



# Multiple Drones to Haze Blackbird Flocks in Sunflower

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## Background

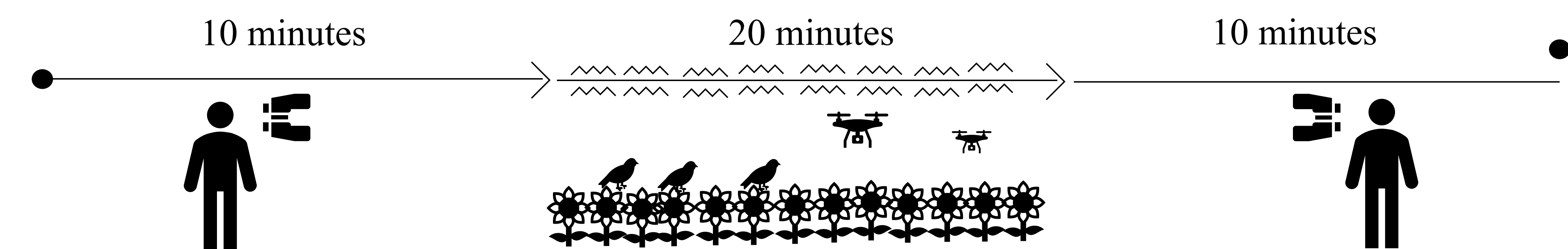
- Annual blackbird damage to ND sunflower is \$10.7 million (8.7% yield loss)
- Drones as frightening devices evoke anti-predator behavior in birds
- Hazing with one drone can be effective but often not threatening enough for large flocks

## Objectives

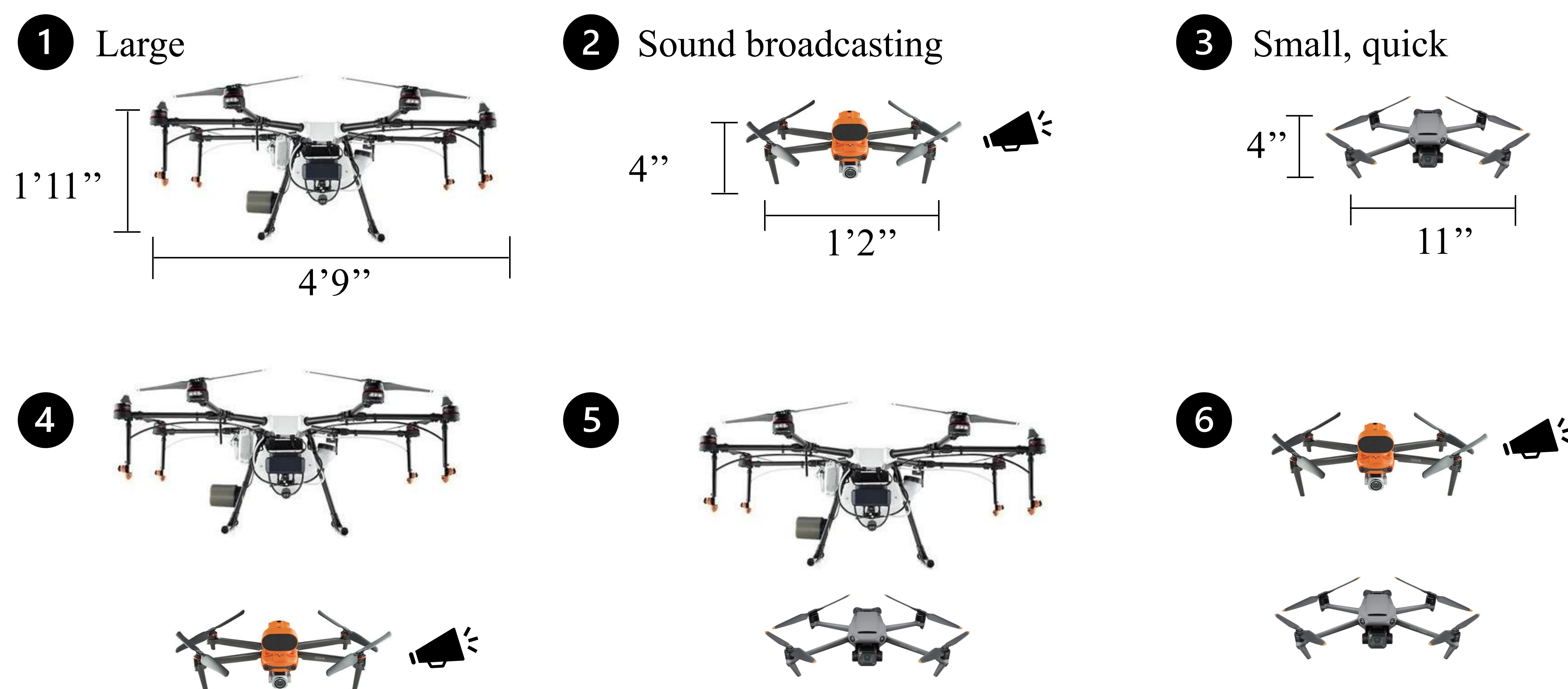
- 1) Determine if perceived riskiness changes with platform using flight initiation distance (FID)
- 2) Evaluate if hazing efficacy increases with multiple drones with various threatening features

## Methods

We observed flock behavior for 10-min pre- and post-hazing (20 min). We used linear models to evaluate the effects of multiple drones on flight initiation distance and flock reduction (considering flock and environmental variables) and a Fisher's Exact Test to evaluate probability of abandonment.



## Treatments

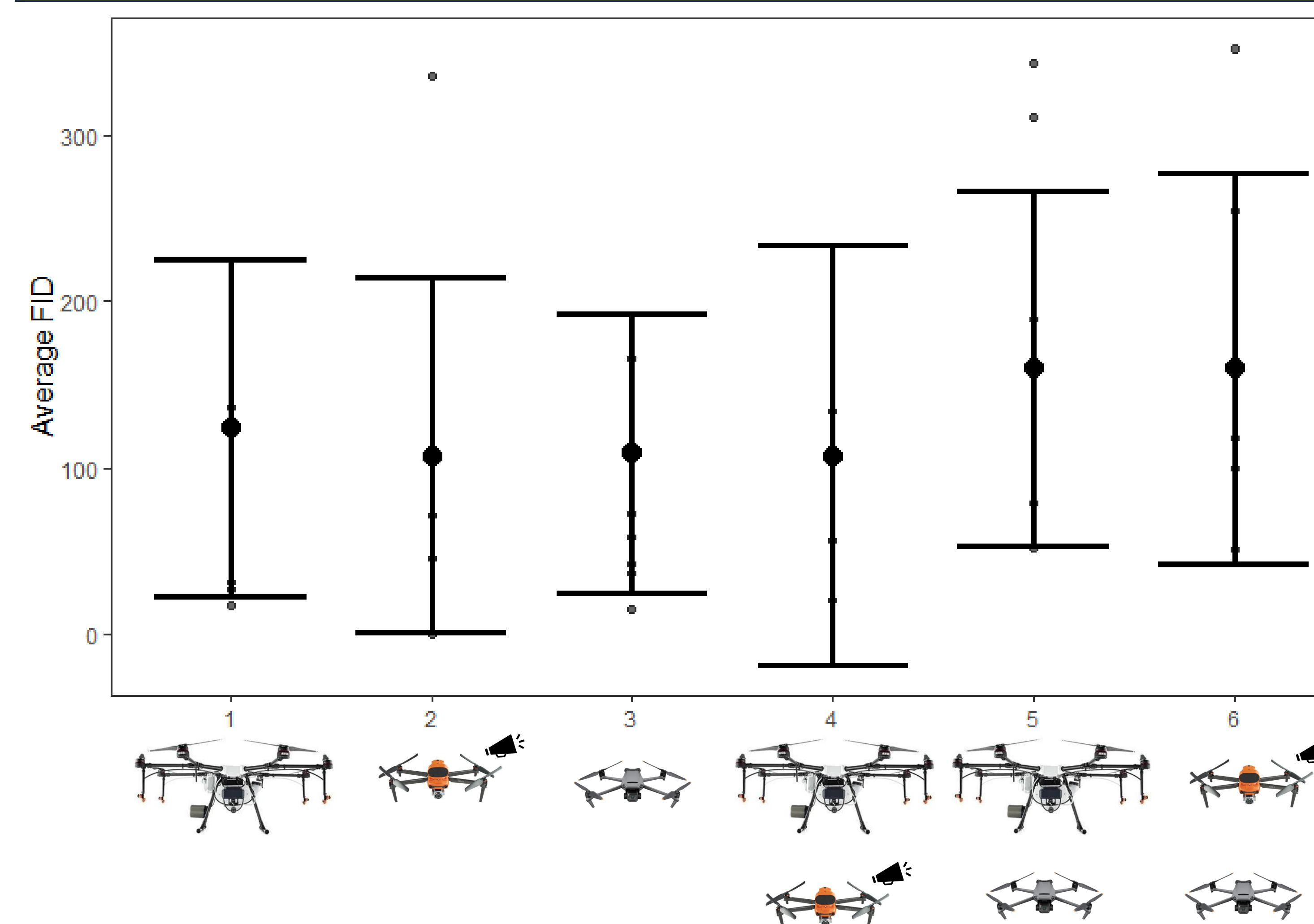


**Fig 1.** We conducted hazing trials on mixed-species blackbird flocks. We used 3 drones DJI Agras (large), Autel Evo 2 RTK Series 3 (sound broadcasting), DJI Mavic 3 Classic (small, quick). The sound broadcasting drone played: merlin calls, firecrackers, pyrotechnics and blackbird distress calls.

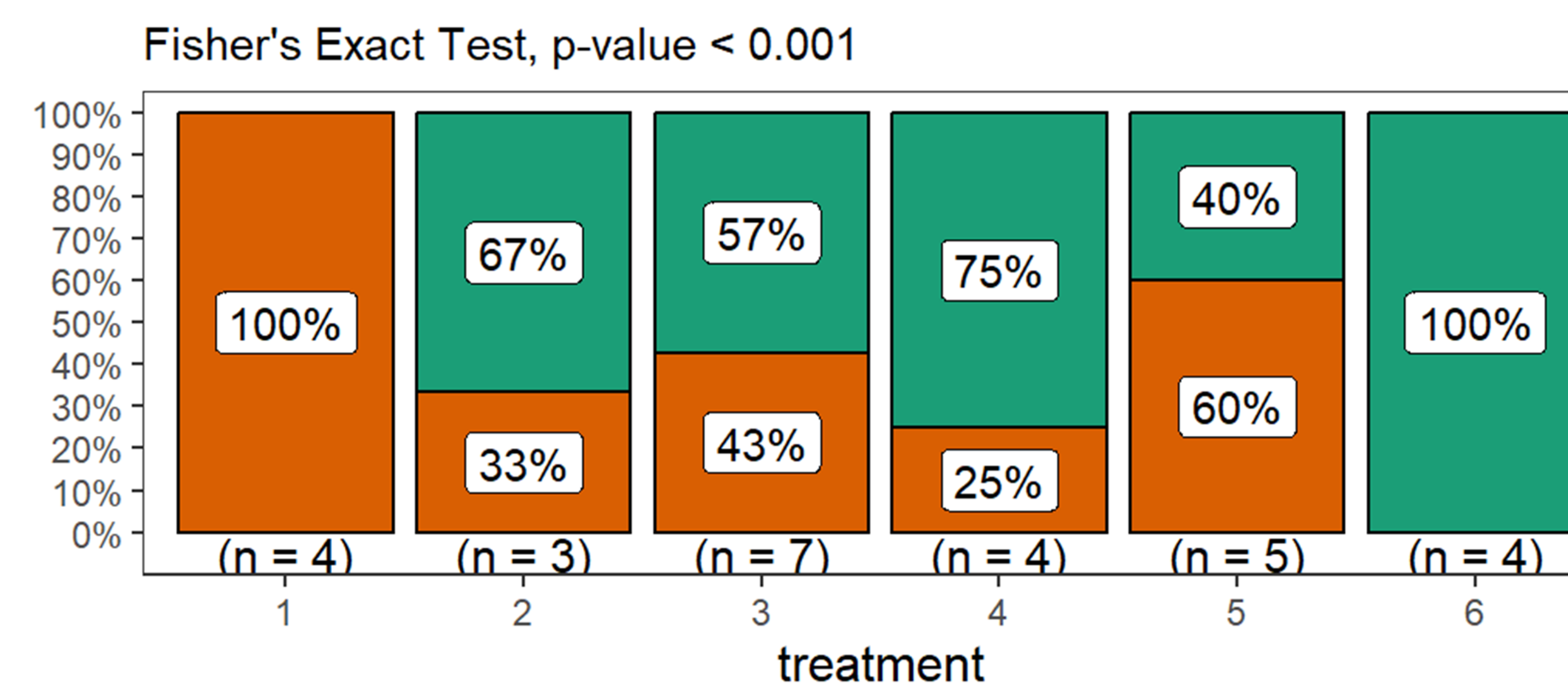
### Acknowledgements

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## Results

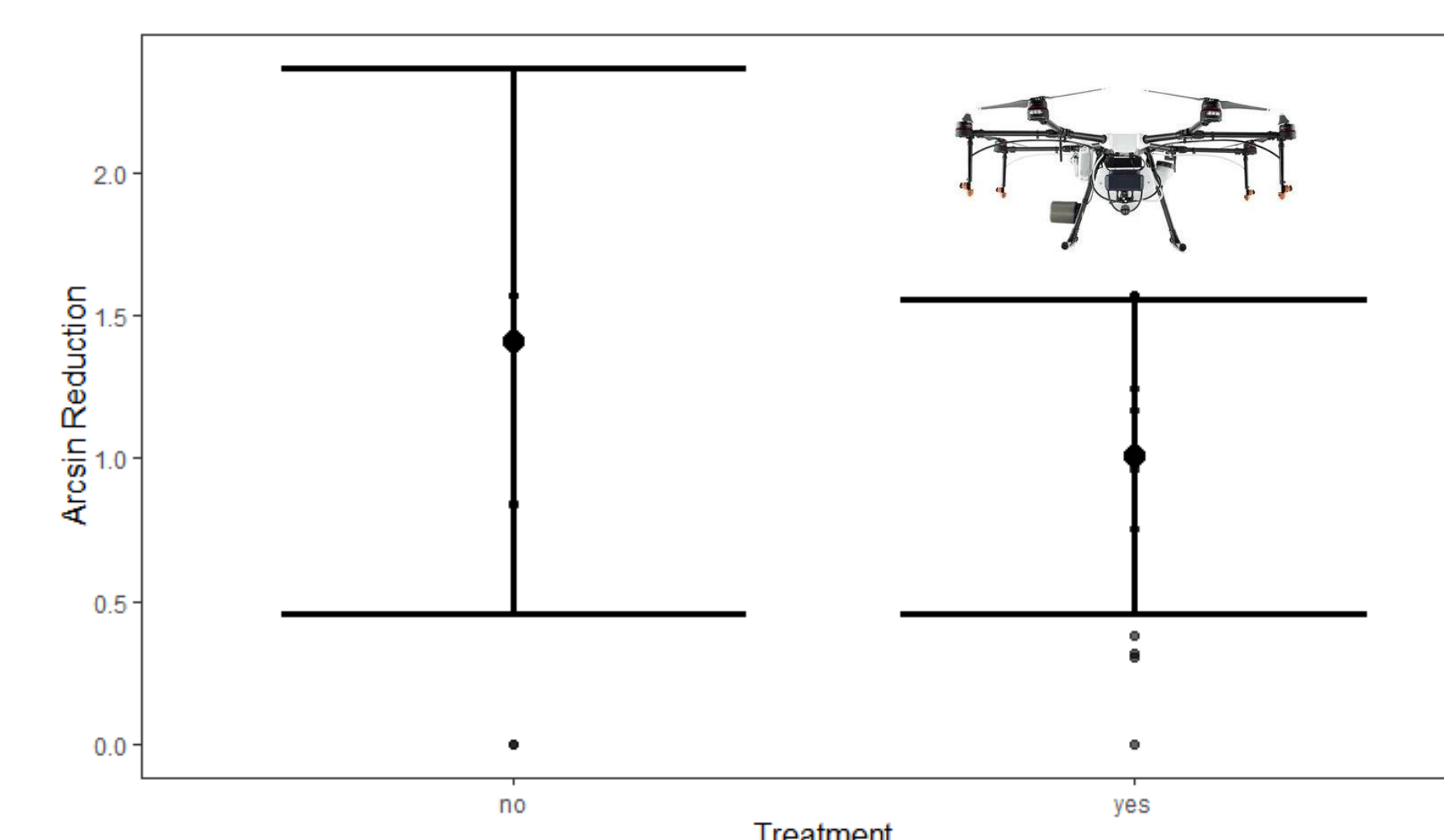


**Fig. 5:** Flight initiation distance did not significantly differ by treatment (see Fig. 1) but increased with larger flock sizes ( $p=0.037$ ) and greater distances between the flock and the drone launch site ( $p=0.0004$ ).



**Fig. 3:** Treatments (see Fig. 1) with the sound-broadcasting drone had the highest probability of abandonment whether alone (2) or in combination (4, 6).

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**Fig. 4:** Greater flock reduction was observed when the large drone was absent but not significantly so ( $p=0.1013$ ). Flock reduction also increased with increased temperature ( $p=0.0396$ ).

## Discussion

- Multiple drones equipped with various negative stimuli did not elicit a significant change in FID, but evidence suggests increased hazing efficacy is possible.
- Drones broadcasting sound appeared more effective at causing field abandonment, where the large, slower drone was less effective at reducing flock sizes.
- Low sample sizes ( $n=27$ ) could have influenced significance.
- Future directions include how various threatening sounds broadcast during hazing impact flock behavior.