

Song Discrimination Between Two Subspecies of Vesper Sparrow: *Pooecetes gramineus affinis* and *Pooecetes gramineus confinis*



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Bird Song

- Each bird species perform unique vocal signals (calls or songs), which can reliably be used to identify species.
- Birdsong is important for reproductive selection, and for the defense of breeding territories.
- Bird songs are culturally transmitted (among oscine passerines). Syllables or phrases are usually unique to species, subspecies or populations.
- Song divergence often parallels genetic divergence between isolated populations.



Vesper Sparrow

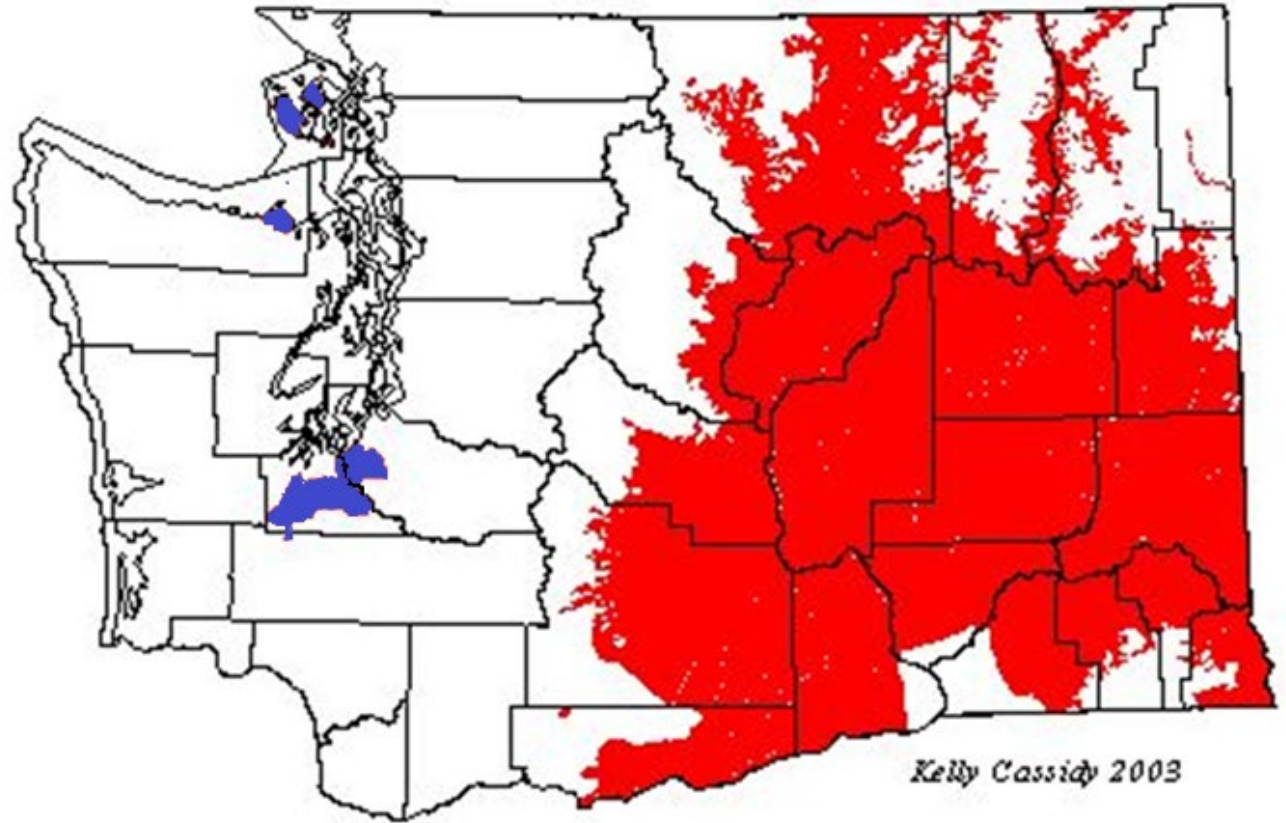
Pooecetes gramineus

- White eye-ring, white outer retrices, and chestnut lesser wing coverts.
- Nearctic migrant.
- Inhabits grasslands with sparse trees and shrubs.
- Limited research on taxonomy of subspecies, mainly based on geographic isolation, and morphological differences of museum specimens.



Vesper Sparrow Subspecies in Washington State

- Oregon vesper sparrow
Pooecetes gramineus affinis
- Western vesper sparrow
Pooecetes gramineus confinis



“Oregon” Vesper Sparrow

Pooecetes gramineus affinis



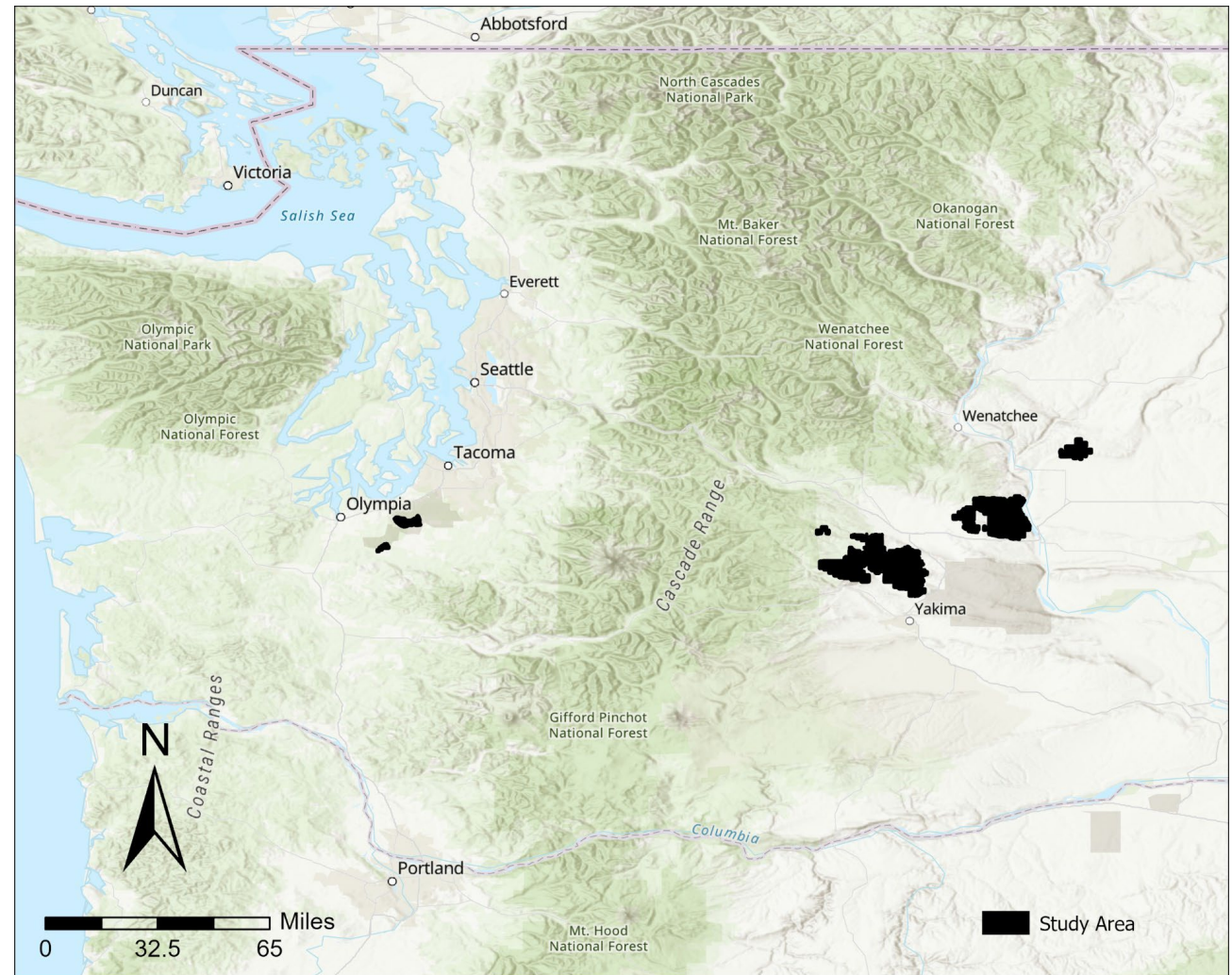
“Western” or “Great Basin” Vesper Sparrow

Pooecetes gramineus confinis



Overview of Study Areas

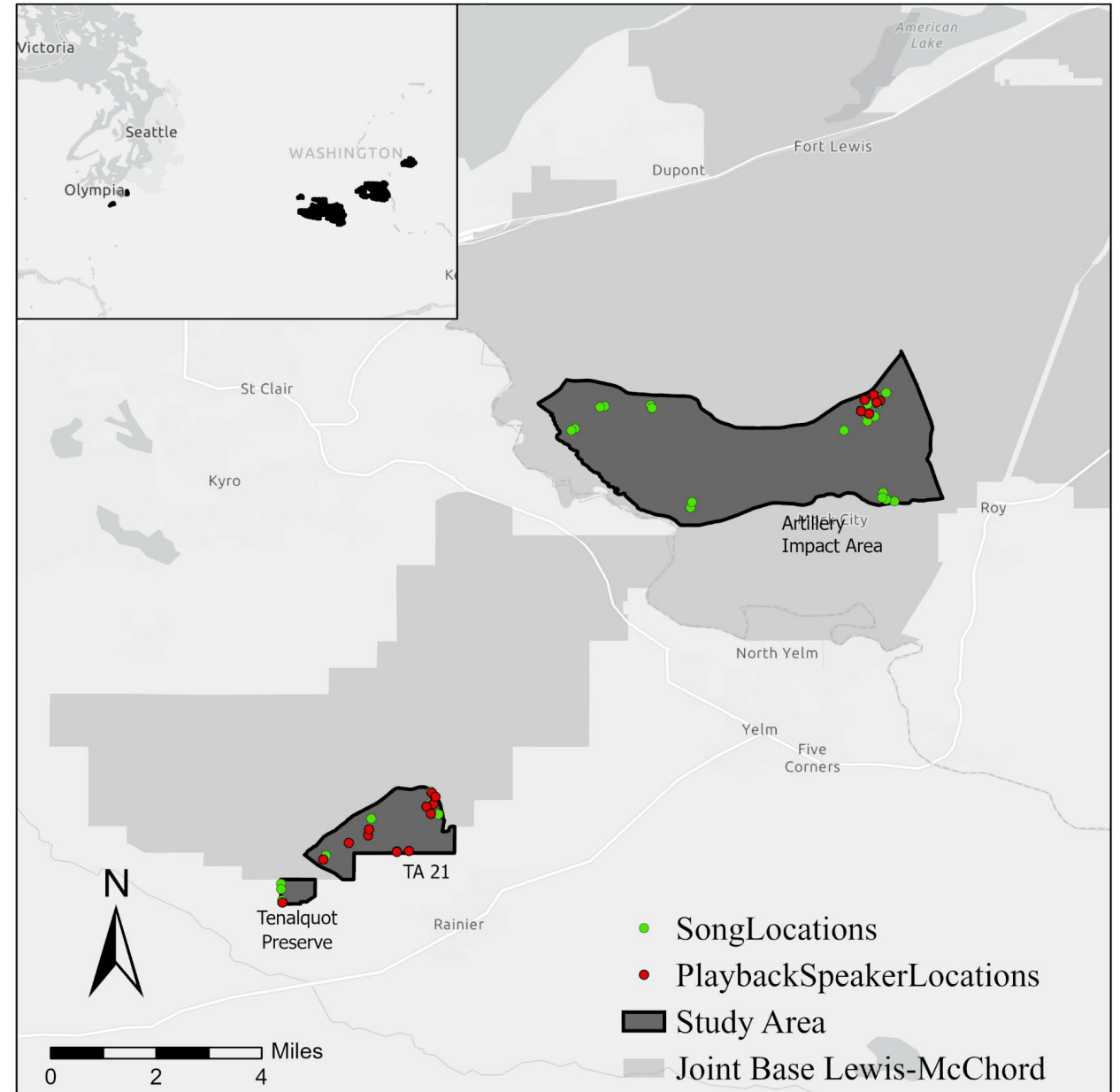
- Oregon vesper sparrow study sites were selected because they were the only place in Washington where the subspecies breeds in numbers.
- Western vesper sparrow study sites were chosen using eBird data. Sites were selected based on proximity to Oregon vesper sparrow population, frequency of vesper sparrow detections, and public access.



Puget Lowlands

- Access to *P. g. affinis* study sites required coordination with Joint Base Lewis-McChord Fish & Wildlife.
- Access into many locations within the Artillery Impact Area required an escort from an Unexploded Ordnance Specialist.
- Limited access in Spring of 2020 meant that playback experiments were restricted to one area within the Artillery Impact Area.

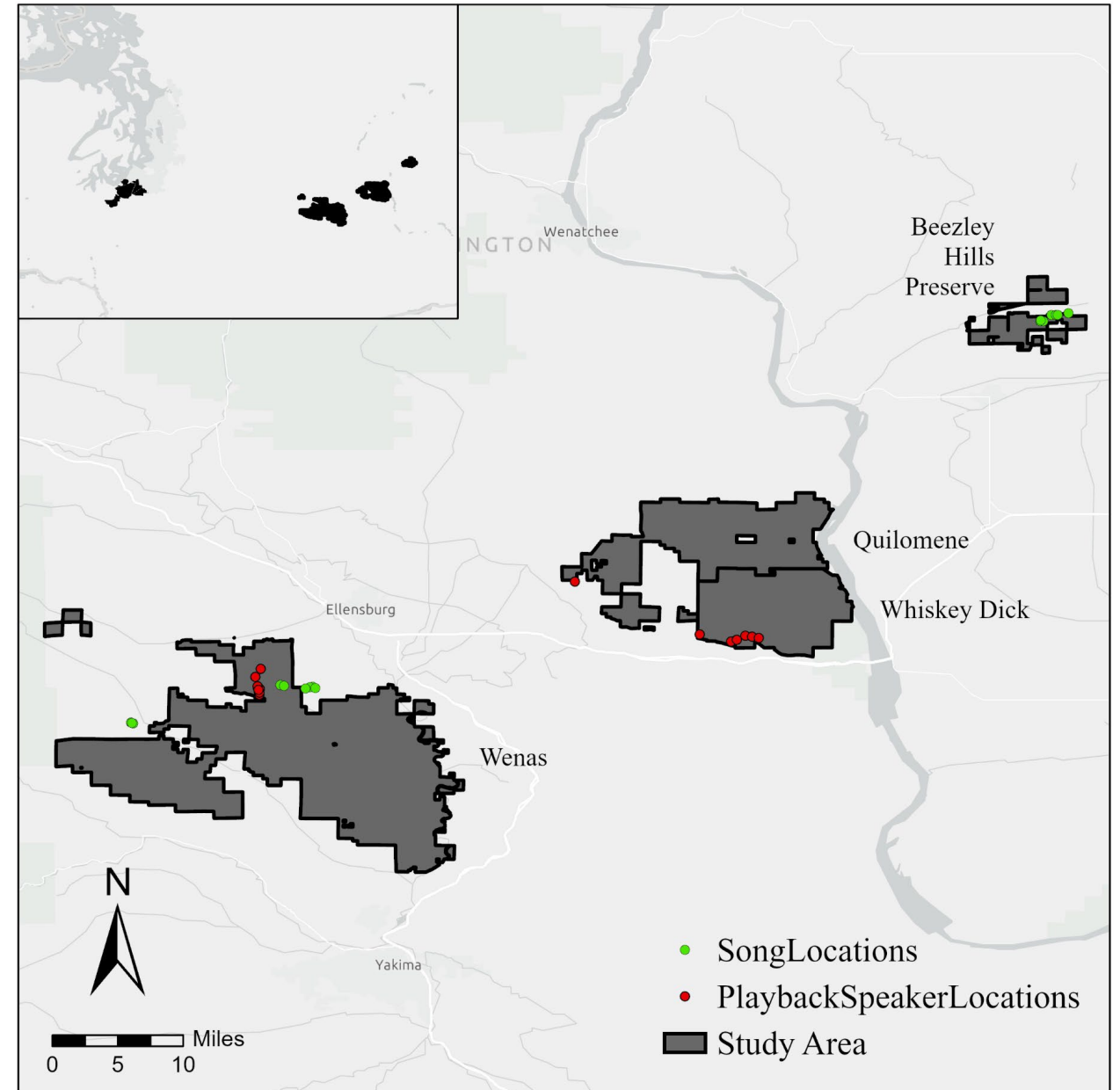
P. g. affinis Study Area



Columbia Basin

- Song recordings took place at Wenas Wildlife Area which is managed by Washington Department of Fish and Wildlife, and The Nature Conservancy's Beezley Hills Preserve.
- Due to the COVID-19 pandemic, a permit to conduct field work was denied at Beezley Hills, and Quilomene/Whiskey Dick Wildlife Areas were used as backup sites.

P. g. confinis Study Area

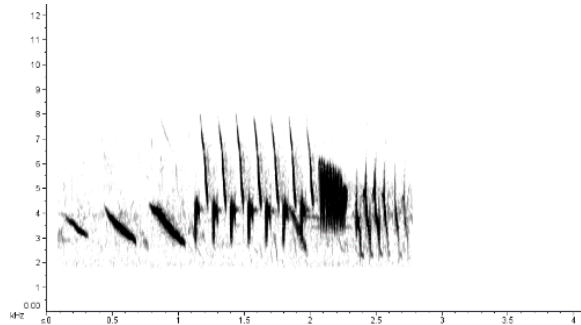


Song Recordings

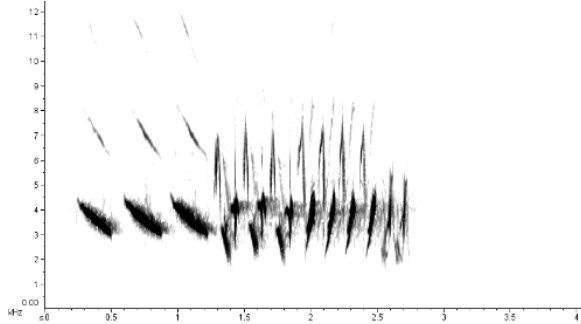
- Recorded with 44.1kHz sampling rate in 16-bit WAV format.
- Olympus LS-100 Multi-track PCM recorder and a Sennheiser ME62 microphone with parabolic reflector.
- Removed background noise using bandpass filters with Raven Pro.
- 6-minute playback treatments w/ 10-second intersong interval made with Audacity.



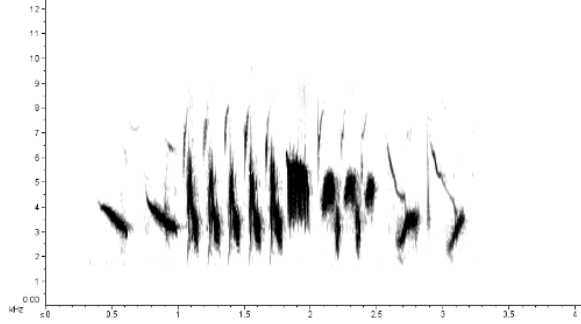
P. g. affinis



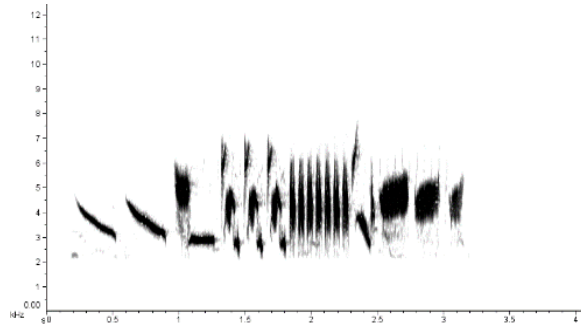
Lower Weir – 01



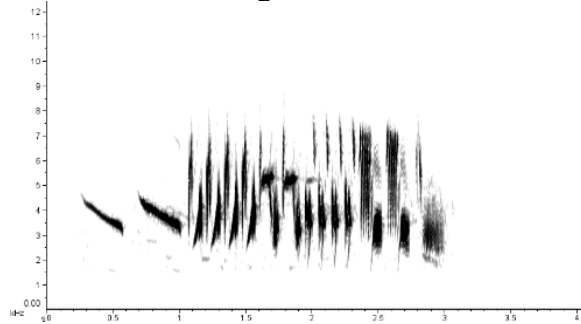
Upper Weir – 04



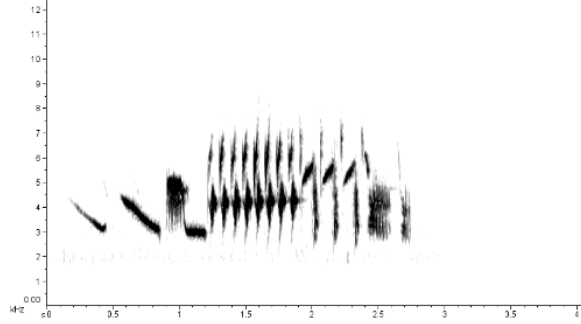
Tenalquot – 02



Range 53 – 01

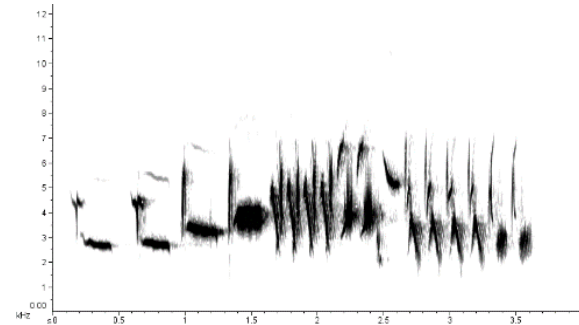


Range 74 – 01

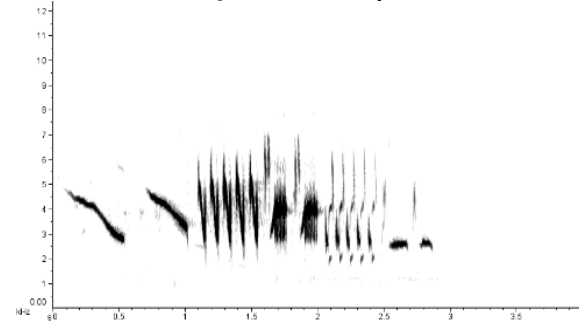


Range 76 – 06

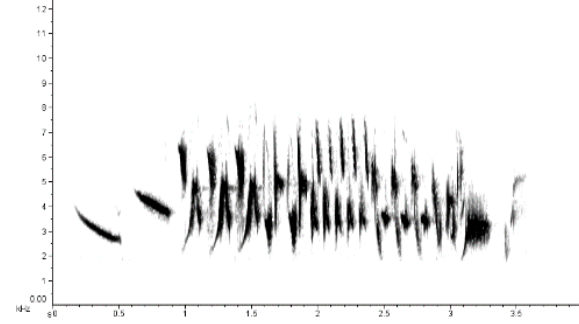
P. g. confinis



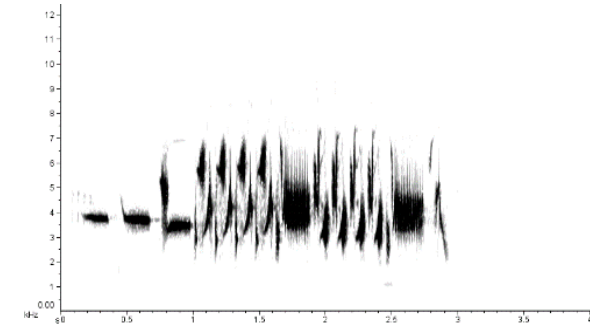
BBQ Horse Camp - 01



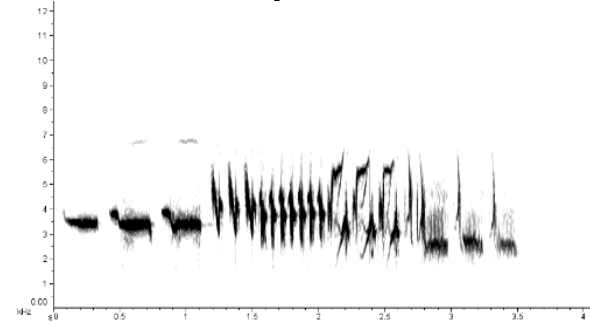
Wenas – 01



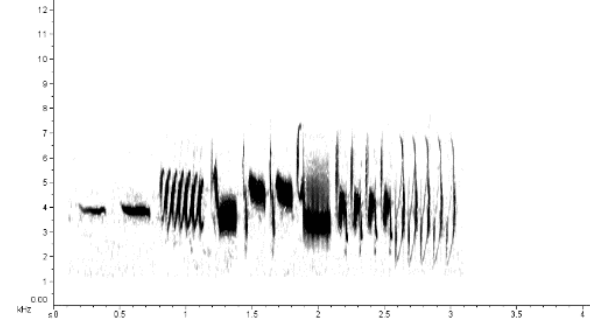
Wenas – 04



Beezley Hills – 01



Beezley Hills – 02

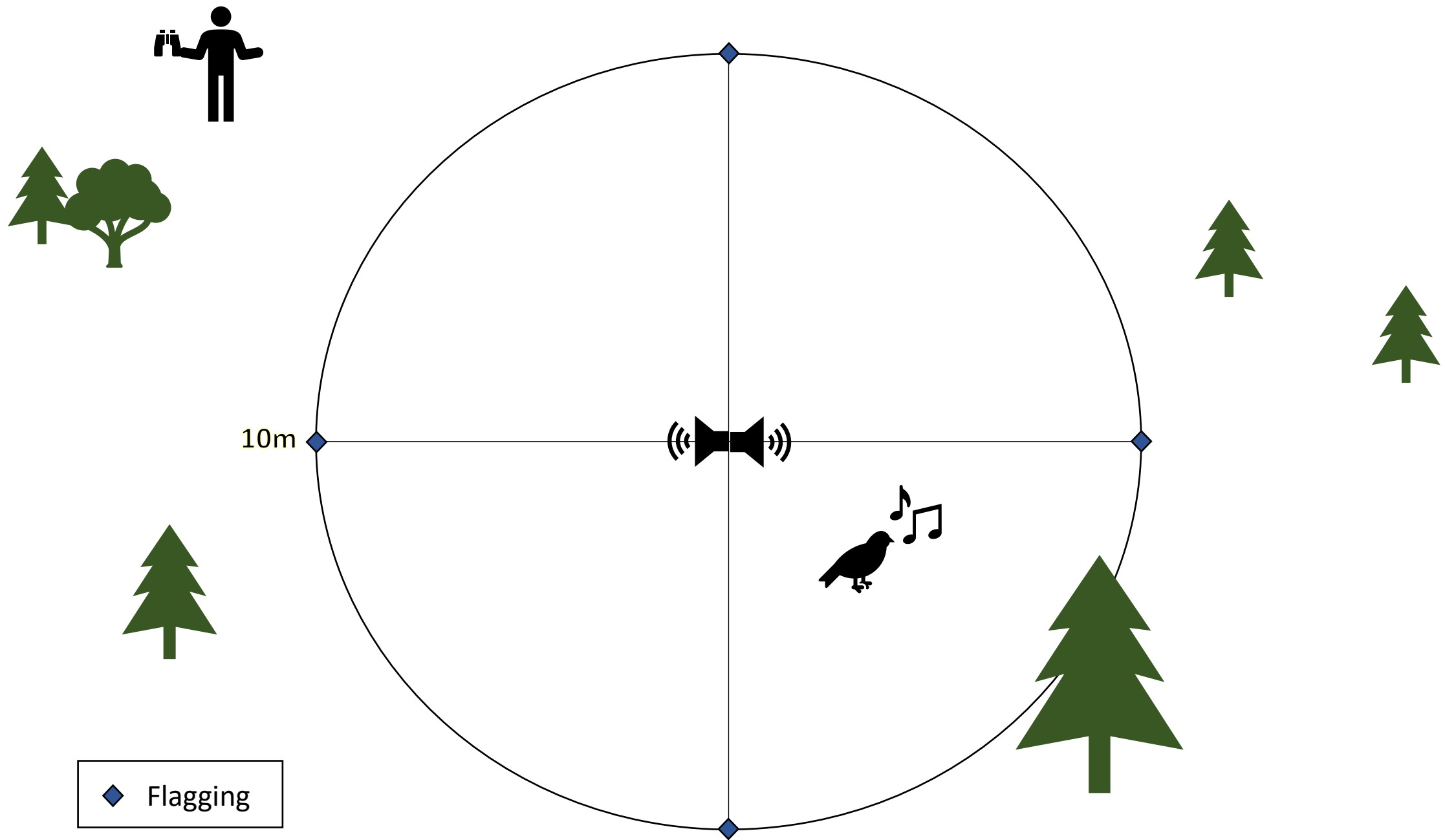


Beezley Hills – 05

Playback Experiment

- Playback stimuli were broadcast at approx. 90 dB(A) from UBL JFLIP 4 Bluetooth speakers mounted at 2 meters high, playing WAV files through an auxiliary cord sourced from an iPod.
- 17 Oregon vesper sparrows were the subjects of 33 playback trials.
- 16 western vesper sparrows were the subjects of 30 playback trials.
- Trials were staggered between sites.
- No adjacent territories received playback on the same day.
- Subjects were never exposed to a song sourced from their own breeding site.





Response variables

- Minimum distance to speaker
- Time spent within 10m of speaker
- Number of songs
- Number of flights
- Wing waves
- Soft songs



Analysis

- Principal Component Analysis
- Linear mixed-effect models
- AICc – Model ranking w/ Akaike's Information Criterion (corrected for small sample size)
- Examined parameter effects among top-ranked model with $\Delta\text{AICc} < 2$.
- Parameters were considered to have a strong effect if 95% confidence interval did not overlap zero.

Principal Component Analysis

Response Variables	Loadings		
	PC1 _{approach}	PC2 _{fly}	PC3 _{song}
No. songs during treatment			0.845
No. flights during treatment	0.244	0.757	
Distance during treatment (m)	-0.747	-0.206	
Time within 10m during treatment	0.788	0.172	0.128
No. songs post-treatment	0.215		0.751
No. flights post-treatment		0.828	
Distance post-treatment	-0.717	-0.231	
Time within 10m post-treatment	0.799	-0.254	0.193
Eigenvalue	2.441	1.457	1.334
Proportion of variance	0.305	0.182	0.167

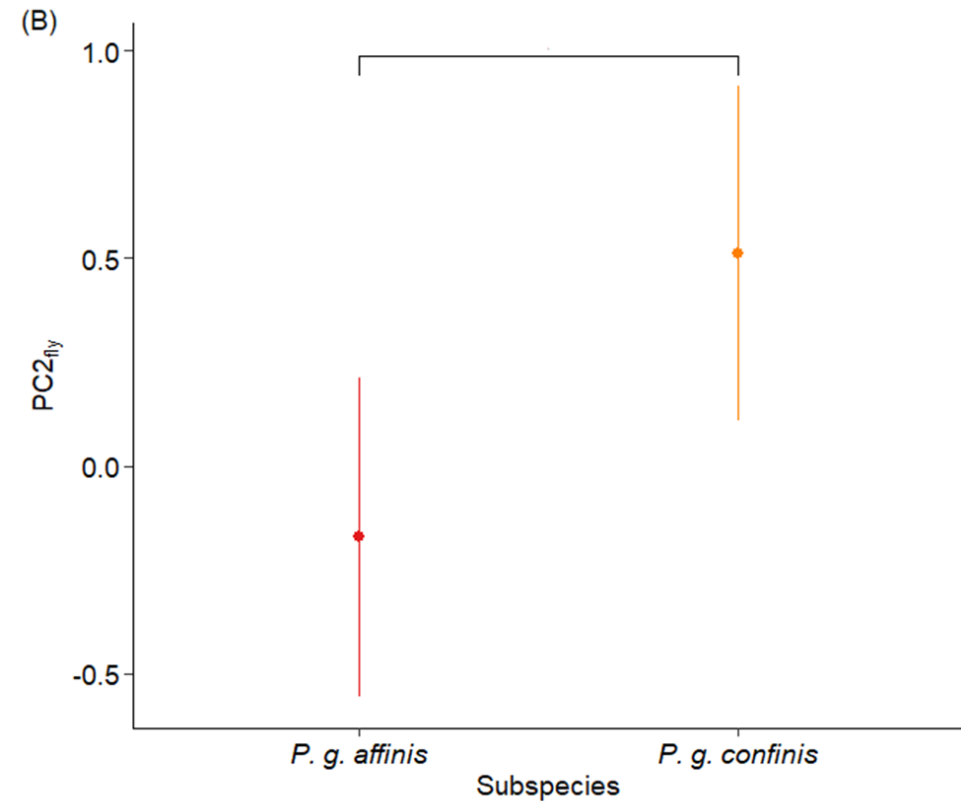
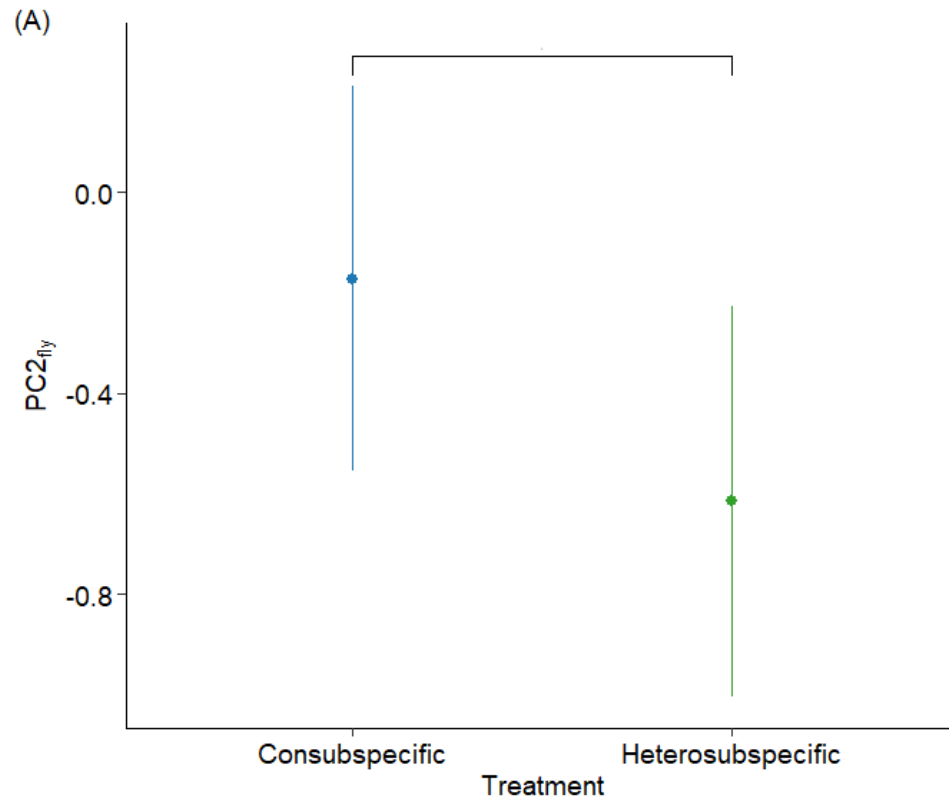
The three principal components accounted for 65.4% cumulative variance in the data.

PC1_{approach}

- Subjects approached within 10 meters of the speaker in 90.5% of trials.
- Subjects approached within 1 meter of the speaker in 47.6 % of trials.
- None of the parameters in the top models had a strong influence on approach behavior.
- Vesper sparrows exhibited strong approach behavior regardless of treatment type.



PC2_{fly}

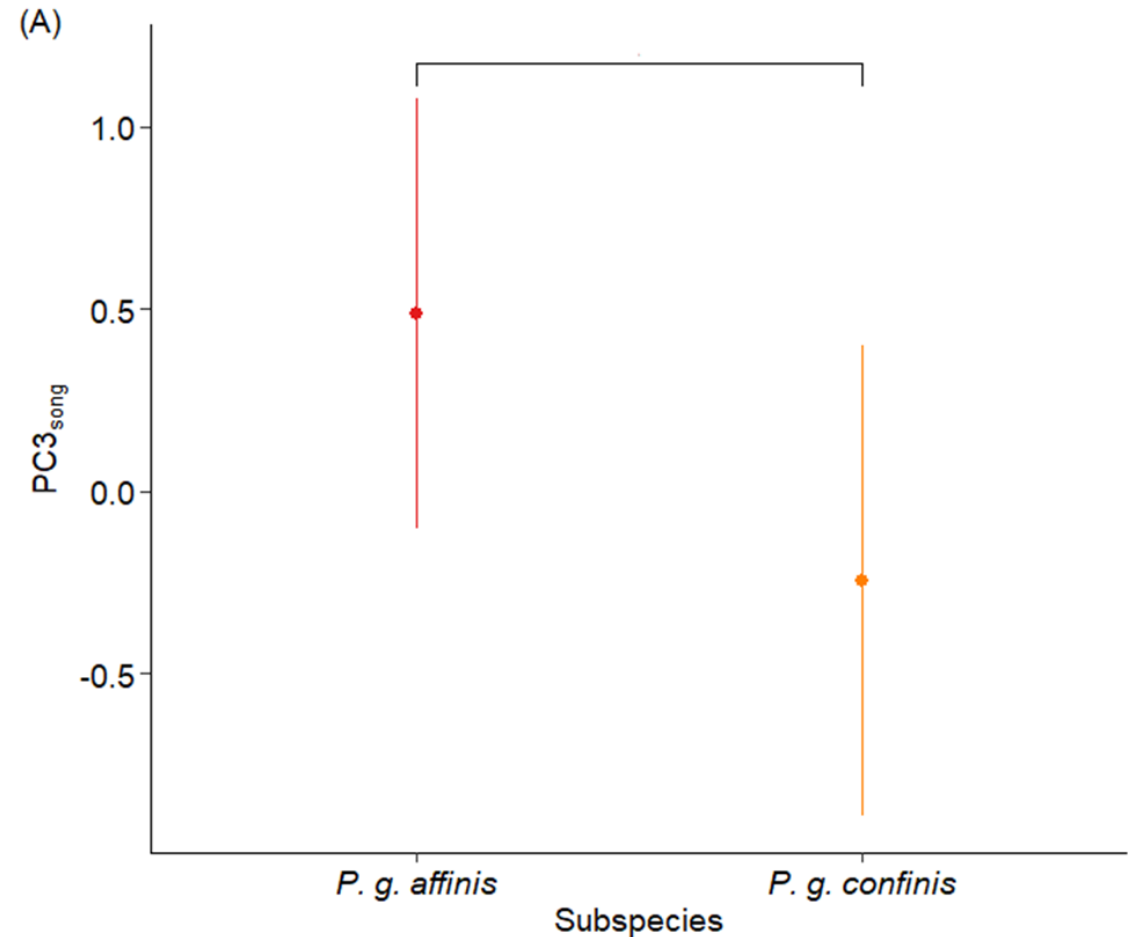


- **Treatment type** ($\beta = 0.44 \pm 0.17$, 95% CI [0.10, 0.78]), **subject subspecies** ($\beta = 0.68 \pm 0.25$, 95% CI [0.18, 1.18]), and **Julian date** ($\beta = -0.02 \pm 0.01$, 95% CI [-0.03, -0.001]), had strong influence on flight behavior.

PC3_{song}



- **Subject subspecies** ($\beta = -0.73 \pm 0.23$, 95% CI [-1.20, -0.28]), and **Julian date** ($\beta = -0.02 \pm 0.01$, 95% CI [-0.03, -0.001]) had a strong influence on vesper sparrow song behavior.
- Treatment type did not have an influence on vesper sparrow song behavior.



Conclusion

- Vesper sparrows exhibited discrimination between subspecific stimuli with increased flight behavior when presented with consubspecific songs.
- Oregon vesper sparrows responded to playback with more song behavior overall.
- Western vesper sparrows responded to playback with more flight behavior overall.

