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The Feasibility of Using Drones to Count Songbirds

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The Feasibility of Using Drones to Count Songbirds

Abstract
Point and transect counts are the most common bird survey methods, but are subject to biases and accessibility issues. To eliminate some of these biases, we propose attaching a recorder to a consumer-grade quadcopter (Unmanned Aerial Vehicle, or UAV) to estimate songbird populations from audio recordings. We conducted a blind experiment using broadcast recordings to estimate the detection radius of a compact recorder attached to a UAV, and found that the detection radius did not vary significantly when the UAV was flown at elevations of 20, 40 and 60m. We field tested our system by comparing UAV-based bird counts with standard point count surveys at 51 locations on State Game Lands 249, PA. Species richness was similar at standard and UAV point counts, but species composition differed. For most species, the number detections on UAV recordings were similar to standard counts, but UAV surveys under-sampled Mourning Doves Zenaida macroura, Gray Catbirds Dumetella carolinensis, and Willow Flycatchers Empidonax traillii. Birds with quiet or low frequency songs are likely to be under-detected by UAV-based methods, due to masking by the drone noise of the quadcopter. Recordings of bird songs from ground-based recorders show that bird song output was slightly reduced when the quadcopter was overhead. The development of quieter quadcopters would overcome the masking and the possible behavioral response issues that we highlighted. We demonstrate that low-cost UAVs provide a useful new method of surveying songbirds that is accessible to organizations and researchers with restricted budgets.

Keywords
Bird Populations, Drone, UAV

Disciplines
Animal Sciences | Environmental Monitoring | Environmental Sciences | Environmental Studies | Ornithology

Comments
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The feasibility of using drones to count songbirds

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Can drones be used to survey songbirds?

Drones allow low cost access to inaccessible or dangerous terrain.

We attached a pocket digital recorder to a DJI Phantom II quadcopter, to see whether we can record bird song remotely.

Part 1 – Experiment

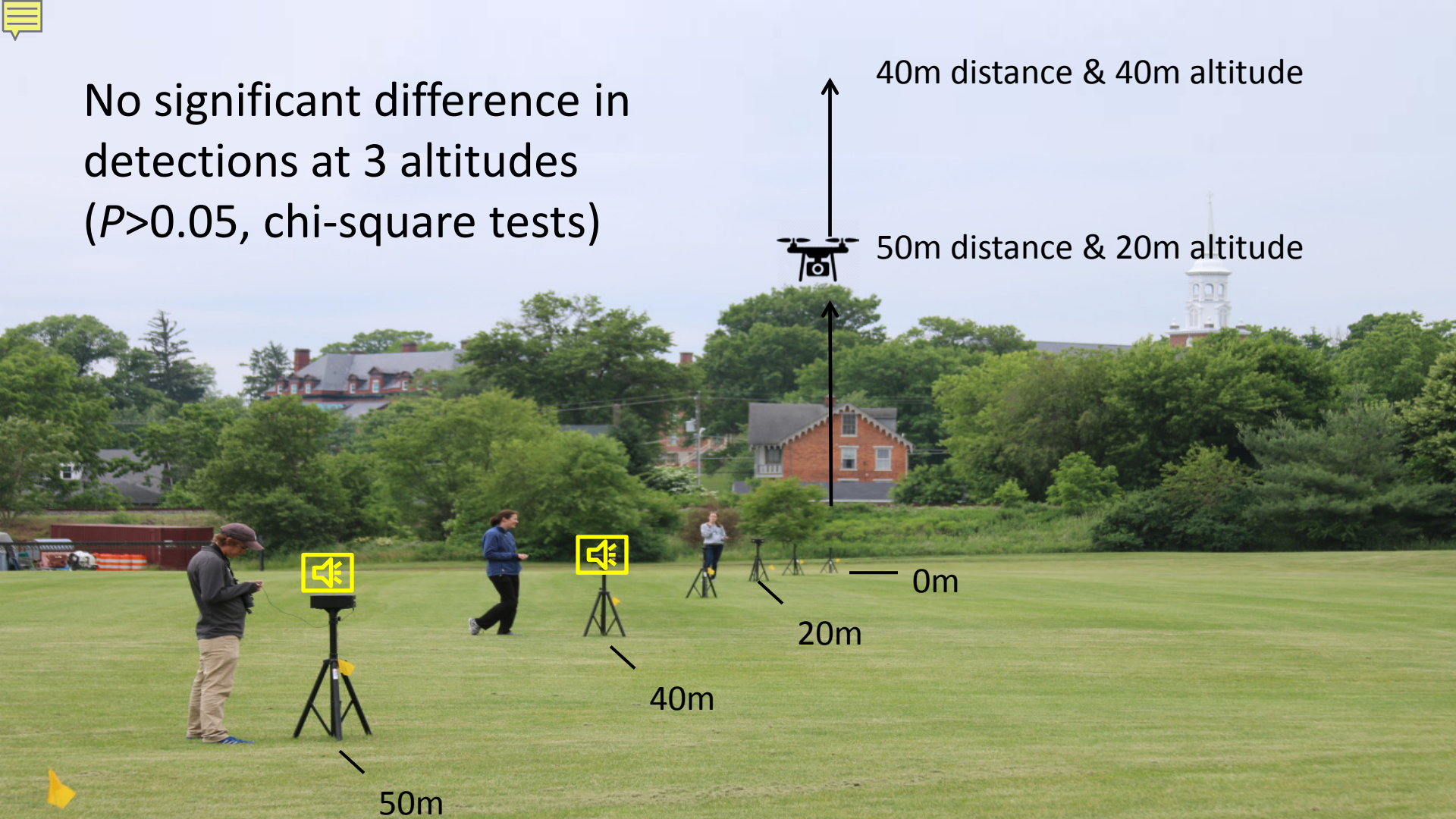
Janine Barr (‘15)

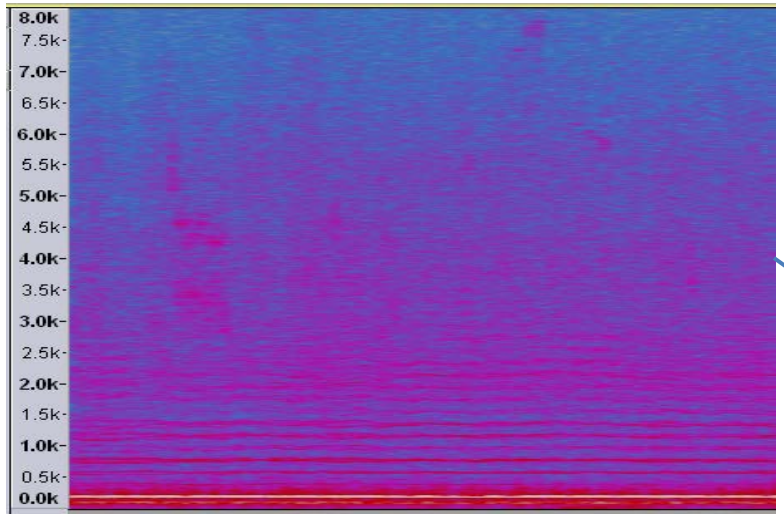
Part 2 – Field testing

Megan Zagorski (‘16)

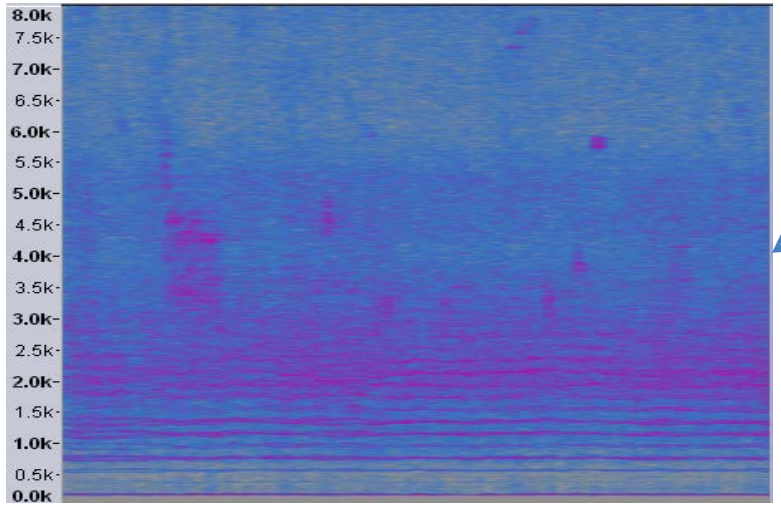
Experimental design

- Blind experiment – recordings randomized by J Barr, and analyzed by A. Wilson
- Recorder at 8m below UAV with fishing line
- 3-5 songs of 6 species (source: Cornell)
- Played at volumes *approx.* natural (70-95 dB @ 1m)
- Treatments:
  - 3 altitudes (20m, 40m, 60m)
  - 11 radial distance (0-100m, 10m increments)

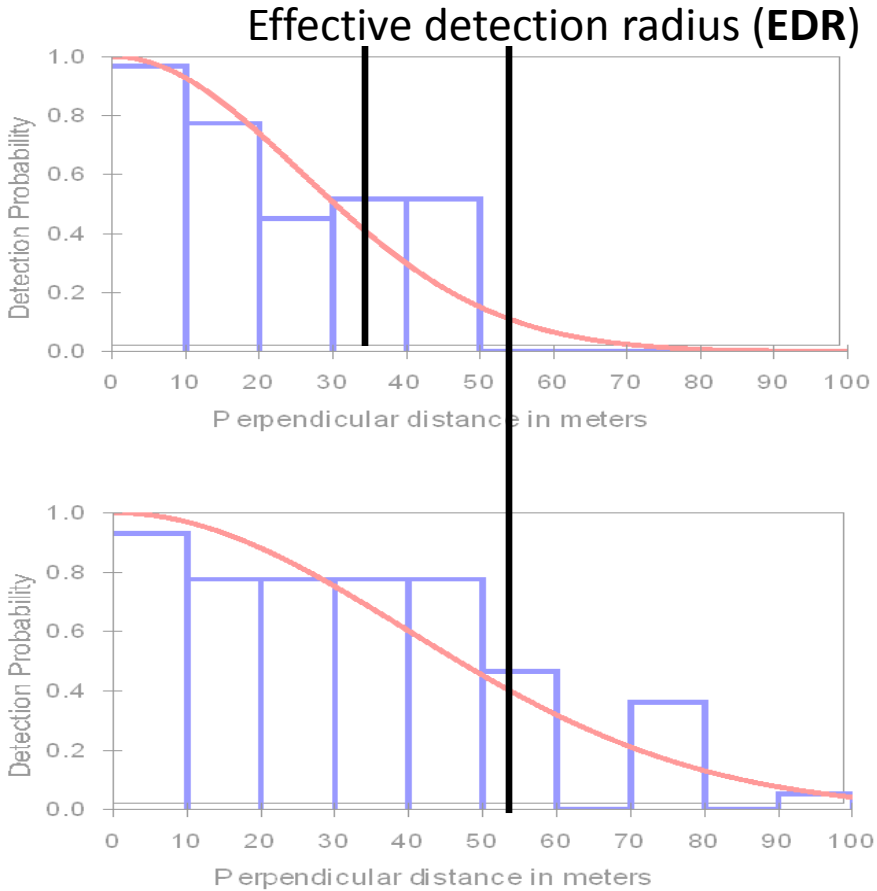

No significant difference in detections at 3 altitudes (*P*>0.05, chi-square tests)
40m distance & 40m altitude
50m distance & 20m altitude
0m
20m
40m
50m

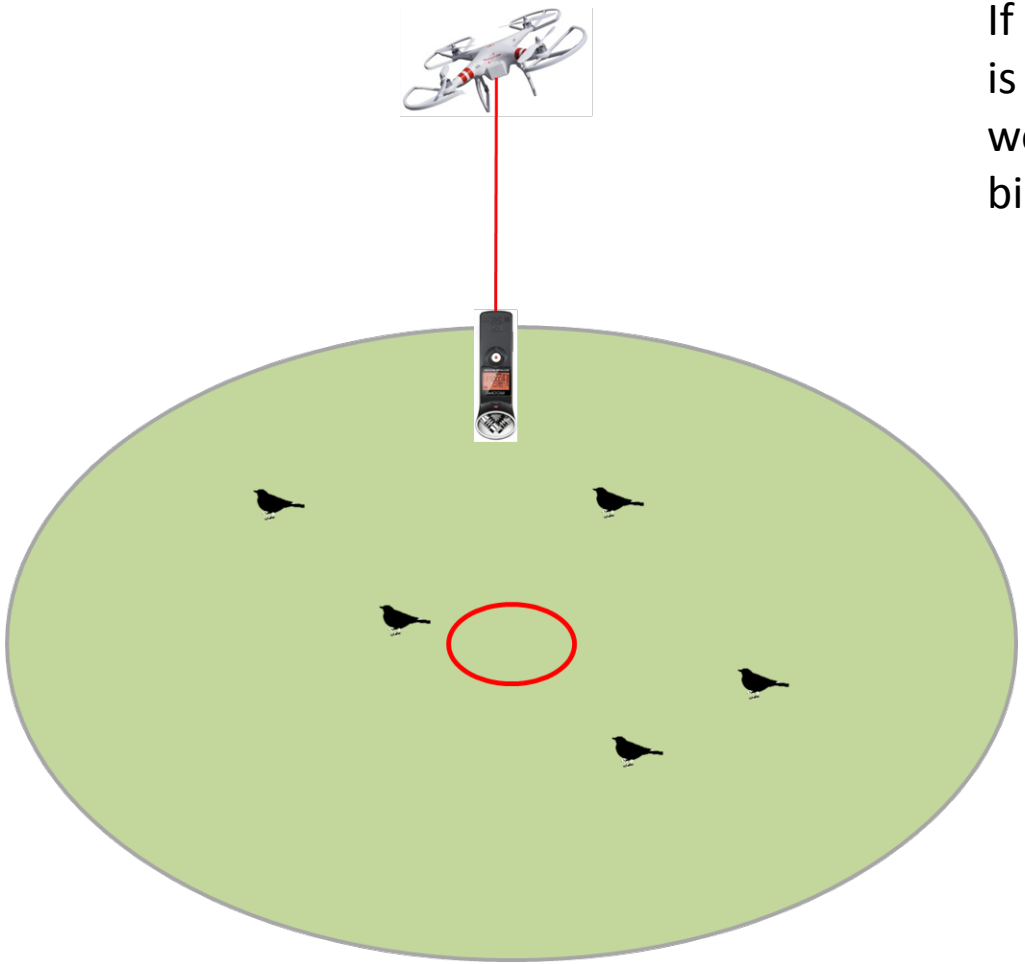


Apply a “High pass” filter in Audacity

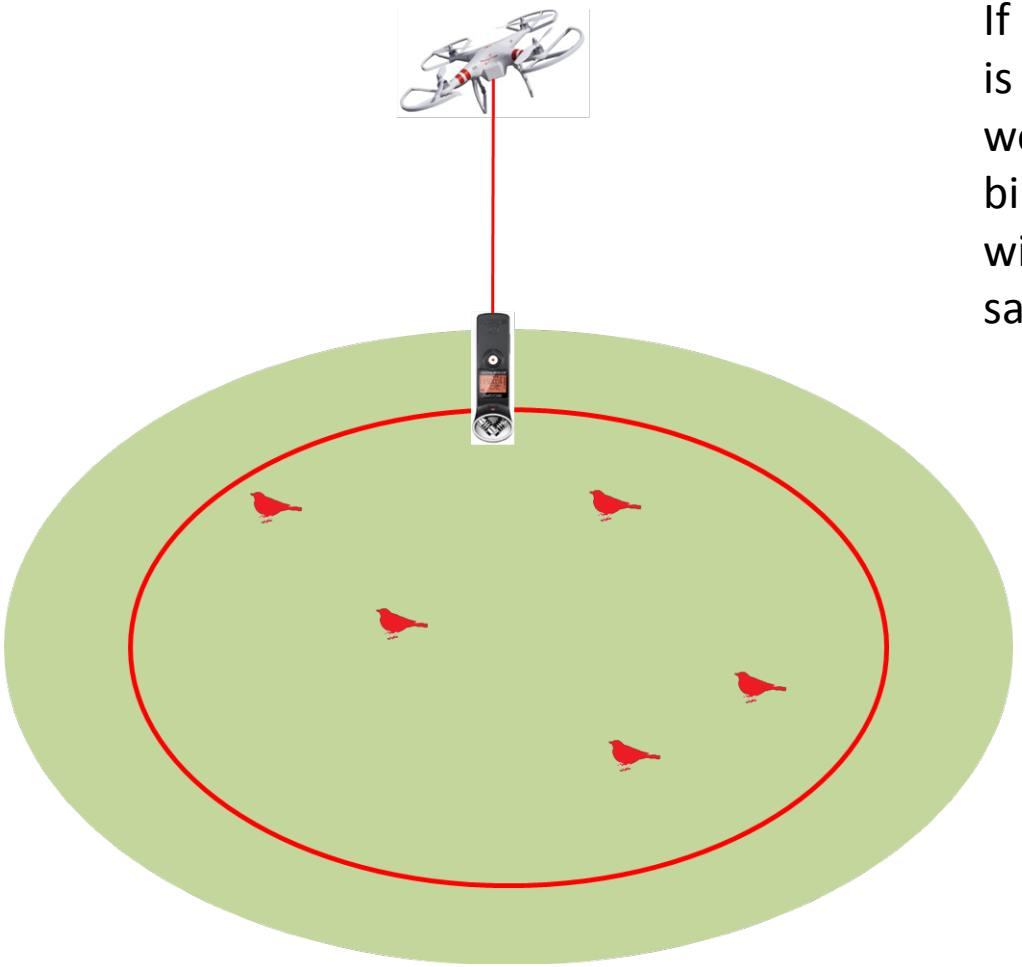


Estimates of detection (using Program Distance)

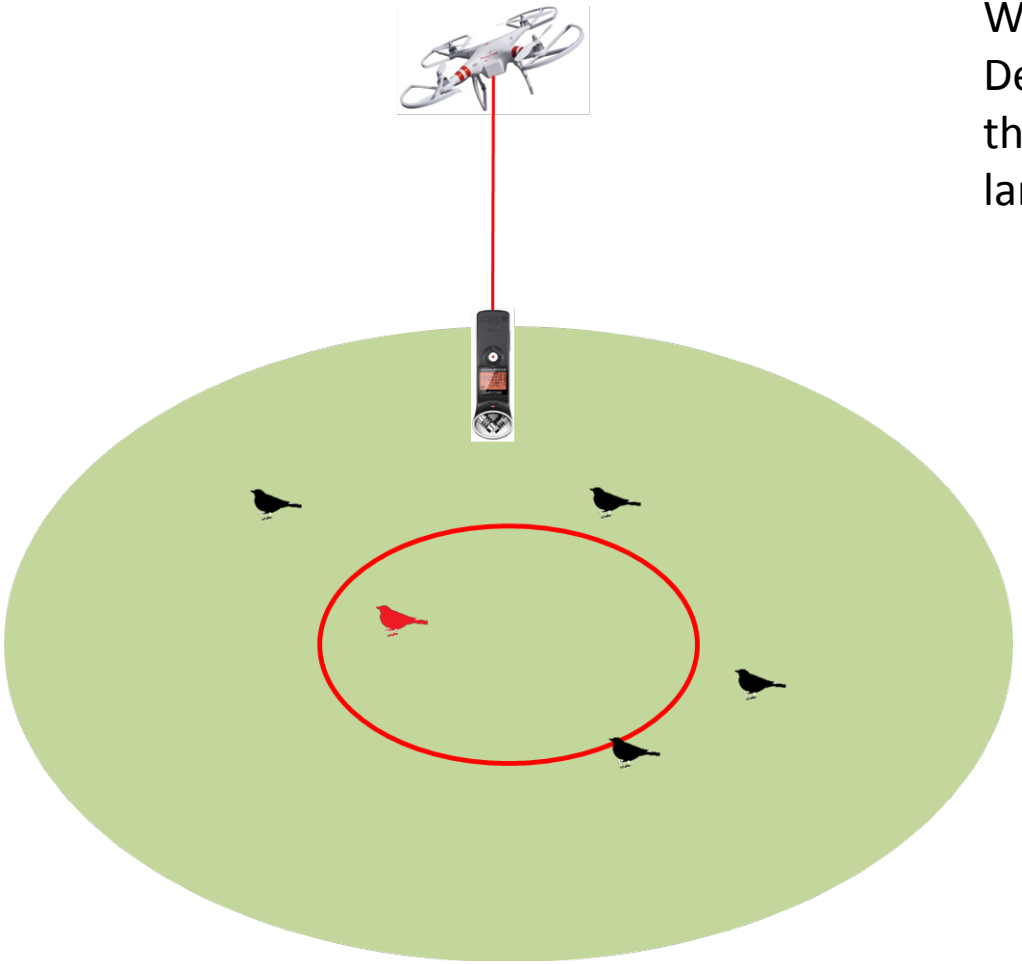




If Effective Detection Radius is too small (red circle), we would not detect enough birds.

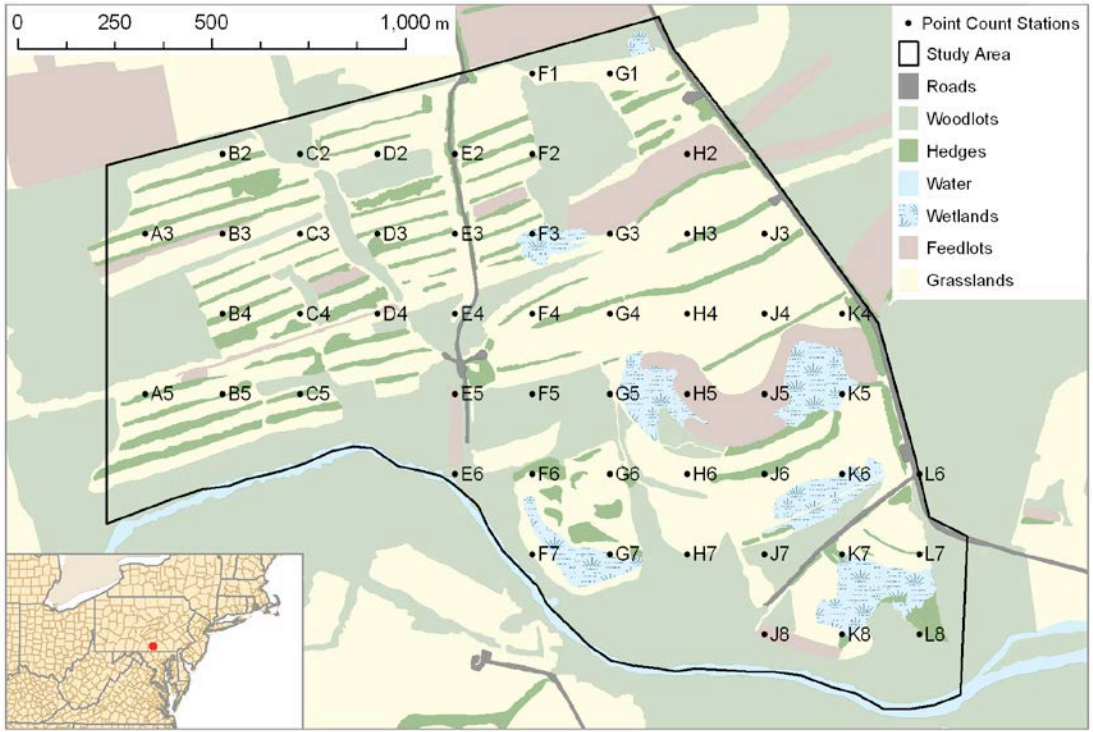


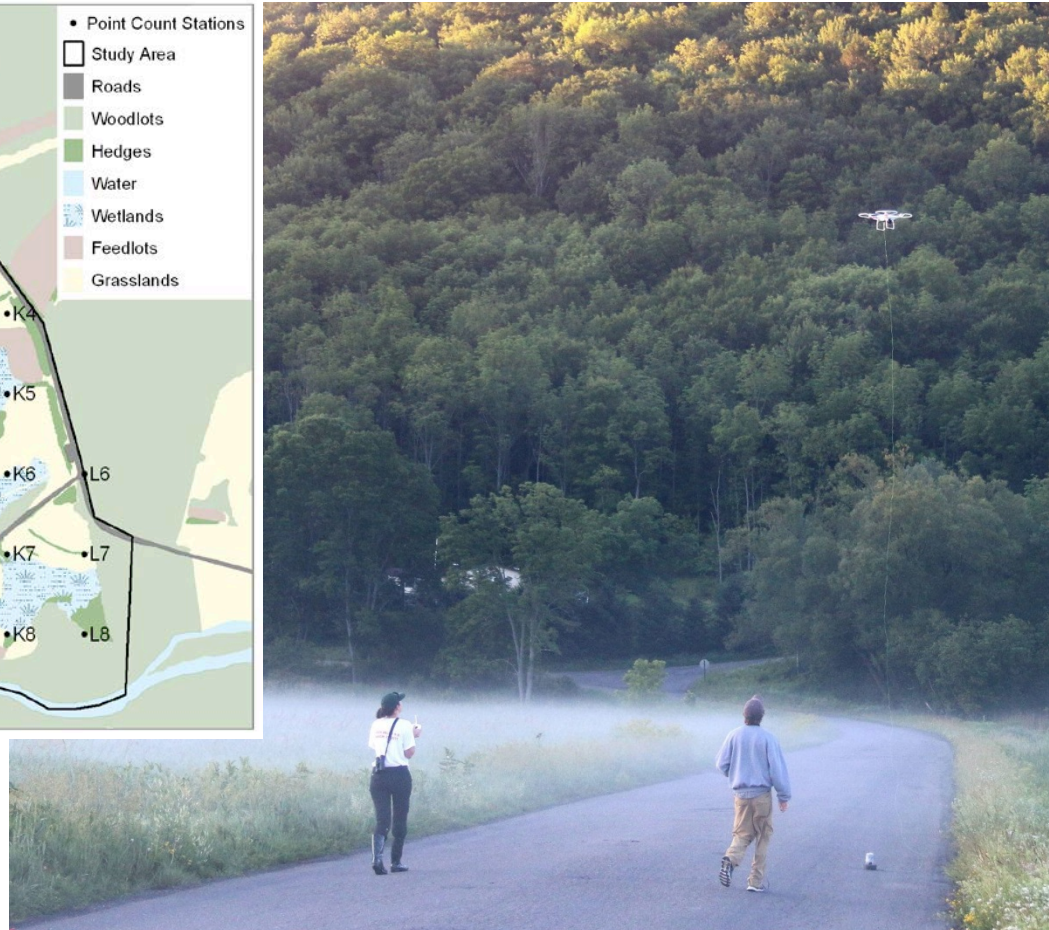
If Effective Detection Radius is too large (red circle), we would not detect too many birds! Deciphering audio with multiple individuals of same species is very tricky.



We think that our Effective Detection Radius is close to the “sweet spot”, not too large, not too small

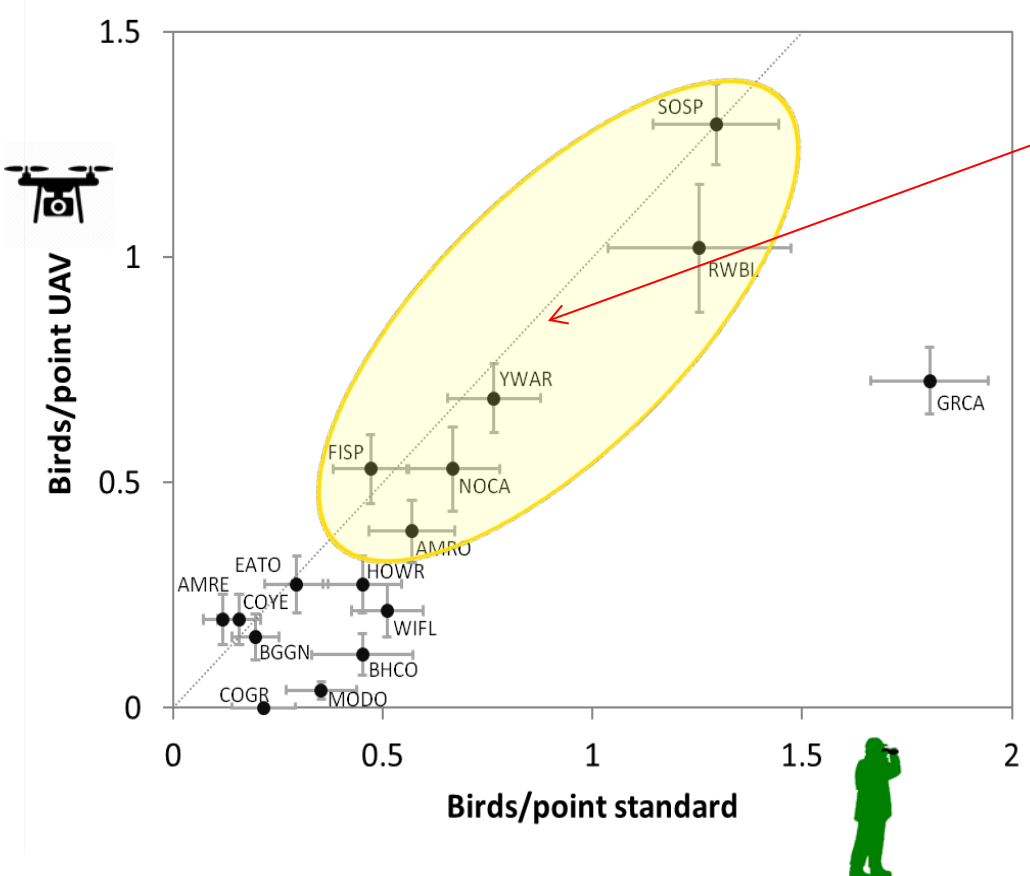
Field Testing (June 2015)





State Game Lands 249
Adams County, PA

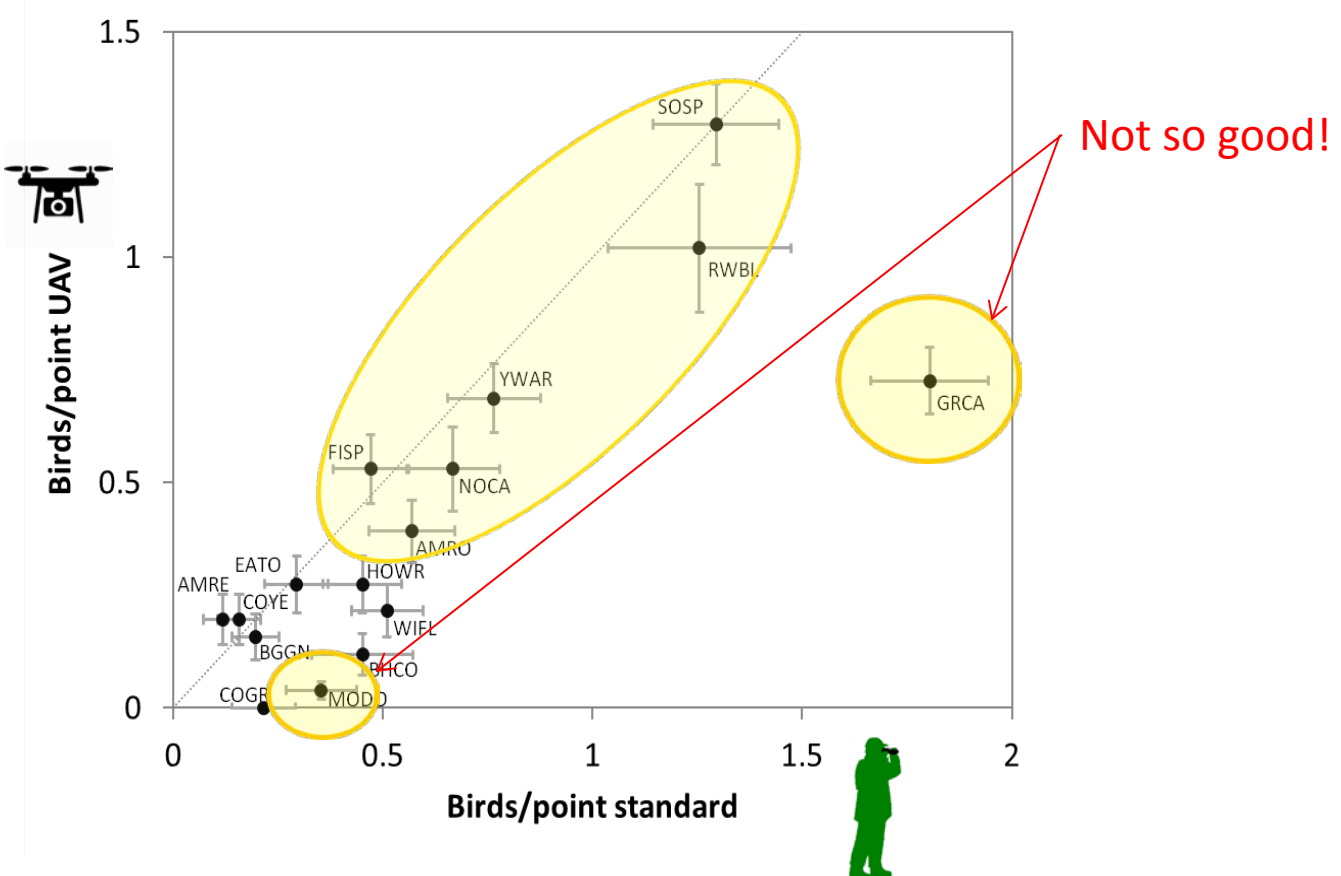
How do UAV counts compare to “standard” counts?

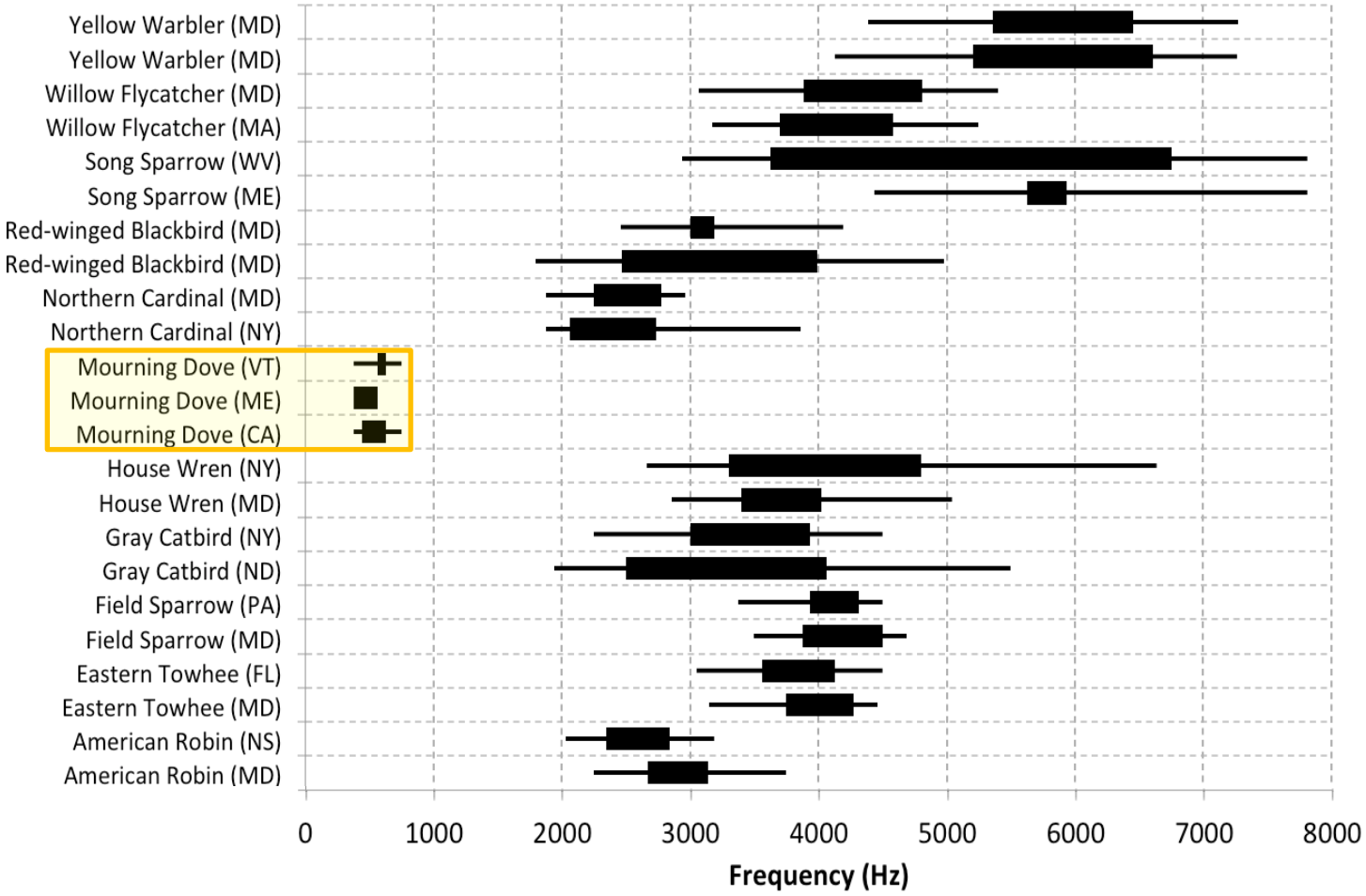


Similar = good!

Each four letter code is a different species

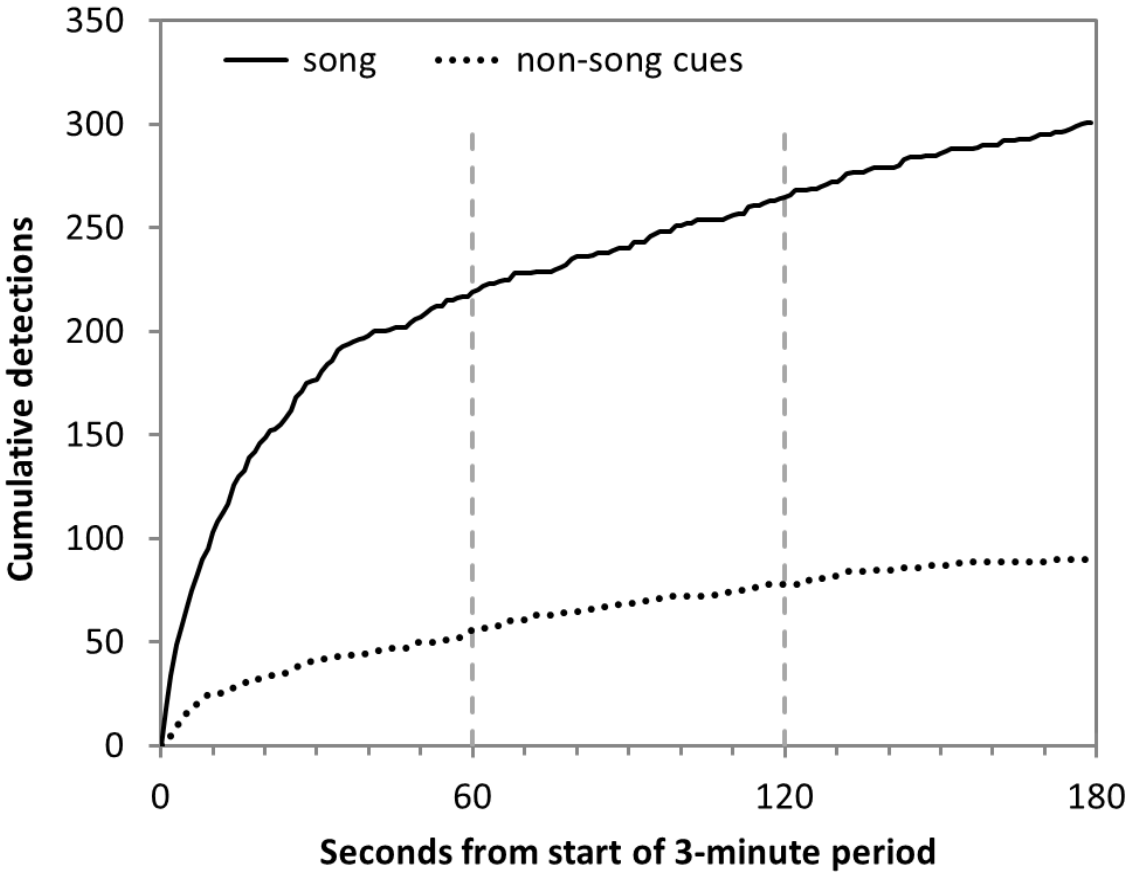
How do UAV counts compare to “standard” counts?





Analysis of Cornell recordings

Crucial – maximizing survey efficiency



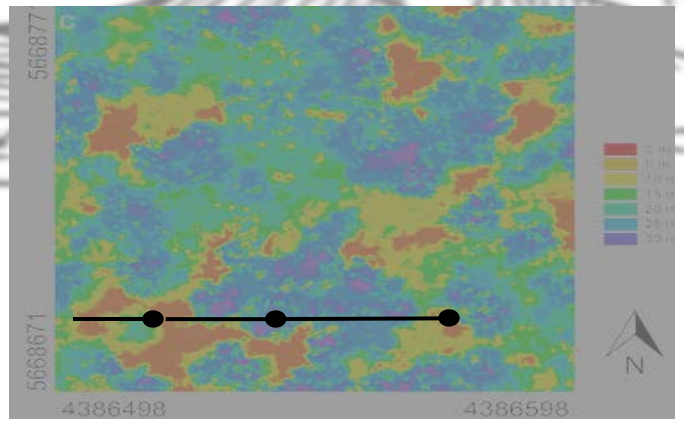
Future research

Technological

- Reduce UAV noise
- Improve battery life
- Custom build microphones

Biological

- Transect counts
- Behavioral effects



Species	Time	X	Y
Wood Thrush	8:01:50	4386505	5668681
Ovenbird	8:02:35	4386515	5668697
Veery	8:02:49	4386528	5668716

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- Margaret. A. Cargill Foundation
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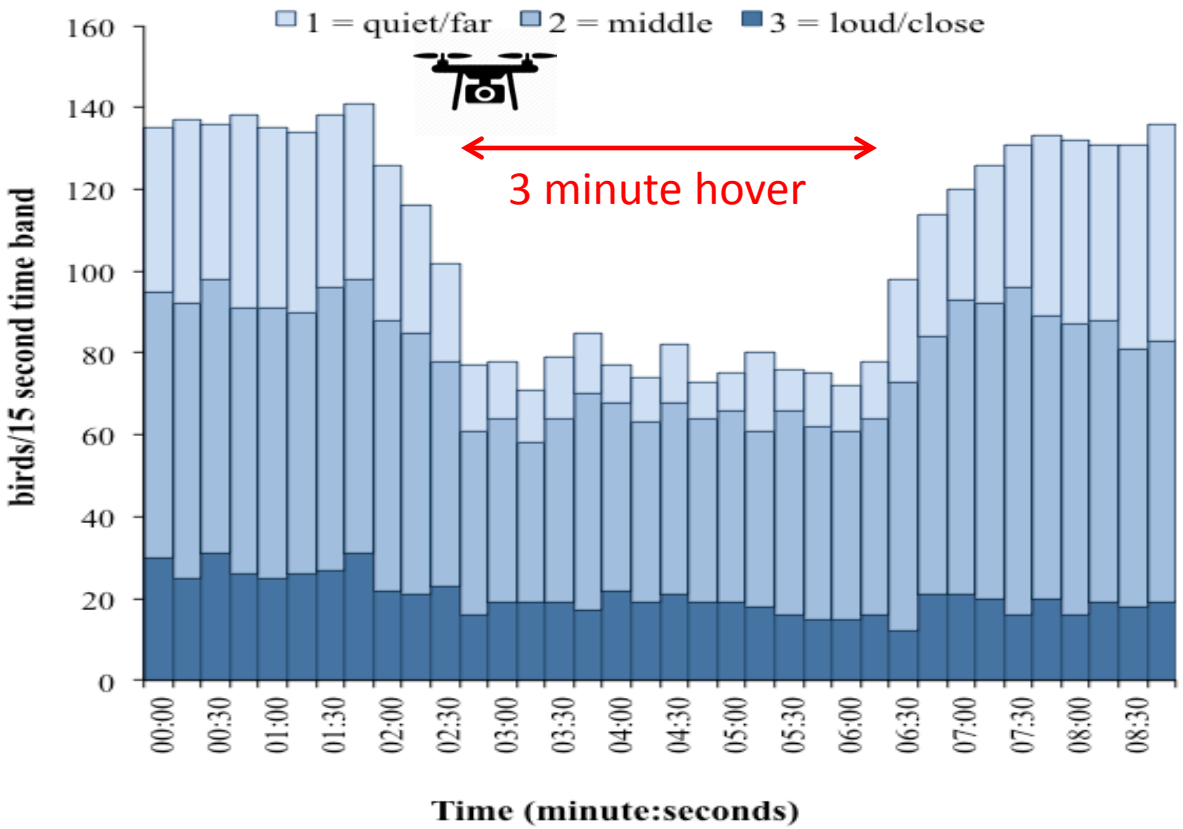
Did we see any effect on song output?



Best guess Effective detection radius (**EDR**)