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The Effects of Owl Decoys and Non-threatening Objects on Bird Feeding Behavior

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Introduction

The relationship between predator and prey is a well studied phenomenon and is attributed to evolutionary changes of both the hunter and hunted in an ongoing struggle for survival (Lima 1988; Lima and Dill 1990). Adaptations that exemplify this predator-prey relationship include those found in many bird species. For example, birds of prey have evolutionarily developed adaptations such as sharp talons and keen eyesight to hunt small prey. Many bird prey species, on the other hand, have developed behaviors to outwit their pursuers, such as camouflage and misdirection (Caro 2005). Humans have capitalized on this predator-prey relationship to protect crops and food from enterprising organisms. The traditional scarecrow, with its mimicry of human features, has long been used in place of human presence to deter pests such as crows and seed-eating birds. Birds are known to inflict damage on seed crops and fruit orchards and can have financial impacts on various agricultural industries (Simon 2008). While scaring away bird pests is often desired, bird pest species, food type, location, time of day or season, and lifelike appearance of a predator facsimile may contribute to the efficacy of any scare treatment (Marsh et al. 1992; Simon 2008). Many modern scarecrows take their inspiration from nature, appearing as lifelike birds of prey to deter smaller avian pests (Marsh et al. 1992).

There is some controversy concerning the efficacy of these artificial predators. According to Conover (1985), scarecrows are not effective deterrents for some species, such as the American crow (*Corvus brachyrhynchos*). Depending on the unwanted bird species, scarecrows and raptor models (especially hawk and owl decoys) that appear most lifelike through motion, coupled with startling sounds or recorded distress calls, have been shown to cause the greatest deterrence (Marsh et al. 1992). This is most likely because a static, traditional scarecrow or perched bird of prey does not closely enough resemble a threatening situation for birds (Marsh et al. 1992). Generally, raptor models are believed to be more effective than human effigies (Marsh et al. 1992). Debate remains as to the most effective models for bird deterrence.

In this study, we tested songbird reaction to an owl decoy, which simulated the presence of a predator, compared to a non-threatening object placed in their environment within an oak woodland in Oregon’s Willamette Valley. Results can contribute to a valuable understanding about the efficacy of employing decoys over other pest deterrents and ultimately, predator evasion adaptations of birds.

We examined the bird deterrence effect of placing an owl model or cardboard box near bird feeders. We predicted that the introduction of a decoy owl would dramatically reduce the numbers of birds observed at feeders due to behaviors inherent in birds that are vulnerable to avian predation. In contrast, we expected that the presence of a box of similar shape, size, and color to the owl model would not reduce the frequency of bird-to-feeder visits; a box would be unsuccessful in discouraging bird visitations because it fails to resemble a threatening situation. However, if we were to find reduced feeding rates in both experimental situations, this might suggest a more general behavioral response by the birds to an unfamiliar object placed in their environment.

Methods

Study Site. We established bird feeders on the Linfield College campus at Cozine Creek, McMinnville, OR located at 45.2° N, 123.2° W and monitored them throughout the fall migration period during September and October, 2010. The Willamette Valley, which covers an area of over 30,000 km^2, includes approximately 25,000 km of streams. Cozine Creek is one of the many streams and rivers that eventually drain north to the Columbia River. Characterized by oak savannas and woodlands, the regions surrounding Cozine Creek provide ideal habitats for migrating bird species and are inhabited by various songbird populations (Roth et al. 2004).

Trial Set-ups. We measured the effects of no object, a box, and a plastic owl on the numbers of birds who visited feeders. Three to four days prior to introducing the objects, we hung four to five bird feeders (approximately 40 cm tall, 8 cm in diameter) filled with black oil sunflower seeds from tree branches in oak woodland regions surrounding Cozine Creek. We chose the type of birdfeed based on similar experiments performed near Cozine Creek, in which black oil sunflower seeds successfully attracted birds (unpublished data). The three- to four-day acclimation period was designed to familiarize birds with the new food sources (Gyimesi et al. 2010). Feeders were hung approximately 1.5 m from the ground, with feeder sites located over 60 m apart and out of direct line of sight with one another.

The number of times birds came to the feeders was recorded during bird-to-feeder frequency observations made between 1:00 and 4:00 pm with two observers positioned approximately 15 m away; previous studies have shown that human observers do not inhibit the feeding behavior of some bird species (Montevecchi and Maccarone 1987). Any effects of our presence were uniform across all trials.

There were three possible treatments for the bird feeders. The decoy owl treatment consisted of a great horned owl (*Bubo virginianus*) decoy (42 cm tall, 17 cm in diameter). The second treatment used a brown cardboard box of similar shape and size to that of the owl decoy (19.5 x 20 x 41 cm). Both objects were placed at the same height as the bird feeders and 1.5 m away from them. A third, control treatment included the bird feeder without the box or owl nearby. For each site, we first observed the feeder without the box or owl present and recorded the species and number of birds that came to feed. These initial control observations were followed by observing the same feeder after an owl decoy or a box was placed near it. We conducted eight observation sessions at sites with the owl treatment and seven observation sessions at sites with the box treatment. Each treatment observation session lasted fifteen minutes, with a five-minute interval between control and test. During each treatment, we observed and recorded the species and number of bird visitations. Each visit to a feeder was recorded as one visit, regardless of whether the same individual left and returned to the feeder multiple times.

Statistical Analysis. We analyzed our data by combining all bird frequency data regardless of species. Secondly, we compared bird frequencies concentrating on two individual species for which sufficient sightings existed for analysis, the black-capped chickadee (*Poecile atricapillus*) and red-breasted nuthatch (*Sitta canadensis*). For each data set, we compared the frequencies of the control treatment versus that of a second treatment, either the decoy owl or the box, using Student's paired t-tests (SPSS 1998; White and Bennetts 1996). Each data set was then analyzed using power analysis (with G Power 3.1.2 statistical software) to detect type II error.

Results

Overall Effect. The effects of each treatment type (control, owl, and box) on the mean frequency of bird-to-feeder visits for all species observed are shown in Figures 1 and 2. Comparing the presence of the owl decoy to no object at the feeder revealed a statistically significant difference between bird-to-feeder frequencies for the control and owl treatment periods (Figure 1, $t = 2.444$, $df = 7$, $p < 0.05$). When the owl model was introduced, the number of birds observed at the feeders decreased. The box treatment, however, did not suggest a difference in behavior compared to control treatments; there was no significant difference between the frequency of bird-to-feeder visits and the control treatments in the absence of an object (Figure 2, $t = -0.871$, $df = 6$, $p > 0.05$).

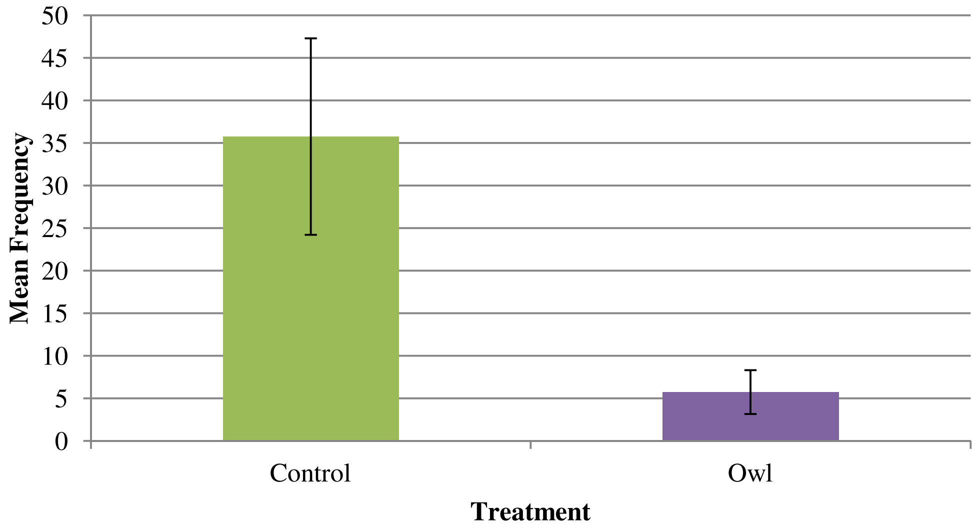

Figure 1. The mean frequencies ± standard error of birds observed during control and owl treatment periods. There is a significant difference between the mean frequency values (t = 2.444, df = 7, $p < 0.05$) where the introduction of an owl decoy decreased the number of birds frequenting the feeders.

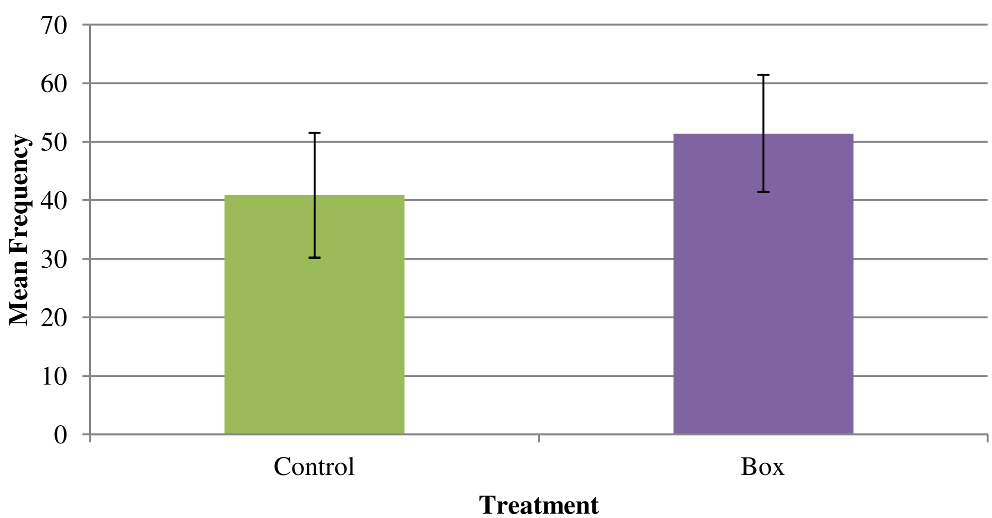

Figure 2. The mean frequencies ± standard error of birds observed during control and box treatment periods. There is not a significant difference between the frequency values (t = -0.871, df = 6, $p > 0.05$).

Species-specific Effect: Red-breasted Nuthatch. Red-breasted nuthatch visits to the feeders when either the decoy owl or the box was present were not statistically different than the control treatment; however, our sample size was small. Figure 3 shows the species-specific response of the red-breasted nuthatch to each of the treatments. The owl treatment ($t = 1.257$, $df = 7$, $p > 0.05$) resulted in a power analysis value of 0.444, while the box treatment ($t = 0.670$, $df = 6$, $p > 0.05$) produced a power value of 0.253.

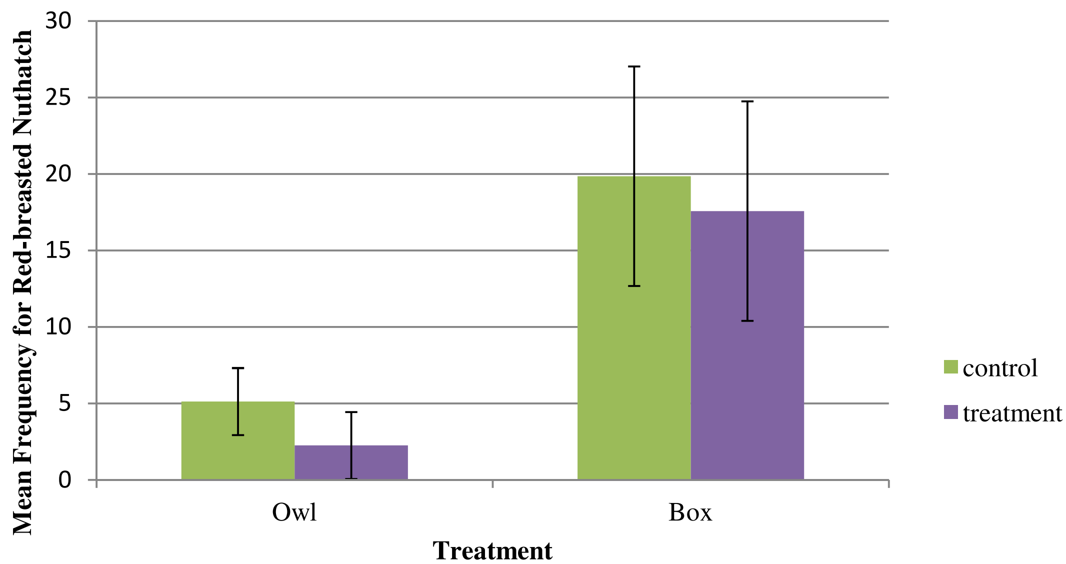

Figure 3. The mean frequencies ± standard error for the red-breasted nuthatch per treatment form. The owl treatment did not significantly affect red-breasted nuthatch behavior ($t = 1.257$, $df = 7$, $p > 0.05$). The box treatment frequencies also did not significantly differ from control period frequencies ($t = 0.670$, $df = 6$, $p > 0.05$).

Species-specific Effect: Black-capped Chickadee. Figure 4 illustrates the black-capped chickadee's response to the two test treatments. Frequencies observed during either test treatment did not vary significantly from control treatments. However, as with the nuthatch, the black-capped chickadee sample size was small. The owl treatment ($t = 2.056$, $df = 7$, $p = 0.078$) produced a power value of 0.127, while the box treatment ($t = 0.670$, $df = 6$, $p > 0.05$) yielded a similarly small power value of 0.098.

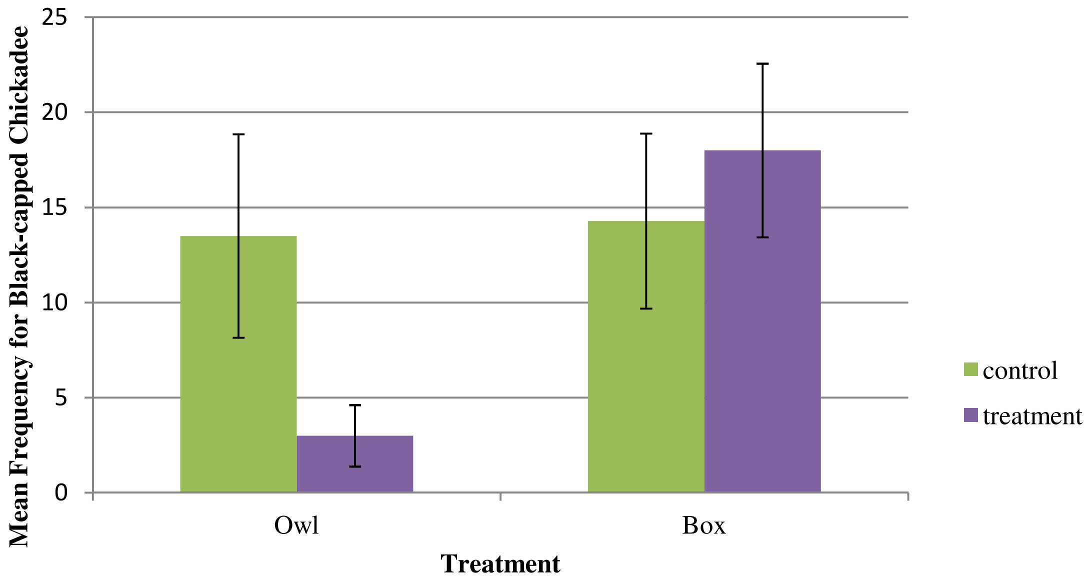

Figure 4. The mean frequencies ± standard error for the black-capped chickadee for each treatment form. The owl treatment did not significantly affect black-capped chickadee behavior ($t = 2.056$, $df = 7$, $p = 0.078$), although the p value was near 0.05. The box treatment frequencies also did not significantly differ from control period frequencies ($t = -0.752$, $df = 6$, $p > 0.05$).

Discussion

Our findings indicate that the owl decoy significantly deterred birds from feeding, while the box treatment did not. Therefore, birds seemingly did not react to an unusual, non-threatening object in their environment, but rather they appeared to be able to detect and react to the appearance of a predator. The bird deterrence effect of a model predator has often been studied with respect to animal feeding behavior and agricultural ecology, but various conclusions have been reached. Conover (1985) suggested that traditional scarecrows are not effective deterrents for some species. While raptor models are believed to be more effective than human effigies for most small bird types, birds often habituate to the artificial predator's presence after some period of time. Habituation to an artificial predator is slowed when models appear more lifelike and threatening and simulate a more realistic predation situation (Conover 1985; Marsh et al. 1992).

Our study strongly suggests (CI = 95%) that the decrease in the number of visits birds made to feeders was related to the introduction of the owl model to their environment. This change in behavior is likely related to the birds' reactions to the predatory features of the decoy. Studies with similar owl decoys indicated that a model created from an amalgam of owl features – such as the decoy used in this study – produces widespread, if temporary, aversion by birds (Marsh et al. 1992). Our comparison of songbird behavior to a non-threatening object (the box) and to the decoy owl indicate that the visible predatory features of the model, including huge eyes, realistic beak, and ear tuffs, stimulated the birds to select safety over food. Great horned owls (*Bubo virginianus*), western screech owls (*Otus kennicottii*), and the smaller northern pygmy owl (*Glaucidium californicum*), whose habitat range includes western Oregon, have been known to prey upon songbirds, including our observed species (Burns 2004). Since Cozine Creek supports large numbers of passerines in fall migration, these owls are likely present.

The presence of predators in the immediate area could induce cautious behavior in the local songbird populations. A study conducted by Montevecchi and Maccarone (1987) on the effect of decoy owls on adult and juvenile gray jays concluded that, since the juveniles did not react to the scarecrow, this aversion could be learned through previous encounters with an owl predator. It is therefore possible that the birds of Cozine Creek have had exposure to these types of predators, suggesting that predatory features displayed by the owl decoy may have effectively deterred birds from feeders. The capacity to learn such behaviors may also be an adaptive response to the presence of a predator.

Songbirds generally forage for food, employing a series of interconnected tradeoffs in which they sacrifice safety for food to maximize survival (Werner and Anholt 1993). For instance, songbirds must often leave the protected underbrush for more open terrain, where other animals can easily predate upon them (Brown 1992). Anti-predator tactics would be necessary and vital adaptations to increase the likelihood of surviving during foraging attempts. Our results suggest that the songbirds foraging in Cozine Creek are adapted to recognize and avoid potential threats. They chose to forgo the opportunity of high payoff, in the form of easily obtained birdseed, in a high-risk situation of a perceived predator. This behavior indicates that the songbirds have evolved to maximize foraging capacity while minimizing risk. If birds do not adapt to predators in their environment, as suggested by Reznick and Ghalambor (2001), their populations will decline, with the potential for extinction, as the result of directional selection.

Our analysis of the experimental treatments on the red-breasted nuthatch and black-capped chickadee did not show a significant difference in frequency caused by the decoy owl compared to the box. We analyzed these species because they visited the feeders most frequently out of all observed species. Chickadees and nuthatches are smaller insectivores that might have different evasion techniques than the other observed species, which only eat seeds (Bélisle et al. 2001; Fontaine and Martin 2006). Low power values for each species suggest a high likelihood of type II error (Ellison and Gotelli 2004). Thus, we believe that our sample sizes were too small to obtain any significant information about the treatments' impacts on these species. Larger sample sizes could allow for a more complete analysis of species-specific reactions to the presence of an owl decoy near feeding sites. Although there was not a statistically significant difference in chickadee reactions to the different treatments, the p value was 0.078, suggesting that a predator evasion adaptation might exist in that particular species. Additional testing could confirm this general trend.

Cozine Creek is surrounded by a patchwork of oak and deciduous forests and open savannah covered in Himalayan blackberry (*Rubus armeniacus*) undergrowth. Our study sites were placed throughout this mixed landscape with some respect to active bird sites and with a preference for trees that allowed for optimal observation. In general, many passerines, including those species seen in our study, may prefer habitats that provide cover, such as dense shrubby understory, compared to open grasslands (Martin 1993). A useful modification of this experiment would be to target well-defined habitats where certain bird species are mostly likely to be found, such as those sites with adequate cover. Our study sites were only loosely directed toward areas of high observed bird abundance. Low bird abundance at some study sites may be explained by a number of factors, including the type of bird bait, openness of habitat, and the time of year. We used bird feeders that dispensed sunflower seeds, which likely selected for generalists and seed-specific species. We also conducted our experiment in late autumn, so some migratory birds may have already left the area, leaving only resident individuals (Ricklefs 2000). This would have skewed our data to a specific group of non-migrant, seed-eating birds, excluding a variety of other guilds. To better understand the effects of our treatments on general bird behavior, the study could be repeated in spring, when species richness is highest, or year round, and could include other forms of bait to increase observed biodiversity (Campbell and Reece 2007).

According to Marsh et al. (1992), birds often avoid owl models for several hours or days, but soon recognize that a decoy is not a threat. Fifteen-minute time intervals for displaying an owl model may not have been sufficient to test the effect of habituation to the perceived predator. A continuation of our study involving other food types, expanded feeder placement, different time(s) of year, and/or variations in treatment time periods might support our findings and increase understanding of how songbirds react to predators.

The appearance of an owl decoy was effective in deterring feeding behavior in a variety of bird species. These findings may suggest possible alternatives to harmful pest-control practices, which include the introduction of invasive species and chemicals to the environment (Reganold et al. 1990). Decoy predators impact targeted pests and allow the rest of a community to remain undisturbed (Marsh et al. 1992); non-lethal methods to protect crops may minimize the impact of agricultural industries on organisms associated directly and indirectly with the crops. The deterrence effect of an artificial predator may improve methods employed in agricultural science and expand understanding of animal behavior in response to perceived predation.

Our conclusions suggest that predation has evolutionary consequences beyond morphological adaptations. The songbird populations could identify and avoid a perceived predator, even if it meant rejecting an abundant source of food. We hypothesize that there are two possible explanations for the evolutionary mechanism behind these observed behaviors: there is an adaptation towards anti-predation behavior in the presence of owls or an adaptation towards the capacity to learn such behavior; the behavior of birds near Cozine Creek may be a combination of the two. Our observations are not limited to avian behavioral patterns; predator-evasion techniques have been suggested for many species, including such diverse animals as stickleback fish and monarch butterflies (Huntingford 1976; Brower 1988). The Cozine Creek songbird populations are additional examples of evolutionary adaptations in behaviors as basic as foraging and predator-evasion and have far-reaching implications for our understanding of general animal behavior.

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