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FLIGHT DISTANCES OF BLACK-BILLED MAGPIES IN DIFFERENT REGIMES OF HUMAN DENSITY AND PERSECUTION[1]

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Key words: Black-billed Magpie; Pica pica; persecution; human density; flight distance; flushing response.

Vertebrate responses to human beings have both a learned and genetic component. The learned component is apparently influenced by both the number and outcome of individual human–bird interactions that occur within the animal's lifetime (e.g., Buitron 1983, Knight and Temple 1986). Some bird species have adjusted to high human density and have become "urbanized" (e.g., Cooke 1980). The ability of birds to coexist with humans is largely attributed to the absence of active persecution (e.g., shooting) (Knight et al. 1987). Outside of urban or protected areas, however, active persecution occurs, whether legally (e.g., hunting seasons) or illegally. In the presence of persecution it would be maladaptive to habituate to humans, and birds show avoidance behavior (Knight 1984, Knight et al. 1989).

Terrestrial vertebrates may show variation to human intruders by altering flushing response and flight distance (Altmann 1958). Both are important behavioral attributes of organisms in that they affect survival and essential daily routines (e.g., foraging, social behavior). The Black-billed Magpie (*Pica pica*) is a common spe-cies in Europe and western North America and has made the transition to an urban environment (Birkhead 1991). We examined two hypotheses pertaining to flushing response and flight distance in magpie populations in northeastern Colorado. First, in the absence of active persecution, we predicted that the flushing response and flight distance of magpies would correlate negatively with human density. Second, magpie flushing response and flight distance would be greater in areas with human persecution than in areas without persecution.

METHODS AND STUDY AREA

To examine the effects of human density and persecution on magpie flushing response and flight distance, we studied magpies in: (1) an urban, nonpersecuted population; (2) rural, nonpersecuted populations; and (3) rural, persecuted populations. We visited 11 sites in northeastern Colorado between 12 December 1989 and 13 April 1990. Three urban, nonpersecuted locations were in the city of Fort Collins (approximately 90,000 people); four rural, nonpersecuted sites (hereafter called state parks) in Larimer and Jefferson counties; and four rural, persecuted sites in Larimer County. The rural areas were predominately shrub and grassland, whereas the urban sites were residential neighborhoods and parks. Because the discharge of firearms is prohibited in both the urban and state park sites, we assumed that magpies in these areas were not subject to active persecution.

TABLE 1.   Responses of Black-billed Magpies to a person in urban and rural areas, northeastern Colorado.

Response of magpies to person	Rural, nonpersecuted	Rural, persecuted	Urban, nonpersecuted
Proportion of magpie groups that flushed	21/22	20/20	15/21
Distance (m) between person and magpies when magpies first flushed ($\bar{x} \pm$ SD)	28.9 ± 15.9	64.7 ± 39.2	9.4 ± 8.3

Outside the city limits and state parks, use of firearms was common. In these areas, ranchers and farmers treat magpies as pests since they believe magpies prey upon poultry (e.g., eggs and young chicks), feed on open sores on livestock, and feed on cultivated fruit and ornamental shrubs. Although magpies are protected under the Migratory Bird Treaty Act (1972), they are shot without a permit if found "committing or about to commit depredation," or if they become a nuisance (Code of Federal Regulations, Section 50, Part 21, rev. Oct. 1, 1989). These observations, and conversations with people in the agricultural/livestock business, led us to assume that magpies were being actively persecuted in our "rural, persecuted" areas.

Upon locating a magpie(s), we (always one person carrying binoculars) would pause 15 sec to ensure that we had been seen. Only magpies that were perched in trees and had an unobstructed line of sight between them and us were approached. We would then walk toward the tree containing the bird(s) at approximately 0.5 m/sec. Two variables were measured: flushing response, (i.e., whether the bird(s) flew at our approach) and flight distance (i.e., the distance between us and tree containing the bird[s] upon flushing). We restricted our observations to magpies at feeding areas; magpies were not approached when they were associated with active nests. Individual sites were visited only once to avoid counting the same birds. Data were collected when temperatures were >5°C, wind speed was <12 km/hr, and there was no precipitation.

Because individuals in flocks may detect an approaching person sooner than individual birds, which in turn may affect flight distances (Siegfried and Underhill 1975, Lazarus 1979, Dhindsa and Boag 1989), we did not approach groups of >4 birds. Data were analyzed using Chi-square contingency, Fisher Exact and Mann-Whitney U-tests (Zar 1984). The latter two tests were one-tailed.

RESULTS

Magpie group size did not differ among the three treatments ($\chi^2 = 2.16$, $P > 0.90$) enabling us to compare the effects of human density and persecution across treatments. Our hypothesis that human density affects flushing response and flight distance was supported. Birds in state parks flew at greater distances than did birds in Fort Collins (Mann-Whitney $U = 317.5$, $P < 0.0025$; Table 1). Also, magpies in Fort Collins flushed less often than those in state parks (Fisher Exact test, $P = 0.04$).

The data partially support our second hypothesis that persecution will result in a higher flushing response and greater flight distance. Magpies in rural, persecuted areas flew at greater distances than magpies in state parks (Mann-Whitney $U = 319$, $P < 0.001$; Table 1). Magpie flushing response, however, did not differ between rural, persecuted areas and state parks (Fisher Exact test, $P = 0.52$).

DISCUSSION

Both human density and history of persecution correlated with flight distance and flushing response of magpies. Magpies in Fort Collins had the shortest flight distance and the lowest flushing response to humans; whereas, in rural, persecuted areas magpies showed the greatest flight distance and always flushed. Magpies, however, showed equivalent flushing responses in rural areas suggesting that persecution alone does not explain this behavior. Due to the proximity of persecuted and nonpersecuted rural areas, it is possible that magpies might use both areas. In such cases it is possible that individual birds might respond differently depending on where they are. Different reactions in the same bird would suggest a learning process which could be important to their survival as a generalist in areas with different histories of human activity.

Magpies in urban areas are in contact with nonthreatening humans more often than are magpies in rural areas. Consequently, they have greater opportunities to learn from their interactions with humans. Rural magpies did not show a similar level of habituation to humans, either because of different levels of persecution or because of fewer, or more varied, human encounters. In areas where magpies are not persecuted, they need not flush at great distances. If magpies are not habituated to human presence they may spend disproportionately more time avoiding humans thereby taking time away from essential daily activities (e.g., feeding). Our findings suggest that behavior of Black-billed Magpies is highly adaptive and influenced by the unique human history of particular areas.

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THE ADAPTIVE SIGNIFICANCE OF EGGSHELL REMOVAL BY NESTING BIRDS: TESTING THE EGG-CAPPING HYPOTHESIS[1]

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Key words: American Coot; Fulica americana; *egg-capping; eggshell removal; hatchability.*

Many birds remove empty eggshells from their nests soon after their nestlings have hatched (reviewed by Nethersole Thompson and Nethersole Thompson 1942, Tinbergen et al. 1963). Tinbergen et al. (1963) suggested five possible reasons why birds might remove hatched eggshells from the nest: (1) sharp shell edges could injure newly hatched chicks, (2) unhatched eggs could become trapped inside hatched shells, thereby reducing hatchability, (3) hatched shells could interfere with brooding, (4) hatched shells could reduce nest hygiene and increase the risk of bacterial infection, and (5) hatched shells could reduce nest camouflage, thereby increasing the risk of predation by visually-oriented predators. Through an elegant series of experiments on eggshell removal in Common Black-headed Gulls (*Larus ridibundus*), Tinbergen (1963) and colleagues (Tinbergen et al. 1963) found considerable support for the nest-camouflage hypothesis, but they did not test any of the other four hypotheses.

Removal of hatched eggshells has been observed in a variety of birds where nest camouflage seems to be an unlikely selective advantage. Common Ringed Plovers (*Charadrius hiaticula*) and Red Knots (*Calidris canutus*) have precocial offspring that leave the nest soon after hatching, yet they remove hatched eggshells from their nests (Tinbergen et al. 1963, Whitfield and Brade 1991). Hatched eggshells are also removed by a variety of cup- and cavity-nesting passerines (Nethersole Thompson and Nethersole Thompson 1942; Arnold, pers. observ.), but empty shells are unlikely to increase the conspicuousness of these birds' nests. Thus, it seems unlikely that the nest-camouflage hypothesis can account for eggshell removal in all species of birds.

Derrickson and Warkentin (1991) recently reported several instances in which unhatched eggs became trapped inside the shells of previously-hatched eggs, a phenomenon that they referred to as "egg-capping." They suggested that egg-capping could lower hatchability by reducing embryonic gas exchange or by interfering with the pipping process, and that egg-capping might be an important and unappreciated factor affecting the evolution of eggshell removal in birds. Derrickson and Warkentin (1991) reported that two of two capped eggs in a single Northern Mockingbird (*Mimus polyglottos*) nest failed to hatch, and that two of two capped Merlin (*Falco columbarius*) eggs from two different nests failed to hatch (but both of these eggs turned out to be infertile). Although their data are suggestive of a hatchability cost to egg-capping, their limited observations constitute insufficient evidence of such a cost.

In this note, I attempt to test the egg-capping hypothesis as it relates to eggshell removal by American Coots (*Fulica americana*). American Coots usually remove newly-hatched eggshells from their nests within an hour of hatching (Arnold, pers. observ.). This is probably not related to nest camouflage because hatched eggshells are relatively inconspicuous in comparison to the large overwater nest bowls used by coots. Moreover, American Coots suffer very low rates of nest predation during hatching (ca. 0.2% daily loss rate; Arnold, unpubl. data), and losses are mostly caused by