Fall 2009 – Bird and Bat Biological Survey Report

Naval Station Newport Wind Project

Newport , Rhode Island

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EXECUTIVE SUMMARY

During late fall 2009, Tetra Tech, Inc. (Tetra Tech) conducted field surveys to document avian and bat activity at the Naval Station Newport Wind Project (Project Area) in Newport, Rhode Island. The surveys were initiated by Naval Facilities Engineering Command Mid-Atlantic as part of the planning and permitting process for proposed wind energy development. The fall 2009 surveys are the first set of surveys planned for the project during the pre-construction period. Fall surveys included migrant point count surveys and a bat acoustic survey. The surveys began on 1 October 2009 and were not intended to cover the full fall migration period.

The results of these surveys provide useful data on temporal and spatial use of the Project Area by birds and bats. The late fall 2009 surveys create a baseline dataset to compare with any future post-construction surveys.

Point Count Survey

During late fall 2009, Tetra Tech biologists conducted standardized point count surveys at 12 different locations to determine the number and species of migrant birds using the Project Area. Point count surveys were conducted on four separate days during October and November 2009. All 12 points were sampled during each survey event. Transects were chosen based on proximity to the proposed development and to ensure that representative habitat types of the Project Area were sampled. All birds visually or audibly detected at each survey point were recorded during 10-minute sampling periods. A total of 2,435 individual birds were documented, representing 57 species with an overall relative abundance of 50.73 birds/point. There was a mix of species observed including gulls, ducks, waterfowl, passerines, sparrows, raptors, wading birds, introduced, and pest species. The peregrine falcon (*Falco peregrinus*) was the only state listed endangered species observed. Four state listed avian species of special concern were documented including the white-throated sparrow (*Zonotrichia albicollis*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), and great-blue heron (*Ardea herodias*). No federally listed threatened or endangered species were documented.

Bat Acoustic Survey

The fall and early winter 2009 field surveys included over 2 months (1 October–10 December 2009) of passive acoustic bat monitoring. Three acoustic bat detectors were used to assess bat activity, species richness, and habitat use of the Project Area. Two bat detectors were located in the onsite meteorological tower (high and middle) and one detector was located on the Bishop Rock peninsula. Detectors monitored bat echolocation calls for approximately 12 hours per night, resulting in 2,688 detector-hours. The 71 night sampling period consisted of 191 detector-nights, with 107 bat call sequences recorded and an overall Index of Activity of 56.6 (minutes of activity/detector-nights * 100). Four bat species were documented during the fall 2009 bat acoustic surveys: eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*), which are migratory tree roosting bats; and big brown bat (*Eptesicus fuscus*), a common non-migratory bat that commonly occurs in developed landscapes. Bat activity rates and phenology do not indicate a large magnitude of bat migration at the project site. No state or federally listed species were recorded during the fall acoustic monitoring study.

1.0 INTRODUCTION

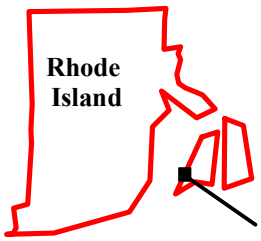
1.1 Project Overview

The following describes the fall 2009 bird and bat survey results of avian and bat resources within the proposed Naval Station Newport Wind Energy Project (Project Area). The Project Area is located within the Naval Station Newport approximately 3 miles north of the Town of Newport, Rhode Island (Figure 1-0).

The purpose of this survey is to provide baseline information on avian and bat species composition, relative abundance, and distribution within the general Project Area, as well as any rare, threatened, or endangered bird or bat species with the potential to be affected by project activities. This information can be used to assess the potential risk to these species and will also support federal, state, and local permit applications for the project.

1.2 Project Area Description

The U.S. Navy is proposing to construct a wind energy facility within Naval Station Newport located in Newport, Rhode Island. The proposed facility would include installation of wind turbines at 12 potential locations along the shoreline of Narragansett Bay. If the current wind study proves feasible, turbines will be erected at up 139 m (459 ft). All infrastructure, including transmission lines and substation facilities, would be constructed on previously developed land on base property. While most of the turbines are expected to be located within 30 m (98 ft) of the shoreline, no construction or disturbance below the tidal line is anticipated. The proposed turbines will be located along an 8 kilometer (km) (5 mile [mi]) stretch of base.



Source: ESRI Data and Maps on CD-ROM, 2007

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LEGEND

- Naval Station Newport
- Potential Turbine Location
- River
- Limited Access Road
- Highway
- Major Road
- Local Road

Figure 1. Naval Station Newport Wind Project, Newport, Rhode Island

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2.0 MIGRANT POINT COUNT SURVEY

2.1 Introduction

The northeastern United States is known to support a diverse group of avian species during spring and fall migration periods. Diurnal migrants such as raptors, shorebirds, and waterfowl can be visually documented during migration, where as nocturnal migrants can be more difficult to assess and quantify. Many neo-tropical passerine species are nocturnal migrants that stopover en route during the day to rest and refuel before resuming migration. Field surveys were designed to target migrant stopover and staging in order to understand how and when species use particular locations. Migrant point count surveys were conducted at Naval Station Newport during fall 2009 to document use of the Project Area, including temporal and spatial trends.

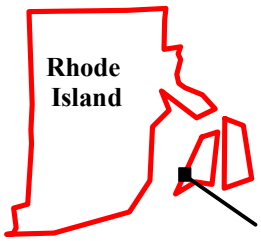
This section summarizes observations made at the Naval Station Newport Project Area during the fall 2009 migrant surveys. Data on species composition, diversity, abundance, and location within the Project Area are presented and discussed.

2.2 Methods

A Tetra Tech biologist conducted standardized surveys on 12 point count stations at Naval Station Newport during the fall 2009 migration season (Figure 2-0). During the fall season each point was sampled five times on different days. Point count locations were selected based on the proposed turbine layout and were situated within representative habitat types. Points were spaced at distances greater than 200 m (656 ft) apart using a handheld Global Positioning System (GPS) to ensure individual birds were not double counted. The points were located within the main base area (fenced area) and in sections to the north along Burma Road (non-fenced area). The linear distance covered between point 1 and point 12 was approximately 8 km (5 mi). Standardized survey protocols were established by Tetra Tech biologists prior to conducting the surveys.

Surveys targeted optimal weather conditions with light winds and no precipitation. Surveys began around sunrise, and most surveys were completed within 4 hours. Each point was surveyed for 10 minutes. Every bird that was detected either audibly or visually was identified to species and recorded onto standardized Tetra Tech data sheets. The behavior of migrant birds was also noted.

Point count elevations ranged from approximately sea level to 45 m (150 ft). All point count locations were within 0.6 km (0.4 mi) of the coast of Narragansett Bay. The habitat at the point count locations included natural shoreline, bulk-headed coastline, rip rap, protected coves, urban development, fields, recreational areas, forest, and early successional shrub habitat.



Source: ESRI Data and Maps on CD-ROM, 2007

1 0 1
Miles

LEGEND

- Naval Station Newport
- Meterological tower
- Point Count Location
- River
- Limited Access Road
- Highway
- Major Road
- Local Road

Figure 2.0 Point Count Locations at Naval Station Newport, Newport, Rhode Island.

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2.3 Results

A total of 2,435 birds representing 57 species were observed and recorded at Naval Station Newport during four survey dates in October and November, 2009 (Table 2-0 and Table 2-1; Appendix A, Table 1). The mean number of birds detected across the four surveys was 608.75 (Table 2-1). Birds observed were a combination of year-round residents and migrants.

The number of birds (species richness) detected at each point ranged from 9 to 27 across all 12 survey points. The overall relative abundance across the four survey dates was 50.73 birds/point (Appendix A, Table 1). Species with the highest relative abundance were Canada goose *(Branta canadensis)* (14.00 birds/point, *n* = 672), herring gull (*Larus argentatus)* (5.96 birds/point, *n* = 286), rock dove (*Columba livia*) (4.79 birds/point, *n* = 230), European starling *(Sturnus vulgaris)* (4.67 birds/point, *n* = 224), red-breasted merganser (*Mergus serrator*) (2.88 birds/point, *n* = 138), and double-crested cormorant (*Phalacrocorax auritus)* (2.44 birds/point, *n* = 117). These six species represented 68 percent of the total observations during the four surveys (Table 2-0 and Table 2-1). The greatest number of birds (*n* = 990) detected on a single survey occurred on 14 October 2009 (Table 2-1).

Table 2-0. Summary of point count surveys at Naval Station Newport, fall 2009.

Species	Total	Relative abundance (birds per point)	Frequency of occurrence	Species	Total	Relative abundance (birds per point)	Frequency of occurrence
American black duck	7	0.15	8.3%	Killdeer	3	0.06	8.3%
American crow	51	1.06	83.3%	Laughing gull	25	0.52	50.0%
American goldfinch	26	0.54	58.3%	Mallard	36	0.75	8.3%
American robin	53	1.10	58.3%	Merlin	1	0.02	8.3%
Belted kingfisher	1	0.02	8.3%	Mourning dove	16	0.33	33.3%
Black-capped chickadee	27	0.56	41.7%	Northern cardinal	13	0.27	41.7%
Blue jay	20	0.42	50.0%	Northern flicker	11	0.23	33.3%
Brown thrasher	1	0.02	8.3%	Northern mockingbird	29	0.60	66.7%
Bufflehead	15	0.31	8.3%	Osprey	1	0.02	8.3%
Canada geese	672	14.00	58.3%	Peregrine falcon	4	0.08	25.0%
Carolina wren	1	0.02	8.3%	Purple finch	15	0.31	25.0%
Cedar waxwing	10	0.21	25.0%	Red-breasted merganser	138	2.88	58.3%
Chestnut-sided warbler	4	0.08	8.3%	Red-eyed vireo	1	0.02	8.3%
Chipping sparrow	6	0.13	16.7%	Red-tailed hawk	5	0.10	25.0%
Common eider	5	0.10	16.7%	Rock dove	230	4.79	33.3%
Common grackle	57	1.19	25.0%	Ruby-crowned kinglet	1	0.02	8.3%
Common loon	3	0.06	25.0%	Savannah sparrow	14	0.29	33.3%
Common yellowthroat	3	0.06	25.0%	Sharp-shinned hawk	3	0.06	16.7%
Cooper's hawk	6	0.13	41.7%	Snow bunting	25	0.52	16.7%
Double-crested cormorant	117	2.44	58.3%	Song sparrow	35	0.73	75.0%
Downy woodpecker	1	0.02	8.3%	Sparrow species	1	0.02	8.3%
Duck species	26	0.54	16.7%	Tufted titmouse	6	0.13	41.7%
Eastern phoebe	2	0.04	16.7%	Turkey vulture	1	0.02	8.3%
Eurasian starling	224	4.67	58.3%	Unidentified raptor	1	0.02	8.3%
Gray catbird	15	0.31	41.7%	Unidentified warbler	5	0.10	8.3%
Great-blacked backed gull	70	1.46	58.3%	White-throated sparrow	18	0.38	50.0%
Great-blue heron	1	0.02	8.3%	White-winged scoter	51	1.06	25.0%
Herring gull	286	5.96	91.7%	Yellow warbler	1	0.02	8.3%
House Sparrow	18	0.38	16.7%	Yellow-billed cuckoo	1	0.02	8.3%
House wren	3	0.06	16.7%	Yellow-rumped warbler	13	0.27	25.0%

Table 2-1. Summary of point count surveys by date at Naval Station Newport, fall 2009.

Species	10/2/2009	10/14/2009	11/5/2009	11/19/2009	Grand Total	Mean per survey
American black duck		7			7	1.75
American crow	8	13	19	11	51	12.75
American goldfinch	8	9	2	7	26	6.50
American robin	5	6	26	16	53	13.25
Belted kingfisher				1	1	0.25
Black-capped chickadee		2	13	12	27	6.75
Blue jay	15	2	2	1	20	5.00
Brown thrasher	1				1	0.25
Bufflehead			15		15	3.75
Canada geese		522	150		672	168.00
Carolina wren		1			1	0.25
Cedar waxwing		8	2		10	2.50
Chestnut-sided warbler		4			4	1.00
Chipping sparrow		6			6	1.50
Common eider				5	5	1.25
Common grackle		50	2	5	57	14.25
Common loon			2	1	3	0.75
Common yellowthroat		1	1	1	3	0.75
Cooper's hawk	2	2		2	6	1.50
Double-crested cormorant	43	27	34	13	117	29.25
Downy woodpecker	1				1	0.25
Duck species		20	6		26	6.50
Eastern phoebe	2				2	0.50
Eurasian starling	40	3	36	145	224	56.00
Gray catbird	6	4	1	4	15	3.75
Great-blacked backed gull	17	29	17	7	70	17.50
Great-blue heron			1		1	0.25
Herring gull	53	79	57	97	286	71.50
House Sparrow	1			17	18	4.50
House wren	2	1			3	0.75
Killdeer		3			3	0.75
Laughing gull	6	10	5	4	25	6.25
Mallard	14	15		7	36	9.00
Merlin		1			1	0.25
Mourning dove	12		2	2	16	4.00
Northern cardinal	2	2	6	3	13	3.25
Northern flicker	2	4	3	2	11	2.75
Northern mockingbird	5	12	11	1	29	7.25
Osprey	1				1	0.25
Peregrine falcon	1	1	1	1	4	1.00
Purple finch	4	3	5	3	15	3.75
Red-breasted merganser		3	44	91	138	34.50
Red-eyed vireo			1		1	0.25
Red-tailed hawk	1	2	1	1	5	1.25
Rock dove	50	53	67	60	230	57.50
Ruby-crowned kinglet			1		1	0.25
Savannah sparrow	1	6	7		14	3.50
Sharp-shinned hawk		3			3	0.75
Snow bunting			6	19	25	6.25
Song sparrow		6	15	14	35	8.75
Sparrow species	1				1	0.25
Tufted titmouse	1	1	3	1	6	1.50
Turkey vulture	1				1	0.25
Unidentified raptor				1	1	0.25
Unidentified warbler		5			5	1.25
White-throated sparrow		1	17		18	4.50
White-winged scoter		50	1		51	12.75
Yellow warbler	1				1	0.25
Yellow-billed cuckoo	1				1	0.25
Yellow-rumped warbler		13			13	3.25
Species Richness	**31**	**39**	**35**	**31**	**57**	
Total	**308**	**990**	**582**	**555**	**2435**	**608.75**

The most frequently observed species at Naval Station Newport were herring gulls (observed at 91.0 percent of points), American crow (*Corvus brachyrhynchos*) (83.3 percent), song sparrow (*Melospiza melodia*) (75.0 percent) and northern mockingbirds (*Mimus polyglottos*) (66.7 percent). The remaining species observed were recorded at frequencies less than 60 percent (Table 2-0). Point 7 and point 8 had the greatest species diversity with 27 and 25 bird species, respectively. The lowest species diversity occurred at point 2 and point 12, both with 9 species (Appendix A, Table 1).

Of the 57 species observed during the fall 2009 migrant stopover surveys at Naval Station Newport, five species were considered to be rare, threatened, or endangered (RTE). The peregrine falcon (*Falco peregrinus*) was the only state listed endangered species observed. Four avian species of special concern were documented: white-throated sparrow (*Zonotrichia albicollis*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), and great-blue heron (*Ardea herodias*).

2.4 Discussion

Naval Station Newport provides stopover habitat for a diverse assemblage of migrant and resident avian species. A total of 57 different species were observed during the 4 days of point count surveys. The Project Area had an overall relative abundance of 50.73 birds/point. Point counts were conducted on 2 October, 14 October, 5 November, and 19 November 2009. The objective of the surveys was to capture the late-fall migration season. A more thorough survey that encapsulates the entire fall migration period will be conducted during fall 2010.

All migrant stopover/resident species that were observed and recorded during the fall 2009 surveys are consistent with species typically found in the habitat types available at Naval Station Newport. Canada geese (n = 672), herring gull (n = 286), rock dove (n = 230), and European starling (n = 224) were by far the four most abundant species in or near the Project Area, accounting for 58 percent of the bird observations. In some cases there were large skeins (n =100) of Canada geese migrating from north to south over Narragansett Bay. Flight paths varied, with some skeins moving strictly over the waters of Narragansett Bay and others flying over parcels of the Project Area before moving back out to the bay. The majority of the flight heights of these flocks were greater than 150 m (492 ft). Herring gulls, rock doves, European starlings, and Canada geese are all common year-round residents of the Project Area. Herring gulls were the most frequently observed bird at the Project Area, with occurrence at 91 percent of surveyed points. Some of the most abundant species observed within the Project Area are considered introduced and/or pest species (e.g., European starling and rock dove).

The majority of the 57 different species observed are common throughout the region, although 5 of the documented species at Naval Station Newport are considered RTE species as listed by the Rhode Island Natural Heritage Program. The peregrine falcon was the one state endangered species observed. The four avian species of special concern were the white-throated sparrow, Cooper's hawk, sharp-shinned hawk, and great-blue heron. No federally threatened or endangered species were observed during fall 2009 migrant stopover surveys at Naval Station Newport.

A nesting pair of Peregrine falcons occurs approximately 1.6 km (1 mi) south of the Project Area on the Newport-Jamestown (Claiborne Pell) Bridge (USFWS personal communication). Peregrine falcons were observed hunting rock doves near the aircraft carriers and Officer's club

within the Project Area during two surveys in October. Peregrine falcons are considered year-round residents at Naval Station Newport (US Navy personal communication).

The Project Area contains both coastal and nearshore habitat for a wide range of species. The coastal areas, with characteristics ranging from natural shoreline to bulk headed and rip-rapped coastlines, provide foraging and resting areas for gulls, ducks, and other bird species. During the survey very few shorebirds and wading birds were observed. The coastal point counts documented heavy use of the surveyed area by gull species and Canada geese in particular. Gulls were frequently observed flying over the bay and Project Area in random directions and fluctuating flight heights. Red-breasted mergansers (*Mergus serrator*), buffleheads (*Bucephala albeola*), American black ducks (*Anas rubripes*), mallards (*Anas platyrhynchos*), white-winged scoters (*Melanitta deglandi*), common eiders (*Somateria mollissima*), and common loons (*Gavia immer*) were the duck/waterfowl species observed using the nearshore waters of Narragansett Bay. Most of the duck/waterfowl movements were observed strictly over water and at low flight heights (< 10 m [33 ft]). Also observed was the tendency of these ducks to avoid crossing over land during local movements along the coastline. Duck species, in particular red-breasted mergansers, would fly from a cove north of Bishop Rock peninsula to a cove south of Bishop without ever crossing the spit of land in between. This behavior was observed multiple times during the survey period from point count 4, located at the tip of Bishop Rock peninsula.

The tank farm areas where most of the terrestrial point counts were located contained a mix of early successional habitat, shrub land thickets, forest edge, and grassland habitat. This range of habitats supported the greatest species richness for the Project Area. For example, point 7 had 27 different species observed and point 8 had 25 different species observed. Two tank farms, numbers 4 and 5, were sampled during the point count surveys. Access to tank farm number 3 was restricted and no surveys were conducted in this location. The species observed at both tank farm sites were typical for these habitats, and most are considered “edge” species.

Overall, it appears that the species composition and abundance of the migrant/resident population of passerine songbirds, gulls, ducks, and waterfowl utilizing the Project Area is typical of the region as a whole. Future surveys will document bird activity during the winter, spring, summer, and fall 2010 period.

3.0 BAT ACOUSTIC STUDY

3.1 Introduction

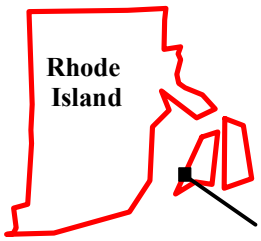
The U.S. Navy is committed to environmental due diligence and has contracted Tetra Tech to conduct a late fall passive acoustic bat monitoring study to assess migration at Naval Station Newport. The goals of this study were to assess bat activity, species richness, and habitat use of the Project Area and to identify the potential for impacts to bats associated with building and operating the proposed facility. This section presents the results of over 2 months of bat activity monitoring using ultrasonic acoustic recorders (Anabat SD-1, Titley Scientific, Inc.) deployed from 1 October to 10 December 2009 on a meteorological measurement tower (met tower) and one other location in the Project Area (Figure 3-0). The study was initiated late in the fall and did not sample the entire fall migration period (typically August through November). However, the survey was conducted during the migration window and provides insight into the late fall migratory period. A second bat acoustic survey is planned for the late-summer/fall migration period 2010 to supplement the results of the late fall 2009 surveys.

3.2 Methods

From 1 October to 10 December 10 2009 two detectors were placed at different heights in the met tower: one at 30 m (98 ft) above ground level (agl) (High detector) and the other at 15 m (49 ft) agl (Middle detector). A third Anabat SD-1 (Bishop Rock low detector) was deployed on a 2 m (6 ft) pole on Bishop Rock peninsula southwest of the met tower (Figures 3-1 and 3-2).

To ensure that the greatest period of bat activity was surveyed, the detectors were programmed to begin recording approximately 45 minutes before sunset and stop recording approximately 45 minutes after sunrise each day. These survey periods and monitoring guidelines are consistent with industry standards for conducting preconstruction bat acoustic surveys. Since the surveys began late in the fall bat migration period it is likely that peak migration activity was not adequately assessed by this survey. Additional spring, summer, late-summer, and fall acoustic monitoring will be conducted onsite in 2010.

Each detector (High, Middle, and Bishop Rock) consisted of an Anabat SD-1 detector. Detectors were powered by a 5-watt solar panel and a 12-volt battery and encased in a waterproof housing. The housing suspended the Anabat microphone downward, and a plastic deflector shield was angled at 45-degrees below the microphone to allow the airspace surrounding the detector to be recorded. Each detector was manually checked by Tetra Tech staff every 2 weeks between 1 October and 10 December 2009. During the bi-weekly site visits each detector's setting was checked to assure consistency in recording among sampling locations.



Source: ESRI Data and Maps on CD-ROM, 2007

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Figure 3.0 Bat Detector Locations at Naval Station Newport, Newport, Rhode Island.

Prepared For: NAVFAC Naval Facilities Engineering Command

Prepared By: TETRA TECH, INC.

Date: 01/10

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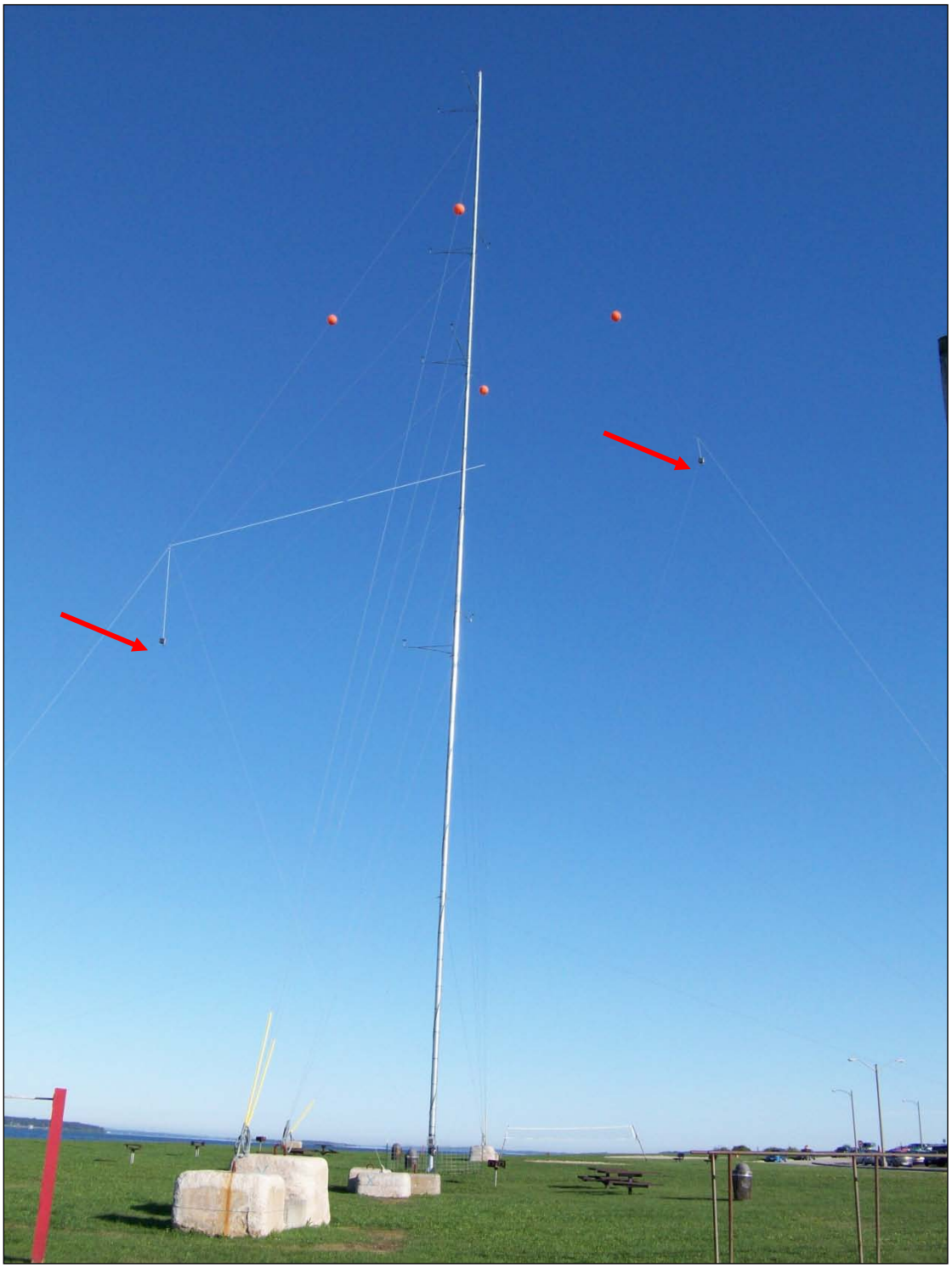

Figure 3-1. Met tower detectors (High and Middle) at the Naval Station Newport Project Area, fall 2009.

Figure 3-2. Low detector at Bishop Rock, Naval Station Newport, fall 2009.

3.2.1 Data Analysis

Potential bat call files were extracted from data files using CFCread© software. CFCread© software screens all data recorded by the bat detector and extracts call files using a filter. To ensure comparability between datasets, the default settings for the CFCread© software were used during the file extraction process. These settings include a maximum time between calls (TBC) of 5 seconds, a minimum line length of 5 milliseconds, and a smoothing factor of 50. The smoothing factor refers to whether or not adjacent pixels can be connected with a smooth line. The higher the smoothing factor, the less restrictive the filter, resulting in more noise files and poor quality call sequences retained within the dataset. A call is defined as a single pulse of sound produced by a bat. A call sequence is defined as a combination of two or more pulses recorded in a single call file.

A qualitative visual comparison was made of recorded bat call sequences of sufficient length to establish reference libraries of bat calls. This technique allows for relatively accurate identification of bat species (O'Farrell et al. 1999, O'Farrell and Gannon 1999). All call sequences were also run through a series of conservative filters based on call sequence characteristics outlined in Szweczak et al. (2008) and from known species call sequences (hand released and zip-line individuals) from a regional call library. A call sequence was considered of suitable quality and duration to be included in data analysis if the individual call pulse(s) exhibited the full spectrum of frequency modulation produced by a bat (i.e., consisting of sharp, distinct lines) with a minimum of 3 pulses.

An Index of Activity (IA) was calculated to eliminate biases associated with variability in survey effort (Miller 2001). Total minutes of bat activity were calculated based on the duration of individual call pulses. Minutes of activity were then compared with the total number of detector-nights per recording station (IA is therefore equal to the total minutes of activity/detector-nights * 100).

3.3 Results

Survey Effort

During the late fall migration survey the three acoustic detectors operated for a total of 191 detector-nights (number of operational nights per detector, pooled). Overall the detectors operated well throughout the survey period. The two met tower detectors, High and Middle, operated for 71 detector-nights each. The Bishop Rock detector operated for 49 detector-nights. Unfortunately, the detector at Bishop Rock powered down for 14 days and the data could not be retrieved for those nights (i.e. possible lightning strike). The three units operated until 10 December 2009, resulting in a total of 2,292 detector-hours during the 191 detector-nights survey effort.

A total of 107 call sequences were recorded during the monitoring period. These call sequences consisted of 1,181 individual call pulses, resulting in an average of 11 call pulses per call sequence recorded. The pooled IA among all detectors was 65.7 (minutes of activity/detector-nights * 100) (Table 3-1).

Species Richness

Bat calls were identified to the lowest possible taxonomic level (Table 3-1). The majority (70 percent) of recorded calls were identified to species level (*n* = 75 call sequences). Four species were positively confirmed during the survey effort: big brown bat (*Eptesicus* fuscus), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*). The remaining call sequences (*n* = 32) did not meet the standards for species level classification. These calls were assigned frequency groups based on the observed mean characteristics frequency exhibited in the spectrogram. These unknown species groups were labeled as either “high frequency unknown” (Fc = 40 kHz) call sequences or “middle frequency unknown” (Fc = 25 kHz). The high frequency unknown category could contain call sequences from tri-colored bat (*Perimyotis subflavus*), eastern red bat, eastern small-footed myotis (*Myotis leibii*), little brown myotis (*Myotis lucifugus*), or northern myotis (*Myotis septentrionalis*). It is likely that since the only known species high frequency calls were attributable to eastern red bat, the majority of high frequency unknown calls were simply fragments of eastern red bat calls. The middle frequency unknown group may contain call sequences from either silver-haired bat or big brown bat. Both of these species were recorded; thus it is likely that calls grouped as middle frequency unknown were fragments of big brown and silver-haired calls.

Eastern red bat was recorded most frequently (*n* = 37 call sequences) during the study and had the second highest overall IA (20.2 minutes of activity/detector-nights * 100). Silver-haired bat was recorded nearly as often as eastern red bat (*n* = 20 call sequences) but had a higher IA (22.8 minutes of activity/detector-nights * 100). Big brown bat calls were infrequently recorded (*n* = 8), but the species had a high IA rate of 13.1 minutes of activity/detector-nights * 100. A total of 10 hoary bat call sequences were recorded, but the species had a low overall IA of 5.2 minutes of activity/detector-nights * 100.

Temporal Distribution of Bat Activity

The earliest date a bat was recorded during the survey period was 1 October, and the latest date a bat was recorded was 26 November (Figure 3-3). Activity was generally inconsistent during the early survey period (October) and sporadic in November. The total number of pulses recorded fluctuated from 0 to 386. Often, nights with zero activity were followed by nights with high activity (Figure 3-3). Peak bat activity near the met tower and Bishop Rock peninsula occurred in early October. Peak numbers of call pulses were recorded on 10 October (*n* = 386), and 8 October (*n* = 124). Overall, among all detectors, 98 percent of call pulses were recorded in October.

The latest date that big brown bat was recorded was 22 October. Eastern red bat was recorded up until 26 November. Hoary bat appeared in the recordings until 22 October. Silver-haired bat was not recorded later than 19 November. The High detector in the met tower recorded the earliest bat call sequences (1 October) as well as the latest (26 November). The Bishop Rock detector recorded bats starting on 4 October and continued recording calls until 19 November. The Middle detector in the met tower recorded bat activity from 3 October through 8 November.

Hourly bat activity trends were highly variable (Figure 3-4). Big brown bat activity was concentrated primarily during the early evening hours from 19:00 to 01:00, with an initial peak at 21:00 and overall peak activity around 23:00. Eastern red bat activity increased steadily from 18:00 to 23:00 and then declined until 02:00. Hoary bat activity was unimodal and was

concentrated between 22:00 and 01:00. Silver-haired bat activity was bimodal increasing from 19:00 to 22:00, with an initial peak rate of calls occurring around 20:00 and a secondary increase from 22:00 to 01:00, with and overall peak rate at 23:00. Unknown species call sequences were recorded between the hours of 18:00 and 02:00, and exhibited peak activity around 23:00. Overall, no bat activity was recorded before 18:00 and no later than 03:00.

Spatial Distribution of Bat Activity

Bat activity levels, as measured by IA, were highest overall at the Bishop Rock (low) detector (IA = 98.6 minutes of activity/detector-nights * 100). The Middle detector recorded activity levels of 63.9 minutes of activity/detector-nights * 100, and the High detector recorded an IA of 30.9 minutes of activity/detector-nights * 100.

Big brown bat was most active near the Middle detector (IA = 4.8 minutes of activity/detector-nights * 100), and active at similar levels at the Bishop Rock detector and High detector (IA = 4.5 and 4.8 minutes of activity/detector-nights * 100, respectively). The greatest concentration of eastern red bat activity was at the Bishop Rock detector (IA = 49.5 minutes of activity/detector-nights * 100). This detector accounted for 71 percent of all eastern red bat activity (IA). The High detector recorded an IA of 11.6 minutes of activity/detector-nights * 100 of red bat activity (17 percent), and the Middle detector recorded an IA of 8.4 minutes of activity/detector-nights * 100 (12 percent).

Hoary bat was recorded only at the Middle and High detectors. The High detector recorded slightly more activity (IA = 10.0 minutes of activity/detector-nights * 100) than the Middle detector (IA= 3.9 minutes of activity/detector-nights * 100). Silver-haired bat was most active near the Bishop Rock and Middle detectors; both these detectors recorded similar IA rates of 35.8 and 24.7 minutes of activity/detector-nights * 100, respectively. Unknown species call sequences were recorded most frequently at the Bishop Rock detector, followed by the Middle detector, and lastly the High detector.

Table 3-0. Summary of acoustic monitoring survey effort by detector at Naval Station Newport, 1 October–10 December 2009.

Detector	Deployment Dates	Call Sequences	Call Pulses	Minutes of Activity	Detector-nights	Index of Acitivty
High	Oct. 1 - Dec. 10, 2009	36	334	29.0	71	40.9
Middle	Oct. 1 - Dec. 10, 2009	45	513	48.2	71	67.8
Bishop Rock (Low)	Oct. 1 - Dec. 10, 2009	26	334	48.3	49	98.6
Total		**107**	**1181**	**125.5**	**191**	**65.7**

Table 3-1. Summary of bat call sequences recorded (*n* = 107) and species recorded at Naval Station Newport, 1 October–10 December 2009.

Species / Group	Call Sequences	Call Pulses	Minutes of Activity	Index of Acitivty
Big brown bat	8	177	25.1	13.1
Eastern red bat	37	461	38.5	20.2
Hoary bat	10	130	9.9	5.2
Silver-haired bat	20	295	43.6	22.8
High Frequency Unknown	16	62	4.1	2.2
Middle Frequency Unknown	16	56	4.3	2.3
Total	**107**	**1181**	**125.5**	**65.7**

Table 3-2. Summary of bat call sequences and species recorded, by detector, at Naval Station Newport, 1 October–10 December 2009.

	Species / Group	Call Sequences	Call Pulses	Minutes of Activity	Index of Acitivty*
High Detector	Big brown bat	3	46	3.4	4.8
	Eastern red bat	9	81	8.3	11.6
	Silver-haired bat	7	82	8.5	11.9
	High Frequency Unknown	4	11	0.6	0.9
	Middle Frequency Unknown	6	13	1.2	1.6
	Total	**29**	**233**	**21.9**	**30.9**
Middle Detector	**Species / Group**	**Call Sequences**	**Call Pulses**	**Minutes of Activity**	**Index of Acitivty***
	Big brown bat	1	20	19.5	27.5
	Eastern red bat	21	309	6.0	8.4
	Hoary bat	3	29		
	Silver-haired bat	8	93	17.6	24.7
	High Frequency Unknown	5	25	1.8	2.5
	Middle Frequency Unknown	7	37	0.5	0.7
	Total	**45**	**513**	**45.4**	**63.9**
Bishop Rock Detector	**Species / Group**	**Call Sequences**	**Call Pulses**	**Minutes of Activity**	**Index of Acitivty***
	Big brown bat	4	111	2.2	4.5
	Eastern red bat	7	71	24.3	49.5
	Silver-haired bat	5	120	17.6	35.8
	High Frequency Unknown	7	26	1.7	3.4
	Middle Frequency Unknown	3	6	2.6	5.4
	Total	**26**	**334**	**48.3**	**98.6**

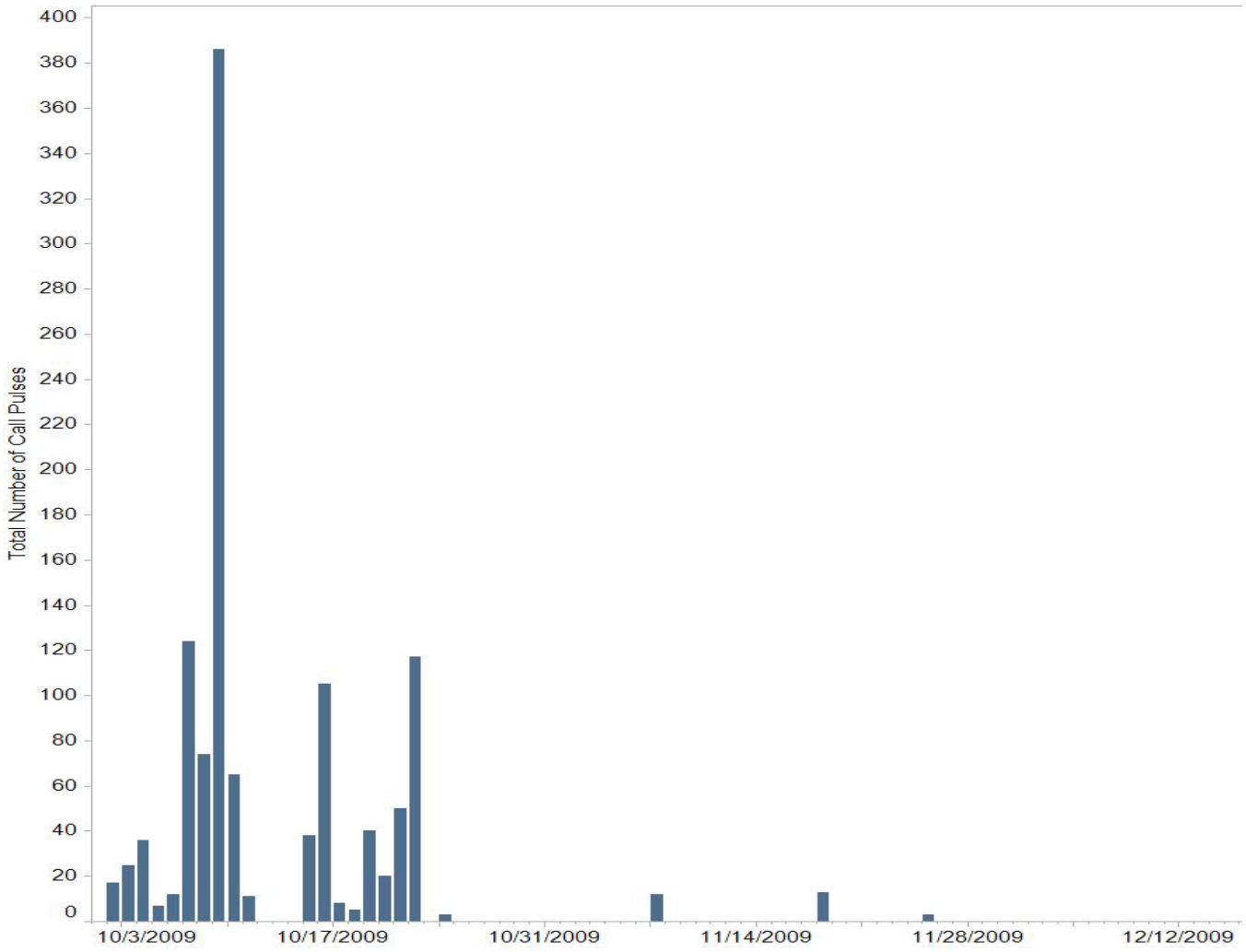

Figure 3-2. Total number of bat call pulses (*n* = 1,181) recorded per night by all detectors pooled (High, Middle, and Bishop Rock detectors) at Naval Station Newport, 1 October–10 December 2009.

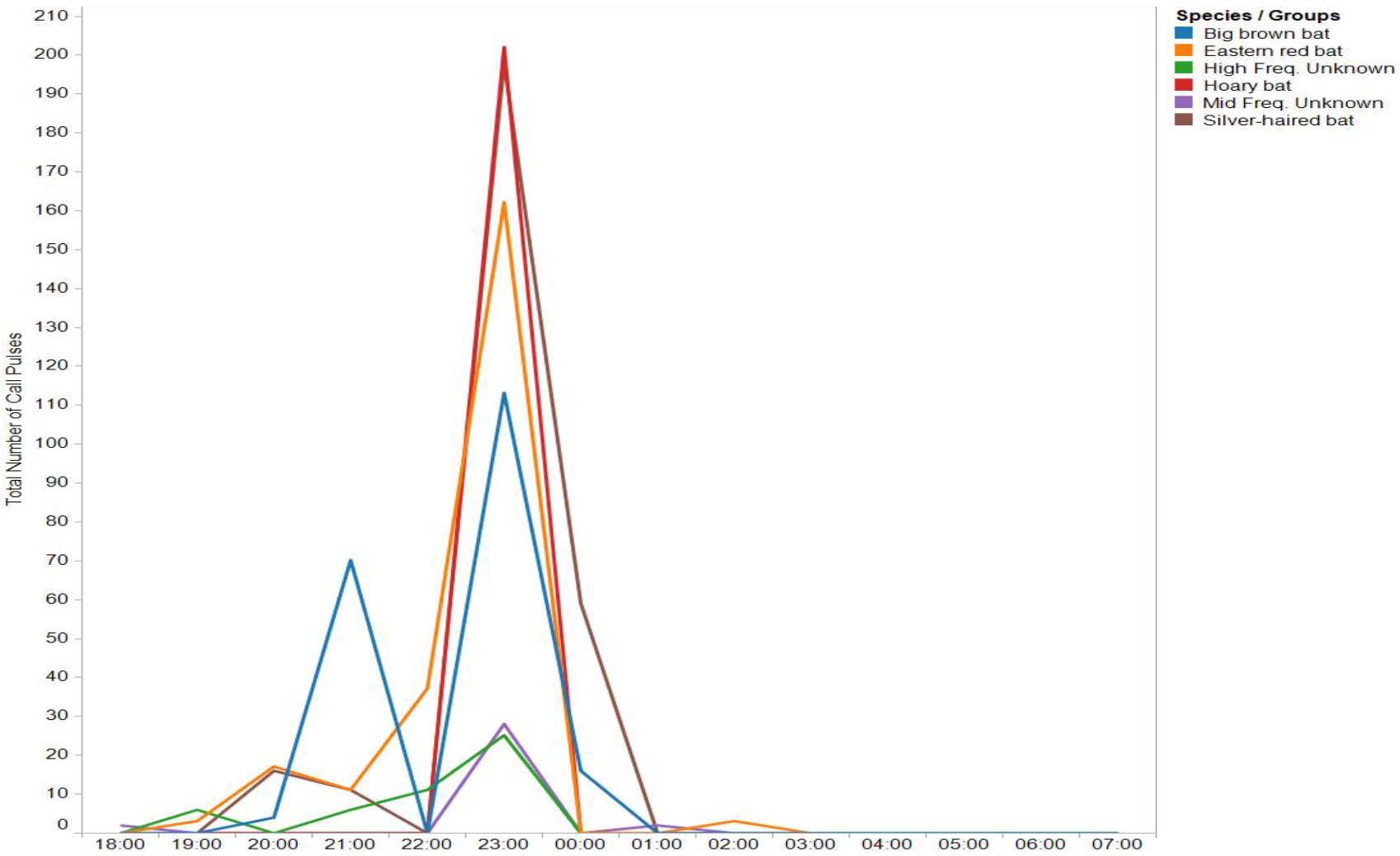

Figure 3-3. Total number of call pulses (*n* = 1,181), by species, recorded per hour by all detectors pooled (High, Middle, and Bishop Rock detectors) at Naval Station Newport, 1 October–10 December 2009.

3.4 Discussion

Current research shows that tree-roosting migratory bat species have been the predominant species found during post-construction mortality studies at wind farms in North America (Arnett el al. 2008). Data from mortality studies show that the three bat species most commonly found during ground searches are migratory bats known to travel long distances: the eastern red bat, hoary bat, and silver-haired bat (Kunz et. al 2007, Arnett et al. 2008). Each of these migratory species was positively identified from recordings during the late fall survey period at the Project Area. The activity rates of migratory species in the late fall study period at the Project Area were greater than those of big brown bat, a non-migratory species.

There is an inherent difficulty in attempting to interpret the number of recorded call sequences as an indication of activity levels; however, detection rates do reflect a relative level of bat activity near the sampling locations. The limited maximum range of a single Anabat detector [approximately 30 m (100 ft)] makes the characterization of landscape-scale movements, such as migration, difficult to assess. The total number of bat call sequences recorded each night by a given detector may or may not reflect the absolute level of bat activity present at the Project Area, although some studies have suggested that there may be a relationship between the number of call pulses recorded and bat activity levels (Gorresen et al. 2008). The bias in passive acoustic surveys of this type stems from the unknowns associated with recorded call sequences. For example, a single foraging individual may produce a large number of call sequences that are within the range of a given detector set. Conversely, a large number of individual bats may pass the detector set and produce an equally large number of call sequences. It is important to note that the survey results are a sample of bat activity in the airspace surrounding the detectors and are not necessarily indicative of bat activity throughout the entire Project Area.

Differences in IA rates among detector locations indicate that during the late fall migration period the Bishop Rock detector recorded substantially more activity than either of the met tower detectors. At the met tower location, the Middle detector recorded the most activity. IA rates at the High detector were nearly half that of the IA recorded at the Bishop Rock detector. Overall, the highest rates of eastern red bat activity were recorded at the Bishop Rock detector, which is consistent with eastern red bat preference for coastal route migration (Cryan 2003, Brooks and Ford 2005).

The cessation of bat activity late in November was likely a result of the low mean nightly temperatures (Racey and Swift 1985). The occurrence of eastern red bat, hoary bat, and silver-haired bat late in the season is consistent with the migratory strategies of these species (DeGraaf, and Yamasaki 2001, Cryan 2003). The relatively low levels of activity recorded during the late fall survey period signify that there was likely not a large population of bats utilizing the Project Area in October and November. The presence of migratory tree bat species late in the fall was not unexpected, especially the comparatively large proportion of eastern red bat calls in the dataset. Eastern red bat, and to a lesser extent hoary bat and silver-haired bat, are known to migrate along coastal areas, especially during the fall (Cryan 2003, Johnson and Gates 2008). Peak bat activity was recorded in early October, corresponding with the end of the fall migration period. It is expected that the results of the spring, summer, and early fall 2010 bat acoustic study will provide a better picture of bat species richness, activity levels, and phenology in the Project Area.

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APPENDIX A

Migrant Point Count Surveys

Appendix A Table 1. Total number of birds, relative abundance, and frequency of occurrence during point count surveys at Naval Station Newport, Fall 2009

	Point Count Location														
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Grand Total**	**Relative Abundance**	**Frequency**
American black duck						7							7	0.15	8.3%
American crow	1		11	3	1	5	7	3	5	4	11		51	1.06	83.3%
American goldfinch	2		2				6	7	4	2	3		26	0.54	58.3%
American robin			3				4	21	3	8	9	5	53	1.10	58.3%
Belted kingfisher	1												1	0.02	8.3%
Black-capped chickadee							1	8	7	6	5		27	0.56	41.7%
Blue jay					5		3	3	4	2	3		20	0.42	50.0%
Brown thrasher							1						1	0.02	8.3%
Bufflehead			15										15	0.31	8.3%
Canada geese	50	195	327	3		20	70		7				672	14.00	58.3%
Carolina wren								1					1	0.02	8.3%
Cedar waxwing								2		5	3		10	0.21	25.0%
Chestnut-sided warbler								4					4	0.08	8.3%
Chipping sparrow					5				1				6	0.13	16.7%
Common eider	4				1								5	0.10	16.7%
Common grackle								50	5	2			57	1.19	25.0%
Common loon				1		1						1	3	0.06	25.0%
Common yellowthroat								1		1		1	3	0.06	25.0%
Cooper's hawk			1			1	1	1			2		6	0.13	41.7%
Double-crested cormorant	35	10	3	28	4	16						21	117	2.44	58.3%
Downy woodpecker							1						1	0.02	8.3%
Duck species	6			20									26	0.54	16.7%
Eastern phoebe							1				1		2	0.04	16.7%
Eurasian starling		10	25			5	30	100	43	11			224	4.67	58.3%
Gray catbird							1	7	1	4	2		15	0.31	41.7%
Great-blacked backed gull	15	6	2	12	2	3						30	70	1.46	58.3%
Great-blue heron			1										1	0.02	8.3%
Herring gull	39	14	13	29	30	13	30	8	11	4		95	286	5.96	91.7%
House Sparrow		3			15								18	0.38	16.7%
House wren								2			1		3	0.06	16.7%
Killdeer			3										3	0.06	8.3%
Laughing gull	5	4	5		4	2						5	25	0.52	50.0%
Mallard			36										36	0.75	8.3%
Merlin							1						1	0.02	8.3%
Mourning dove						11	1			1	3		16	0.33	33.3%
Northern cardinal							2	6	1	1	3		13	0.27	41.7%
Northern flicker							5	2		1	3		11	0.23	33.3%
Northern mockingbird				1	2		5	3	5	9	3	1	29	0.60	66.7%
Osprey											1		1	0.02	8.3%
Peregrine falcon	1		1			2							4	0.08	25.0%
Purple finch							1	4		10			15	0.31	25.0%
Red-breasted merganser	5	1	17	77	7	2						29	138	2.88	58.3%
Red-eyed vireo								1					1	0.02	8.3%
Red-tailed hawk			1				1				3		5	0.10	25.0%
Rock dove	7		18			200			5				230	4.79	33.3%
Ruby-crowned kinglet									1				1	0.02	8.3%
Savannah sparrow							4	1	2		7		14	0.29	33.3%
Sharp-shinned hawk							2		1				3	0.06	16.7%
Snow bunting	6			19									25	0.52	16.7%
Song sparrow		4	5		1	2	6	6	4	3	4		35	0.73	75.0%
Sparrow species							1						1	0.02	8.3%
Tufted titmouse			1				2	1		1	1		6	0.13	41.7%
Turkey vulture											1		1	0.02	8.3%
Unidentified raptor								1					1	0.02	8.3%
Unidentified warbler								5					5	0.10	8.3%
White-throated sparrow			1				1	7	2	1	6		18	0.38	50.0%
White-winged scoter				20	29	2							51	1.06	25.0%
Yellow warbler			1										1	0.02	8.3%
Yellow-billed cuckoo							1						1	0.02	8.3%
Yellow-rumped warbler								5		3	5		13	0.27	25.0%
Grand Total	**177**	**247**	**492**	**213**	**106**	**292**	**189**	**260**	**112**	**79**	**80**	**188**	**2435**	**50.73**	
Species per point	**13**	**9**	**22**	**10**	**13**	**16**	**27**	**25**	**19**	**20**	**22**	**9**	**57**		