Evaluating Behavioral Response of Red-winged Blackbirds toward Unmanned Aircraft Systems (UAS) Exploiting Antipredator Behavior to Enhance Avoidance

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Background

Animals respond to human disturbance using behavior strategies adapted to detect, avoid, and evade natural predators [1].

Recently, unmanned aircraft systems (UAS) have been suggested as a nonlethal method to deter birds from areas of human-wildlife conflict [2].

Several studies have evaluated the response of wildlife toward UAS, but few have operated UAS in a manner to intentionally provoke an escape response [3].

UAS can elicit antipredator behavior in birds, suggesting potential utility as a nonlethal hazing tool [3, 4]. The antipredator behavior of animals may be exploited to optimize efficacy of physical frightening devices such as UAS [5].

If effective, UAS could be incorporated into an integrated pest management plan to reduce economic loss and safety hazards caused by birds.

The threat level perceived by birds toward both flying vehicles and predators can depend on flight dynamics and form [3]

This study aims to evaluate blackbird antipredator response toward UAS.

We will compare the response of captive red-winged blackbirds (*Agelaius phoeniceus*) to a multirotor quadcopter UAS and a remote-controlled predator model approaching at direct and overhead trajectories (Figure 1, 2).

We will also test the response of free-ranging birds toward UAS.

The results of this study will help develop a UAS design as a potential hazing tool to disperse and deter flocks of blackbirds from commercial sunflower fields.

Blackbird flock in a commercial sunflower field. Photograph by Page Klug; USDA-APHIS-WS National Wildlife Research Center

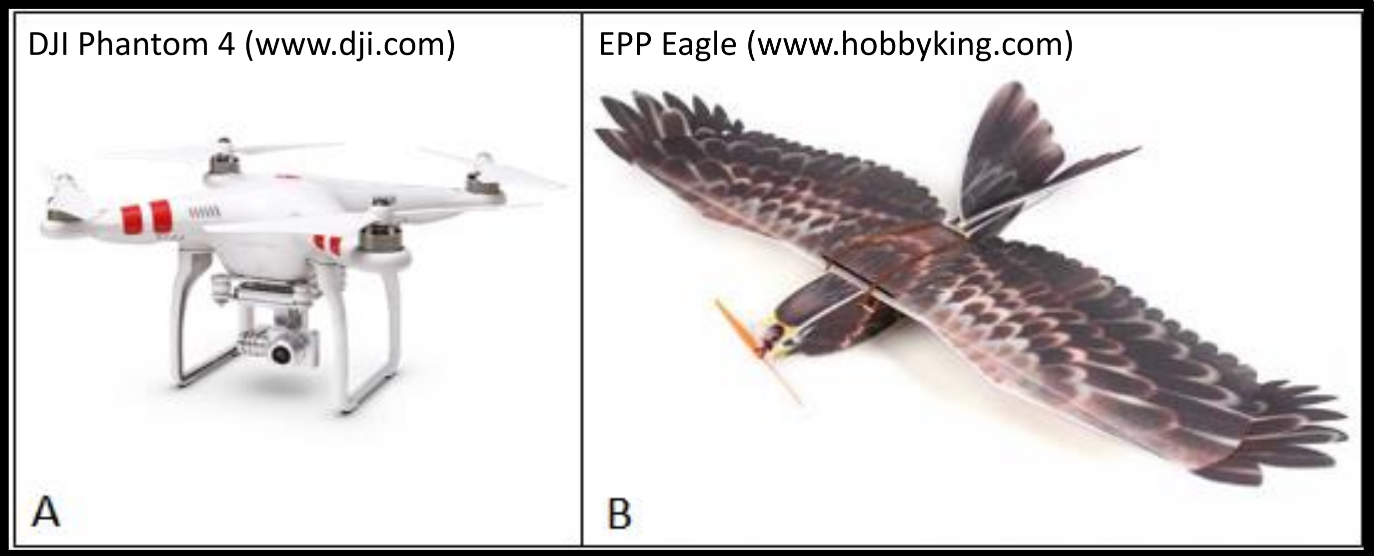


Figure 1. UAS Platforms
We will compare two UAS platforms,

A) a quadcopter UAS (DJI Phantom 4) and

B) a remote-controlled fixed-wing aircraft modeling an aerial raptor (EPP Eagle).

Methods – Seminatural Study

During trials, birds will be temporarily placed in an enclosure constructed of coated steel frame and mesh lining (3.7 x 4.0 x 3.1 m; Figure 2, 3).

To simulate foraging conditions in sunflower fields, blackbirds will be provided food in a feeding tray at 2 m height, which is the approximate height of blackbirds foraging on sunflower heads.

The birds will be approached by either the RC predator model or quadcopter style UAS at a starting distance of 300 m (Figure 2).

UAS approach will be visually obstructed from one side of the enclosure using dark fabric (Figure 2). Using this method, the target individual will be the first to visually detect the aircraft and make an escape decision independent of the flock.

We will record avian alert distance and flight initiation distance during each trial using four cameras facing the birds (Figure 3).

Alert distance is the distance between an approaching stimuli and an animal when behavior changes from a relaxed foraging state to an alert, vigilant state [6].

Flight initiation distance is the distance at which an animal decides to escape from an approaching threat [6].

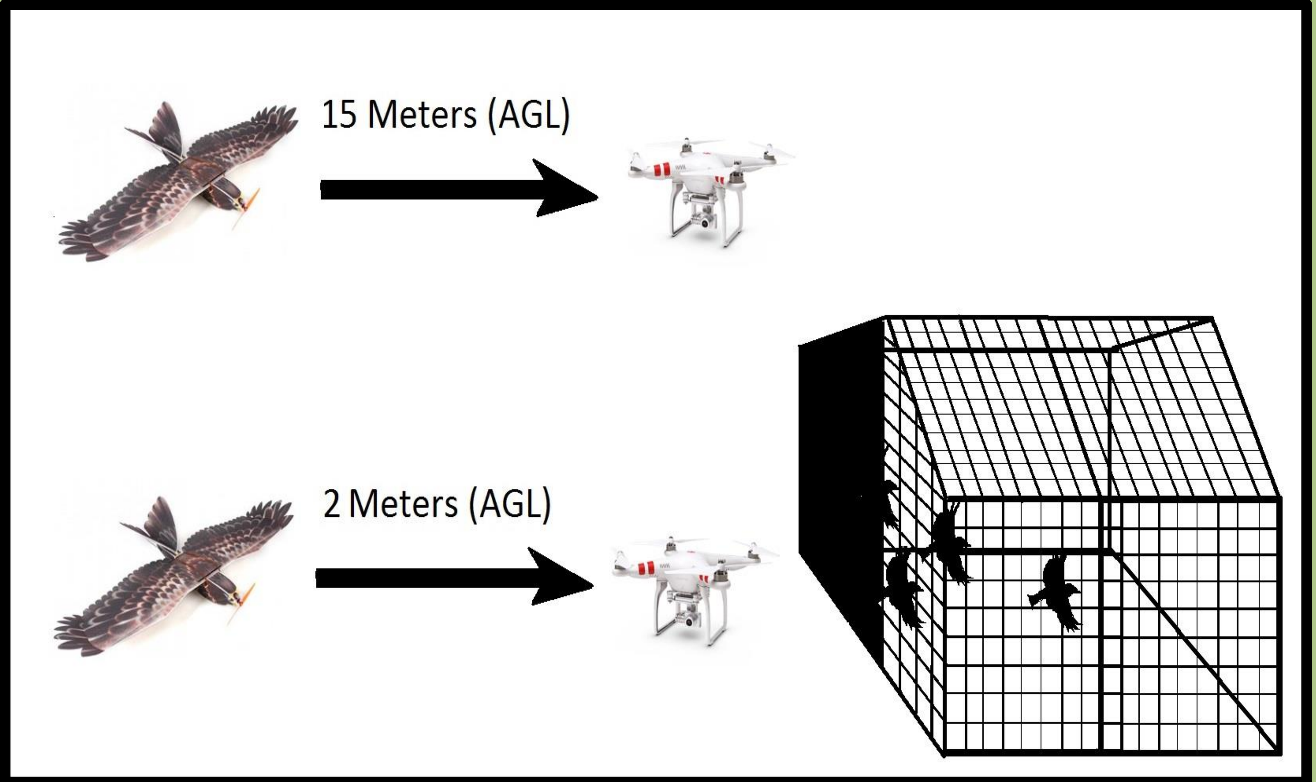


Figure 2. Flight Treatments
Flight treatments will consist of

(1) quadcopter direct approach at 2 m above ground level (AGL);

(2) quadcopter overhead approach at 15 m AGL;

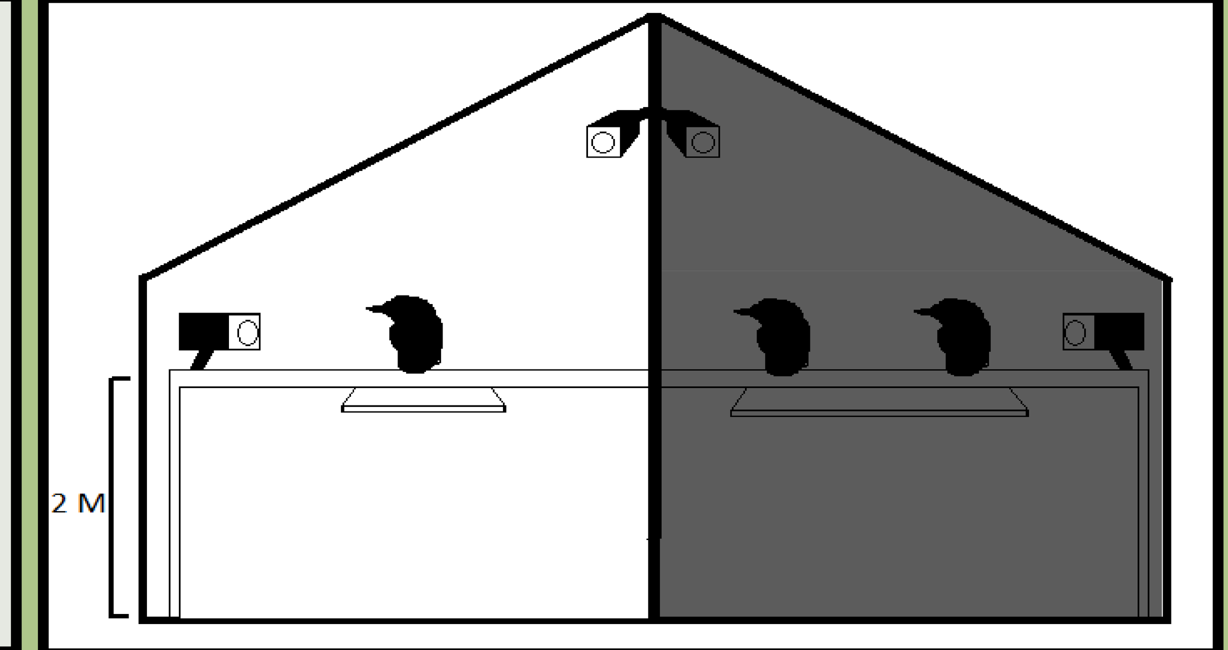
(3) RC aircraft direct approach at 2 m AGL; and

(4) RC aircraft overhead approach at 15 m AGL

Figure 3. Seminatural Enclosure

A single bird will be randomly selected to be the target individual and placed on the side of the enclosure exposed to UAS flights.

Two additional birds will be placed in the opposite side of the enclosure to facilitate flock behavior, but be visually obstructed from UAS approach.



Methods – Field Study

We will conduct the field study in the Prairie-Pothole Region of North Dakota, an area with a historically large red-winged blackbird population.

We will target 30 commercial sunflower fields for UAS flights.

Upon locating a sunflower field containing a foraging flock, we will record approximate flock size and distance between wetland edge and flock edge.

We will approach the blackbird flock directly at a controlled flight speed and altitude using one of the UAS platforms (RC predator model or quadcopter).

An approximated flight-initiation distance from approaching UAS platforms and total flight time and distance of the blackbird flock will be recorded.

Due to resemblance to a natural predator, we expect blackbird flocks to assess the RC predator model as more threatening, and initiate a flight response earlier than the quadcopter.

We also expect blackbirds to travel farther away from the predator model, and as a result, spend more time in flight.

Summary

By measuring behavioral response of red-winged blackbirds towards UAS, we will evaluate the efficacy of both a quadcopter style UAS and an RC predator model as potential hazing tools.

If the quadcopter provokes a delayed escape response in blackbirds compared to a simulated raptor attack, modifications to the quadcopter may be necessary to increase the antipredator response and thus efficacy as a hazing tool.

Future directions may involve evaluating the effects of speed, flight dynamics, and color of UAS platforms on escape response in birds [7].

Other possibilities may include installation of lighting systems to improve detection, sound speakers that play distress or predator calls, lasers, or on-board deployment systems that discharge nonlethal projectiles or repellents toward pest-species [4, 8].

The rapidly evolving technology of UAS suggests a promising future for integrating these unique tools into global pest management strategies.

Future UAS technology may include on-board bird-detection systems, extended battery longevity, and fully autonomous flight capabilities to increase the range of effectiveness and cost-effectiveness while decreasing habituation by birds [4].

Acknowledgements & Literature Cited

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