Bat and Bird Data Analysis and Results Summary

May 2021 to April 2022

Progress Report #2 & 3

US Wind Metocean Buoy Campaign

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Executive Summary

This report summarizes bat and bird acoustic data collected between 19 May 2021 and 05 April 2022 at the E14 US Wind buoy. Results are presented cumulatively such that findings reported in prior reports are contained in subsequent reports. Bat and bird acoustic sensors were deployed with the E14 US Wind buoy on 19 May 2021 and continue to collect data at the time of this reporting. Here we present the bat and bird acoustic results associated with the above water acoustic sensors deployed on the buoy. To date we have recorded 37 bat and 72 bird occurrences, representing 14 unique species identified by their vocalization characteristics (**Table 1**). Bat acoustic detections were produced by three species: eastern red bat, hoary bat, and silver-haired bat. Silver-haired bats accounted for 67.6% (n=25) of bat vocalization sequences. Bird acoustic detections were produced by 11 species (Table 1). Gull species accounted for 87.5% of all avian vocalization sequences with most calls produced by herring gull (n=59).

Table 1. Bat and Bird Species Identified between 19 May 2021 and 05 April 2022

Taxonomic Group	Species / Species Group	Vocalization Sequences
Bats	Eastern Red Bat	9
	Hoary Bat	3
	Silver-haired Bat	25
Bats Total		**37**
Birds	Herring Gull	59
	Great black-backed Gull	3
	Laughing Gull	1
	Common Loon	1
	Semipalmated Plover	1
	Solitary Sandpiper	2
	Spotted Sandpiper	1
	Magnolia Warbler	1
	Chestnut-sided Warbler	1
	Blackpoll Warbler	1
	Wood Thrush	1
Birds Total		**72**
TOTAL		**109**

Justification

Bats have been observed offshore for over 100 years (Merriam 1887; Thomas 1921) yet the extent of their presence in the pelagic environment is only recently beginning to be understood. In the Eastern US, most species found offshore are long-distance migratory species, which include eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and silver-haired bats (*Lasionycteris noctivagans*) (Sjollema 2014). Short-distance migratory species from the genus (*Myotis* and *Perimyotis*) have also been detected. Offshore bat activity peaks significantly throughout the autumn migration period of August–early November (Peterson et al. 2014;

Lagerveld 2015, 2017, 2020). Bats have experienced significant population declines via turbine collisions as a result of terrestrial wind energy development; whether a similar collision risk will be experienced at offshore facilities is an open question.

Off the coast of Maryland (USA) the offshore environment provides habitat for waterbird species, including sea ducks, loons, gulls, scoters, terns, alcids, gannets, shearwaters, petrels, and shorebirds. Some passerine species may also use the offshore environment during long-distance seasonal migrations (DeLuca et al. 2015). Understanding the prevalence of certain bird species within the US Wind project area is paramount to evaluating relative exposure and potential risks to species when considering adverse effects such as collision and displacement (Garthe and Hüppop 2004; Furness and Wade 2012; Robinson Willmott et al. 2013).

Understanding the prevalence of birds and bats in the offshore environment and under what ambient conditions they occur prior to, during, and after wind farm construction will provide US Wind the capacity to detect changes to species prevalence and support an informed response to any potential species impacts and identification of any mitigation strategies.

Operations and Analysis Summary

The SM4 Bird acoustic sensor has been operational for 308 days with 161 days of data analyzed (**Figure 1**). The SM4 Bat acoustic detector has been similarly operational for 308 days with 223 days of data analyzed (**Figure 2**). Between 30 December 2021 and 24 January 2022, there was an apparent power supply issue that left the system non-operational for 25 days. Between 25 January 2022 and 05 April 2022, both acoustic sensors were collecting data but there was an error on both units whereby the internal clocks reset, making it impossible to know the timestamps for each detection. The clock error did not influence the bat acoustic data because there were no bat vocalizations recorded over the 70-day period, which is consistent with our expectations that bats are mostly absent offshore between the late fall and early spring. However, 43 mostly gull vocalization sequences were recorded during the clock error period and we were unable to match the vocalizations to a specific day within the data collection period.

Data collected by SD card A on the SM4 Bird sensor spanning 30 Aug 2021–31 Oct 2021 did not transfer to the analysts working drive. We have now re-copied the contents of Card A and those data are currently being analyzed (**Table 2**). Data associated with the period spanning 06 April 2022 and 30 June 2022 (data collection period 4) are currently being processed (**Table 2)**.

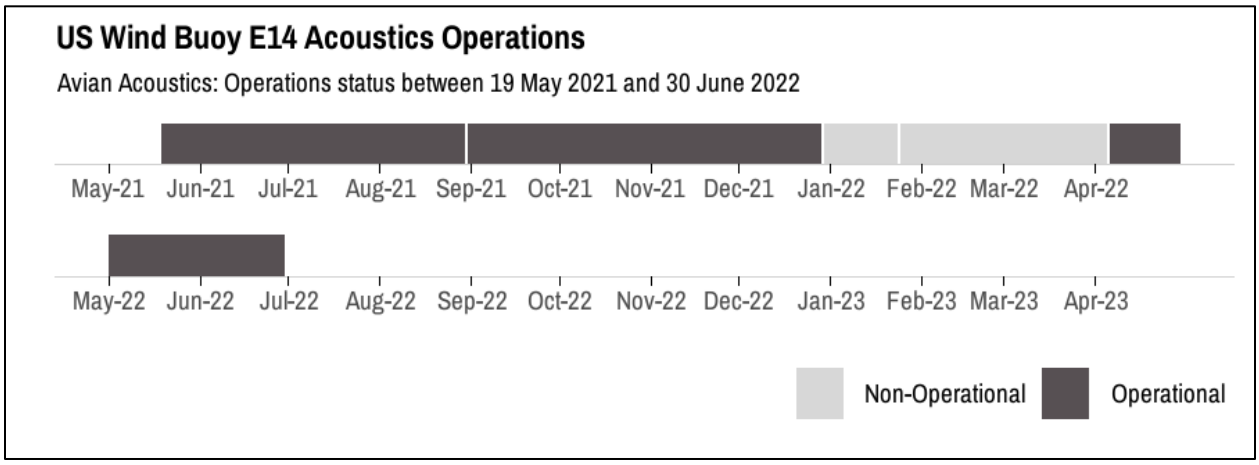

Figure 1. Bird acoustic sensor operations on the E14 US Wind buoy during data collection periods 1–3.

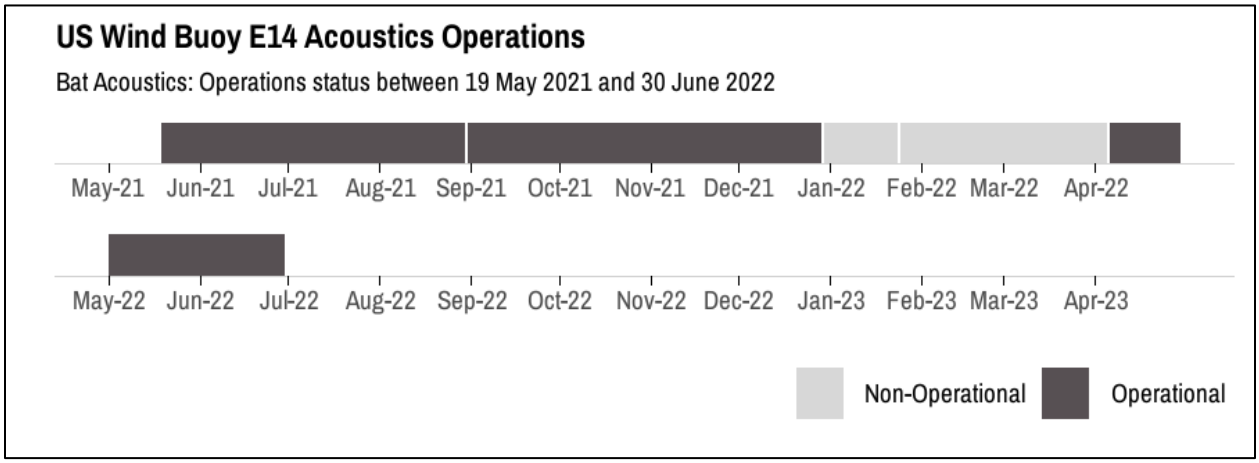

Figure 2. Bat acoustic sensor operations on the E14 US Wind buoy during data collection periods 1–3.

Table 2. Deployment and Operation Information Associated with SM4 Bat Acoustic Data and SM4 Bird Acoustic Data Collected at the E14 US Wind Buoy

Taxonomic Group	Collection Period	Collection Period Date Range	Collection Period (days)	Detector Operational Periods	Detector Operational Period (days)	% Days Operational	Data Status
Bats	1	19 May 2021–30 Aug 2021	103	19 May 2021–30 Aug 2021	103	100.0%	Analyzed and reported in this volume
	2	30 Aug 2021–24 Jan 2022	145	30 Aug 2021–29 Dec 2021	120	82.7%	Analyzed and reported in this volume
	3	25 Jan 2022–05 Apr 2022	70	Acoustic recordings collected but instrument clock failed	NA - Timestamp data unavailable	NA	Analyzed and reported in this volume
	4	06 Apr 2022–30 June 2022	85	Early indication is all 85 days were operational	-	-	Data processing
Birds	1	19 May 2021–30 Aug 2021	103	19 May 2021–30 Aug 2021	103	100.0%	Analyzed and reported in this volume
	2	**Card A**: 30 Aug 2021–31 Oct 2021	61	30 Aug 2021–31 Oct 2021	61	100.0%	Data processing
		Card B: 01 Nov 2021–24 Jan 2022	83	01 Nov 2021–29 Dec 2021	58	69.8%	Analyzed and reported in this volume
	3	25 Jan 2022–05 Apr 2022	70	Acoustic recordings collected but instrument clock failed	NA - Timestamp data unavailable	NA	Analyzed and reported in this volume
	4	06 Apr 2022–30 June 2022	85	Early indication is all 85 days were operational	-	-	Data processing

Bat Acoustic Analysis Summary

Upon data receipt we uploaded the contents of each card to the Normandeau ReMOTe server for storage and processing. We then ran each data set through bat acoustic identification software SonoBat (Arcata, USA). Generally running files through a scrubber can eliminate WAV files that are algorithmically determined to be noise files rather than bats based on features of the sonogram. For example, WAV files with bandwidth below 20 kHz can be identified and eliminated as produced by audible insect noises, and files that have pulses of sound above 20 kHz can be kept for further analysis. With the buoy data, it is difficult to pre-filter noise because, unlike insect chatter, noise associated with the other equipment on the buoy such as the LiDAR make detectable pulsing ultrasonic noise that scrubber algorithms will not eliminate. We therefore used the SonoBat automated identification classifier on all recorded WAV files.

We determined the most typical SonoBat output for non-bat high frequency recordings (i.e., noises generated by peripheral buoy sensors) was a constant pulse approximately every 10 m/sec with a mean characteristic frequency of ≈39.75 kHz and a bandwidth of ≈4 kHz. The characteristics of these sounds are not like any bat species, and we determined which calls were more likely bats based on these parameters effectively scrubbing all the files to a reduced batch for manual vetting (≈90% reduction).

Bat Acoustic Results Summary

To date we have recorded 37 discrete bat call sequences at the E14 buoy (Figure 3, Table 3Table 3. Bat Occurrences by Date

No bat recordings were captured between 25 Jan 2022 and 05 April 2022 when timestamps were not correctly recorded.). Overall bat activity was low at the buoy with the maximum of five vocalization sequences in a day on 19 October 2021 and four sequences per day on only two occasions. One vocalization from an eastern red bat was recorded during the spring 2021 migratory period (**Figure 3**). The remaining 36 vocalization sequences were recorded during the fall 2021 migratory period between August and October (**Figure 3)**. Increased activity during the fall migratory period is consistent with the literature. Overall, bat activity was very low throughout the summer months consistent with the literature and other survey data, which show that bat activity is higher during fall migration. Spectrograms collected at the E14 US Wind Buoy for eastern red bat, hoary bat, and silver-haired bat are shown in **Figure 4, Figure 5,** and **Figure 6**.

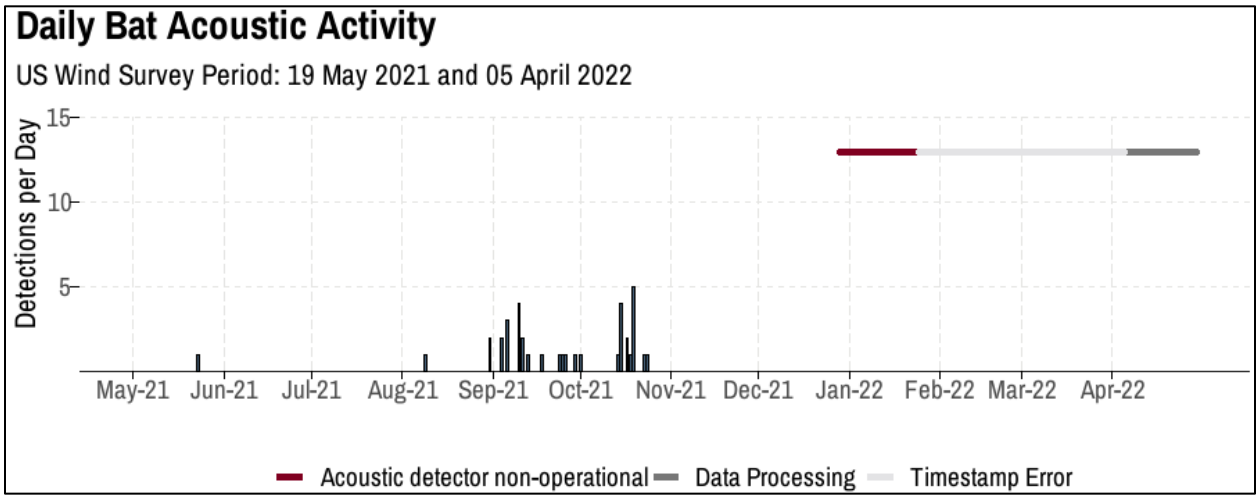

Figure 3. Daily bat occurrences at the E14 US Wind buoy during collection period 19 May 2021–05 April 2022.

Table 3. Bat Occurrences by Date

No bat recordings were captured between 25 Jan 2022 and 05 April 2022 when timestamps were not correctly recorded.

Species	Date	Vocalization Sequences
Eastern red bat	23 May 2021	1
Eastern red bat	09 Aug 2021	1
Eastern red bat	31 Aug 2021	2
Silver-haired bat	04 Sep 2021	2
Eastern red bat	06 Sep 2021	2
Silver-haired bat	06 Sep 2021	1
Silver-haired bat	10 Sep 2021	4
Silver-haired bat	11 Sep 2021	2
Silver-haired bat	13 Sep 2021	1
Eastern red bat	18 Sep 2021	1
Eastern red bat	24 Sep 2021	1

Species	Date	Vocalization Sequences
Silver-haired bat	25 Sep 2021	1
Eastern red bat	26 Sep 2021	1
Silver-haired bat	29 Sep 2021	1
Hoary bat	01 Oct 2021	1
Hoary bat	14 Oct 2021	1
Silver-haired bat	15 Oct 2021	4
Silver-haired bat	17 Oct 2021	2
Silver-haired bat	18 Oct 2021	1
Silver-haired bat	19 Oct 2021	5
Hoary bat	23 Oct 2021	1
Silver-haired bat	24 Oct 2021	1

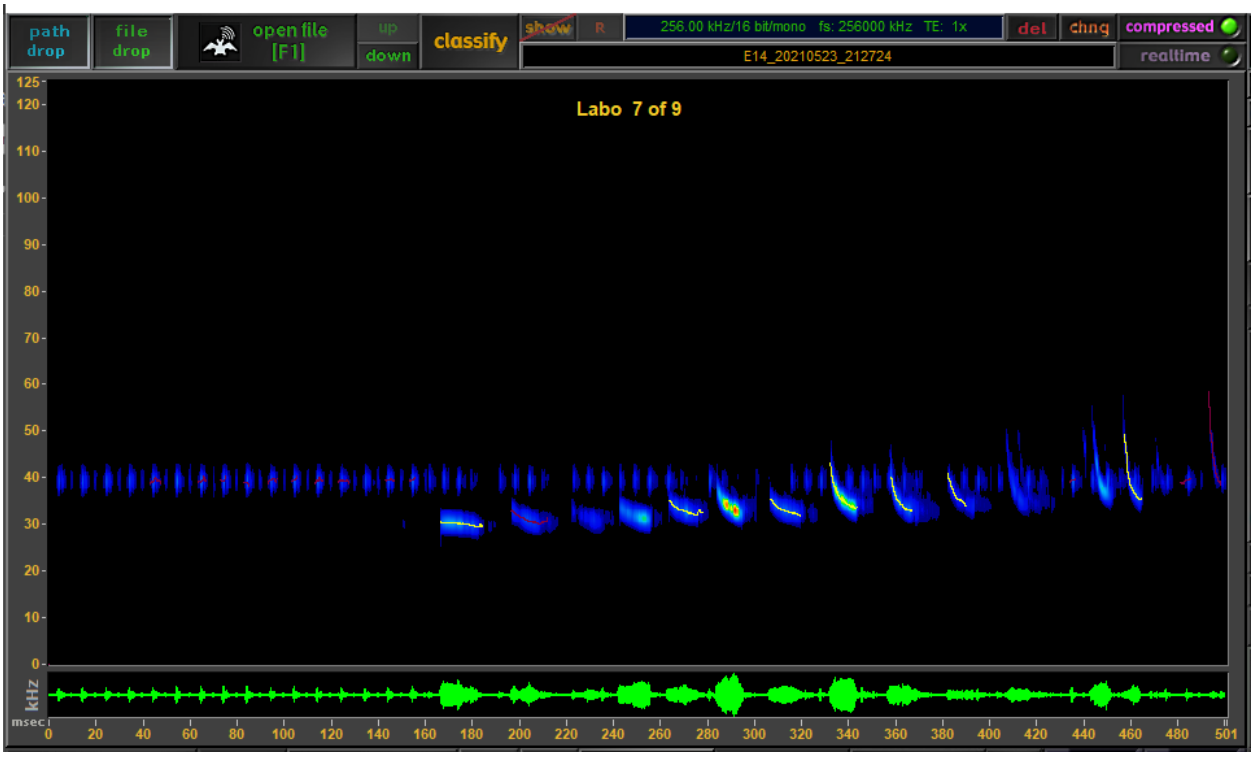

Figure 4. Spectrogram of eastern red bat collected at the E14 US Wind buoy.

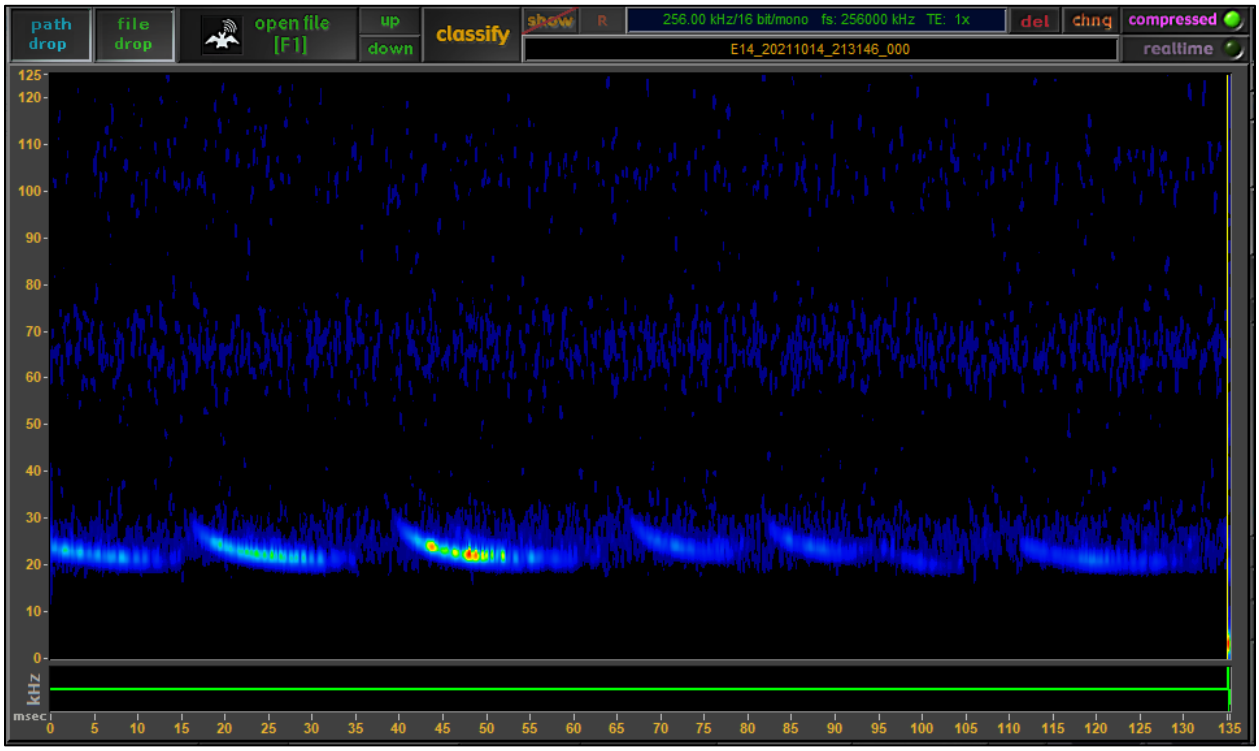

Figure 5. Spectrogram of hoary bat collected at the E14 US Wind buoy.

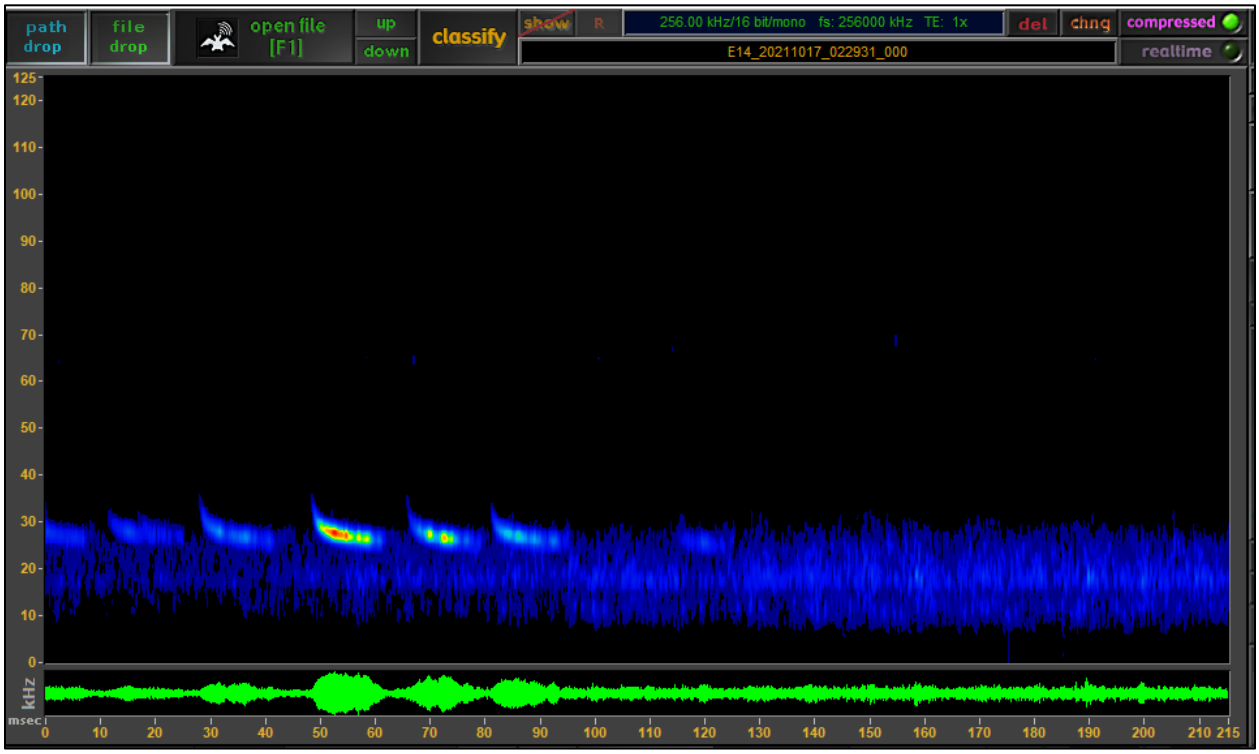

Figure 6. Spectrogram of silver-haired bat collected at the E14 US Wind buoy.

Bird Acoustic Analysis Summary

Bird acoustic data were processed with Wildlife Acoustics Kaleidoscope Pro software using automated detection parameters determined for the flight calls of species in **Table 4** using flight call audio data in the Cornell Lab of Ornithology Macaulay Library archives (https://search.macaulaylibrary.org/catalog). These 30 species were chosen based on sightings noted in ebird.org for the eastern US region and cross-referenced with the Migratory Bird Treaty Act. Note that detection parameters for the species listed do not necessarily exclude other species or non-bird sounds, so manual auditory (headphones) and visual (spectrogram) review of the detections is necessary to confirm any bird call within or outside the list and to exclude false alarms. Additional bird species were confirmed from any detections that did not fall within those listed in **Table 4**, focusing on but not limited to gulls, terns, and sandpipers. This species list is not to be taken as exhaustive as the Kaleidoscope settings can also detect species outside this list.

Manual auditory (headphones) and visual (spectrogram) review was conducted on every detection in the first 200 detections within each cluster generated by the Kaleidoscope Pro software auto-detection cluster analysis. Any clusters with fewer than 200 detections had every detection reviewed. Any detections that were not birds were confirmed to be water, wind, or buoy noise, or some combination of those, and are not listed. For this analysis, one call corresponds to at least one confirmed detection within any one-minute time span. Two calls from the same species within the same minute period are counted as one occurrence.

Table 4. Bird Species whose Flight Calls were used for Automatic Detection Parameter Selection

Herring Gull	Bonaparte's Gull	Great Black-backed Gull
Cape May Warbler	Northern Parula	Palm Warbler
Ovenbird	American Redstart	Yellow Rumped Warbler
Gray-cheeked Thrush	Black Throated Blue Warbler	Black and White Warbler
Blackpoll Warbler	Common Yellow Throat	Bay-Breasted Warbler
Least Bittern	Green Heron	Veery
Magnolia Warbler	Chestnut-sided Warbler	White-throated Sparrow
Blackburnian Warbler	Bobolink	Blue Grosbeak
Yellow Warbler	Savannah Sparrow	Indigo Bunting
Swainson's Thrush	Wood Thrush	Northern Waterthrush

Bird Acoustic Results Summary

We have detected 11 species across 72 vocalization sequences during the first three data collection periods with most calls occurring during the late spring/early summer and late summer/early fall (**Figure 7**). Overall, bird activity at the buoy was consistently low during the summer months with more than 10 detections in a day reached only once. Analysis of bird acoustic data is still underway for the 61 days between 30 Aug 2021 and 31 Oct 2021 contained on data card A, which will be reported in the next progress report. Gull species accounted for 63 (87.5%) of the 72 avian vocalization sequences (**Table 5**). The most commonly occurring species was herring gull (n=59). We observed three vocalization sequences attributed to warbler species: Chestnut-sided Warbler, Blackpoll Warbler, and Magnolia Warbler (**Table 5**).

Representative acoustic bird calls from each species detected at the buoy are pictured in **Figure 9** through Error! Reference source not found..

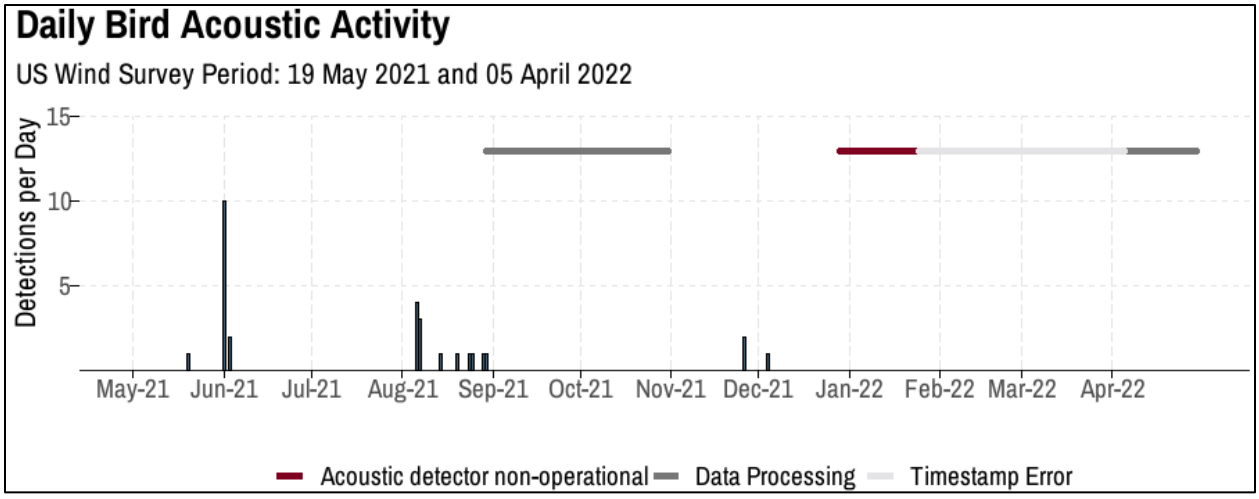

Figure 7. Daily bird occurrences at the E14 US Wind buoy during collection period 19 May 2021–05 April 2022.

Table 5. Bird Occurrences by Date or Data Period for Individuals Recorded when Instrument had a Clock Error

Species	Date	Vocalization Sequences
Chestnut-sided Warbler	20 May 2021	1
Herring Gull	01 Jun 2021	10
Herring Gull	03 Jun 2021	2
Herring Gull	06 Aug 2021	4
Herring Gull	07 Aug 2021	2
Spotted Sandpiper	07 Aug 2021	1
Herring Gull	14 Aug 2021	1
Herring Gull	20 Aug 2021	1
Wood Thrush	24 Aug 2021	1
Solitary Sandpiper	25 Aug 2021	1
Semipalmated Plover	29 Aug 2021	1
Solitary Sandpiper	30 Aug 2021	1
Herring Gull	26 Nov 2021	1
Blackpoll Warbler	26 Nov 2021	1
Common Loon	4 Dec 2021	1
Herring Gull	25 Jan 2022–05 Apr 2022	38
Great black-backed gull	25 Jan 2022–05 Apr 2022	3
Laughing Gull	25 Jan 2022–05 Apr 2022	1
Magnolia Warbler	25 Jan 2022–05 Apr 2022	1

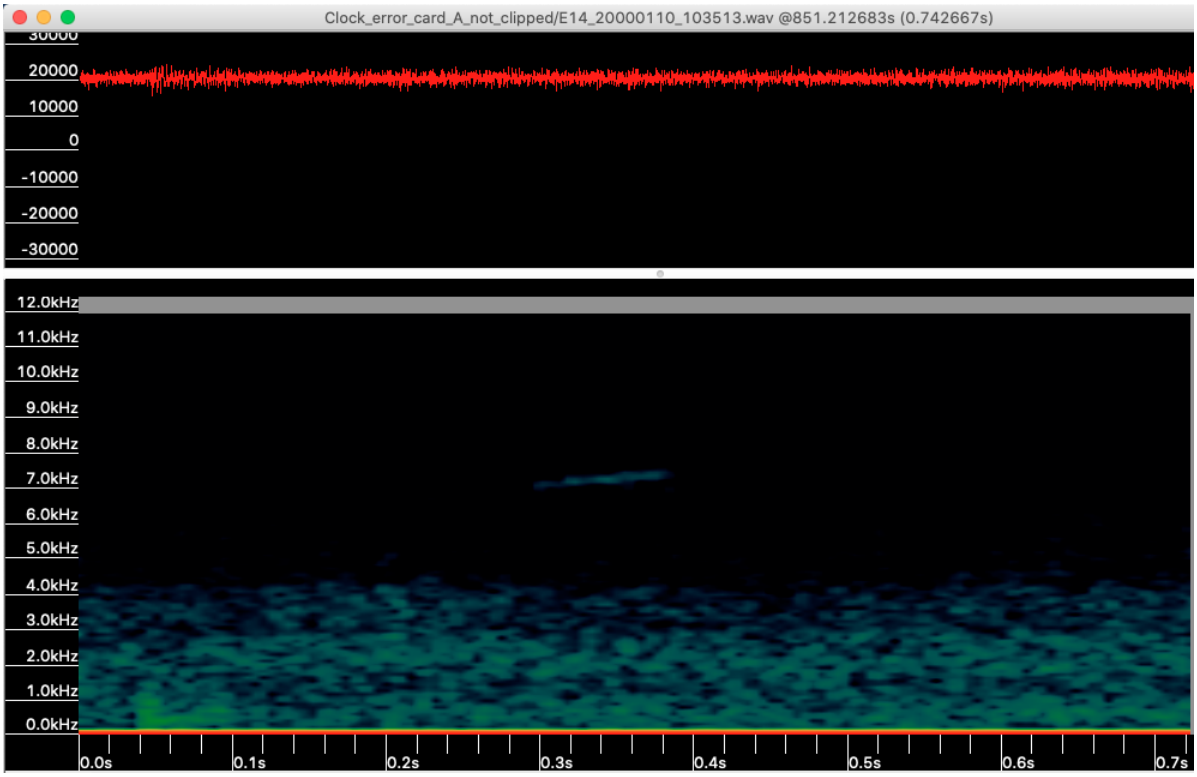

Figure 8. Spectrogram of magnolia warbler call collected at the E14 US Wind Buoy.

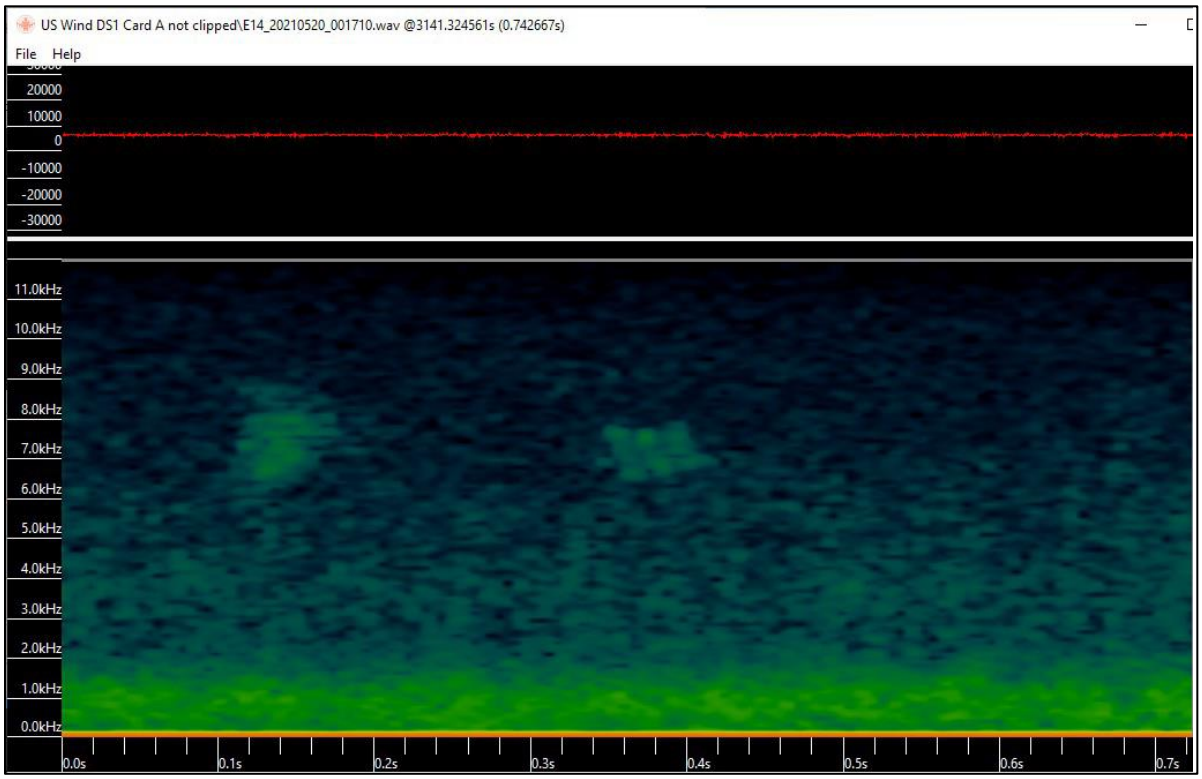

Figure 9. Spectrogram of chestnut-sided warbler call collected at the E14 US Wind Buoy.

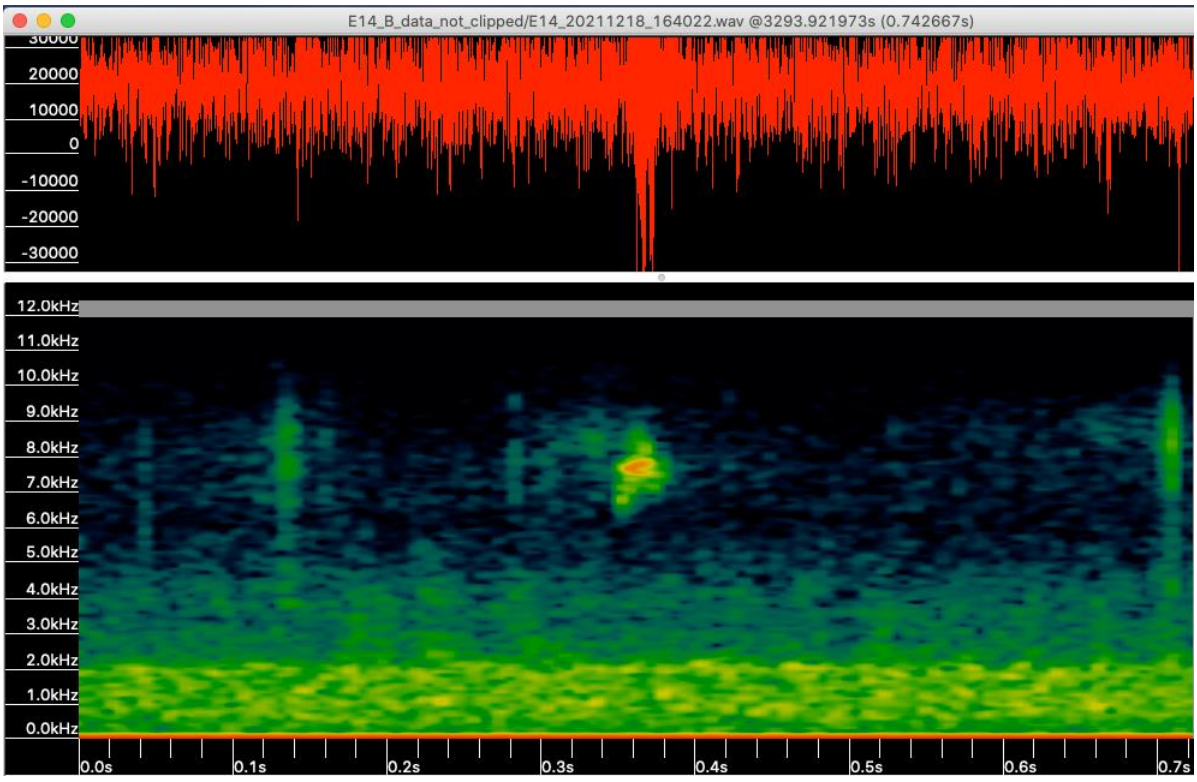

Figure 10. Spectrogram of blackpoll warbler call collected at the E14 US Wind Buoy.

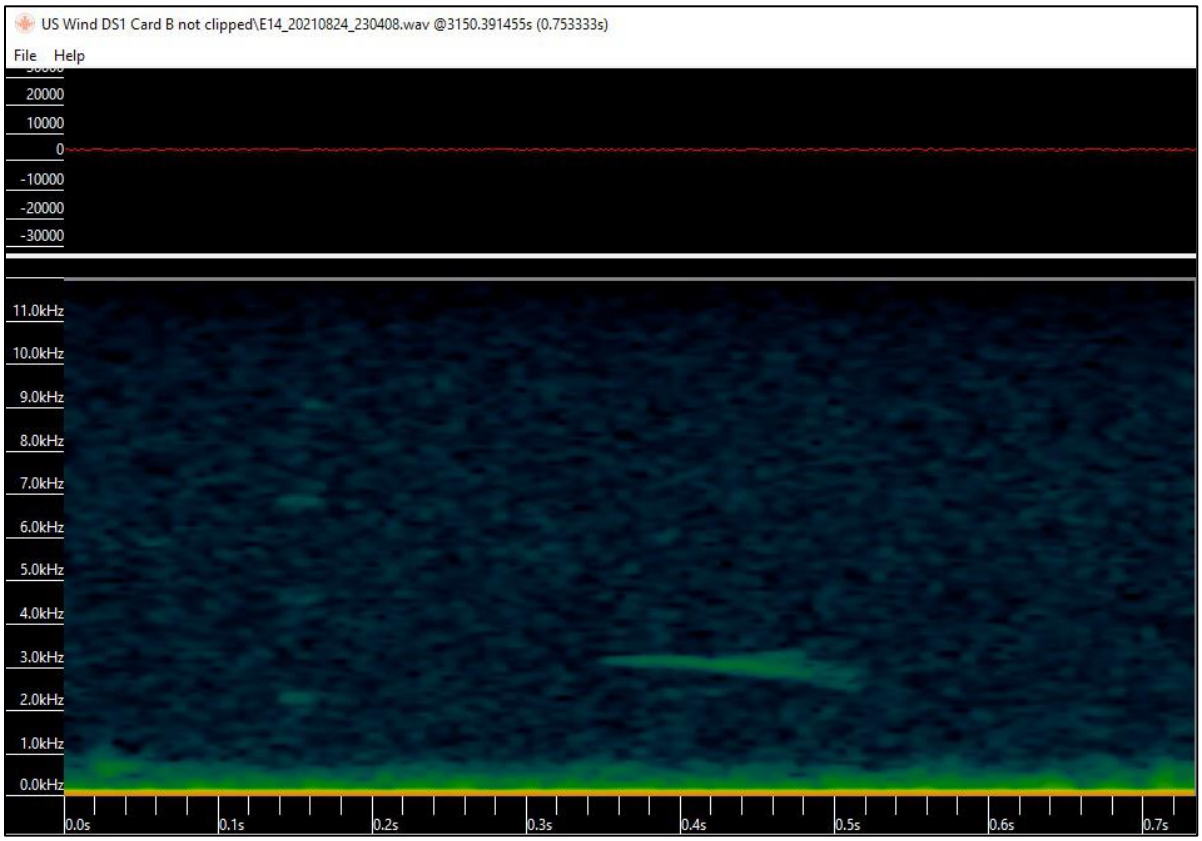

Figure 11. Spectrogram of wood thrush call collected at the E14 US Wind Buoy.

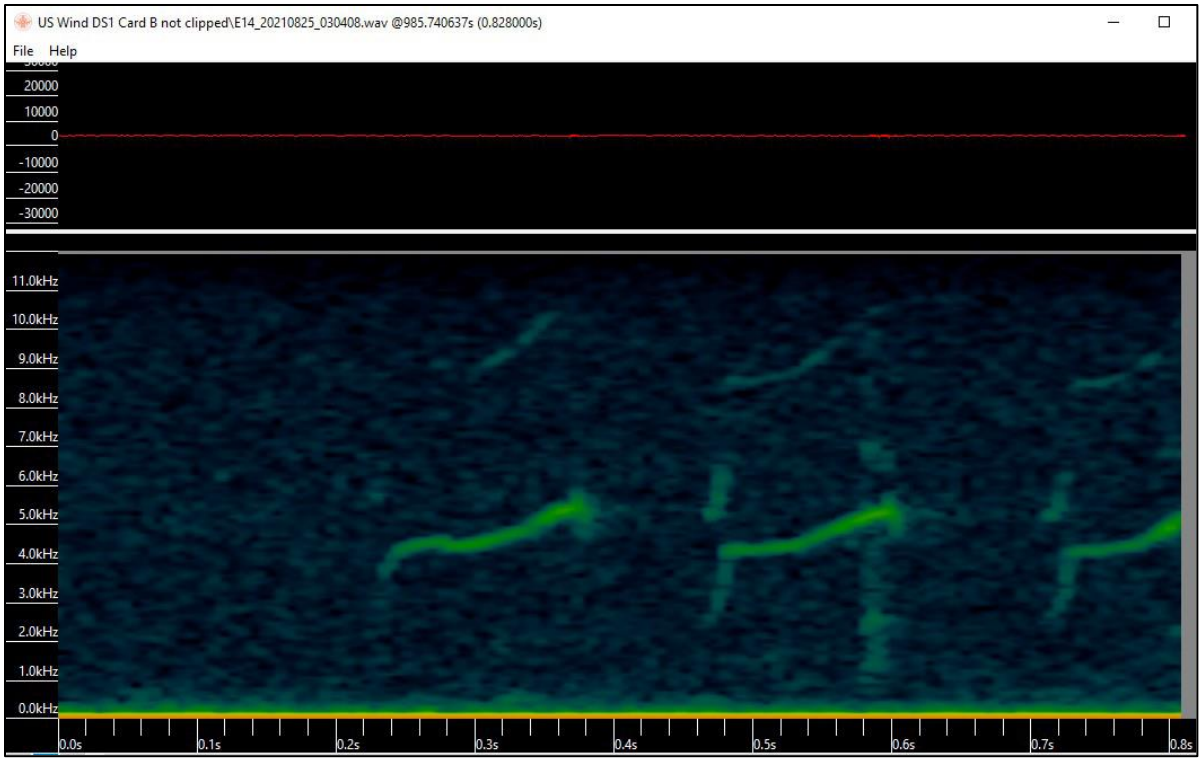

Figure 12. Spectrogram of solitary sandpiper call collected at the E14 US Wind Buoy.

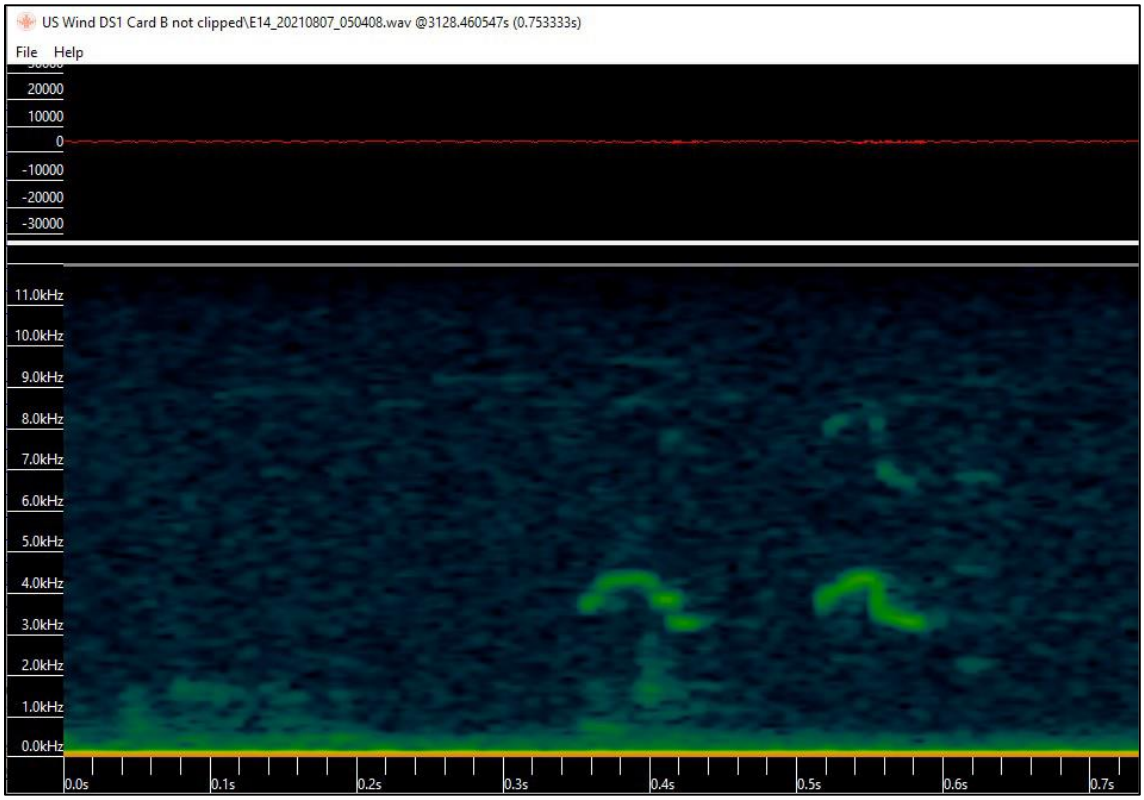

Figure 13. Spectrogram of spotted sandpiper call collected at the E14 US Wind Buoy.

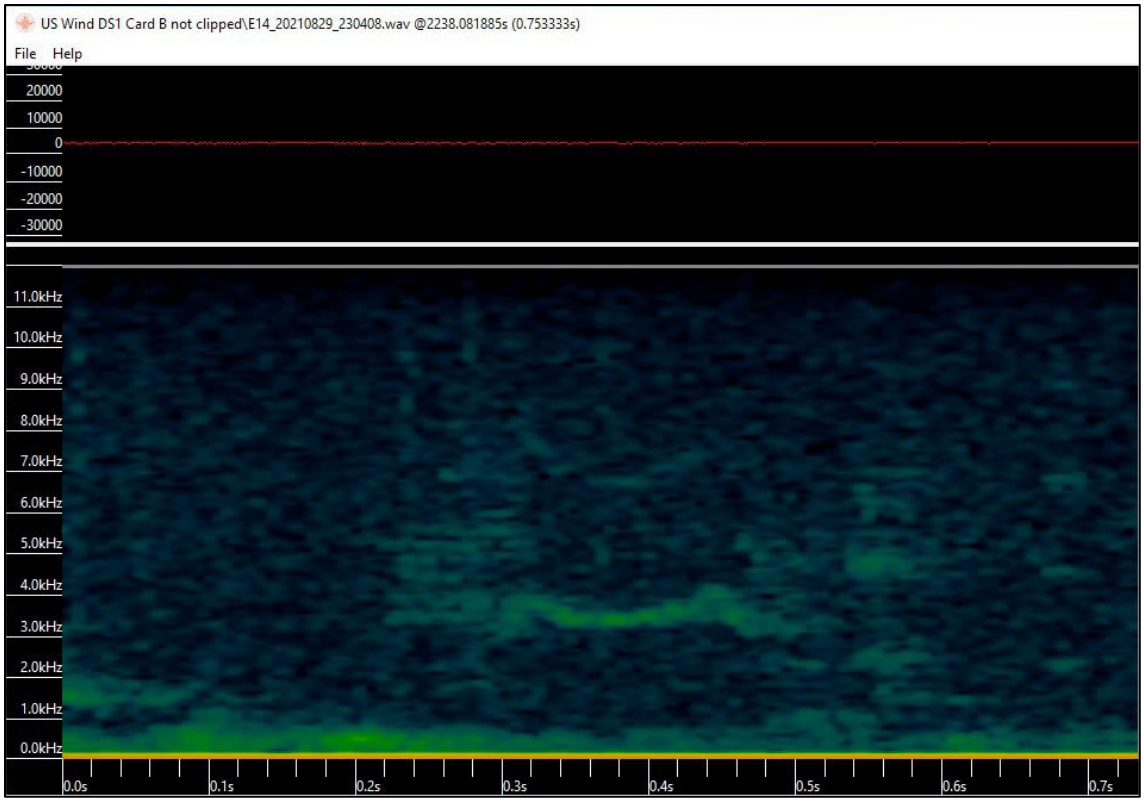

Figure 14. Spectrogram of semipalmated plover call collected at the E14 US Wind Buoy.

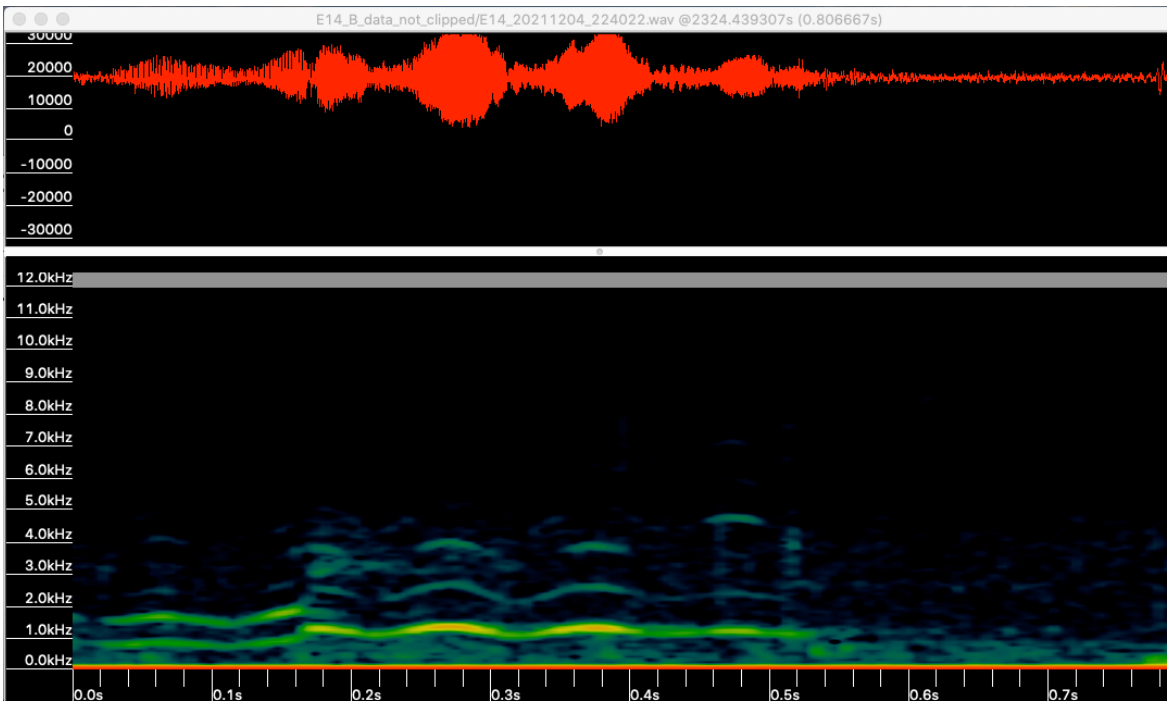

Figure 15. Spectrogram of common loon call collected at the E14 US Wind Buoy.

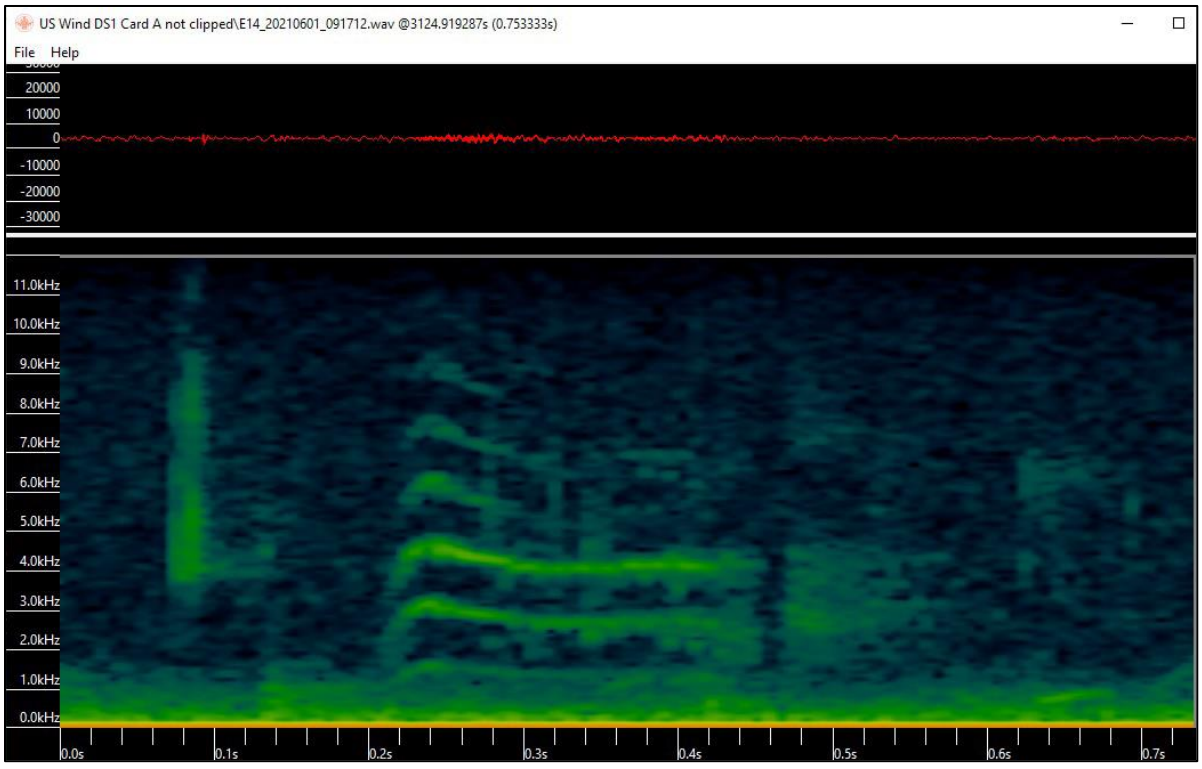

Figure 16. Spectrogram of American herring gull call collected at the E14 US Wind Buoy.

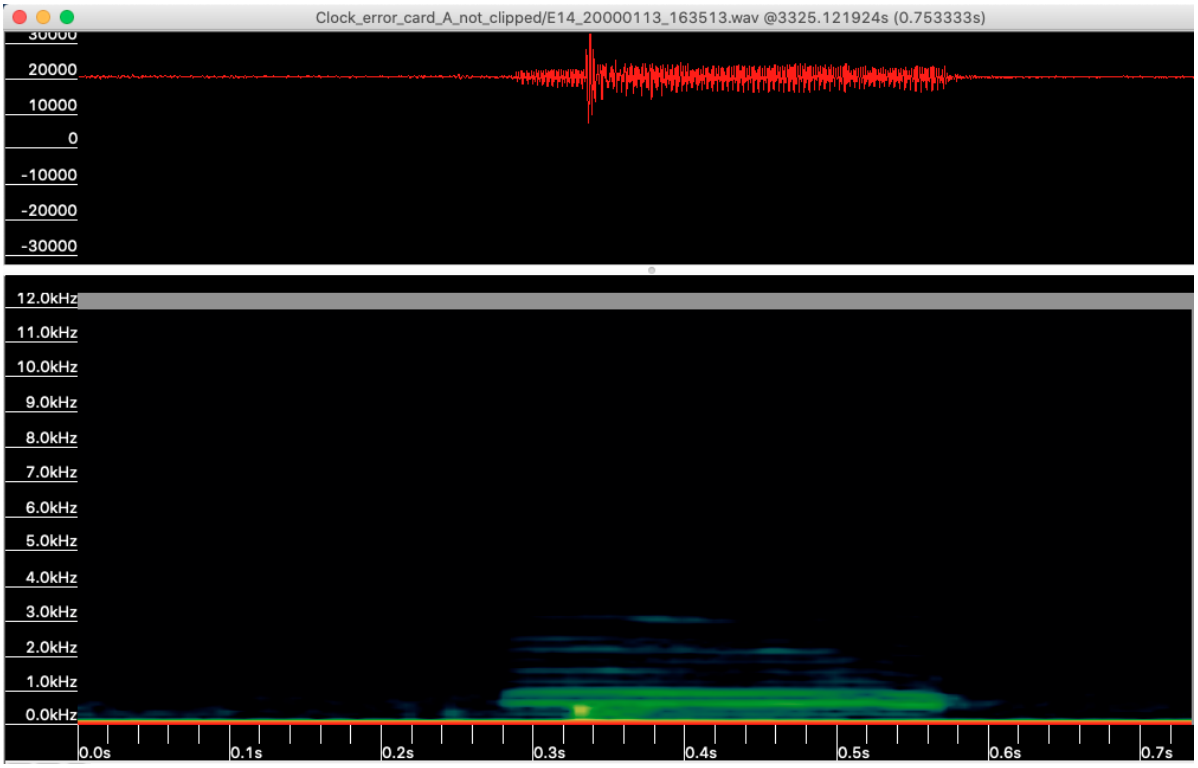

Figure 17. Spectrogram of laughing gull call collected at the E14 US Wind Buoy.

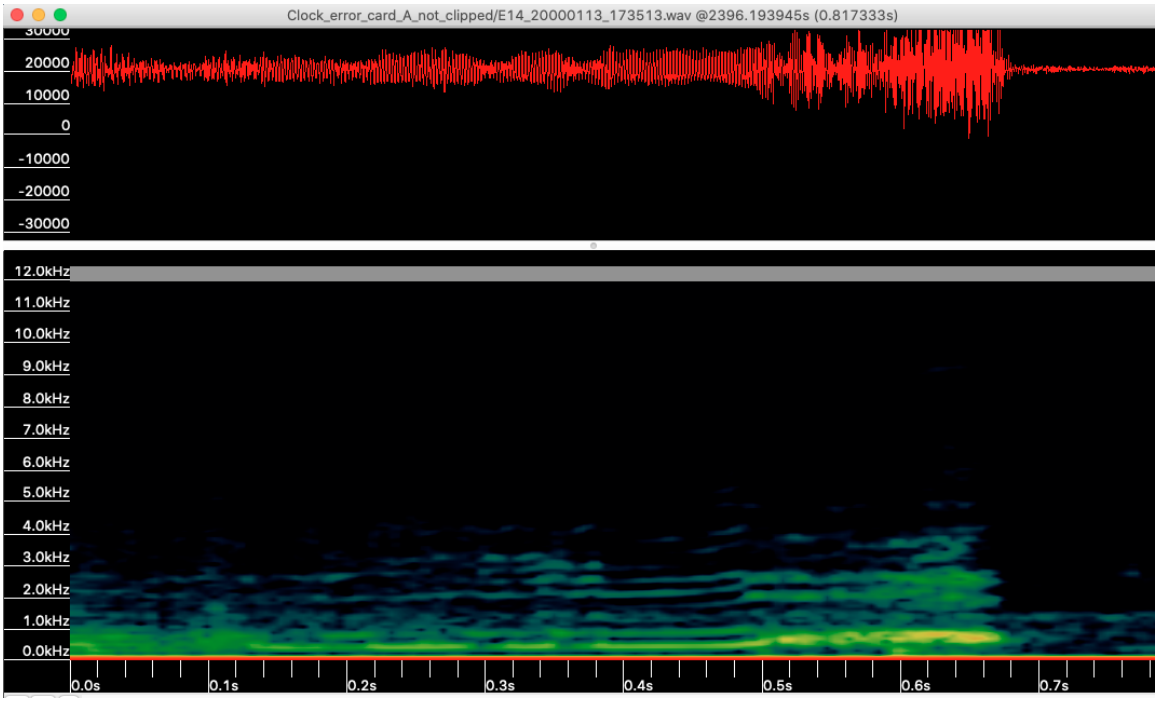

Figure 18. Spectrogram of great black-backed gull call collected at the E14 US Wind Buoy.

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