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TECHNICAL MEMORANDUM

Results of
Bat Acoustic Surveys at the
Proposed Rocky Ford Wind Resource Area
For the Period April 27 to November 1, 2010

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July 2013

INTRODUCTION

BP Alternate Energy (BPAE) proposed development of a wind energy facility in Botetourt and Rockbridge Counties, Virginia. BPAE requested that Western EcoSystems Technology, Inc. (WEST) develop and implement a standardized protocol for a baseline study of bat activity within the Rocky Ford Wind Resource Area (RFWRA) for the purpose of estimating the impacts of the proposed wind energy facility on bats and to assist with siting turbines to minimize impacts to bats. The protocol for the baseline study is similar to that used at other wind energy facilities across the nation and has been developed based on WEST's experience studying bats at proposed wind energy facilities throughout the US and includes passive acoustic sampling using Anabat™ bat detectors to quantify bat activity in the study area. This memorandum is meant to convey progress and summarize results for the period April 27 to November 1, 2010.

Field Methods

Bat activity was surveyed within the RFWRA using two Anabat detectors from April 27 through November 1, 2010, both of which were placed at fixed ground-based stations. Bats were surveyed using Anabat™ SD-I (Titley™ Scientific, Australia) acoustic detectors. Anabat detectors record bat echolocation calls with a broadband microphone. The echolocation sounds are translated into frequencies audible to humans by dividing the frequencies by a pre-determined ratio. A division ratio of 16 was used for this study. Bat echolocation detectors also detect other ultrasonic sounds, such as those made by insects, raindrops hitting vegetation, and other sources. A sensitivity level of six was used to reduce interference from these other sources of ultrasonic noise. Calls were recorded to a compact flash memory card with large storage capacity. The detection range of Anabat detectors depends on a number of factors (e.g., echolocation call characteristics, microphone sensitivity, habitat, the orientation of the bat, atmospheric conditions; Limpens and McCracken 2004), but is generally less than 30 meters (m; 98 feet [ft]) due to atmospheric absorption of echolocation pulses (Fenton 1991). To ensure similar detection ranges among detectors, microphone sensitivities were calibrated using a BatChirp (Tony Messina, Las Vegas, Nevada) ultrasonic emitter as described in Larson and Hayes (2000).

For each station, bat passes were sorted into two groups based on their minimum frequency as measured in kilohertz (kHz):

High frequency (HF): Above 30 kHz
Low-frequency (LF): Below 30 kHz

Within these categories, an attempt was made to identify passes made by eastern red bats (*Lasiurus borealis*) and hoary bats (*Lasiurus cinereus*).

INTERIM RESULTS AND DISCUSSION

During the period April 27 to November 1, 2010, 5,849 bat passes were recorded during 303 detector-nights, resulting in a mean of 17.74 bat passes per detector per night (Table 1). Detectors were operable for 88.9% of study period. Activity by bats varied considerably between stations (Figure 2), with 8.78 bat passes per detector-night recorded at station RF1 and 26.69 bat passes per detector-night at station RF2 (Table 1). High-frequency bats accounted for about 80% of all bat passes recorded at the RFWRA. A similar distribution between high and low-frequency calls was recorded at each station.

Low-frequency bat activity peaked in late May and was relatively low through much of the remaining study period, with the exception of a smaller peak during the first week in May (Figure 2). High-frequency bat activity was relatively low in May and early June, but increased slightly through late June and July. High-frequency bat activity spiked during two weeks in mid-August, with moderate activity recorded through mid-October, when activity decreased to relatively low levels. Overall bat activity generally mirrored high-frequency bat activity, though the two low-frequency peaks in May were reflected in the overall bat activity (Figure 2).

At station RF1, 24.4% of high-frequency passes were identified as eastern red bat, while only 3.8% of high-frequency passes at station RF2 were identified as eastern red bat calls. Overall, 7.2% of high-frequency bat calls were identified as eastern red bats. Hoary bats accounted for 16.7% of low-frequency calls at station RF1, while only 2.8% of low-frequency calls were identified as hoary bats at station RF2. Overall, 6.6% of low-frequency bat calls were identified as hoary bat passes.

Table 1. Results of acoustic bat surveys conducted within the Rocky Ford Wind Resource Area from April 27 to November 1, 2010. Bat passes are separated by call frequency: high frequency (HF) and low frequency (LF).

AnaBat Station	# of HF Bat Passes	# of LF Bat Passes	# of Eastern Red Bat Passes*	# of Hoary Bat Passes**	Total Bat Passes	Detector-Nights	Bat Passes/ Night***
RF1	774	324	189	54	1,098	125	8.78±1.23
RF2	3,915	836	148	23	4,751	178	26.69±2.28
Total	**4,689**	**1,160**	**337**	**77**	**5,849**	**303**	**17.74±1.33**

* eastern red bat passes were included in high-frequency (HF) numbers.
** hoary bat passes were included in low-frequency (LF) numbers.
*** ± bootstrapped standard error.

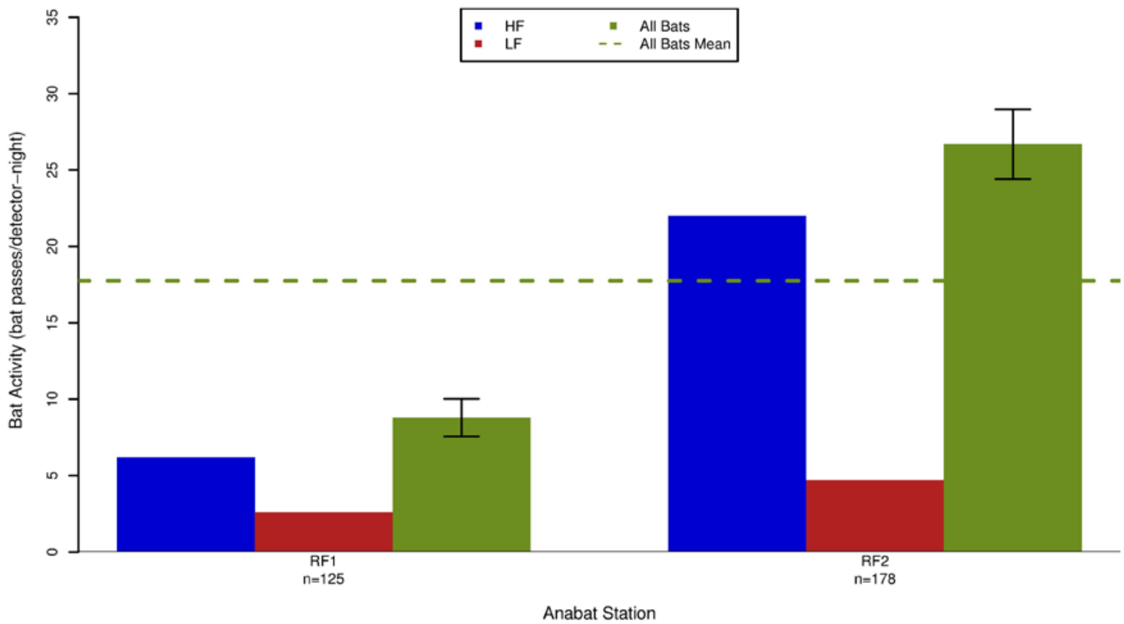

Figure 2. Number of bat passes per detector-night at fixed stations within the Rocky Ford Wind Resource Area for the study period April 27 to November 1, 2010. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

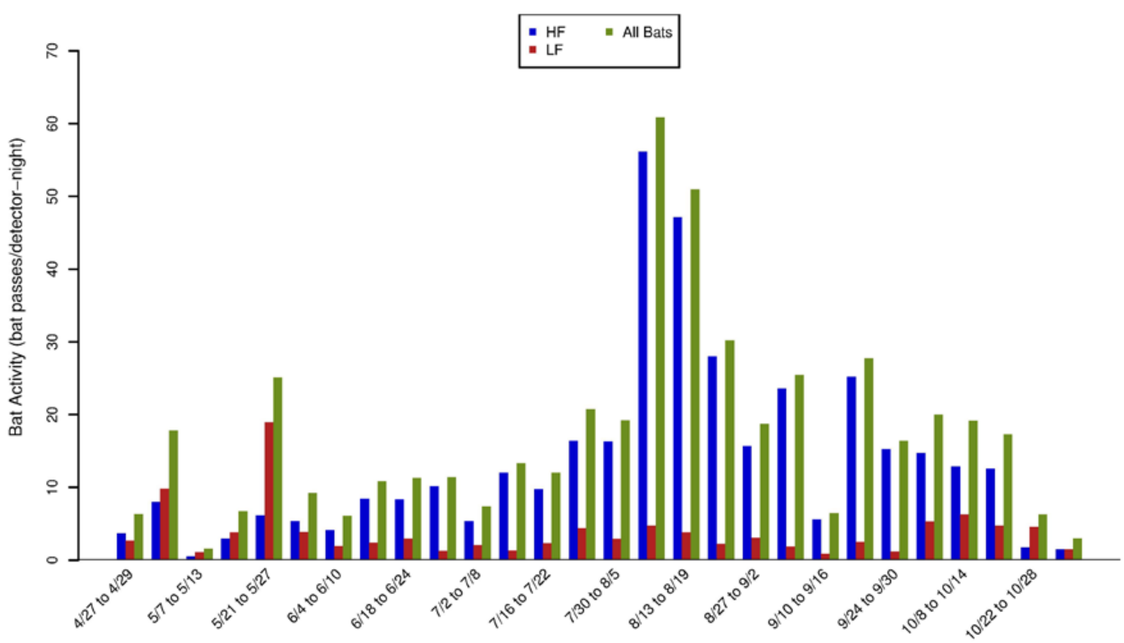

Figure 3. Weekly patterns of bat activity among fixed stations within the Rocky Ford Wind Resource Area for the study period April 27 to November 1, 2010.

DISCUSSION

Assessing the potential impacts of wind energy development on bats at the RFWRA is complicated because the proximate and ultimate causes of bat fatalities at turbines are poorly understood (Kunz et al. 2007a, 2007b; Baerwald et al. 2008; Cryan and Barclay 2009; Long et al. 2010a, 2010b) and monitoring elusive, night-flying animals is inherently difficult (O'Shea et al. 2003). Although installed capacity for wind energy has increased rapidly in recent years, release of study results from these existing wind energy facilities has lagged the influx of newly proposed facilities (Kunz et al. 2007b); therefore, it is often the case that information gleaned from existing wind energy facilities is not available to inform assessments at proposed facilities. To date, post-construction monitoring studies of wind energy facilities suggest that the majority of fatalities occur during the post-breeding or fall migration season (Johnson 2005, Arnett et al. 2008) and migratory tree-roosting species (e.g., eastern red, hoary, and silver-haired bats) compose the majority of reported bats killed (Arnett et al. 2008, Gruver et al. 2009).

While inconsistencies among studies (e.g., differences in study period length and timing, type of equipment, placement of equipment, and presentation of data) complicate comparisons across studies, some generalizations can be made. Bat fatality rates in the Northeast (Virginia, West Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York. Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, and eastern Ontario) varied considerably among studies, within the highest fatality rate reported in 2003 at the Mountaineer facility in West Virginia (31.69 bat fatalities/MW/year; Kerns and Kerlinger 2004) and the lowest during the 2011 study in Kibby, Maine (0.12; Stantec 2012). The bat fatality rate recorded during the 2003 Mountaineer study was nearly twice as high as the second highest bat fatality rate in the Northeast (17.53 bat fatalities/MW/year at Mount Storm [2009], West Virginia; Young et al. 2010). To date, bat fatality rates reported at Northeastern wind energy facilities have varied considerably; it is likely that bat fatality rates at the RFWRA would be within the range of bat fatality rates recorded at other wind resource areas in the Northeast region.

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