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Appendix O-2 : Offshore Bat Acoustic Survey Report

Coastal Virginia Offshore Wind Commercial Project

Dominion Energy®

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CONSTRUCTION AND OPERATIONS PLAN

Coastal Virginia Offshore Wind Commercial Project

Appendix O-2 Offshore Bat Acoustic Survey Report

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ABBREVIATIONS AND PROJECT TERMS

BOEM	Bureau of Ocean Energy Management
CVOW	Coastal Virginia Offshore Wind
Dominion Energy	Virginia Electric and Power Company d/b/a Dominion Energy Virginia
ft	foot
ha	hectares
km	kilometer
Lease Area	The designated Renewable Energy Lease Area OCS-A 0483
m	meter
MA	Massachusetts
ME	Maine
mi	Statute mile
NOAA	National Oceanic and Atmospheric Administration
Project	Dominion Coastal Virginia Offshore Wind (CVOW) Commercial Project
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

O-2.1 INTRODUCTION

The Virginia Electric and Power Company, doing business as Dominion Energy Virginia (Dominion Energy) is proposing to construct, own, and operate the Coastal Virginia Offshore Wind (CVOW) Commercial Project (the Project). The Project will be located in the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) Offshore Virginia (Lease No. OCS-A-0483) (Lease Area), which was awarded to Dominion Energy through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Wind Energy Area (WEA) offshore of Virginia in 2013. The Lease Area covers 176 square miles (112,799 acres, 45,658 hectares [ha]) and the western boundary is located approximately 27 mi (miles, 43.99 kilometers [km]) offshore of Virginia Beach, Virginia and the eastern boundary is located approximately 35.8 mi (57.7 km) offshore of the Virginia barrier islands in Northampton County, Virginia (Figure O-2-1).

Dominion Energy proposes to construct the Project over a period of approximately three years. The Project will connect from the western side of the Lease Area through subsea Offshore Export Cables to be installed within the Offshore Export Cable Route Corridor and terminate in the Proposed Parking Lot, west of Firing Range at SMR, located east of Regulus Avenue and north of Rifle Range Road.

The Offshore Project Components, including the Offshore Substations, Inter-Array Cables, and Wind Turbine Generators (WTGs), will be located in federal waters in the Lease Area, while the Offshore Export Cable Route Corridor will traverse both federal and state territorial waters of Virginia. The Offshore Project Area includes the entire Lease Area and the Offshore Export Cable Route Corridor where the Offshore Project Components would be installed.

Dominion Energy contracted Tetra Tech, Inc. to deploy acoustic bat detectors during offshore geophysical and geotechnical survey activities in 2020-2021 within the Lease Area. The acoustic detectors were deployed on eight geophysical and geotechnical survey vessels, which traversed the Lease Area for 411 nights between April 2020 and May 2021, to assess the presence/absence of bats. The Offshore Export Cable Route Corridor is expected to have no effect on bats since there are no project components at or above sea level, therefore only bat activity within the Lease Area was analyzed in this report. The results from this survey provide an environmental baseline for bats, which will support permitting activities and Offshore Project siting.

O-2.1.1 Lease Area Description

The Lease Area is within the Mid-Atlantic Bight, which is an oceanic region that spans coastal and offshore waters from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina, and is characterized by a broad expanse of gently sloping, sandy-bottomed continental shelf. In this area, the shelf extends up to 93 mi (150 km) offshore, where the waters reach to about 656 ft (feet, 200 meters [m]) deep (Figure O-2-1). Water depths range from 62 to 134 ft (19 to 41 m) in the Lease Area.

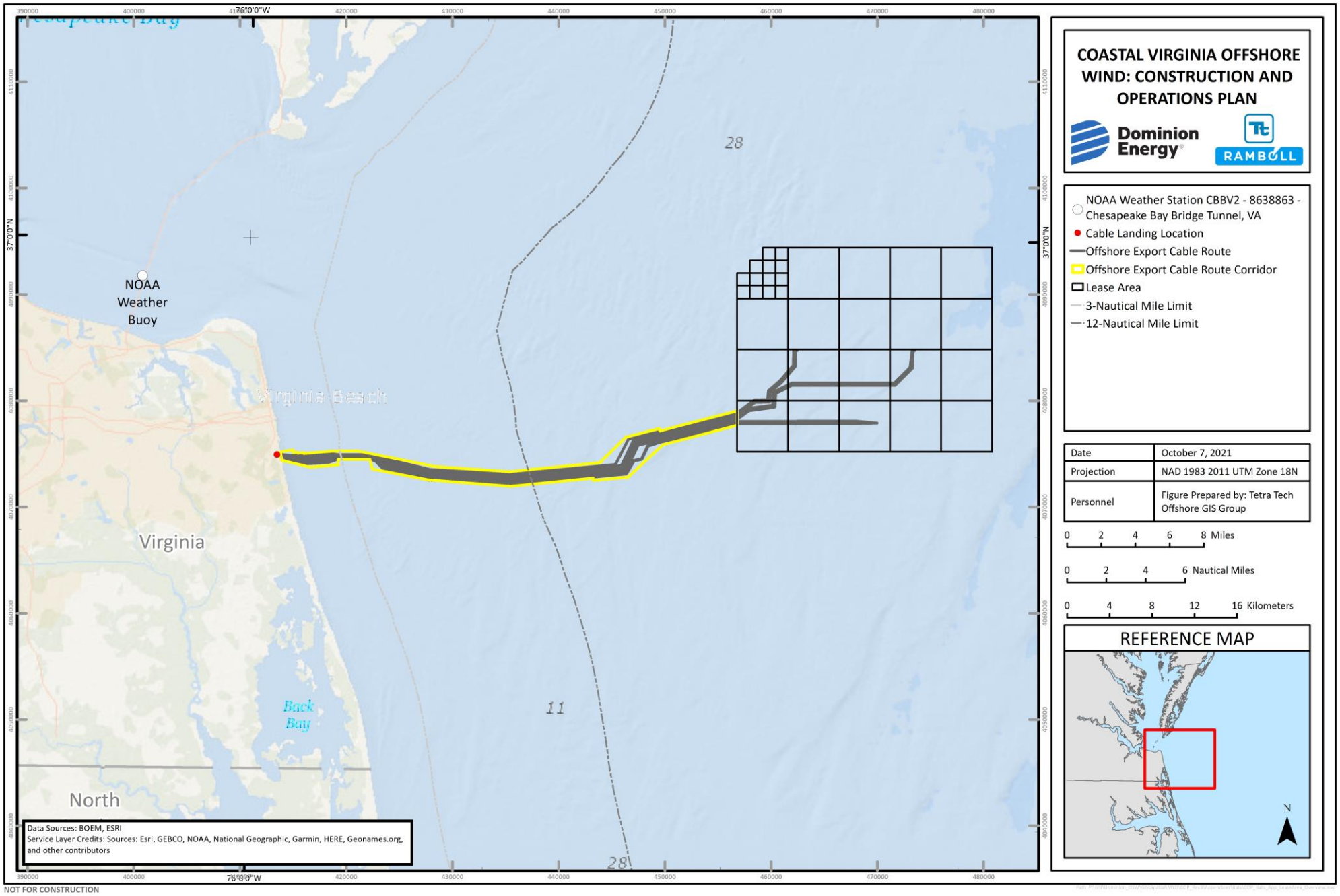

Figure O-2-1. Offshore Project Area

O-2.1.2 Bat Species Potentially Occurring in the Lease Area

Although specific movements of bats offshore Virginia are largely undocumented, bats have been documented in the marine environment in the United States (U.S.) (Grady and Olson 2006; Cryan and Brown 2007; Johnson et al. 2011; Hatch et al. 2013; Pelletier et al. 2013; Stantec 2016; Dowling and O'Dell 2018). Acoustic bat detectors deployed aboard research vessels at sea have occasionally detected bat activity up to 80 mi (130 km) from shore (Stantec 2016).

Although non-migratory bats and regional migrants are rarely observed offshore, migratory tree bats have been the most frequently documented offshore. Migratory tree bats have the potential of occurring in the Lease Area during migration based on species range and documented offshore occurrence. Tree bats generally migrate to southwestern and southern parts of the U.S. to overwinter (Cryan 2003, Cryan et al. 2014), including North Carolina and Virginia (LeGrand et al. 2020), and have been documented in the offshore environment (Hatch et al. 2013). Even though roosting opportunities are essentially absent, migratory tree bats may potentially be transient in the Lease Area during migratory periods (spring and late summer/early fall) and have been observed offshore during fall migration (Johnson et al. 2011; Sjollema 2011; Hatch et al. 2013; Peterson et al. 2014; Dowling et al. 2017). However, their use of the Lease Area would "likely be rare" (BOEM 2012) and offshore use is expected to be "very low and limited to spring and fall migration periods" and "under very specific conditions like low wind and high temperatures" (BOEM 2020).

In the Mid-Atlantic, only the silver-haired bat (*Lasionycteris noctivagans)*, eastern red bat (*Lasiurus borealis)*, and hoary bat (*Lasiurus cinereus)* are considered to possibly migrate or forage in Wind Energy Areas in the region (BOEM 2012; BOEM 2020). Eastern red bats are the most frequently encountered species off the Atlantic Seaboard during fall migration and may regularly travel along the Outer Continental Shelf during migration (Hatch et al. 2013, Peterson et al. 2014, Dowling et al. 2017). In the Mid-Atlantic, 78 percent of all bat detections offshore were from eastern red bats, and they were observed up to 27 mi (43 km) offshore (Hatch et al. 2013, Sjollema et al. 2014). Silver-haired bats in particular may migrate along coastlines, and both silver-haired and hoary bat were recorded off the northeastern Atlantic Coast (Cryan 2003, NJDEP 2010). The eastern red bat, silver-haired bat, and hoary bat also represent the most commonly found species during post-construction mortality studies at most operational land-based wind energy facilities in North America (Arnett et al. 2008). Seminole bat (*Lasiurus seminolus)* and northern yellow bat (*Lasiurus intermedius)* are also long-distance migrants that occur in Virginia, but their use of the offshore environment is undocumented.

Regional migrants primarily consist of cave-hibernating bat species that also migrate during the fall (Peterson et al. 2014, Stantec 2016), but exhibit lower activity in the offshore environment than the long-distance migratory tree bats (Sjollema et al. 2014, BOEM 2020). In the Mid-Atlantic, the maximum distance any *Myotis* species (e.g., northern long-eared bat [*Myotis septentrionalis]*, little brown bat [*Myotis lucifugus]*, eastern small-footed bat [*Myotis leibeii]*, and southeastern myotis [*Myotis austroriparius]*) were detected offshore was 6.8 mi (11 km) (Sjollema et al. 2014). Big brown bats (*Eptesicus fuscus)*, little brown bats, and northern long-eared bats occur along coastal Virginia and are associated with coastal islands (Peterson et al. 2014; Table O-2-1). Little brown bats and big brown bats have been observed traveling from Martha's Vineyard to the mainland in the late summer and fall, most likely to reach hibernacula on the mainland (Dowling et al. 2017). Although northern long-eared bats are found on Martha's Vineyard in

abundance, they have not been observed to be seasonally migrating to the mainland for winter hibernation during nanotag tracking surveys (Dowling et al. 2017). While in a different region, the Biological Assessment for Vineyard Wind 1 indicated that there are no records of northern long-eared bats on the Atlantic Outer Continental Shelf, and concluded that it was "extremely unlikely" that this species would pass over offshore portions of that project (BOEM 2019). No recorded offshore presence has been confirmed, although unknown Myotis species (possibly little brown bats and northern long-eared bats) have frequently been documented on coastal islands, and occasionally in offshore environments (Peterson et al. 2014, Sjollema et al. 2014), but predominantly at distances much closer to the mainland than the Lease Area. Tri-colored bats (*Perimyotis subflavus)* have been acoustically documented on large islands up to 5 mi (8 km) offshore (Johnson and Gates 2008), although they have not been detected in distant offshore environments.

Table O-2-1. Bat Species Potentially Occurring in the Lease Area.

Common Name	Scientific Name	Migratory Status a/	Offshore Presence	Federal Status b/
Brazilian free-tailed bat	*Tadarida brasiliensis*	Long-distance migrant	No offshore records found.	–
Eastern red bat	*Lasiurus borealis*	Long-distance migrant	Numerous historical and current accounts in offshore environments up to 200 mi (322 km) offshore. Observed by boats with no land nearby.	–
Hoary bat	*Lasiurus cinereus*	Long-distance migrant	Numerous historical and current accounts in offshore environments up to 50 mi (80 km) offshore. Observed by boats with no land nearby and some occurrences of non-residents in Bermuda 650 mi (1,046 km) from nearest mainland.	–
Indiana bat	*Myotis sodalis*	Regional migrant	No offshore records found. Unidentified *Myotis* species have been recorded in offshore environments up to 85 mi (137 km) from mainland.	E
Northern yellow bat	*Lasiurus intermedius*	Long-distance migrant	No offshore records found.	–
Seminole bat	*Lasiurus seminolus*	Long-distance migrant	Have been observed during fall migration and winter on the island of Bermuda (650 mi [1,046 km] from the coast of the U.S.).	–
Silver-haired bat	*Lasionycteris noctivagans*	Long-distance migrant	Numerous historical and current accounts in offshore environments up to 130 mi (210 km) offshore. Observed by boats with no land nearby and some occurrences of non-residents in Bermuda 650 mi (1,046 km) from nearest mainland.	–

Common Name	Scientific Name	Migratory Status a/	Offshore Presence	Federal Status b/
Eastern small-footed bat	*Myotis leibeii*	Regional migrant	Has only been observed in coastal environments and islands very close to land such as Mount Desert Island, Maine (ME) (<0.5 mi [<0.8 km]). Unidentified *Myotis* species have been recorded in offshore environments up to 85 miles [137 kilometers] from mainland.	–
Evening bat	*Nycticeius humeralis*	Regional migrant	No offshore records found.	–
Little brown bat	*Myotis lucifugus*	Regional migrant	Often found on large islands with suitable habitat up to 5 mi (8 km) offshore such as Nova Scotia; Martha's Vineyard, Massachusetts (MA); and Mount Desert Island, ME. Has been observed regionally migrating from Martha's Vineyard to mainland.	SSA
Northern long-eared bat	*Myotis septentrionalis*	Regional migrant	Often found on large islands with suitable habitat up to 5 mi (8 km) offshore such as Nova Scotia; Martha's Vineyard, MA; and Mount Desert Island, ME. Unidentified *Myotis* species have been recorded in offshore environments up to 85 mi (137 km) from mainland.	SSA, T
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	Regional migrant	No offshore records found.	–
Southeastern myotis	*Myotis austroriparius*	Regional migrant	No offshore records found. Unidentified *Myotis* species have been recorded in offshore environments up to 85 mi (137 km) from mainland.	–
Tri-colored bat	*Perimyotis subflavus*	Regional migrant	Often found on large islands with suitable habitat up to 5 mi (8 km) offshore such as Nova Scotia; Martha's Vineyard, MA; and Assateague Island, MD and VA..	SSA, P
Big brown bat	*Eptesicus fuscus*	Non-migratory	Often found on large islands with suitable habitat up to 5 mi (8 km) offshore such as Nova Scotia; Martha's Vineyard, MA; Assateague Island, MD and VA); and Mount Desert Island, ME.	–

Notes

a/ Sources: Griffin 1940, Zimmerman 1998, Buresch 1999, Broders et al. 2003, Menzel et al. 2003, Wingate 2007, Johnson and Gates 2008, Harvey et al. 2011, Pelletier et al. 2013, Hatch et al. 2013, Sjollema 2011, Pelletier et al. 2013, Sjollema et al. 2014, Smith and McWilliams 2016, Dowling et al. 2017, USFWS 2018, and BCI 2021.

b/ SSA = Undergoing Species Status Assessment (USFWS 2020a); P = Under petition to be listed on the Endangered Species Act (USFWS 2017). T= Threatened or E= Endangered under the Endangered Species Act (USFWS 2018)

A total of 17 bat species are known to occur in Virginia, 14 of which have the potential to occur onshore nearest to the Lease Area (Table O-2-1; Harvey et al. 2011, NCWRC 2015, VDGIF 2018, BCI 2021). The ranges of the federally endangered gray bat (*Myotis grisescens*) and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) do not occur along the coast of Virginia (Timpone et al. 2011; VDGIF 2020a, 2020c) and are highly unlikely to be present in the Lease Area. While bat distribution and abundance

offshore are largely unknown (Pelletier et al. 2013), available information indicates that migratory tree bats (hoary, eastern red, Seminole, northern yellow bat, and silver-haired bats) have the potential to pass through the Lease Area. However, a small number of bats are expected in the Lease Area (BOEM 2020) given its distance from shore (BOEM 2012). The potential occurrence of the remaining nine bat species (evening bat [*Nycticeius humeralis*], big brown bat, little brown bat, northern long-eared bat, eastern small-footed bat, southeastern myotis, tri-colored bat, Brazilian free-tailed bat [*Tadarida brasiliensis*], and Rafinesque's big-eared bat [*Corynorhinus rafinesquii*]) is very low, as they are not generally observed offshore (Sjollema et al. 2014, Dowling and O'Dell 2018, BOEM 2020).

O-2.1.3 Federally Protected Bats

Of the 45 species of bats known to occur in the continental U.S., five species and two subspecies are currently federally listed as threatened or endangered, and protected under the federal Endangered Species Act (USFWS 2018). These include the Florida bonneted bat (*Eumops floridanus*), gray bat, Indiana bat (*Myotis sodalis*), Mexican long-nosed bat (*Leptonycteris nivalis*), northern long-eared bat, Ozark big-eared bat (*Corynorhinus townsendii ingens*), and Virginia big-eared bat. Of these species, the northern long-eared bat and Indiana bat are known to occur in coastal Virginia but are not likely to occur in the Offshore Project Area. Although the area is not included in commonly published range descriptions for the species (VDGIF 2020b), recent acoustic studies and mist-netting efforts have identified apparent year-round activity of an isolated group of Indiana bats in the coastal plain and southeastern portion of the state (Silvis et al. 2017; De La Cruz and Ford 2018); however, this species has yet to be documented offshore and is not expected to occur offshore. The tri-colored bat, which is also not likely to occur in the Offshore Project Area, is currently under a status review for potential listing under the Endangered Species Act as a threatened or endangered species with designated critical habitat (USFWS 2017). The status review for the tri-colored bat began in December 2017 and is still pending. In addition to these species, the U.S. Fish and Wildlife Service (USFWS) is conducting a discretionary status review of the little brown bat and northern long-eared bat (USFWS 2021). The USFWS expects to release the findings of the status review for the northern long-eared bat, tri-colored bat, and little brown bat in the spring of 2021, and publish the regulatory guidance pertaining to the review in the fall of 2022 (USFWS 2020a).

O-2.1.4 Northern Long-eared Bat

The USFWS currently prohibits some forms of incidental take (e.g., within hibernacula or from tree removal activities) of the northern long-eared bat within the white-nose syndrome zone (USFWS 2016). The white-nose syndrome zone includes all counties affected by white-nose syndrome and an additional 150 mi onshore buffer around these counties. The zone now encompasses the entire northern long-eared bat range within the U.S., including Virginia; although, the zone does not extend offshore to the Lease Area (USFWS 2020b).

O-2.2 Method

Tetra Tech, Inc. conducted acoustic bat monitoring in the Lease Area from April 14, 2020 through May 15, 2021, using bat detectors mounted near the top of 11 roving offshore survey vessels.

O-2.2.1 Acoustic Detectors

Wildlife Acoustics Song Meter SM4BAT Monitoring Systems (bat detectors) recorded bat activity in full spectrum format using the settings in Attachment O-2-1. Each detector was powered by internal D-cell batteries and recorded bat activity from 1 hour before sunset until 1 hour after sunrise each night. The incoming echolocation calls were recorded onto high-capacity data storage cards, which were exchanged monthly by trained technicians while the ship was in port and then uploaded to a secure cloud-based server. The technicians also checked the functionality of the bat detector during each card exchange visit during the survey period.

One detector was mounted on the highest accessible point of each survey vessel; photographs can be found in Attachment O-2-2. The Wildlife Acoustics SMM-U1 microphones were mounted on the top of railings with an unobstructed view of the sky. The detectors remained in their original location on each vessel during surveys (with the exception of detector CVOW-5, which was moved further from radar equipment), however the vessels were continuously in transit within the Offshore Project Area and returned to port at least once a month.

Onboard Global Positioning Systems and Daily Progress Report notes allowed accurate georeferencing of each bat pass and an estimation of survey effort (number of nights vessels were within the Lease Area) provided by the subcontracted vessel companies. Bat passes presented are limited to those recorded within the Lease Area. On each night the detector was recording, the location of the vessel was recorded at sunset and again at sunrise. All nights that the vessel was within the Lease Area both at sunset and sunrise were counted as detector-nights. However, it is unknown whether the vessel remained within the Lease Area during the entire night. Nights where the vessel was within the Lease Area at either sunset or sunrise (not both) or neither were removed from the analyses incorporating survey effort.

O-2.2.1.1 Acoustic Analysis

Bats emit pulses of high frequency sound to navigate in their environment and search for prey. A single pulse (or call) is generally not helpful for identifying species; however, a series of pulses (also known as an echolocation sequence or bat pass) can more reliably be used to assign a species classification. A bat pass is defined as an echolocation sequence with two or more call pulses separated by two or more seconds (Loeb et al. 2015).

Analysis of bat acoustic data was conducted using a two-phased approach: 1) filter data with a USFWS approved software program (see USFWS 2019) to remove non-bat sounds and assign an initial species or group classification, and 2) manually review and cross-validate a subset of these data using an additional, independent echolocation software program to confirm species presence. Project acoustic data were filtered and classified using Kaleidoscope Pro (Wildlife Acoustics, Inc.) version 5.1.0, with the classifier "Bats of North America 5.1.0" for species of bats in Virginia. Classifiers were further modified to reflect the species with the potential to occur in the Lease Area (step 1). A sensitivity level of "0 balanced/neutral" was used per Wildlife Acoustics and USFWS (2019) recommendations.

Every bat pass auto-classified as a species and each unidentified bat pass was manually reviewed with Kaleidoscope Pro to remove noise and ensure accurate activity rates. After filtering and initial classification of the acoustic data, species presence was cross-validated and manually confirmed for a subset of the data

using SonoBat (SonoBat, Inc.) version 4.2.0, with the Southeast regional classifier to confirm presence. All bat passes auto-identified as species not typically found offshore were manually reviewed. SonoBat was used for this step because of its extensive reference library of known echolocation sequences and superior spectrogram platform for reviewing full spectrum calls. During manual review, a recording was considered suitable for species level identification if 1) the recording included search phase pulses, 2) the individual call pulses within the bat pass were not oversaturated, and when possible 3) the individual call pulses included the presence of harmonics. Eastern red bat and Seminole bat passes are not able to be accurately distinguished from each other through manual vetting and were placed in a single group due to similar call characteristics. Bat passes lacking sufficient detail to be identified at the species level were classified as "unidentified high frequency bat" if the characteristic frequency was greater than or equal to 35 kilohertz, and "unidentified low frequency bat" if the characteristic frequency was lower than 35 kilohertz.

O-2.2.1.2 Regression Analysis

A generalized linear mixed model (GLMM) with a logit-link function was constructed to assess how wind speed, temperature and time of night affected the presence of bats within the Lease Area with ship included as a random effect. Weather data was collected from the National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center using a buoy at the Chesapeake Bay Bridge Tunnel, Virginia (Station CHBV2; NOAA 2021; Figure O-2-1). Wind speed and temperatures were averaged across each hour of the survey period. All statistical tests were conducted in R version 4.05 R Core team 2018. The explanatory variables wind and temperature were rescaled using the scale function in R. Pearson's correlations were used to check for collinearity between explanatory variables using the package "corrplot," and the package "lme4' was used to run the GLMM.

O-2.3 Results

O-2.3.1 Bat Acoustic Survey Results

During the 2020-2021 acoustic survey, 411 detector-nights were sampled within the Lease Area from April 14, 2020 to May 15, 2021 (Table O-2-2). The detector stations survey effort (detector-nights) and bat activity are provided in Table O-2-2, and photographs can be found in Attachment O-2-2. Detector stations were fully operational during the entire survey period with the exception of detectors CVOW-3, CVOW-5, and CVOW-10 which experienced clock errors resulting in minimal loss of data, and detector CVOW-7 had minimal data loss due to dead batteries. The vessels for detectors CVOW-2 and CVOW-8 were surveying the Offshore Export Cable Route Corridor, not within the Lease Area, and will not be discussed further.

A total of 592 bat passes were recorded within the Lease Area and identified to the species level or frequency group (Table O-2-2 and Figure O-2-2) with a minimum of zero passes and a maximum of 182 passes recorded in a single night. A total of 440 bat passes were recorded within the Lease Area during detector-nights with minimum zero passes and a maximum of 121 bat passes recorded in a single night. Recordings during detector-nights resulted in an overall mean activity rate of 1.07 bat passes/night, with a standard error of 0.39 (Table O-2-2).

Table O-2-2. Survey Effort and Bat Activity within the Lease Area, 2020-2021.

Detector	Vessel	Survey Dates	Detector-Nights a/	Total Bat Passes During a Detector-Night b/	Activity Rates: Bat Passes/ Detector-Night (Standard Error) c/	Total Bat Passes d/
CVOW-1	Terrasond Sara Bordelon	04/14/2020-12/13/2020	73	73	1.00 (0.54)	170
CVOW-3	Terrasond Marcelle	4/21/2020-12/18/2020	28	0	0.00 (0)	34
CVOW-4	Geoquip Speer	6/3/2020-7/30/2020	34	12	0.35 (0.35)	12
CVOW-5	Geoquip Dina Polaris	6/22/2020-10/1/2020	59	324	5.49 (2.54)	324
CVOW-6	Geoquip Saentis	6/26/2020-8/31/2020	10	0	0.00 (0)	0
CVOW-7	Terrasond Kommandor Iona	8/28/2020-11/30/2020	21	9	0.43 (0.30)	28
CVOW-9	Geoquip Dina Polaris	11/13/2020-5/13/2021	111	1	0.01 (0.01)	2
CVOW-10	Geoquip Speer	11/13/2020-3/12/2021	41	2	0.05 (0.05)	2
CVOW-11	Geoquip Saentis	3/20/2021-5/15/2021	34	19	0.56 (0.39)	20
Overall			**411**	**440**	**1.07 (0.39)**	**592**

a/ Detector nights include nights in which the vessel was within the Lease Area at both sunset and sunrise.
b/ Incudes bat passes recorded during nights fulfilling detector-night definition above.
c/ Activity rates include only bat passes recorded during nights fulfilling detector-night definition above.
d/ Incudes all bat passes recorded in the Lease Area regardless of the vessels' location at sunset and sunrise.

O-2.3.1.1 Species Presence and Activity Rates

Bat passes identified at the species level within the Lease Area included two species and three groups. All bat basses identified to species or species group are attributed to migratory tree bats. The activity rates of bat passes recorded during detector-nights within the Lease Area for each species or group is presented in Table O-2-3. Eastern red bat/Seminole bat (0.36 bat passes per detector-night) and Unknown High Frequency Species (0.57 bat passes per detector-night) exhibited the highest activity rates within the Lease Area.

Bat passes were distributed across the Lease Area ranging from 23.8 mi (38.3 km) to 39.7 mi (63.9 km) from nearest shore (Figure O-2-2). Although concentrations of eastern red bat/ Seminole bat, silver-haired bat, and hoary bat passes appear on the map, they often represent single nights with multiple bat passes and not repeated use of the same area over many nights (Figure O-2-3). Twelve groups of over ten continuously recorded bat passes total 409 bat passes or 69 percent of all bat basses recorded in the Lease Area.

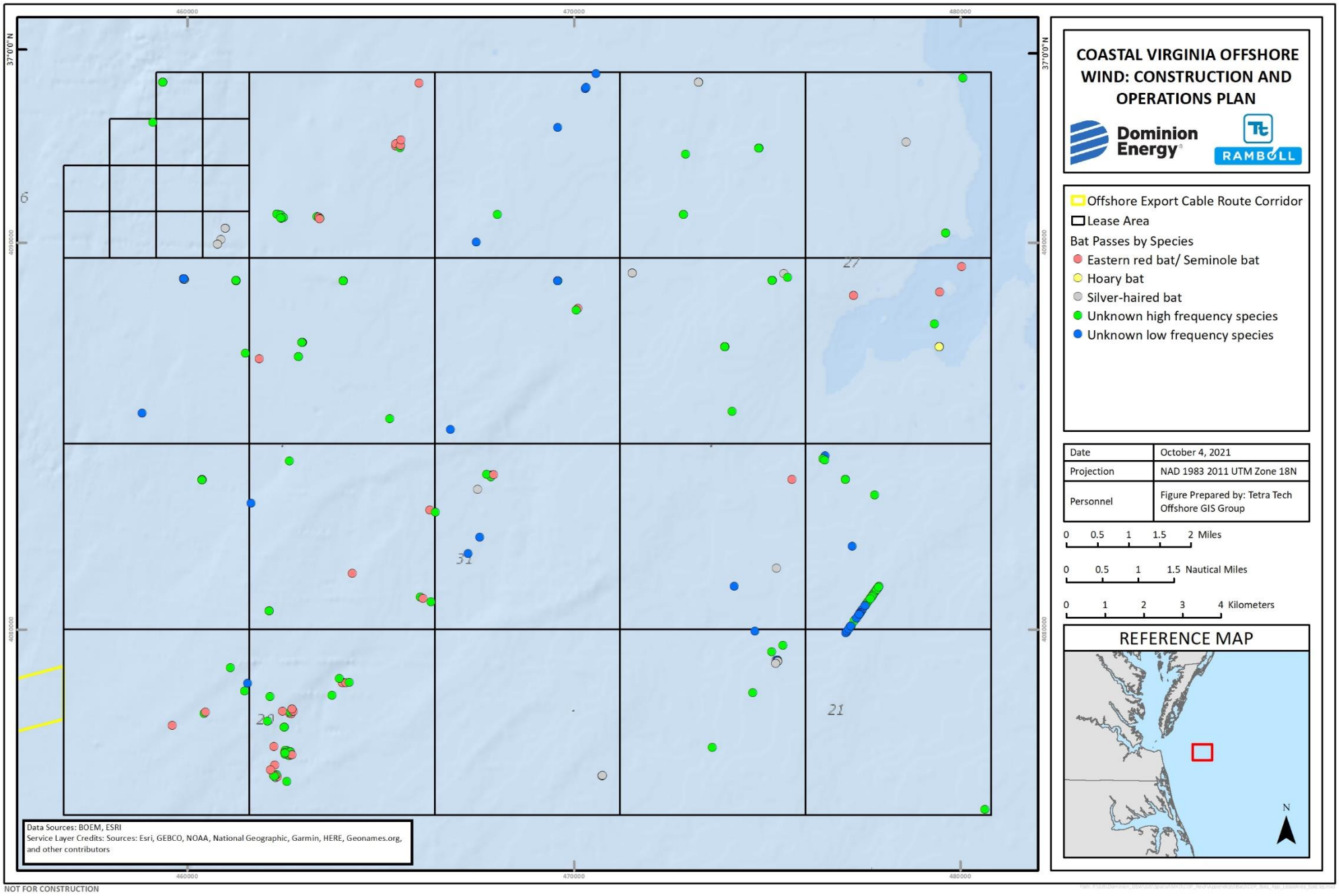

Figure O-2-2. Bat Passes by Location and Species in the Lease Area

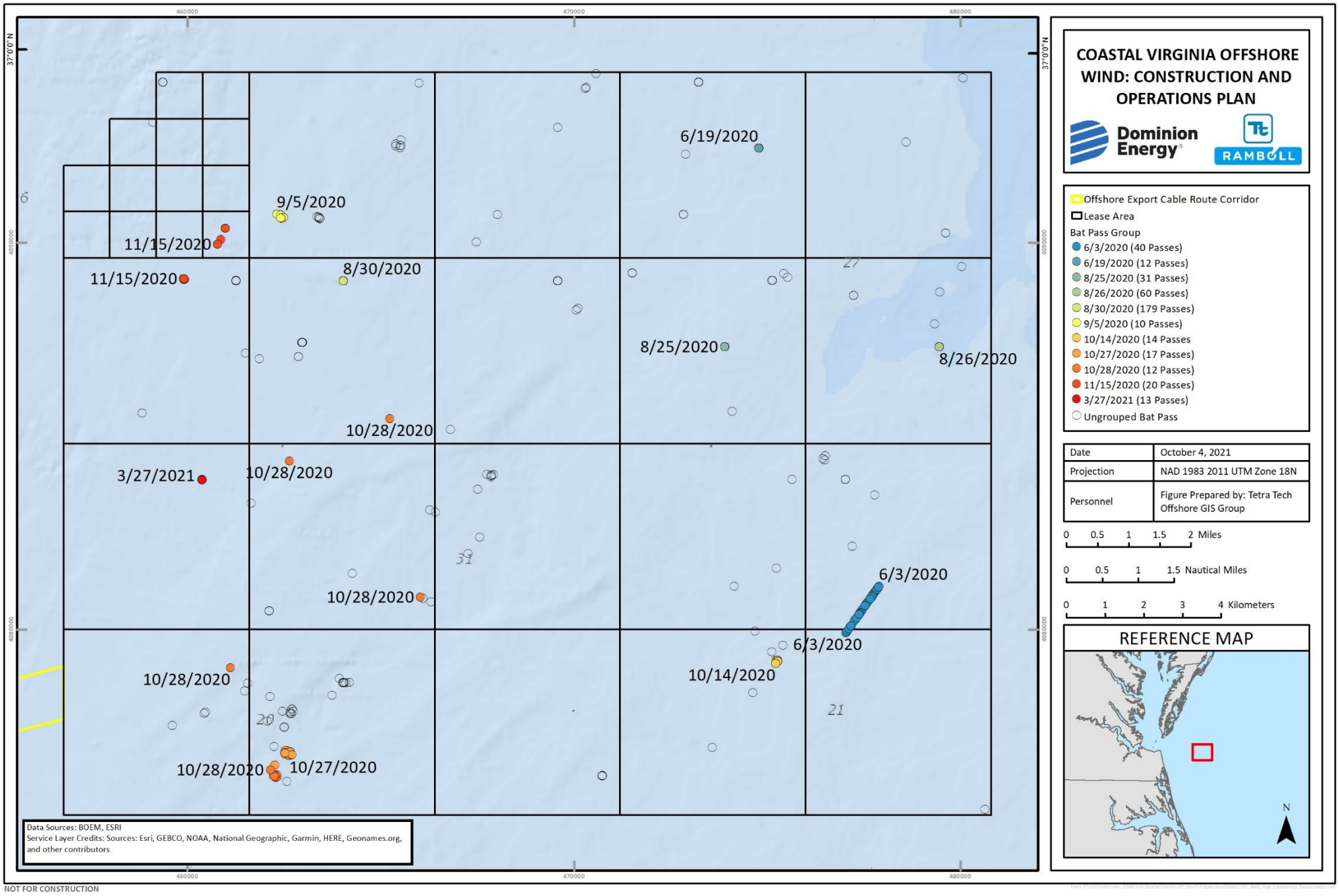

Figure O-2-3. Bat Passes by Group in the Lease Area

Table O-2-3. Average Activity Rates (Bat Passes/Detector Night) Recorded per Species in the Lease Area, 2020-2021

Detector Stations	Eastern red bat/Seminole bat	Hoary bat	Silver-haired bat	Unknown high frequency species	Unknown low frequency species
CVOW-1	0.27	0.00	0.15	0.42	0.15
CVOW-3	0.00	0.00	0.00	0.00	0.00
CVOW-4	0.03	0.00	0.00	0.32	0.00
CVOW-5	1.83	0.03	0.49	2.63	0.51
CVOW-6	0.00	0.00	0.00	0.00	0.00
CVOW-7	0.05	0.00	0.14	0.10	0.14
CVOW-9	0.00	0.00	0.00	0.01	0.00
CVOW-10	0.00	0.00	0.00	0.05	0.00
CVOW-11	0.12	0.00	0.00	0.35	0.09
Overall Mean	**0.36**	**0.01**	**0.12**	**0.57**	**0.13**
Standard Error	**0.20**	**<0.01**	**0.06**	**0.19**	**0.04**

During the survey period, eight bats were visually observed roosting on survey vessels during the day and night or flying around them during the day (Attachment O-2-3). One hoary bat, three eastern red bats, and one silver-haired bat were all observed, as were three that could not be identified. Six bats were observed in the fall of 2020 and two eastern red bats in the spring of 2021. Of these visual observations, four were observed while in the Lease Area, one offshore, one while docked in Norfolk, and two have unknown locations (Attachment O-2-3). Only the bat (unknown species) observed flying during the daytime within the Lease Area off the Kommandor Iona may be associated with a group of bat passes recorded on a vessel; these were of a group of silver-haired bat passes recorded on detector CVOW-7 on October 8, 2020 around 6:06-7:55 in the morning and again at 19:02 in the evening.

O-2.3.1.2 Timing of Activity

The survey period began on April 14, 2020 and the first bat pass was recorded on April 20, 2020. Detection rates were highest in late August through mid-November consistent with migration periods for migratory tree bats (Figure O-2-4 and Figure O-2-5). Migratory tree bats accounted for all bat passes identified to species (Table O-2-3 and Figure O-2-2). Three spikes in detection rates are evident in the data, with approximately 40 bat passes recorded on June 3, 2020, and 65 predominantly silver-haired bat passes on August 26, 2020 followed by 182 predominantly eastern red bat/ Seminole bat passes on August 30, 2020. The detection rates during these nights were atypically high compared to all other survey nights and may be indicative of higher numbers of migrating bats or of a low number of bats staying in close proximity to the ship for an extended period of time. The detection rates (bat passes per hour during all survey nights) were highest between 20:00 and 23:00 hours with a second pulse of activity between 2:00 and 6:00 in the morning (Figure O-2-6).

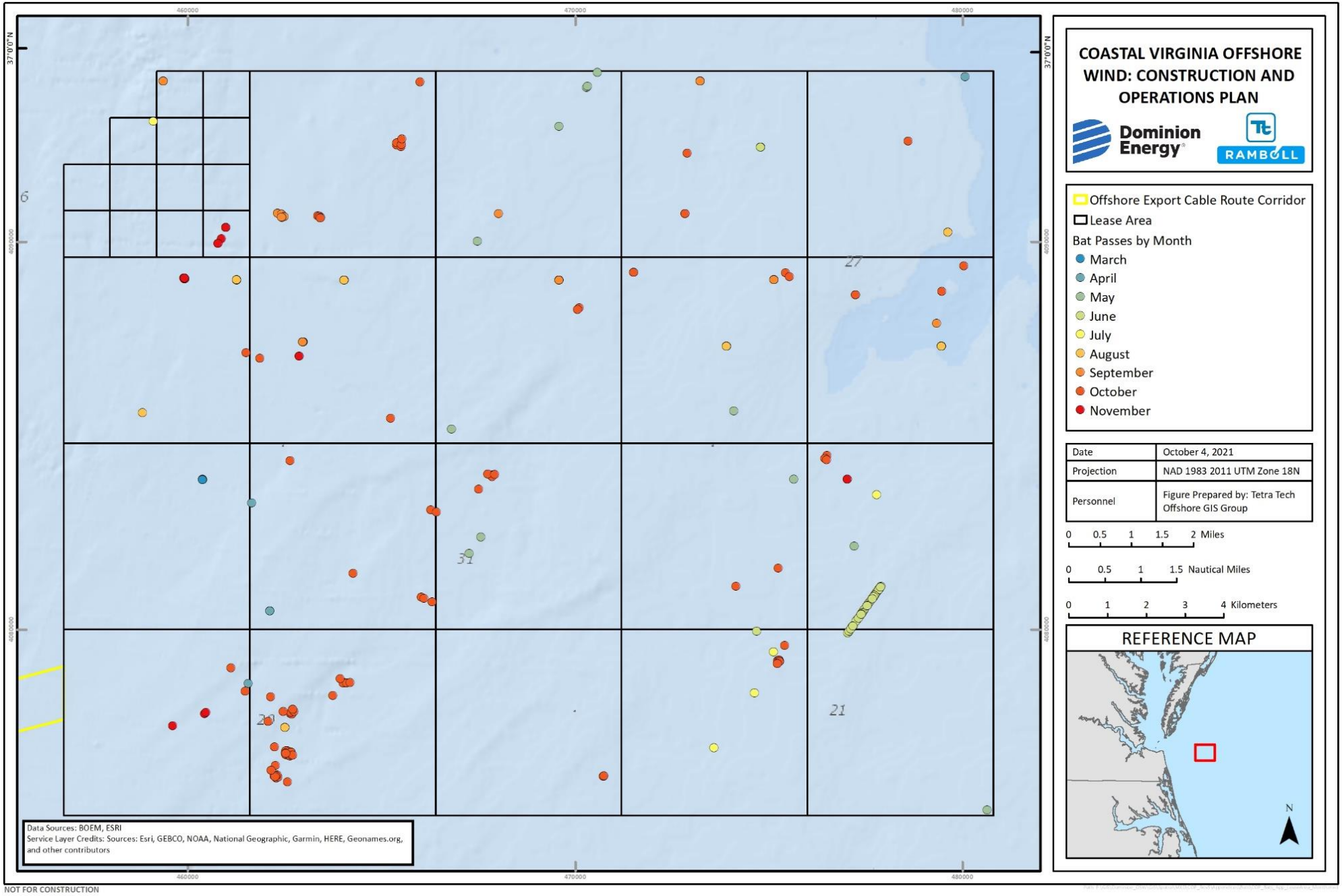

Figure O-2-4. Map of Bat Passes by Month

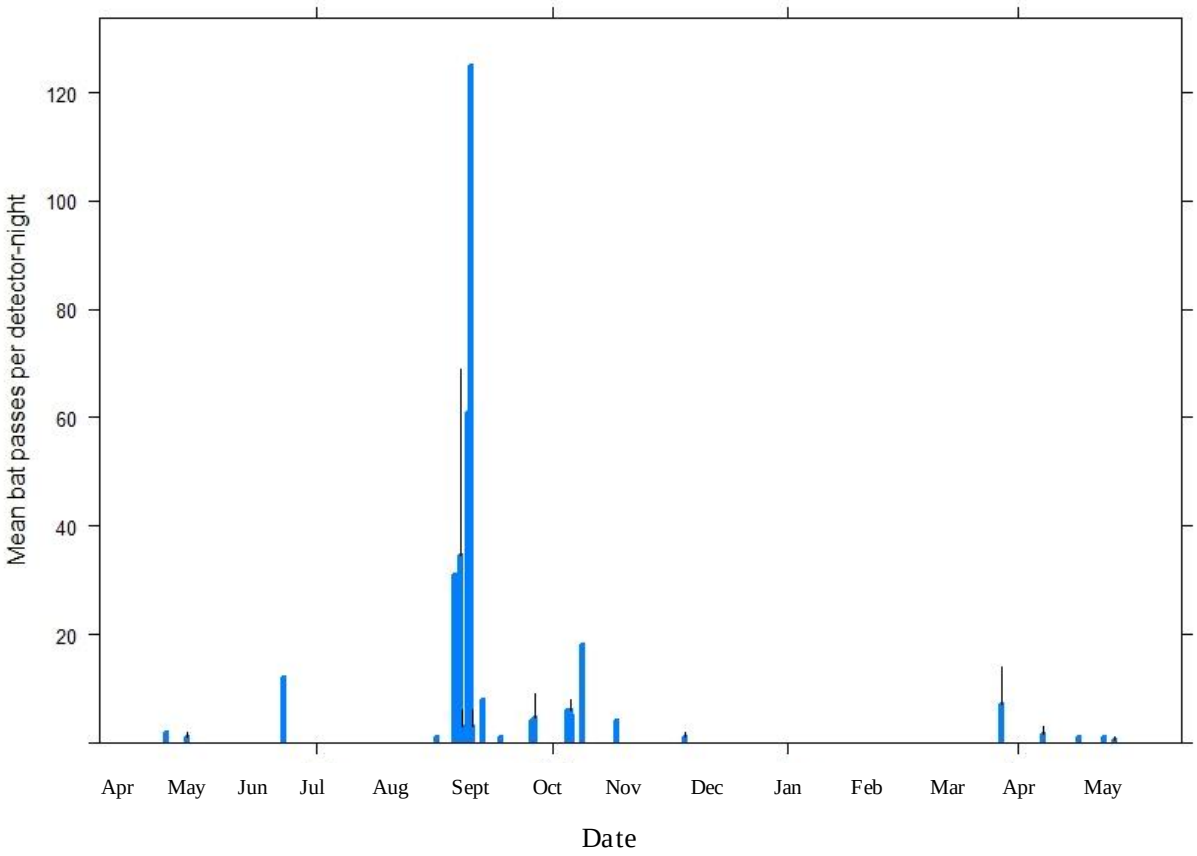

Figure O-2-5. Activity Rates of Bat Passes Recorded by Date in the Lease Area

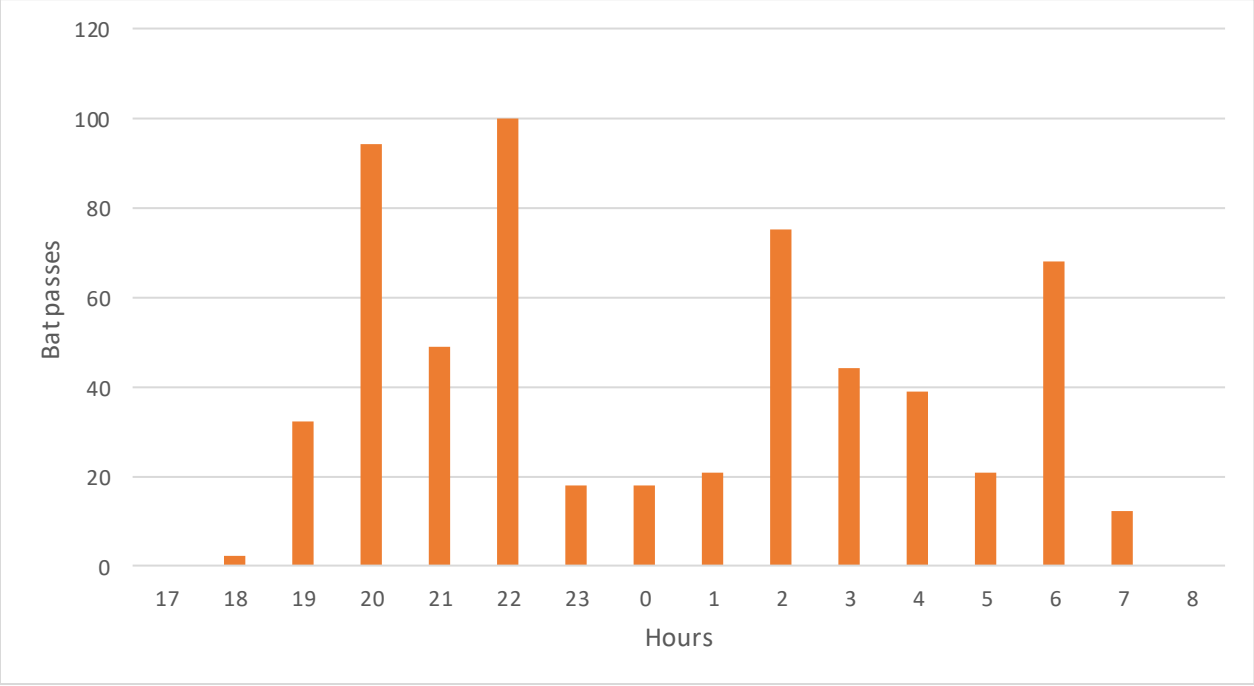

Figure O-2-6. Bat Pass Distribution Across Hours of the Night in the Lease Area

O-2.3.1.3 Regression Analysis

A GLMM was used to test if weather (i.e., wind and temperature) and hour of night were significant predictors of bat activity. The results of the GLMM indicated that there was no significant correlation between bat activity and wind speed (GLMM; $R^2 = 0.00\%$, $Z = 0.09$, $P = 0.930$), temperature (GLMM; $R^2 = 0.00\%$, $Z = 0.09$, $P = 0.928$), or time of night (GLMM; $R^2 = 0.00\%$, $Z = 0.41$, $P = 0.681$).

O-2.4 Discussion

O-2.4.1 Protected Bats

Federally listed species with the potential to occur within the Lease Area include northern long eared bat and Indiana bat. Based on publicly available information, the occurrence of these species offshore, or within the Lease Area, is highly unlikely (Section O-2.1.3) based on the lack of evidence that either species forages or travels offshore. In addition, these species are closely associated with forests and rarely travel more than 1,000 ft (305 m) from forested habitats (USFWS 2011). No Myotis species were acoustically confirmed during the survey It is possible that Myotis species were included in the unidentified high frequency bat group, but these calls did not contain characteristics that allow species-level classification even with manual review and were likely approach phase call types (or feeding buzzes) made by eastern red bat/Seminole bat.

O-2.4.2 Other Bat Species

Survey results indicate that bats travel offshore in the Lease Area, and particularly during the fall migration period. During the survey, only long-distance migratory tree bats were confirmed; these include eastern red bat/Seminole bat, hoary bat, and silver-haired bat. Although the acoustic signatures of eastern red bat cannot be distinguished from the Seminole bat, the activity documented in this survey likely represents eastern red bat because they are Virginia's most common tree bat and are commonly documented offshore (Hatch et al. 2013, Dowling et al. 2017, VDWR 2021). Eastern red bats are the most frequently encountered species off the Atlantic Seaboard during fall migration and may regularly travel along the Outer Continental Shelf during migration (Hatch et al. 2013, Dowling et al. 2017). The eastern red bat and Seminole bat were the most commonly recorded species in the Lease Area followed by silver-haired bat and very low detections of hoary bat. The unknown low frequency species group most likely predominantly contains bat passes from the hoary bat and silver-haired bat. The detections of all recorded species were spread across the Lease Area (Figure O-2-2). The potential impacts to bat species and bat avoidance, minimization, and mitigation measures are discussed in Section 4.2.3 and Appendix O-1. Although the understanding of offshore bat activity and behavior is limited; migratory tree bats have been the most common species observed offshore, which is consistent with the results of this study.

Bats were recorded at low levels in the spring and summer and higher levels during fall (85 percent, August 15 through November). Increase in population size after the summer breeding season and coastal navigation during migration may explain why the majority of offshore encounters with migratory tree bats occur during the fall (Cryan 2003). In addition, bat activity offshore may increase at the end of the summer because females no longer need to return to the roost to nurse young throughout the evening and are able to travel longer distances into the ocean to forage (Pelletier et al. 2013). Short, single night spikes in the number of bat passes in September and October may suggest fall migration pulses across the Lease Area; however, it

may also result from an individual bat foraging around the vessel during the night so that it could periodically roost and rest on the ship, as has been observed in other offshore environments (Thompson et al. 2015) and documented in this study. Hour of the night had a bimodal distribution with a lull from 23:00 to 2:00 (Figure O-2-6).

As previously described, bats have been documented foraging around ships during the night and roosting and resting on the ship during the day in the offshore environment (Thompson et al. 2015). A similar situation occurred during this study as three bats were observed roosting on vessels offshore and two were observed flying during the day around vessels offshore. Bat species are thought to forage offshore due to two attributes of open water environments: lack of obstacles that could remove barriers to insect capture, and the temperature over large bodies of water is more stable and may remain warmer than nearby land, and thus sustain insect activity (Pelletier et al. 2013). Numerous types of insects are present offshore, providing foraging opportunities and energy during migration and long-distance travel (Cheng and Birch 1978). Even large-scale insect migrations occur in coastal environments and offshore, which likely impact bat activity rates and may also draw bats out into the offshore environment (Russell et al. 1998, Wikelski et al. 2006, Srygley and Dudley 2008).

In land-based surveys, bat activity levels are known to be affected by temperature and windspeed. Temperature is generally positively correlated with bat activity (Arnett et al. 2007; Wolbert et al. 2014) and high windspeed negatively correlated with bat activity (Arnett et al. 2007). Johnson et al. (2011) observed that bat activity off the coast of Maryland was positively correlated with temperature and negatively correlated with wind speed. Cryan and Brown (2007) observed that hoary bats only arrived on Farallon Island (28 mi [45 km] offshore of San Francisco) on nights with low wind speeds, and Sjollema (2011) observed bat activity decreasing as windspeed increased offshore of the Atlantic Coast from Massachusetts to North Carolina. To date, these trends remain consistent for most offshore studies; however, several studies have documented bat activity at higher wind speeds offshore, compared to onshore environments (Hatch et al. 2013; Sjollema et al. 2014). This latter observation may indicate that bats are forced to fly at higher wind speeds in the offshore environment, or that the species present in the offshore environment (larger bodied species) are less deterred by wind speed. This study did not find any significant correlation between temperature or wind speed and bat activity, which could be due to the different conditions recorded at the offshore weather buoy and at the vessel locations within the Lease Area, or simply that bat activity was unaffected by temperature or wind speed near the vessels.

O-2.4.3 Conclusion

The findings from this study are consistent with our current understanding of bat activity offshore and demonstrate low levels of bat activity (average of 1.07 bat passes per detector night) within the Lease Area (Table O-2-2). For comparison, activity rates in pre-construction onshore wind farm surveys averaged 1.89 bat passes per detector night with a range of 0.53 to 6.27 bat passes per detector night (Solick et al. 2020). This survey has a lower average and is on the lower end of the range of onshore bat activity. This activity generally comprises a few confirmed species of long-distance migrants, none of which are federally listed, and occurs more frequently during the fall migration period. These results are supported by the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia: Final Environmental Assessment, which concluded that only the

silver haired bat, easter red bat and hoary bat would possibly migrate or forage through the offshore Wind Energy Areas (BOEM 2012), the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina: Revised Environmental Assessment, which found that, while rare, bat use offshore may include occasional transitory migratory tree bats (BOEM 2015), and by the cumulative impacts analysis in the Supplemental Environmental Impact Statement for Vineyard Wind 1, which found that cave-hibernating bats do not typically occur offshore (BOEM 2020).

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Attachment O-2-1. Hardware and Software Parameters and Settings

Platform	Parameter	Setting
Hardware		
Wildlife Acoustics SM4BAT	Data type	Full spectrum
	Trigger window	2 seconds
	Trigger max	15 seconds
	Sampling rate	256,000
	Gain	12 decibels
	Minimum trigger frequency	16 kilohertz
	File format	.WAV
	Survey window	1 hour before sunset to 1 hour after sunrise
Software		
Kaleidoscope Pro v5.1.0	Signal of interest	16–120 kilohertz
	Duration	2–500 milliseconds
	Minimum pulses	2
	Classifier	Bats of North America 5.1.0
	Sensitivity	0 Balanced (neutral)
SonoBat v4.2.1	Classifier	Southeast

Attachment O-2-2. Equipment Photographs

Photo ID	Detector ID	Vessel	Deployed
1	CVOW-1	Terrasond Sara Bordelon	04/14/2020

Photo ID	Detector ID	Vessel	Deployed
2	CVOW-2	Alpine Ocean Shearwater	5/13/2020

Photo ID	Detector ID	Vessel	Deployed
3	CVOW-4	Geoquip Speer	6/3/2020

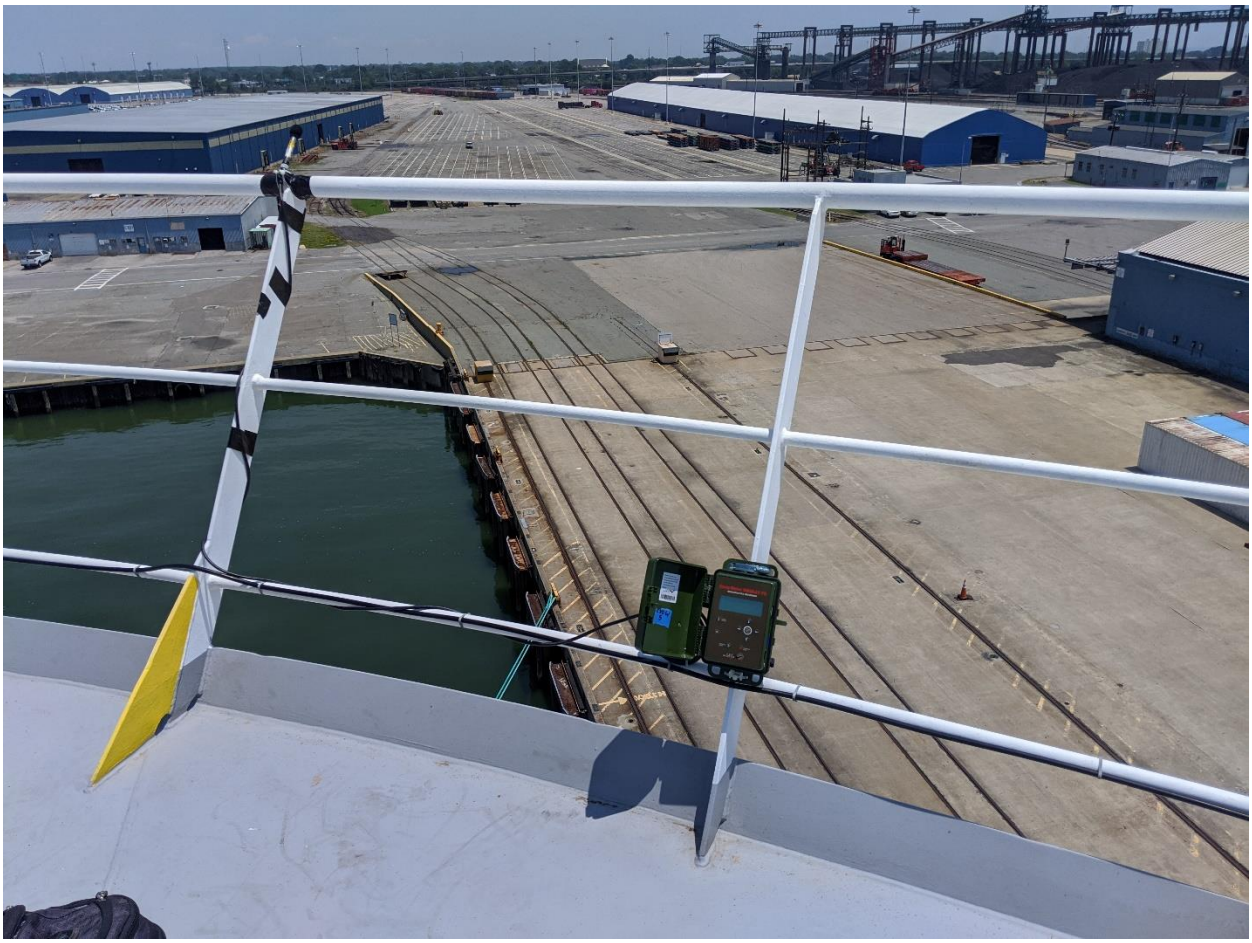
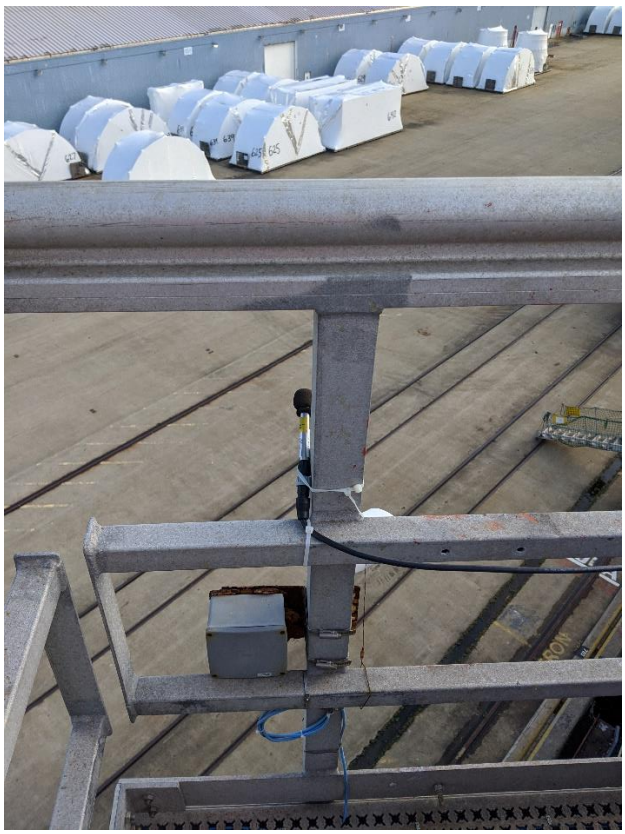


Photo ID	Detector ID	Vessel	Deployed
4	CVOW-5	Geoquip Dina Polaris	6/22/2020



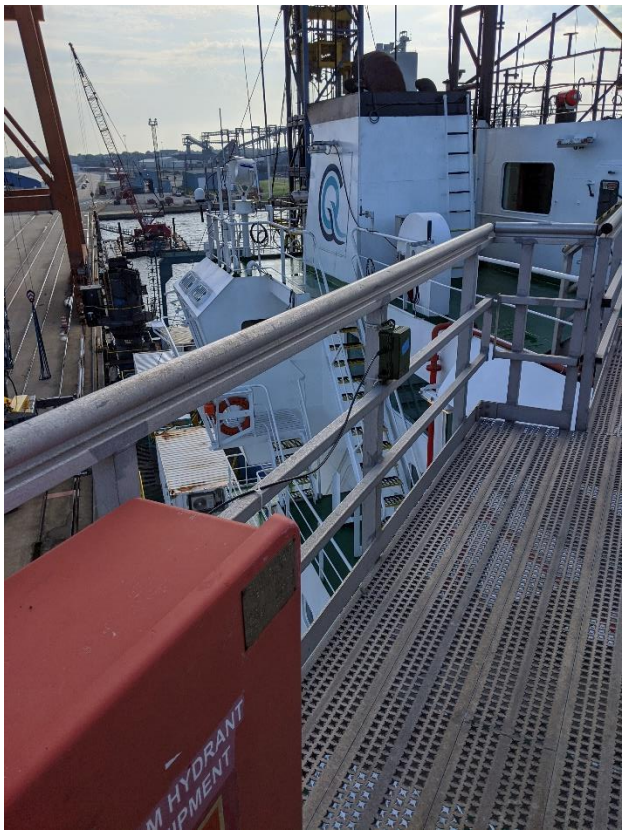


Photo ID	Detector ID	Vessel	Deployed
5	CVOW-6	Geoquip Saentis	6/26/2020

Photo ID	Detector ID	Vessel	Deployed
6	CVOW-7	Terrasond Kommandor Iona	8/28/2020

Photo ID	Detector ID	Vessel	Deployed
7	CVOW-8	Alpine Ocean Minerva	9/16/2020

Photo ID	Detector ID	Vessel	Deployed
8	CVOW-9	Geoquip Dina Polaris (re-deployed)	11/13/2020

Attachment O-2-3. Bat Photographs

Photo #	Vessel	Date	Species	Ship Location	Notes
1	CVOW-3 Marcelle Bordelon	8/26/2020	Hoary bat	Within Lease Area	Flying during the daytime

Photo #	Vessel	Date	Species	Ship Location	Notes
2	CVOW-1 Sara Bordelon	8/27/2020	Silver-haired bat	Within Lease Area	Day roosting on deck

Photo #	Vessel	Date	Species	Ship Location	Notes
3	CVOW-5 Dina Polaris	9/2/2020	Suspected silver-haired bat	Offshore	Day roosting on deck

Photo #	Vessel	Date	Species	Ship Location	Notes
4	CVOW-3 Marcelle Bordelon	10/4/2020	Eastern red bat	Within Lease Area	Roosted in workshop on toolbox

Photo #	Vessel	Date	Species	Ship Location	Notes
5	CVOW-7 Kommandor Iona	10/8/2020	Unknown	Within Lease Area	Flying during the daytime

Photo #	Vessel	Date	Species	Ship Location	Notes
6	CVOW-3 Marcelle Bordelon	10/11/2020	Unknown	Unknown	Night roosting on deck

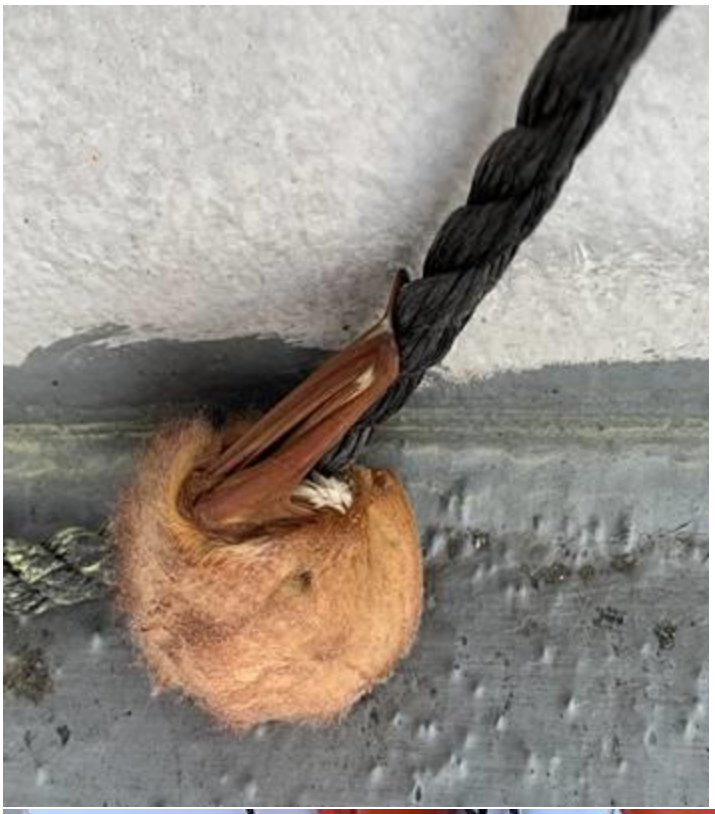


Photo #	Vessel	Date	Species	Ship Location	Notes
7	Go Discovery	4/7/2021	Eastern red bat	Unknown	Day roosting on deck

Photo #	Vessel	Date	Species	Ship Location	Notes
8	Go Discovery	4/10/2021	Eastern red bat	Docked in Norfolk	Day roosting on deck