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The risks of avian mobbing and distraction behavior: an anecdotal review.—The adaptive value of a behavioral trait usually is assessed in terms of its costs and benefits. Although the ultimate units of interest are fitness units, proximate measures such as time and energy expenditure or risk incurred by the performer usually are used as fitness surrogates, for expediency. Time and energy expenditures are more readily quantified than risk and thus have tended to dominate discussions of the costs of behavior. In the case of antipredator behavior, however, time-energy investment may be a poorer approximation of cost than is risk (Trivers 1972). Even for species like the American Avocet (*Recurvirostra americana*), in whose breeding biology antipredator behavior seems to play a major role (Sordahl 1986), mobbing and distraction of predators consumes only a small part of the daily time budget (Gibson 1978). Risk, however, is an elusive factor. Predation is rarely observed, and injury or mortality resulting from mobbing or distraction of a predator is a very small subset of all natural predation events. Furthermore, because mobbing and distraction usually occur in a context of parental care (Shedd 1978, 1982; Sordahl 1986) and because parental care is essential for the survival of the eggs or young in virtually all birds, death or injury resulting from these behaviors is expected to be rare because parental self-sacrifice would be counter-selected (Skutch 1976, Gochfeld 1984). Most authors simply note that these behaviors appear to be risky but probably are not highly so because: (1) the performer is alert and aware of the predator, and (2) there is little contrary evidence. It is the purpose of this paper to show that the risks of mobbing and distraction, though they may be statistically small (Gochfeld 1984:353, Hennessy 1986), are not negligible (see also Curio and Regelmann 1986). I include a literature review of anecdotes describing negative outcomes for performers of these behaviors.

Review of literature.—Predators often seem reluctant to leave an area when mobbed (pers. obs.), creating a situation with potential for aggression toward vigorous mobbers. Predators have often been reported to attack their mobbers (Forbush and May 1939:102; Meinertzhagen 1959:98, 162; Cade 1962:398; Cade 1967:49; Stefanski and Falls 1972:1509; Böcking pers. comm. in Curio 1978:178). There are many other reports of mobbers being killed or captured by the predator (Mason 1915; Forbush 1927:109; MacIntyre 1936 in Watson 1977:89; Broun 1947; Meinertzhagen 1959:87, 88, 119, 162; Cade 1962:395; Wetmore 1965:439; Friemann 1975; Myers 1978; Denson 1979; Todd 1980; McCaffery 1982; Walker 1983; England 1986; Wilson 1986). Predators such as large falcons that prey on adult birds may be particularly dangerous to mob. Meinertzhagen (1959:162) noted that the Northern Hobby (*Falco subbuteo*) is intolerant of mobbing, and Burger (pers. comm. in Gochfeld 1984:354) saw a Peregrine Falcon (*F. peregrinus*) capture one of the Common Terns (*Sterna hirundo*) that was mobbing it over a colony. Gochfeld (1984:354) further noted that he has captured mobbing Common Terns by hand. Some predators may actually capitalize on mobbing by hunting in pairs or provoking mobbing as a hunting strategy (Smith 1969). Mobbing may be so intense that the mobber fails to see a second predator (Rudebeck 1950–51:208). Southern (1970) repeatedly observed a Northern Harrier (*Circus cyaneus*) chasing crows in a group that was mobbing a Great Horned Owl (*Bubo virginianus*), suggesting that it was trying to take advantage of their preoccupation.

Distraction behavior is probably less dangerous than mobbing, because it usually is performed at a somewhat greater distance from the predator. I found only two records of a distracting bird being killed by the predator to which it was displaying (Jourdain 1936:32, Brunton 1986). But Balda's (1965) observation of a Loggerhead Shrike (*Lanius ludovicianus*) killing a Mourning Dove (*Zenaidra macroura*) that was distracting the author illustrates a dangerous property of distraction behavior—it attracts more predators than initially were

present. The circumstances of distraction display may also create significant psycho-physiological stress, even resulting in the displayer's death (Graul 1975:16, Blohm 1981).

Discussion.—The 35 examples cited above of birds being attacked, captured, killed, or dying of stress while mobbing ($N = 30$) or distracting ($N = 5$) a predator document that these behaviors are dangerous. As Hennessy (1986) pointed out, their level of danger (i.e., the probability of injury or death for an individual) relative to other behaviors is not known. Such data would be extremely difficult to obtain. However, there are other reasons to believe that mobbing and distraction are highly risky (Curio and Regelman 1986), such as geographical variation in mobbing that is appropriate to the danger posed by local predators (Curio 1975). From a theoretical viewpoint, because the ability of many bird species to harm a predator is questionable, it may be necessary for mobbers to endanger themselves in order to "convince" the predator that their threat is real (Zahavi 1977). The threat, then, may be a sort of challenge which should often be declined because of the dissimilar benefits and costs for mobber and predator (Maynard Smith and Parker 1976, Dawkins and Krebs 1979).

The vulnerability of a mobbing or distracting bird should correlate with the distance from the predator at which the display is performed. Proximity increases the displayer's conspicuousness and the probability of eliciting an attack. An important corollary is that the effectiveness of display is probably related directly to the risk involved. It is noteworthy that distraction display practically is nonexistent in groups other than birds (Armstrong 1954:128), presumably because the risks are too high if the decoy cannot escape into an element out of the predator's reach. Even terrestrial predators such as dogs often come quite close to capturing displaying shorebirds and ducks (pers. obs.). Instances of birds distracting their avian predators are rare (Armstrong 1954:127, pers. obs.). Thus ground predators, particularly mammals, are the chief recipients of distraction behavior.

In summary, birds that mob or distract predators place themselves in close proximity to dangerous animals that may attack them. No quantitative risk assessments for individual birds have yet been made. However, I cite here 35 reports from the literature of birds being attacked or dying while mobbing or distracting a predator. Taken together, these anecdotes strongly support the hypothesis that mobbing and distracting birds are at deadly risk.

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Frequency of Northern Bobwhite X Scaled Quail hybridization.—Occurrence and plumage of Northern Bobwhite (*Colinus virginianus*) X Scaled Quail (*Callipepla squamata*) hybrids are well documented (McCabe, *Auk* 71:293–297, 1954; Sutton, *Southwest. Nat.* 8:108–111, 1963; Johnsgard, "Grouse and Quail of North America," Univ. of Nebraska Press, Lincoln, 1973). Wild hybrids are reported from three counties of the Texas rolling plains (Sutton 1963) and one county in the South Texas plains (Lehmann, "Bobwhites in the Rio Grande Plain of Texas," Texas A&M Univ. Press, College Station, 1984). Sutton (1963) suggested that interbreeding may be fairly common in portions of the rolling plains. I estimated frequency of hybridization between Texas Bobwhite (*C. virginianus texanus*) and Chestnut-bellied Scaled Quail (*C. squamata castanogastris*) in the South Texas plains.

Observations and collections are from a 4251-ha portion of the Jennings Ranch, Zapata County, Texas. In the 1986–87 hunting season, 1787 Northern Bobwhites and 257 Scaled Quail were harvested. A juvenile female hybrid (no specimen) was shot on 13 December 1986 and a juvenile male hybrid (specimen in author's possession) was shot on 16 January 1987. Thus, hybrids comprised 0.11 and 0.78% of bobwhite and Scaled Quail harvest, respectively. I trapped 433 Bobwhite and 40 Scaled Quail during October 1987, including one adult male hybrid on 5 October 1987 and two juvenile hybrids (sexes unknown) on 8 October 1987. Trapping sites of the juveniles were >1 km apart and were >3.5 km from the trapping site of the adult. I banded, photographed, and released these birds. Hybrids comprised 0.69 and 7.50% of trapped bobwhites and Scaled Quail, respectively. A juvenile male hybrid (Museum # JTK 88181) was shot on 16 January 1988. Harvest during the 1987–88 season was 1060 bobwhite and 236 Scaled Quail. Hybrids comprised 0.09 and 0.42% of bobwhite and Scaled Quail harvest, respectively.

Estimates of hybrid frequency are conservative. Deep sand sites comprise >15% of the area. Scaled Quail are absent on these sites. Excluding bobwhites trapped and harvested in