



Tailoring the analysis of bat acoustic recordings to ecological research goals: effects of changing software parameters

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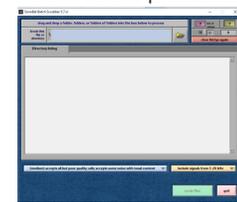
BACKGROUND

- Acoustic data is an important tool for bat monitoring and research.
- Increasingly, there are large repositories of acoustic data (e.g. the National Park Service Bat Acoustic Survey Database; NPS BASD).
- It is vital that our analysis of these data is appropriate for the study question and standardized to allow for effective communication and comparison between studies.
- Objectives:** Assess how altering the 'data scrubbing' and 'call classification' settings in the acoustic data processing program SonoBat affects estimates of:
 - Bat activity (measured in terms of number of bat calls)
 - Functional group activity
 - Species richness

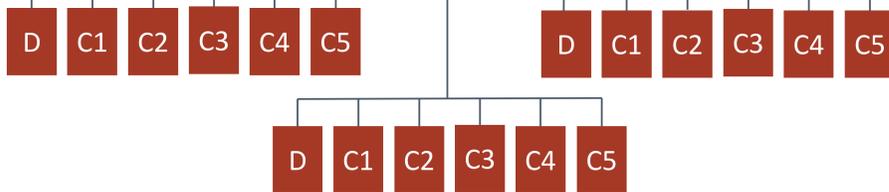
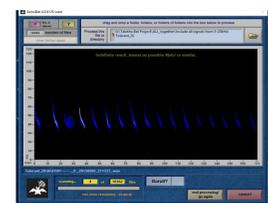
METHODS

- We analyzed acoustic data from 13 sites in Agate Fossil Beds National Park (AGFO) using SonoBat (version 4.0.6; West).

Scrubber: The data were "scrubbed" using different sensitivity settings to remove files of low quality to allow for more efficient processing in the classifier stage.



High Grade Medium Tolerant



Classifier: Then data are run through a classifier algorithm which attributes each file to a bat species and records the probability that this classification is correct.

	Classifier Preferences					
	D	C1	C2	C3	C4	C5
Acceptable Call Quality	0.8	0.6	0.8	0.8	0.8	0.8
Sequence Decision Threshold	0.9	0.8	0.8	0.9	0.95	0.95
Maximum number of calls considered per file	8	8	8	4	16	8

Table 1. SonoBat Classifier settings that were tested. "D" is default settings and "C1" means classifier preferences 1.

RESULTS

Bat Activity

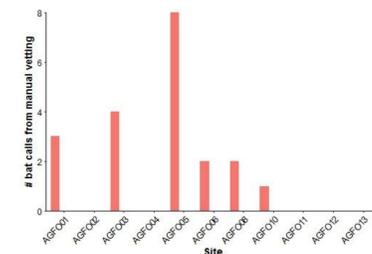


Figure 1. Amount of bat calls found after manually vetting scrubbed files from varying SonoBat scrubber settings. Manual vetting was done in program Raven Pro 1.5.

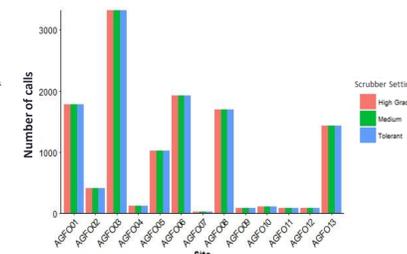


Figure 2. Bat activity estimates using the different SonoBat scrubber setting for each site. SonoBat classifier settings were default (D).

Functional Groups

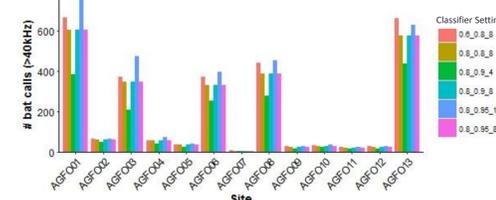
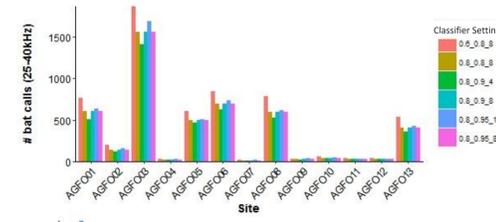
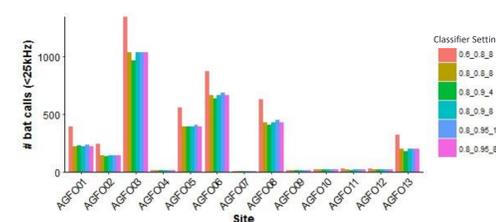


Figure 3. Effects of SonoBat classifier settings (see Table 1) on estimates for amount of bat calls in functional groups (<25kHz, 25-40kHz, >40kHz) when using high grade scrubber setting.

Bat Activity

- Bat calls in the scrubbed files were found through manual vetting only in the high grade setting.
- Scrubber setting does not affect bat activity.

Functional Groups

- There are differences in functional group activity between sites and between classifier settings
- Classifier setting C1 (lower acceptable call quality) had higher estimations for functional groups <25kHz and 25-40kHz.

Species Richness

- Scrubber setting does not affect estimates for number of bat calls from different species.
- The default classifier setting estimated higher amounts of most species.

Species Richness

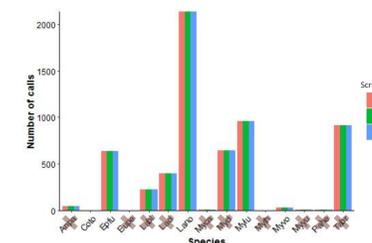


Figure 4. Effects of SonoBat scrubber settings on the estimated number of bat call files for species using default classifier settings (D). The "X" over the name indicates that the species is not likely found in the Park. Note that this study analyzes how the classifier affects estimates, not the accuracy of what the estimates are.

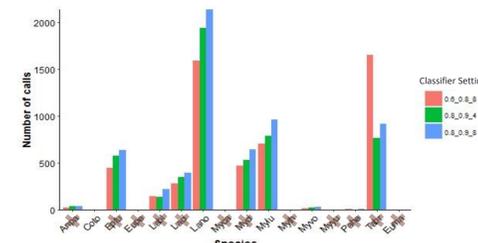


Figure 5. Effects of SonoBat classifier settings (see Table 1) on number of bat call files by species. See Figure 4 for explanation of "X" over name.

CONCLUSION

- Scrubber settings do not affect estimates of bat activity, functional groups, or species richness.
- Classifier settings do affect estimates of functional groups and species richness. The results from this study suggest that the difference in estimates is related to the difference of how stringent the classifier setting is.
- Acceptable call quality had the greatest effect on output estimates compared to other classifier settings. It should be noted that we tested a larger proportional range for acceptable call quality than we did with sequence decision threshold.
- These results suggest that efforts to standardize acoustic data analysis in SonoBat should focus on classifier settings, in particular acceptable call quality.

NEXT STEPS

- Compare our results to actual known estimates of bat activity and richness. (Licht, pers.comm).
- Customize the list of species within the SonoBat classifier algorithm. As of now, SonoBat only allows the user to select regions for the classifier to test against, which can exclude relevant species and include irrelevant species.
- White Nose Syndrome has recently been reported in Nebraska (Figure 6), the state in which these data were collected. It is important that we use these acoustic data to assess potential changes in bat activity and composition using comparable methods.**
- Our study shows the importance of standardizing each analysis step across studies.**

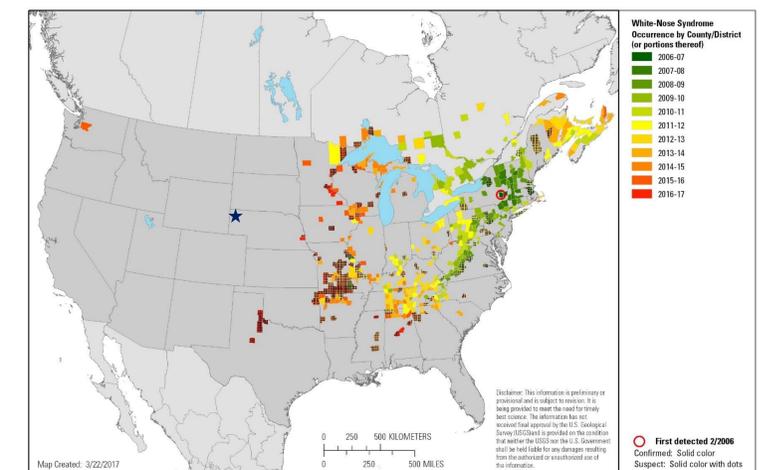


Figure 6. Map of spread of white-nose syndrome across the United States and Canada. The star indicates Agate Fossil Beds National Park. Map from whitenoisesyndrome.org.

ACKNOWLEDGEMENTS

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Licht, Dan. National Parks Service Midwest Regional Wildlife Biologist. 2016. Accuracy of Bat Software. Personal Communication.