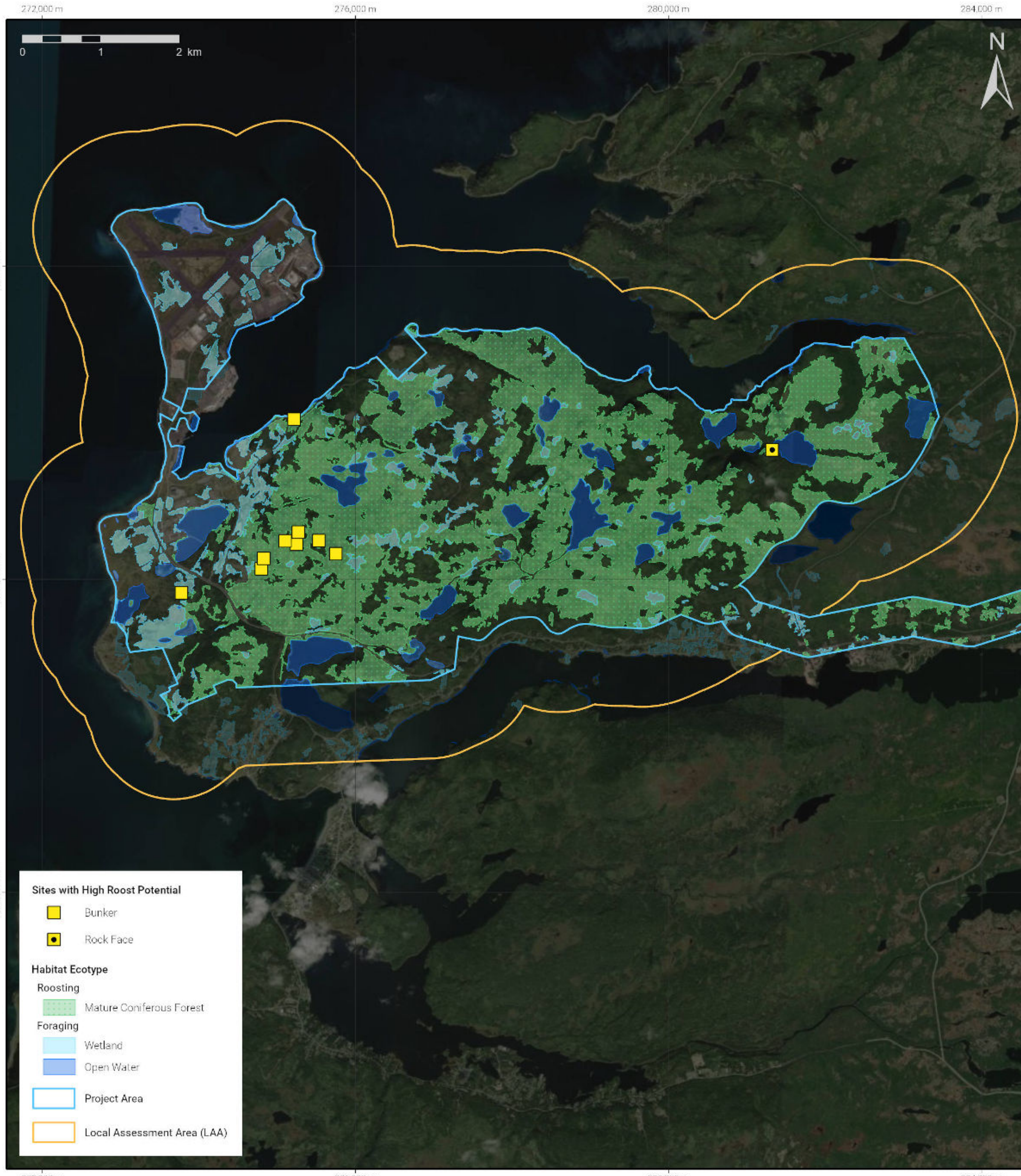
The AC CDC request returned a list of rare fauna within a 5 km radius of the Project Area; however, no bats were listed, ostensibly due to a lack of survey effort in the region.

3.2 Habitat Suitability Mapping

The Project Area is approximately 4,811 ha (including a 250 m buffer from the proposed Project Interconnect Line centerline) and comprises a wide variety of ecotypes. As discussed in the ELC (Appendix D3), there are 10 ecotypes in the Project Area, with Mature Coniferous Forest occupying the greatest amount of area (1,683 ha), or 33% of the Project Area. Wetlands occupy approximately 369 ha (7% of the Project Area). These habitat types may be the most important for the bats within the Project Area (at least the resident species). A large portion of the Project Area can be defined as suitable foraging habitat for the little brown myotis and Northern myotis, with large wetlands and open water bodies scattered across the Argentia Backlands, and abundant mature forest (for Northern myotis).

Although there were no confirmed observations of bat hibernacula within the Project Area, some habitat suitable for roosting and hibernaculum use was observed. Any potential or confirmed hibernacula must be reported to NL WD, and high-potential sites cannot be entered except by approved officials trained in WNS decontamination protocols. Steeper rocky outcrops that have crevices or talus slopes below their cliffs may be suitable for daytime roosts, and it is possible that larger cavities and caves suitable for hibernaculum use exist (Neubaum, 2018). Mature forests such as the balsam fir-dominated forests throughout the Project Area could provide large snags (i.e., dead standing trees) suitable for daytime roost sites or perhaps maternity roosts in the spring (COSEWIC, 2013). Mixedwood Forests are dominated by large yellow birch (*Betula alleghaniensis*) and white birch (*Betula papyrifera*), which can form roost sites for bats. Rolled, peeling bark, hollow crevices, and deciduous snags are often ideal roost sites for species like little brown myotis (Randall *et al.,* 2014). These habitats provide suitable characteristics for bats, with dense forests between more open foraging sites. Anthropogenic infrastructure, such as relic military bunkers and abandoned mine sites, may also provide habitat suitable for roosting or hibernacula use. There are some buildings within the Project Area (e.g., pumphouses) which present a range of potential roost sites for bats (e.g., external crevices behind siding or weatherboarding, inside wall cavity spaces, under ridge vents on the roof) (Fagan *et al.,* 2017). The bunkers pictured in Figure D2-3.2-1 were observed in the Project Area and may provide suitable roosting habitat. Figure D2-3.2-2 illustrates the composition of suitable habitat for bats in the Project Area, including potential bat roosts (e.g., bunkers and exposed rocky cliffs).

Figure D2-3.2-1 Relic Military Bunkers Which Could Have Potential as Bat Roost Sites.

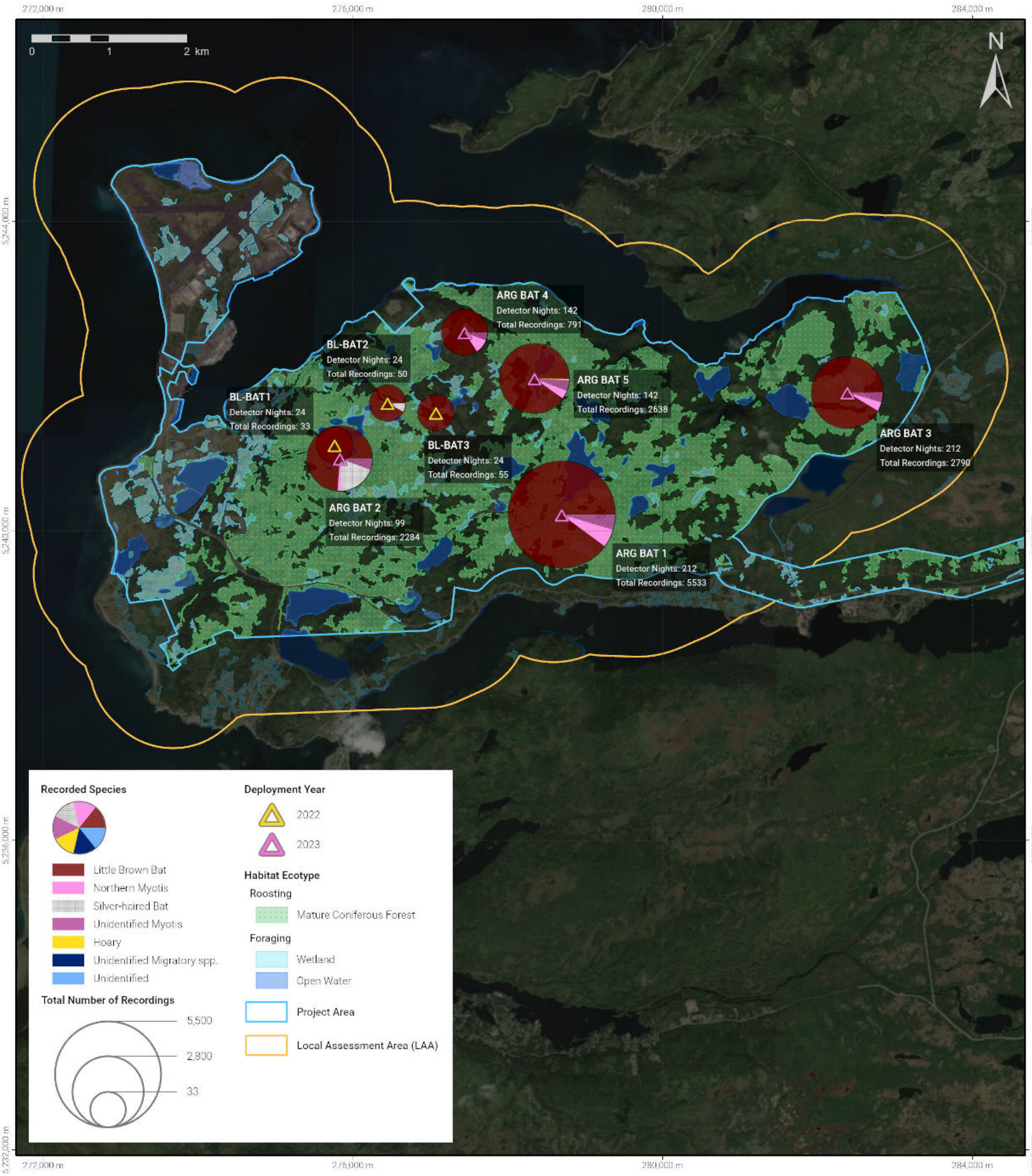


Pattern | Argentia Renewables	FIGURE NUMBER: D2 - 3.2 - 2	COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 22N	PREPARED BY: C. Burke	DATE: 23/05/2024
	FIGURE TITLE: Suitable Bat Habitat and Sites with High Roost Potential	NOTES: Sites with a high potential to support roosting bats were identified throughout various field programs in 2022, 2023, and 2024.	REVIEWED BY:	
			APPROVED BY:	
	PROJECT TITLE: Argentia Renewables		sem	

SEM MAP ID: 238-005-GIS-110-Rev0

3.3 Acoustic Monitoring

The map below (Figure D2-3.3-1) provides a visual overview of the acoustic recordings collected at each detector site throughout 2022 and 2023. Results from the acoustic monitoring efforts for both years are presented in further detail following the map.



Pattern | Argentia Renewables	FIGURE NUMBER: D2 - 3.3 - 1	COORDINATE SYSTEM: NAD 1983 CSRS UTM Zone 22N	PREPARED BY: C. Burke	DATE: 23/05/2024
	FIGURE TITLE: Acoustic Monitoring Results Overview	NOTES:	REVIEWED BY:	
			APPROVED BY:	
	PROJECT TITLE: Argentia Renewables		sem	

SEM MAP ID: 238-005-GIS-118-Rev0

3.3.1 Baseline Bat Observations, Fall 2022

The initial deployment of detectors took place in the fall of 2022 (September 9 to October 2), and a total of 138 echolocation calls were recorded from three Anabat Swift™ bat detectors over the sampling period (Table D2-3.3.1-1). BL BAT 3 had 55 recordings, BL BAT 2 had 50 recordings, and BL BAT 1 had 33 recordings. From the echolocation calls recorded, 97% of observations were of little brown myotis, with four recordings of silver-haired bat, an uncommonly observed migratory species with an unknown range in Newfoundland. Three recordings taken on September 27, and one taken on October 2, were produced by silver-haired bats. The distinguishing features of the spectrograph of a silver-haired bat call versus a little brown myotis call are illustrated in the figure below (Figure D2-3.3.1-1).

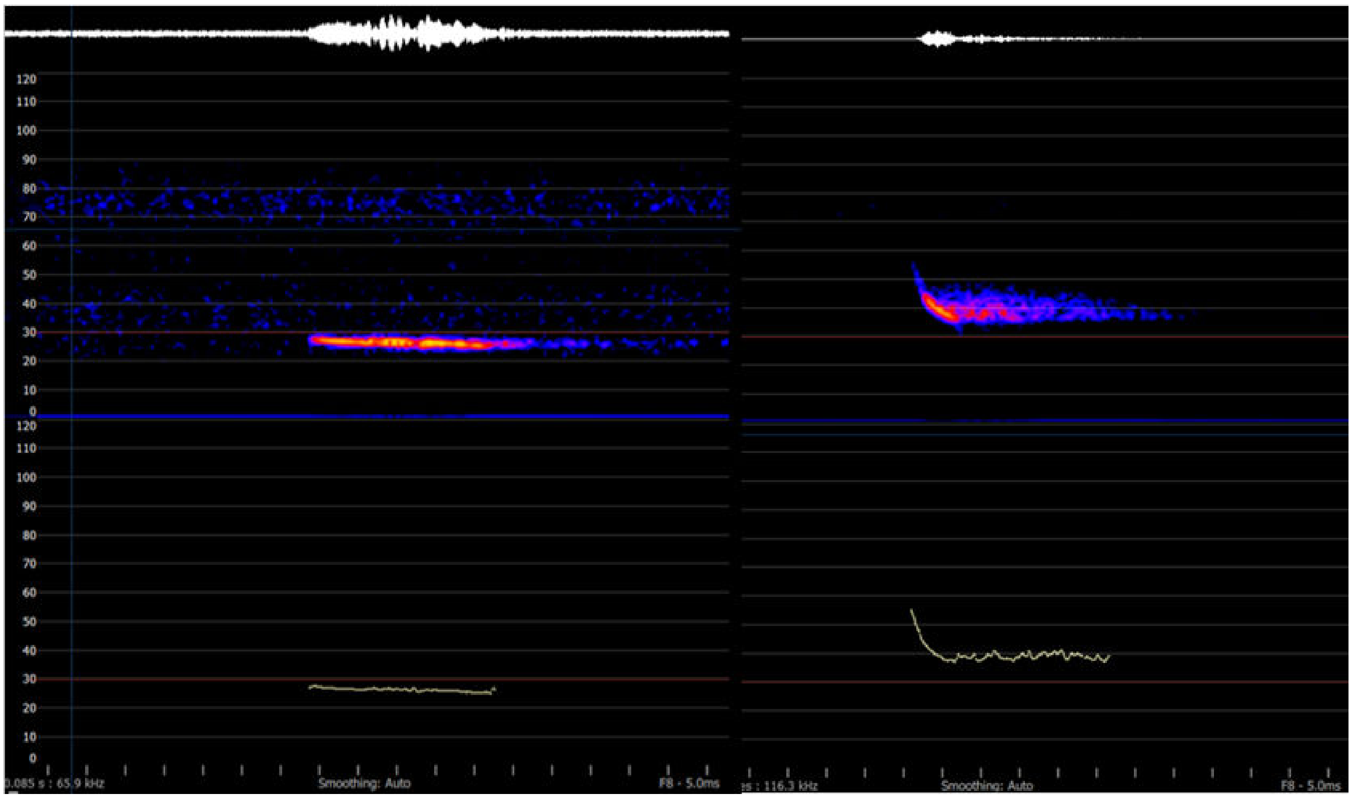


Figure D2-3.3.1-1 Silver-haired Bat (left) vs. Little Brown Myotis (right) Spectrographs, 2022.

Bat activity was highest in mid-September, based on detection frequency over time. Figure D2-3.3.1-2 illustrates how many calls were recorded on each day of the survey, with the peak number of calls on September 14, 2022, ostensibly in the middle of the swarming period. Figure D2-3.3.1-3 examines the results of September 14, 2022, by breaking down the results by detector to show the regions with a higher volume of calls.

Table D2-3.3.1-1 Bat Detection Results by Species, 2022.

Species	Migratory	Detector ID			
		BL Bat 1	BL Bat 2	BL Bat 3	Species Total
Little brown (*Myotis lucifugus*)	No	33	46	55	134
Northern myotis (*Myotis septentrionalis*)	No	0	0	0	0
Silver-haired (*Lasionycteris noctivagans)*	Yes	0	4	0	4
Detector nights		23	23	23	23
Average per detector night		1.43	2.17	2.39	6.00

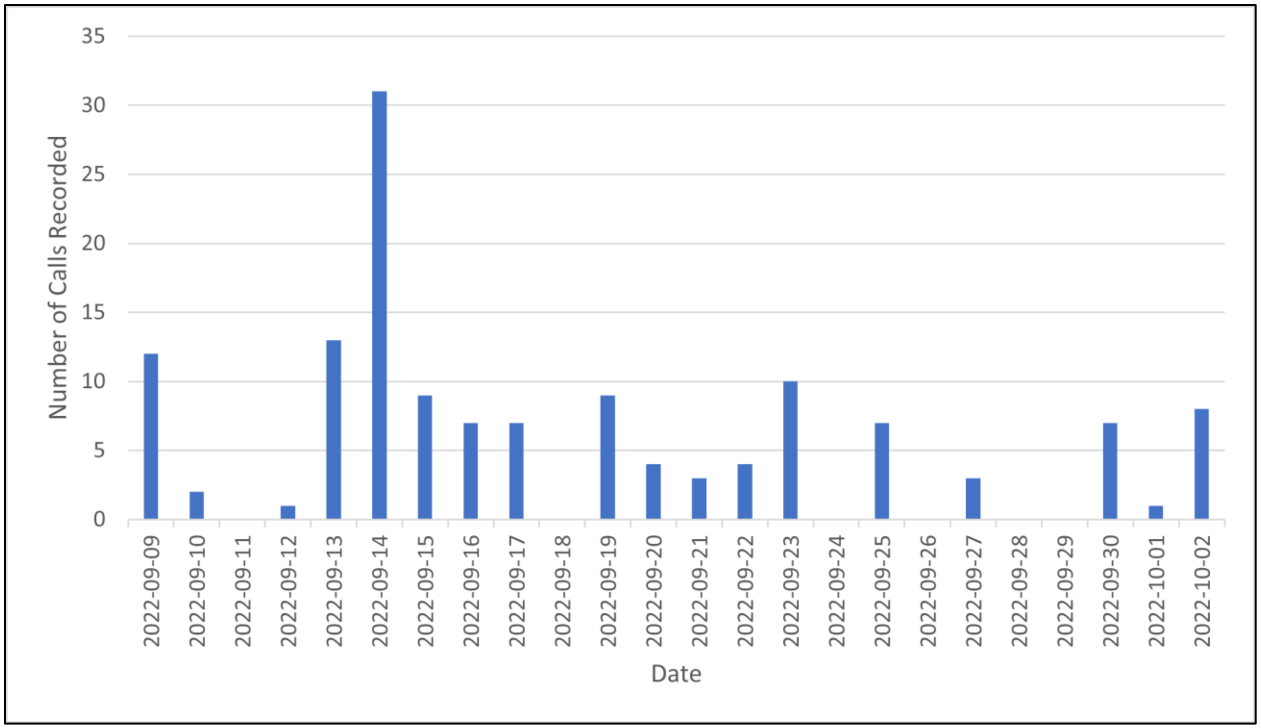


Figure D2-3.3.1-2 Daily Bat Recordings, Project Area, Argentia Backlands, 2022.

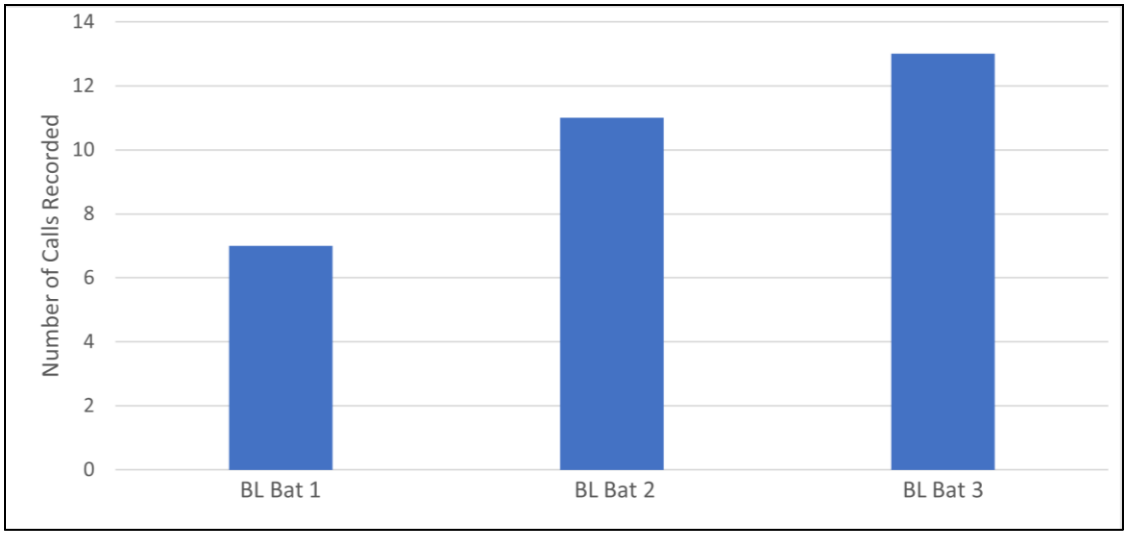


Figure D2-3.3.1-3 Bat Detections Across Three Detectors, September 14, 2022.

3.3.2 Baseline Bat Observations, Spring to Fall 2023

Four species of bats were detected from five detectors during the 2023 bat surveys. The little brown myotis was the most frequently observed species by a large factor (>87% of all detections), while Northern myotis was second (4.6% of all detections). The detections of Northern myotis regularly occurred over the expected bat activity window. Silver-haired bats were mainly detected over three days at ARG BAT 2 and ARG BAT 5, toward the end of the deployment in the fall. It is possible that the individual(s) were migrating through the Project Area and possibly only using local habitats in this migration window. Bat activity was highest in late July and early August with the peak on July 26, 2023 (biased heavily towards little brown myotis). Table D2-3.3.2-1 demonstrates the summary of all the bat detections for 2023.

Table D2-3.3.2-1 Bat Detection and Species Data, Baseline Detectors, Project Area, 2023.

Species	Migratory	Detector ID					Total
		ARG Bat 1	ARG Bat 2	ARG Bat 3	ARG Bat 4	ARG Bat 5	
Little brown (*Myotis lucifugus*)	No	4973	1687	2551	666	2380	12,257
Northern myotis (*Myotis septentrionalis*)	No	306	47	114	80	96	643
Silver-haired (*Lasionycteris noctivagans)*	Yes	0	421	0	0	5	426
Hoary (*Lasiurus cinereus*)	Yes	0	0	0	0	15	15
Myotis (unidentified)	No	254	129	123	44	134	684
Unidentified	Unknown	0	0	2	1	0	3
Unidentified Migratory spp.	Yes	0	0	0	0	8	8
Detector nights		212	99	212	142	142	
Average per detector night		26.10	23.07	13.16	5.57	18.58	

Wind Speed vs. Bat Activity

The ECCC meteorological station in Argentia collected data consistently throughout 2023. Temperature and wind speed data were collected from the Environment and Climate Change Canada (ECCC) database and compared with bat detection data collected during the study. Both temperature (positively) and wind speed (negatively) were correlated with bat detections. Bats were seldom detected when wind speeds rose above 9.5 m/s, with most bat detections occurring during wind speeds below 4.5 m/s (Figure 3.3.2-1).

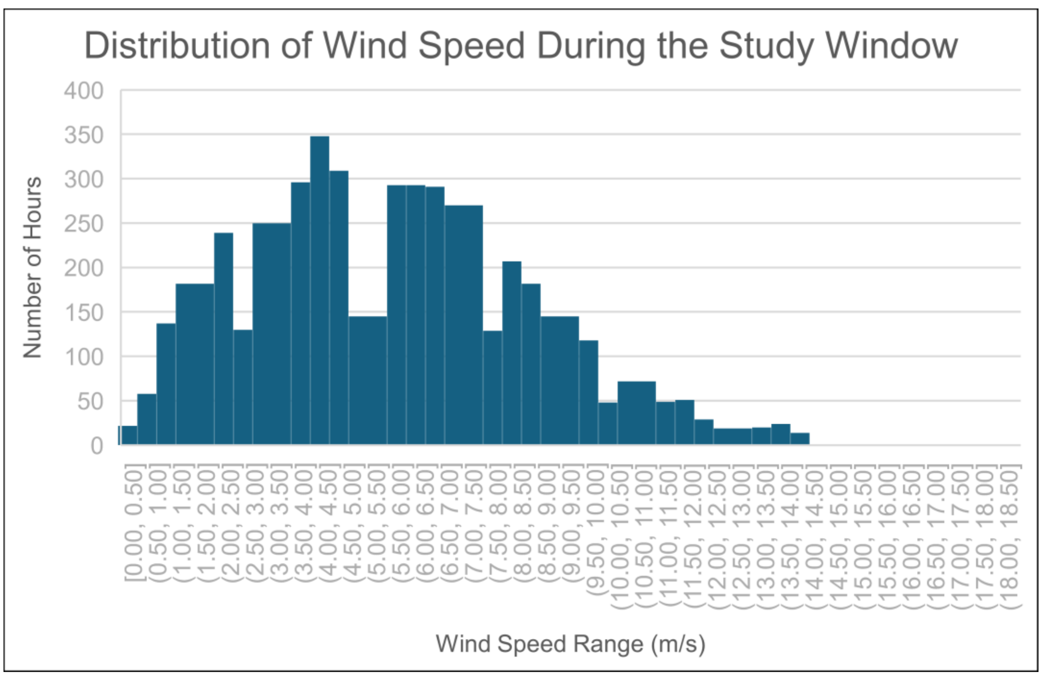


Figure D2-3.3.2-1 Distribution of Wind Speed During the Study Window, 2023.

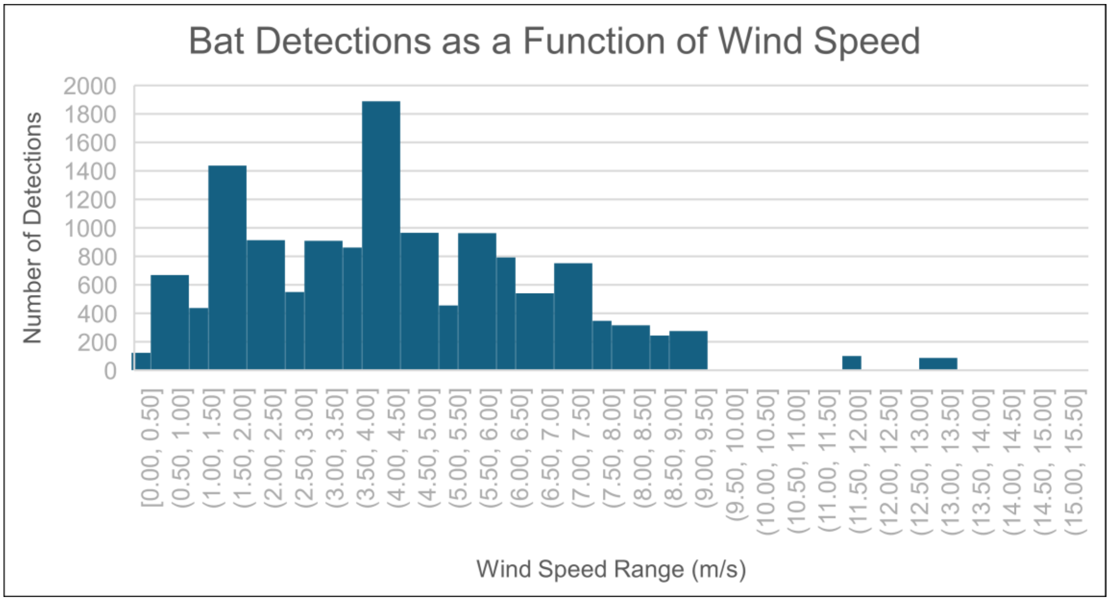


Figure D2-3.3.2-2 Bat Detections as a Function of Wind Speed, 2023.

Bats were detected most often at temperatures above 14 degrees Celsius (Figures D2-3.3.2-3 and D2-3.3.2-4). Bat detections declined at temperatures below 6.5° Celsius.

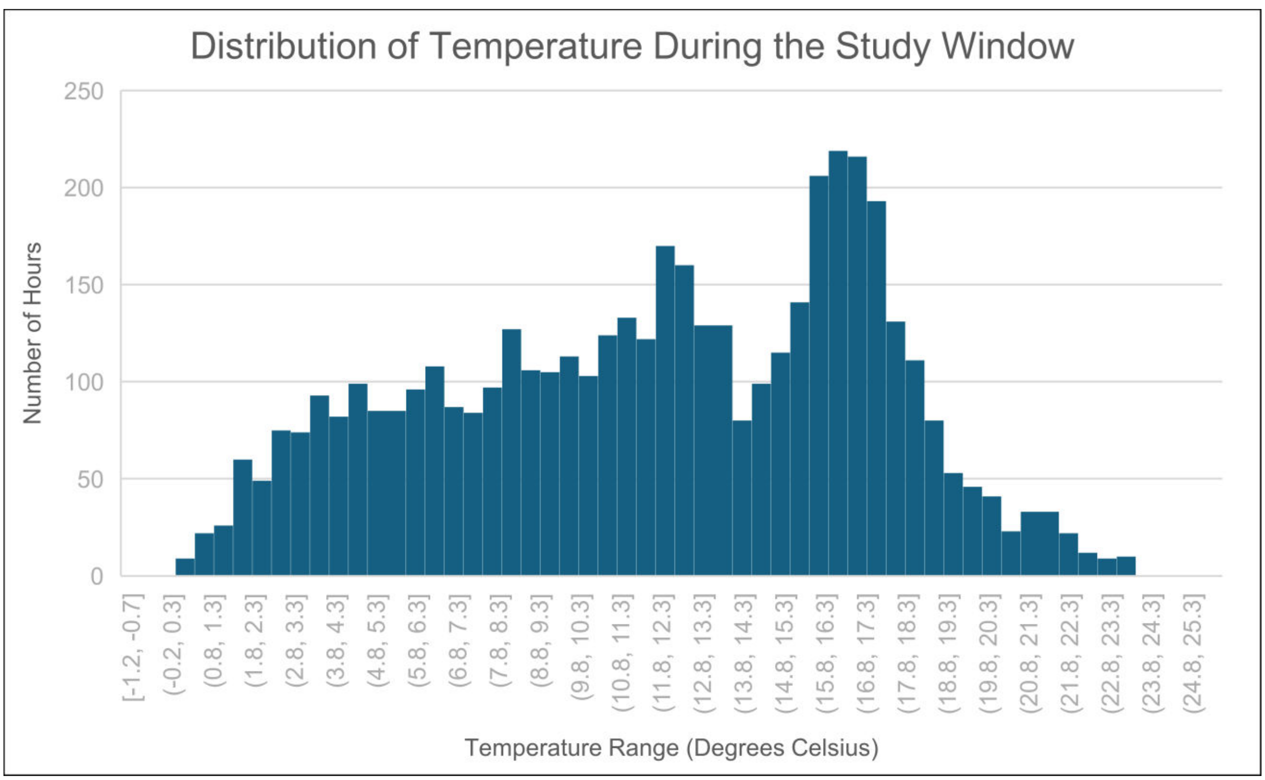


Figure D2-3.3.2-3 Distribution of Temperature During the Study Window, 2023.

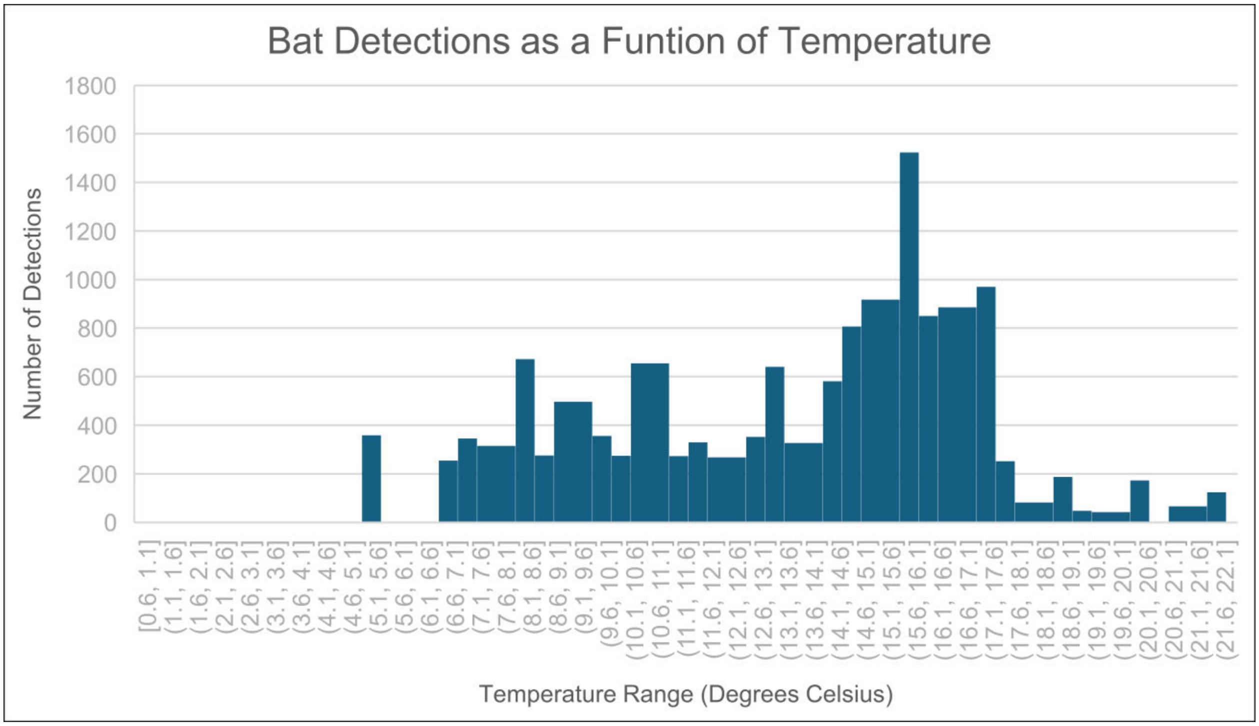


Figure D2-3.3.2-4 Bat Detections as a Function of Temperature, 2023.

4.0 Discussion

Four bat species were detected in the Project Area: the little brown myotis and Northern myotis, which are historically relatively well-known in Newfoundland, and the silver-haired and hoary bats, which are migratory species, and for which very little is known. Most bats recorded from these surveys were little brown myotis, an anticipated result. The observations of migratory silver-haired bats were not predicted as they were only recently confirmed to visit Newfoundland (Wildlife Division, personal communication, 2022) and the extent of their occurrence in Newfoundland is still unknown. The timing and short stay of the silver-haired bats during both 2022 and 2023 suggests that they use the Project Area only as a migratory stopover as they head south for the winter. The Project Area is north of the established range for this species (COSEWIC, 2023).

Bats were detected at all sites in both fall 2022 and in 2023. Much of the Project Area is suitable for bats, especially little brown myotis, which benefit from wide-open foraging areas such as ponds and wetlands near quality roosting areas (Burns *et al.,* 2015). Little brown myotis readily nests within buildings and other human developments suitable for roosting (Burns *et al.,* 2015), and may find suitable roosting habitat in remnant abandoned military infrastructure around the Project Area (surveying these structures, except cursorily, was outside the scope of this Project). In addition, the Project Area has potential roosting habitat within crevices between rocks, or caves, or in the patches of mature forest including large yellow birch, which can provide excellent areas for bat roosting (COSEWIC, 2013; COSEWIC, 2023).

It is difficult to draw conclusions based on one year of data (plus fall 2022), but an interesting finding was that the detector ARG BAT 1 with the most little brown myotis and Northern myotis detections, located adjacent to a small fen, had no migratory bat species detections. These smaller myotis species, especially the Northern myotis, benefit from having a cluttered foraging area (McBurney & Segers, 2021). Such small clearings likely provide these bats with abundant food and a secure foraging area paired with nearby trees. Alternatively, the greatest number of migratory bat detections were adjacent to a large, open pond (ARG BAT 2). This open habitat may be more suited for the larger migratory bats and less appealing to the smaller myotis species (McBurney & Segers, 2021). Future deployments of bat detectors will take this into account.

One of the major stressors for little brown myotis and Northern myotis is White-nose Syndrome (WNS) (COSEWIC, 2013). This fungus has detrimental effects on hibernating bats and most often results in death. Hibernacula affected by WNS have seen more than a 90% decrease in bat populations (Cheng *et al.,* 2021). WNS was first reported on the west coast of Newfoundland in 2018 (NL Fisheries and Land Resources, 2018). Given that WNS is expected to have a catastrophic impact on the myotis spp. in Newfoundland, additive mortality from development projects may lead to cumulative effects on these species. Argentia Renewables is a steward of bat conservation and commits to a robust Species at Risk Impacts Mitigation and Monitoring Plan (SAR IMMP) (note: this document is a draft and requires approval by NL WD) (Appendix R), in addition to a Post Construction Monitoring Plan (PCMP) (Appendix S).

Silver-haired and hoary bats travel large distances between summer foraging and overwintering areas (McGuire *et al.,* 2012). The migration habits of migratory bats are poorly understood (McGuire *et al.,* 2012). Migratory bat species are affected by operational wind turbines, and the continued development of wind energy poses a threat to migratory bat populations (COSEWIC, 2023; Frick *et al.,* 2017; Allison *et al.,* 2019; Kunz *et al.,* 2007; Lawson, 2013). Although the number of detections of migratory bats was relatively low, mitigations and monitoring for migratory bats has been included in the SAR IMMP and PCMP.

Myriad suitable roosting and foraging habitats, combined with the bat activity detected during the study, demonstrate that the Project Area has the amount of bat activity that would be expected for the myotis spp., and more silver-haired detections than was expected (the hoary bat may have been one individual blown off the migratory pathway, given the very few detections, on one occasion). Appropriate mitigation measures are required to protect these species; a comprehensive literature review, combined with Pattern Energy's vast experience in this field, was employed to develop a list of meaningful mitigations for this Project. These are presented in Chapter 4 (Section 4.5) of the Registration document. Acoustic monitoring work will continue through further studies in 2024.

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