AECOM

APPENDIX Q

Offshore Bat Survey Report

Photo credit: Matt Goldsmith, Equinor

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Prepared for

Beacon Wind LLC

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Abbreviations and Acronyms

ac	acre
Beacon Wind	Beacon Wind LLC
BOEM	Bureau of Ocean Energy Management
BW1	Beacon Wind 1
BW2	Beacon Wind 2
COP	Construction and Operations Plan
dB	decibels
E	Endangered
EPTFUS	Big brown bat (*Eptesicus fuscus*)
°F	Degrees Fahrenheit
Fc	characteristic frequency
GPS	Global Positioning System
ha	hectares
HPSGCN	High Priority Species of Greatest Conservation Need
ISO	Independent System Operator
km	kilometer
kHz	kilohertz
LASCIN	Hoary bat (*Lasiurus cinereus*)
LASNOC	Silver-haired bat (*Lasionycteris noctivagans*)
LASBOR	Eastern red bat (*Lasiurus borealis*)
Lease Area	Designated Renewable Energy Lease Area OCS-A 0520
m	meter
mi	Statute mile
ms	milliseconds
MYOLEI	Eastern small-footed bat (*Myotis leibii*)
MYOLUC	Little brown bat (*Myotis lucifugus*)
MW	megawatts
MYOSEP	Northern long-eared bat (*Myotis septentrionalis*)
nm	Nautical mile
NoID	not classified to a species
OCS	Outer Continental Shelf
PERSUB	Tri-colored bat (*Perimyotis subflavus*)
POI	Point of Interconnection
SC	Species of Special Concern
T	Threatened
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time
WEA	Wind Energy Area

Appendix Q Offshore Bat Survey Report

Q.1. Introduction

Q.1.1 Project Summary

Beacon Wind LLC (Beacon Wind) proposes to construct and operate an offshore wind facility located in the designated Renewable Energy Lease Area OCS-A 0520 (Lease Area). The Lease Area covers approximately 128,811 acres (ac; 52,128 hectares [ha]) and is located approximately 20 statute miles (mi) (17 nautical miles [nm], 32 kilometers [km]) south of Nantucket, Massachusetts and 60 mi (52 nm, 97 km) east of Montauk, New York. The Lease Area was awarded through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Wind Energy Area (WEA) offshore of Massachusetts.

Beacon Wind proposes to develop the entire Lease Area in two wind farms, known as Beacon Wind 1 (BW1) and Beacon Wind 2 (BW2) (collectively referred to hereafter as the Project). The individual wind farms within the Lease Area will be electrically isolated and independent from each other. Each wind farm will gather the associated turbines to a central offshore substation and deliver the generated power via a submarine export cable to an onshore substation for final delivery into the local utility distribution system at the selected Point of Interconnection (POI). The purpose of the Project is to generate renewable electricity from an offshore wind farm(s) located in the Lease Area. The Project addresses the need identified by northeast states to achieve offshore wind goals: New York (9,000 megawatts [MW]), Connecticut (2,000 MW), Rhode Island (up to 1,000 MW), and Massachusetts (5,600 MW). The purpose of the Project is to generate renewable electricity from an offshore wind farm(s) located in the Lease Area. The Project addresses the need identified by northeast states to achieve offshore renewable energy targets: New Jersey (7,500 megawatts [MW]), New York (9,000 MW), Connecticut (2,000 MW), Rhode Island (600 MW), and Massachusetts (3,200 MW). BW1 has been subscribed to the State of New York for 1,230 MW. BW2 may also support other offshore wind targets from three potential New England states by taking advantage of the regional transmission system operated by the Independent System Operator (ISO) of New England.

As part of their environmental review of the Lease Area, Beacon Wind contracted AECOM to conduct acoustic bat surveys concurrently with a variety of other survey types conducted within the Lease Area onboard the *Stril Explorer* research vessel. Baseline data of bat species presence and general activity levels collected within the Lease Area are intended to contribute to the development of a qualitative risk assessment and related chapter within the Construction and Operations Plan (COP). The acoustic survey, including detector installation and acoustic data processing, was led by AECOM's United States Fish and Wildlife Service (USFWS)-qualified bat biologist, Brian Cooper.

Q.1.2 Species Potentially Occurring in the Lease Area

Although the proposed landfall location and export cable route are within the lands and waters of New York, the closest landmass to the Lease Area is within Massachusetts. Bats of New York and Massachusetts can be generally categorized into two life-history strategies based on their winter behavior: 1) cave-hibernating species, which typically spend their winters hibernating in caves, underground mines, or man-made structures with similar conditions, and migrate regionally in a radial

pattern to summer maternity areas; and 2) long distance, latitudinal migrants (i.e., migratory tree-roosting bats) which may travel hundreds or even thousands of miles between their summer and winter habitats.

New York and Massachusetts, the two closet land masses to the Lease Area, are home to nine regularly occurring bat species, including the federally threatened northern long-eared bat (*Myotis septentrionalis*) and federally endangered Indiana bat. However, numerous studies on the migratory patterns of Indiana bats have demonstrated that these species tend to avoid open areas when migrating and remain close to tree lines (Butchkoski and Turner 2006; Hicks and Herzog 2006; Turner 2006). These studies also showed that the Northeast Research Unit of migrating Indiana bats tended to avoid areas of open water larger than two mi (1.7 nm, 3.2 km) across such as Lake Champlain and, therefore, would be unlikely to come into contact with wind turbines for the Project. Further, Indiana bats are not known to occur in Queens County, New York where the onshore portions of the Project Area are located (NYNHP 2020). Indiana bats are also not known to occur in the coastal portions of Massachusetts, and the last record of Indiana bats in Massachusetts dates back to 1939 (Griffin 1945). Therefore, only the eight species listed in **Table Q.1-1** are considered potentially present within the Lease Area.

TABLE Q.1-1. SPECIES POTENTIALLY OCCURRING IN THE LEASE AREA

Life-History Strategy	Species	Federal Status	New York Status	Massachusetts Status
Long Distance Migrants	Eastern red bat (*Lasiurus borealis*)	-	-	-
	Hoary bat (*Lasiurus cinereus*)	-	-	-
	Silver-haired bat (*Lasionycterus noctivagans*)	-	-	-
Cave-hibernating	Big brown bat (*Eptesicus fuscus*)	-	-	-
	Tri-colored bat (*Perimyotis subflavus*) a/	-	HPS	E
	Little brown bat (*Myotis lucifugus*)	-	HPS	E
	Eastern small-footed bat (*Myotis leibii*)	-	SC	E
	Northern long-eared bat (*Myotis septentrionalis*)	E	E	E

Notes:
E=Endangered; SC=Special Concern; HPS=High Priority Species of Greatest Conservation Need.
a/ Some recent evidence may suggest a greater degree of latitudinal migration than previously thought (Fraser et al. 2012)
Sources: DEEP 2015; MassWildlife 2020; NYSDEC 2015a and 2015b; USFWS 2023; USFWS 2021.

Q.2. Survey Methods

Q.2.1 Equipment

The acoustic monitoring devices used for this study were Song Meter Mini Bat units, manufactured by Wildlife Acoustics, Inc. These units were selected for their small size, waterproof exterior, long battery life, and ease of use and maintenance by the vessel staff who would be monitoring their status during long deployments. The Mini Bat units use an integral microphone with the same element and waterproof membrane as the SMM-U2 microphones utilized by Wildlife Acoustic's flagship bat detector, the SM-4 Bat Full-Spectrum.

To mount the units to the *Stril Explorer*, sections of galvanized, slotted-steel angle were affixed to the outside of the handrail on the vessel bridge using cable ties. Each unit was then affixed to the steel angle using cable ties, oriented horizontally with the integral ultrasonic microphone facing perpendicular to the long axis of the vessel, toward the open air above the water's surface (**Attachment Q-1, Photographs 1-2**). One unit (Detector A) was placed on the starboard side of the bridge, and another (Detector B) was placed on the port side. The purpose of deploying multiple detectors was to provide redundancy in the event that one unit failed, as well as to increase the likelihood of detecting bats in the Lease Area by recording from both sides of the vessel. Half-inch rubber foam with adhesive backing was used to dampen vibration between the handrail and steel angles, as well as between each unit and the steel angles.

Detectors were programmed using the Song Meter Configurator application for iOS, with the following parameters:

- Time Zone = Coordinated Universal Time (UTC) -4:000;
- Relative timer = On 30 minutes before sunrise; off 30 minutes after sunset;
- Location (determines sunrise/sunset) = 40.830°, -70.553°;
- Recording format = Full-spectrum (.wav);
- Sample rate = 256 kilohertz (kHz);
- Minimum trigger frequency = 16 kHz;
- Maximum recording length = 10 seconds;
- Trigger window = 3 seconds; and
- Gain = 12 decibels (dB).

Detectors were checked by vessel crew on a near-daily basis to confirm battery life and storage capacity using the Bluetooth capability of the units and the Song Meter Configurator application for mobile devices (Android and/or iOS). Before each deployment (August 2020 and March 2021), detectors were updated to the most recent firmware version.

Q.2.2 Survey Period

Acoustic monitoring equipment was deployed on August 9, 2020 and programmed to begin recording on August 10, 2020 (monitors turned on at 00:00, recording approximately half a night of data for the night of August 9, 2020). The monitors were deployed on the *Stril Explorer* through their November 29, 2020 return to port (ending the morning of November 30, 2020). After the winter season, units were redeployed on the *Stril Explorer* from March 25, 2021 to April 22, 2021. On April 22, 2021, the detectors were removed from the *Stril Explorer*, which was scheduled to move on to a new project.

Q.2.3 Acoustic Data Processing

For this Project, only files recorded within the Lease Area were considered. Recording locations were determined by referencing the timestamps of each file against the vessel location for that time, as recorded by the *Stril Explorer*'s Global Positioning System (GPS). The acoustic data processing for this Project involved two steps: automated species classification (autoclassification) and manual verification.

Q.2.3.1 Automated Species Classification

Autoclassification of bat calls was accomplished using the most recent USFWS-approved version of Kaleidoscope Pro software (Kaleidoscope) from Wildlife Acoustics (Classifier Version 5.4.0). The classifier was set to "0 – Balanced (Neutral)," per USFWS review guidance, and signal detection parameters were adjusted to minimize the number of non-bat files assigned species ID due to the prevalence of background noise the detectors were exposed to (wind, waves, metal/mechanical). Signal parameters were set as follows:

- Frequency Range = 16-120 kHz;
- Pulse Duration = 2-50 milliseconds (ms);
- Maximum inter-syllable gap = 500 ms; and
- Minimum number of pulses = 2.

The suite of species included in the classifier consisted of:

- Big brown bat (*Eptesicus fuscus*) = EPTFUS;
- Eastern red bat (*Lasiurus borealis*) = LASBOR;
- Hoary bat (*Lasiurus cinereus*) = LASCIN;
- Silver-haired bat (*Lasionycteris noctivagans*) = LASNOC;
- Eastern small-footed bat (*Myotis leibii*) = MYOLEI;
- Little brown bat (*Myotis lucifugus*) = MYOLUC;
- Northern long-eared bat (*Myotis septentrionalis*) = MYOSEP; and
- Tri-colored bat (*Perimyotis subflavus*) = PERSUB.

Kaleidoscope classifies files which contain bat passes but cannot be assigned to a species as "NoID." Files for which Kaleidoscope does not meet the minimum parameters to be considered likely bat passes are automatically assigned the designation "Noise."

Q.2.3.2 Manual Verification of Acoustic Data

Manual verification consists of comparing the spectrograms of recorded files against the spectrograms of recordings of known species ("voucher calls"). Each species identified by Kaleidoscope (at least one file) was manually verified to confirm identification a minimum of one time per recording month. Because some calls are ambiguous, this frequently required manual review of multiple files per month for each species assignment before a confident identification could be made. As each file was reviewed, if a confident identification could not be made, the file was manually assigned as HiF or LoF based on characteristic frequency (Fc), where.

- LoF indicates Fc less than 35 kHz; and
- HiF indicates Fc greater than or equal to 35 kHz.

After verifying auto-classified species, any NoID files with unusually high- or low-characteristic frequencies (less than 20 kHz or greater than 45 kHz) were manually reviewed and either confirmed

as likely bat passes or discarded as Noise files. NoID files were then assigned a designation of HiF or LoF based on Fc.

After the autoclassification and manual verification steps were completed, the Noise files (autoclassified and manually identified) were discarded from the dataset.

Q.3. Survey Results

Q.3.1 Acoustic Detection Results

During the full survey period, a total of 861 files were identified as likely bat passes within the Lease Area using autoclassification and manual verification methods (**Table Q.3-1**).

Q.3.1.1 Species Presence and Activity Rates

Bat passes identified within the Lease Area included four species and two unidentified species groups (high and low frequency). Bat detections had a relatively even spatial distribution throughout the Lease Area (**Figure Q.3-1** through **Figure Q.3-3**).

TABLE Q.3-1. ACOUSTIC SURVEY RESULTS SUMMARY

Species	Number of Files	Percent of Total Passes
EPTFUS	3	0.3
LASBOR	358	41.6
LASCIN	58	6.7
LASNOC	416	48.3
MYOLEI	0	0
MYOLUC	0	0
MYOSEP	0	0
PERSUB	0	0
HiF	2	0.2
LoF	24	2.8
Total	**861**	**100**

Q.3.1.2 Timing of Activity

Frequency of bat passes does not give an absolute measure of population size or activity levels, but variations in number of bat passes can provide a relative measure of bat activity within an area. A growing body of evidence suggests that bat activity in offshore and open-water environments follows a seasonal distribution pattern, with the highest levels of activity in the late summer to early fall migration period and, to a lesser extent, during the spring migration (Stantec 2016; Stantec 2018; Smith and McWilliams 2012; Tetra Tech and DeTect 2012).

The acoustic bat survey conducted for this Project was opportunistic in nature, and the survey timeframe was predicated by the variety of other survey activities being carried out in the Lease Area by the *Stril Explorer*. Therefore, although the survey period includes the late Summer and Fall 2020 and the early Spring 2021, no data is available for the late Spring and early Summer 2021. However, even with the limited timeframes included in the study period, rates of bat passage appear to demonstrate the bimodal seasonal pattern expected (**Figure Q.3-2** through **Figure Q.3-4**).

Q.3.1.3 Weather Patterns

Evidence suggests that weather conditions and patterns influence bat behavior and may affect migration patterns and flight height (Kunz et al. 2007; Smith and McWilliams 2012; Smith and McWilliams 2016). For example, cold temperatures, excessive windspeed, and precipitation are associated with lower overall bat activity and reduced mortality at wind farms (Arnett et al. 2008).

The rate of bat passes detected in the Lease Area during this survey follows established trends of lower bat activity during periods of high wind and/or low temperatures (**Figure Q.3-5** and **Figure Q.3-6**).

FIGURE Q.3-1. ACOUSTIC BAT DETECTIONS WITHIN LEASE AREA (FULL SURVEY PERIOD)

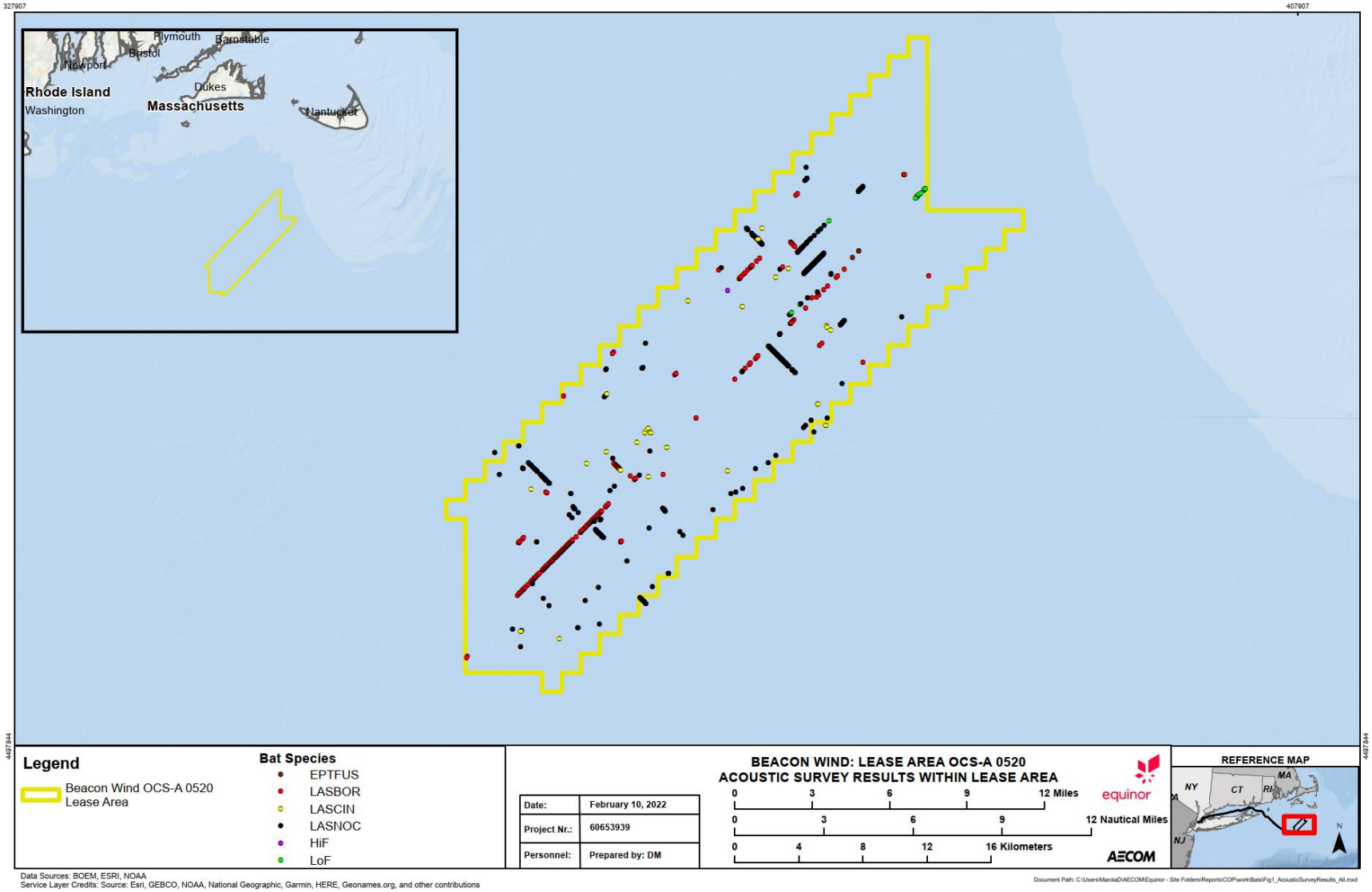


FIGURE Q.3-2. ACOUSTIC BAT DETECTIONS WITHIN LEASE AREA (FALL 2020 SURVEY PERIOD)

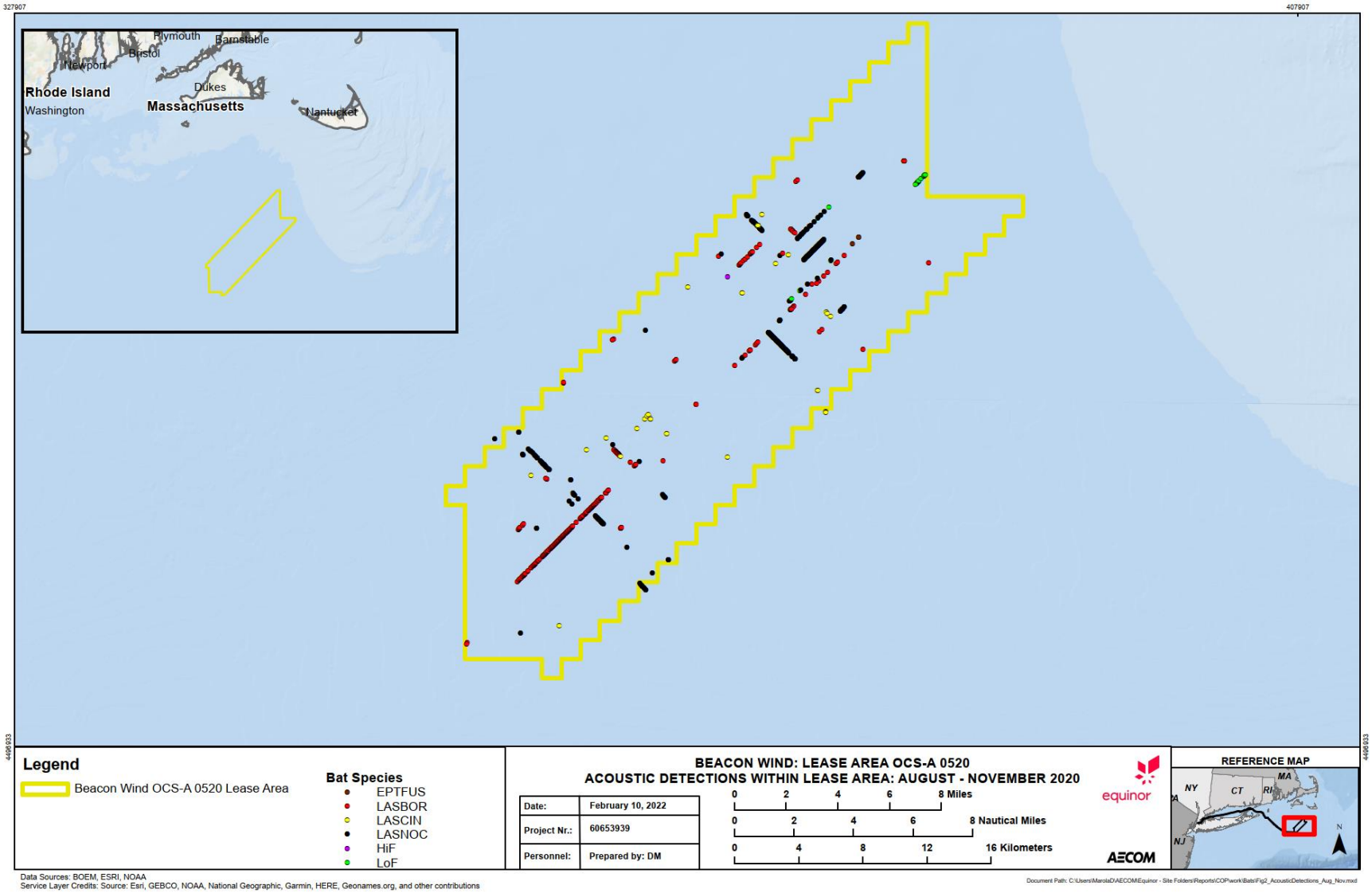


FIGURE Q.3-3. ACOUSTIC BAT DETECTIONS WITHIN LEASE AREA (SPRING 2021 SURVEY PERIOD)

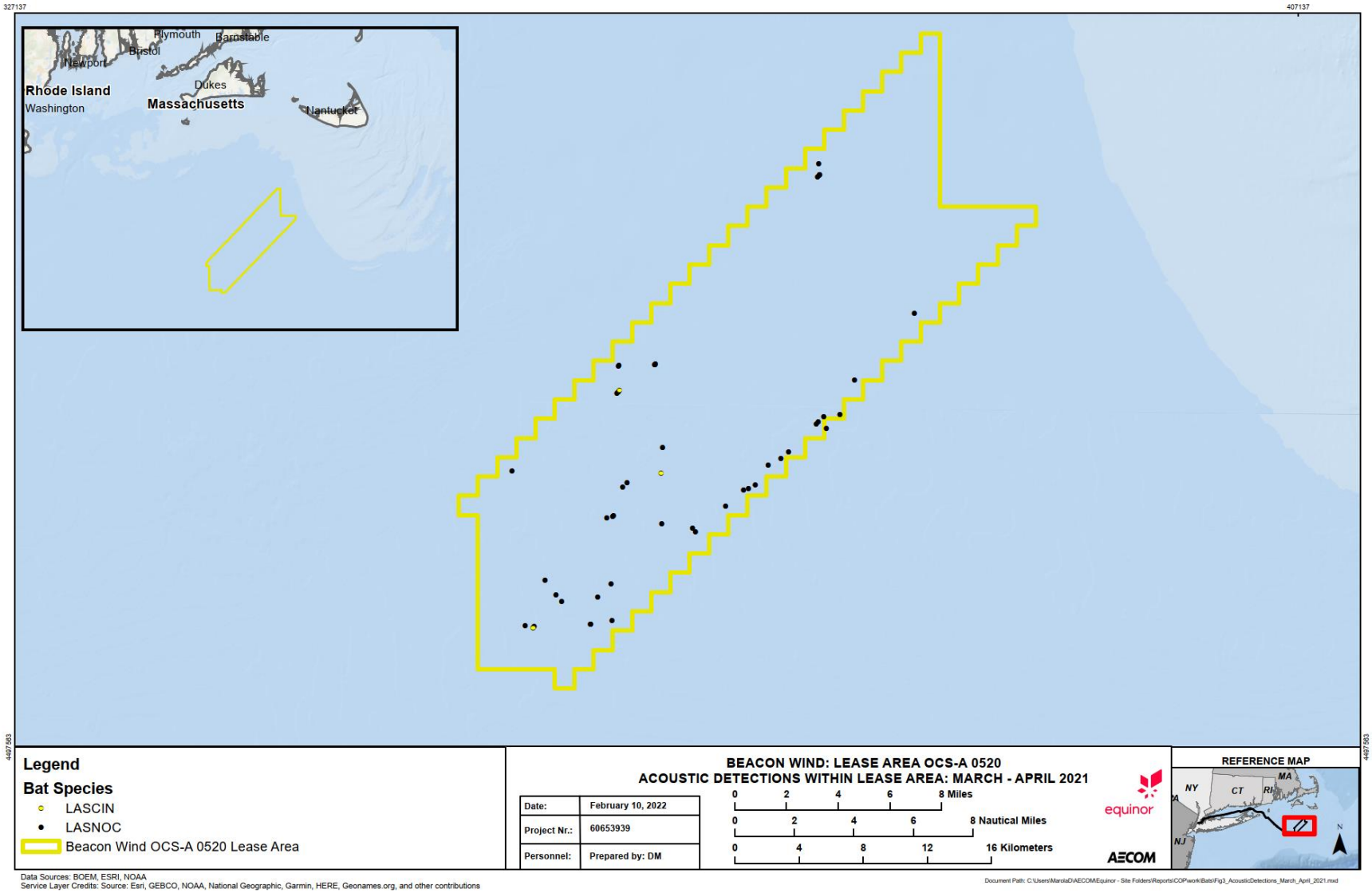


FIGURE Q.3-4. BAT DETECTIONS PER MONTH THROUGHOUT SURVEY PERIOD

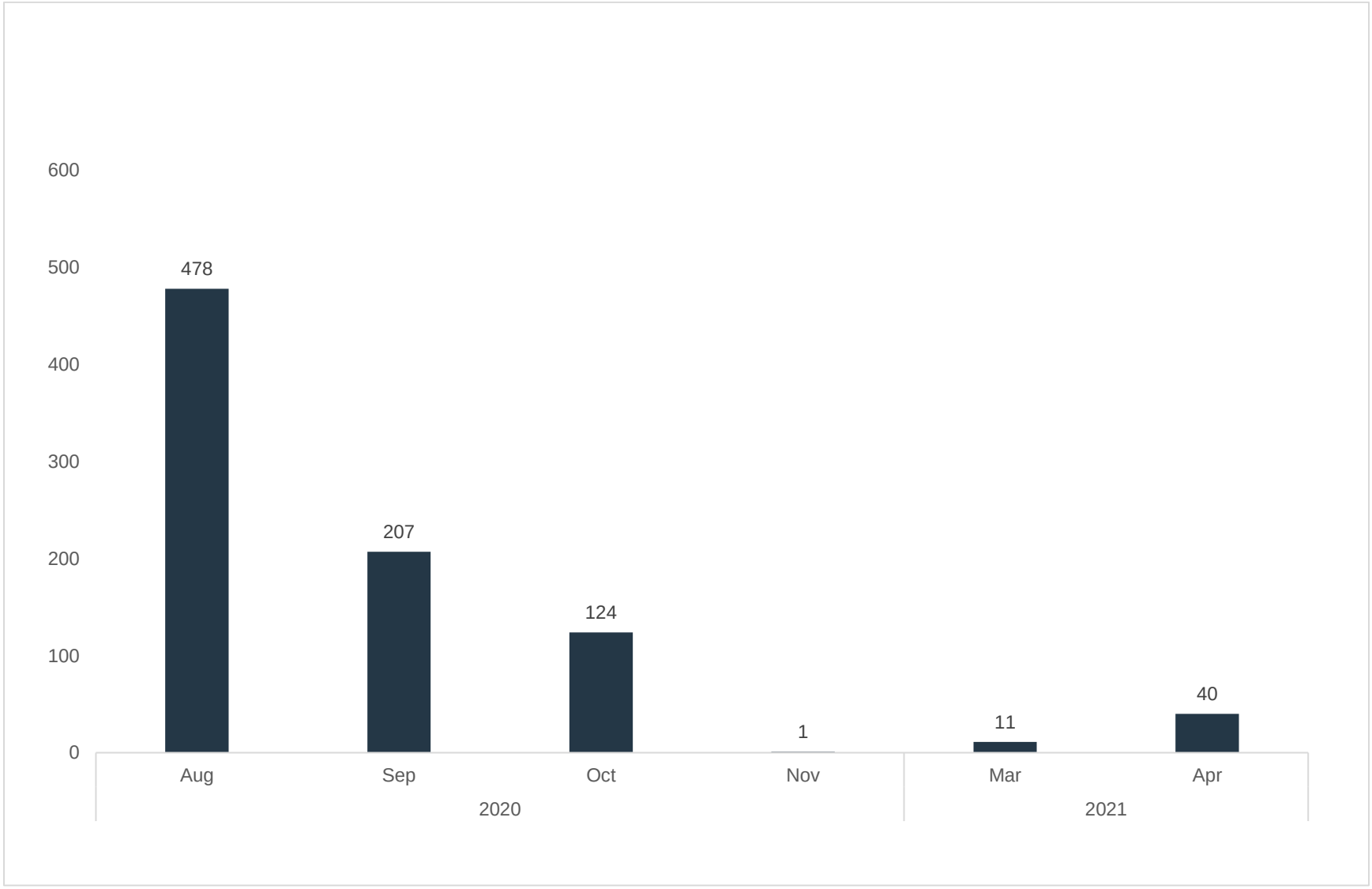


FIGURE Q.3-5. DISTRIBUTION OF BAT PASSES PER THREE-HOUR PERIOD AS A FUNCTION OF TEMPERATURE (DEGREES FAHRENHEIT [°F])

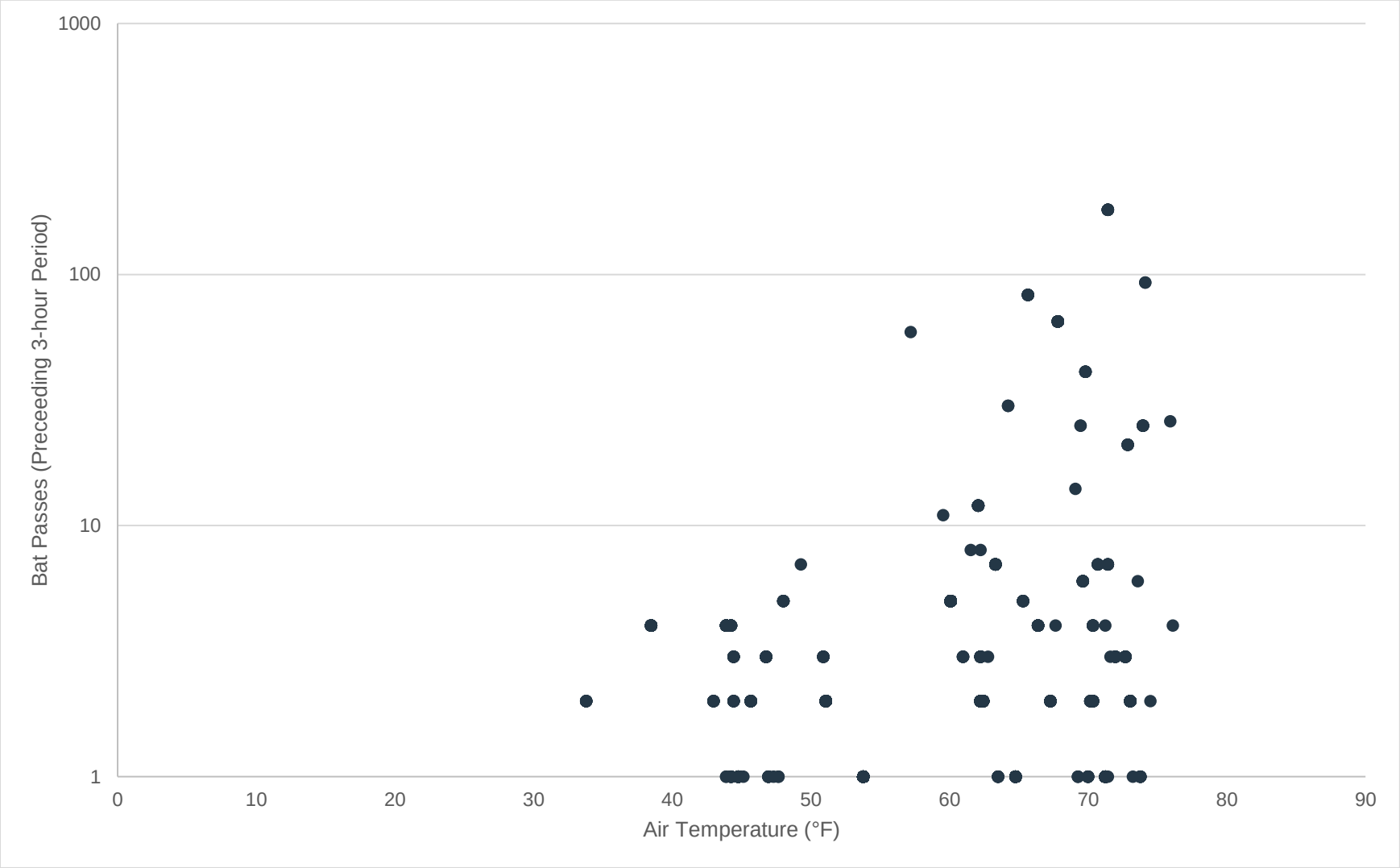
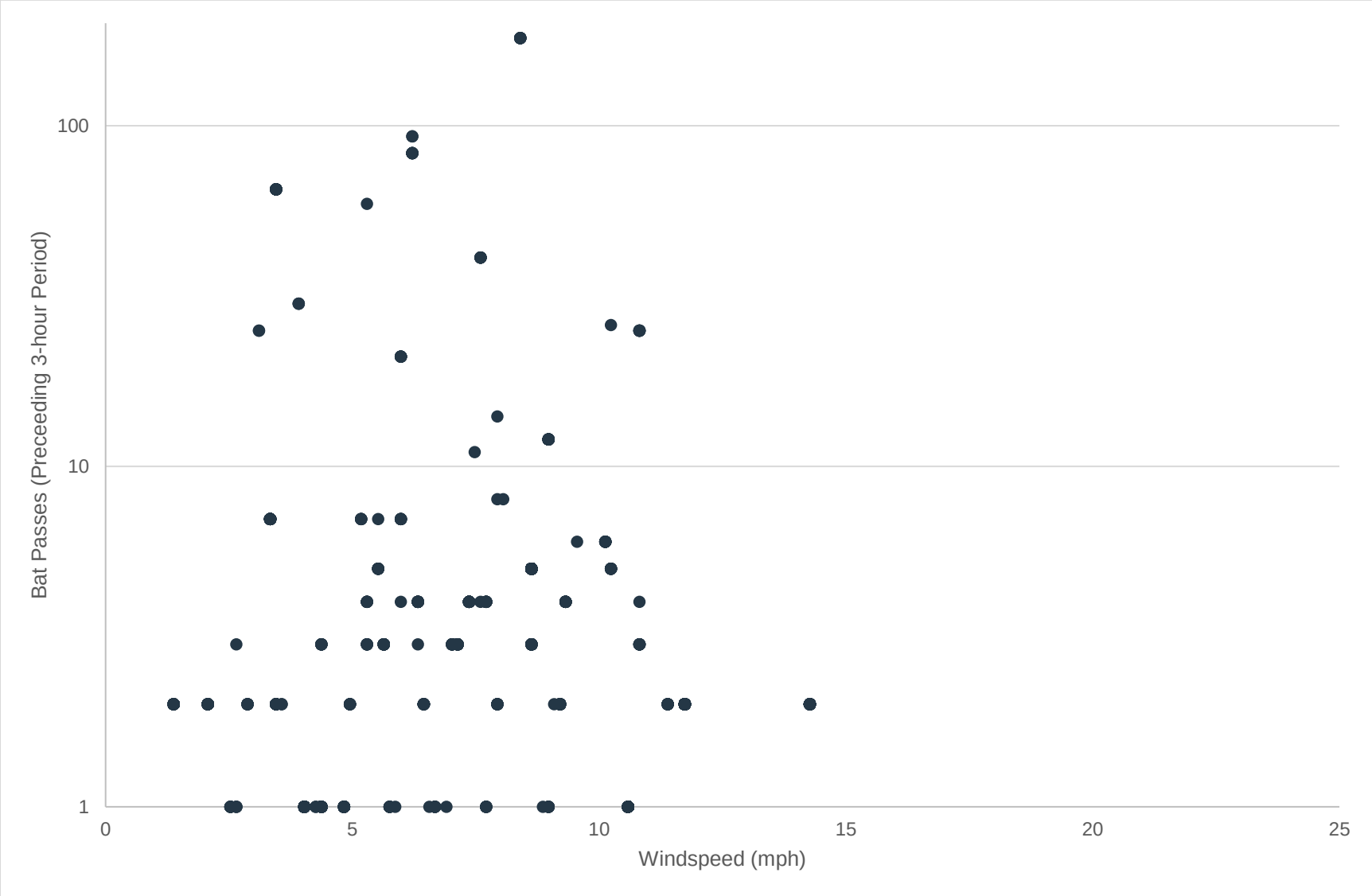


FIGURE Q.3-6. DISTRIBUTION OF BAT PASSES PER THREE-HOUR PERIOD AS A FUNCTION OF WINDSPEED (MILES PER HOUR [MPH])



Q.3.2 Incidental Observations by Vessel Crew Members

Vessel crew members observed bats in the offshore Lease Area on several occasions (**Table Q.3-2** and **Attachment Q-1, Photographs 3-5**). Eastern red bats (*Lasiurus borealis*) were the most frequently observed species and were occasionally observed to roost on the vessel under small overhangs on the bridge and decks. One silver-haired bat (*Lasionycteris noctivagans*) was found dead onboard, having apparently entered the vessel engine's air intake system. The bat was found during regular maintenance of the intake filter. **Table Q.3-2** summarizes the dates and species of bat observations reported by crew members in the Lease Area. In addition to bats found on the *Stril Explorer* in the Lease Area, crew members aboard the *Deep Helder* documented a big brown bat (*Eptesicus fuscus*) roosting on a stowed gangway while operating within the Long Island Sound for other Project-related activities.

TABLE Q.3-2. INCIDENTAL OBSERVATIONS OF BATS DURING OFFSHORE ACTIVITIES

Date	Species	Location	Notes
August 28, 2020	*Lasionycteris noctivagans*	Lease Area	Dead; found on intake filter of *Stril Explorer*
August 31, 2020	*Lasiurus borealis*	Lease Area	Live, roosting on *Stril Explorer* (daytime)
October 12, 2020	*Lasiurus borealis*	Lease Area	Live, roosting on *Stril Explorer* (night-time)
April 17, 2021	*Eptesicus fuscus*	Long Island Sound	Live, roosting on stowed gangway of *Deep Helder* (daytime)

Q.4. Discussion

Q.4.1 State and Federally Listed Species

The state- and federally-listed species identified in **Table Q.1-1** are small, cave-hibernating species, which have well-established preferences for forested habitats and typically do not undertake latitudinal migrations of the magnitude that red, silver-haired, and hoary bats are known for. The growing body of literature surrounding bats in the offshore environment has offered little evidence that any of these species are likely to be encountered with any regularity in offshore environments, such as the Lease Area. The results of this survey are consistent with this pattern of evidence, as none of the *Myotis* or *Perimyotis* bats were confirmed acoustically within the Lease Area during the survey. Although it is possible that tri-colored bats or some *Myotis* species were included in the unidentified high-frequency calls, none of the manually reviewed calls contained the appropriate clarity, call type, and diagnostic features to suggest that is the case. The manually reviewed high-frequency calls were typically either poor-quality recordings not suitable for species identification or atypical calls, which are likely attributable to feeding buzzes and approach phase calls of the eastern red bat.

Q.4.2 Other Bat Species

With the exception of the big brown bat, the four bat species with confirmed presence in the Lease Area are long-distance latitudinal migrants with well-established seasonal use patterns in the offshore environment. The results of this survey suggest that the Lease Area may be used by big brown bats at low levels in the summer and fall, as well as by long-distance migrants (eastern red bats, silver-haired bats, and hoary bats) with peak activity levels in the spring and the late summer through fall. The manual review process to confirm big brown bat detection identified a number of files that Kaleidoscope classified as big brown bats, which were not sufficiently diagnostic in form to differentiate from silver-haired bats, a common species of confusion for software and biologist alike. Therefore, there is some margin of error for the relative abundance of big brown bats present in the unidentified low-frequency call set. However, established literature would suggest that silver-haired bats are likely to be found more regularly in the Lease Area than big brown bats, and the bulk of the potential big brown bat files (reclassified as LoF) were recorded over a short period of time, which may be attributable to small numbers of bats foraging and lingering near the vessel.

Q.5. References

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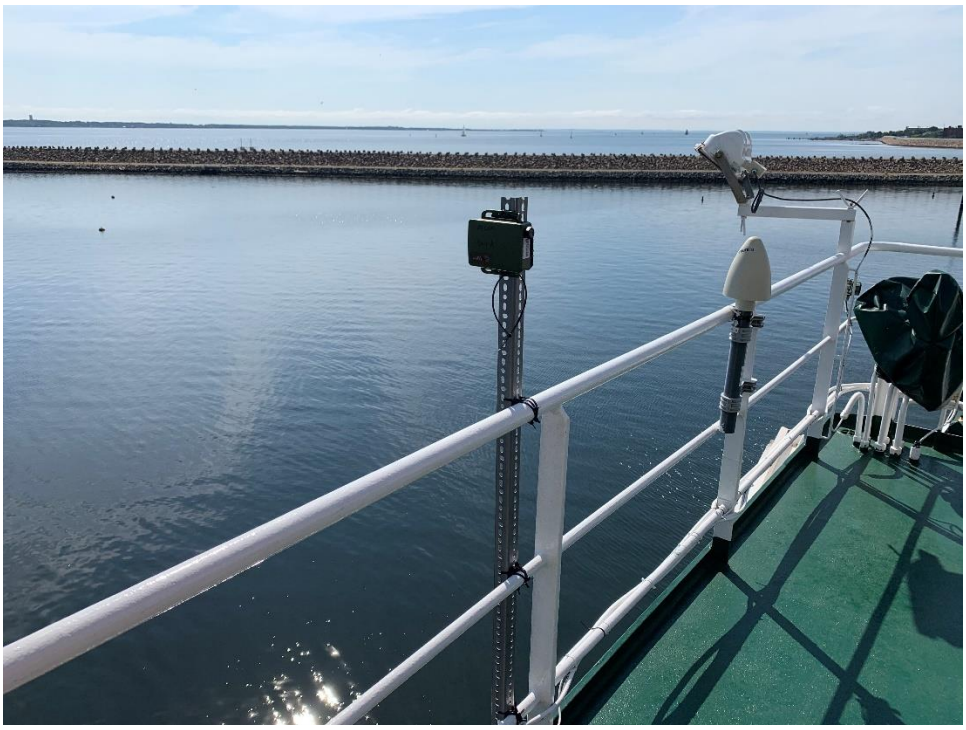
Attachment Q-1

Photographs



PHOTOGRAPH 1. INSTALLATION OF BAT DETECTOR ON PORT SIDE OF *STRIL EXPLORER* BRIDGE (HANDRAIL). AUGUST 9, 2020.

PHOTOGRAPH 2. INSTALLATION OF BAT DETECTOR ON STARBOARD SIDE OF *STRIL EXPLORER* BRIDGE (HANDRAIL). AUGUST 9, 2020.

PHOTOGRAPH 3. SILVER-HAIRED BAT FOUND DEAD IN INTAKE FILTER OF *STRIL EXPLORER* IN LEASE AREA. AUGUST 28, 2020.

PHOTOGRAPH 4. EASTERN RED BAT FOUND ROOSTING ON *STRIL EXPLORER* IN LEASE AREA. AUGUST 31, 2020.

PHOTOGRAPH 5. EASTERN RED BAT FOUND ROOSTING ON *STRIL EXPLORER* IN LEASE AREA. OCTOBER 12, 2020.

Photo credit: Matt Goldsmith, Equinor