March 1972

FACTORS RELATING TO ALARM STIMULI IN BIRD CONTROL

Gordon W. Boudreau
Director, Wildlife Technology, Paicines, California

FACTORS RELATING TO ALARM STIMULI IN BIRD CONTROL

GORDON W. BOUDREAU, Director, Wildlife Technology, Paicines, California

I'm sure all of you have often heard of bird control methods which were successful in one place and failures elsewhere. Perhaps you have experienced these results yourself. Quite often, bird control apparatus or concepts are condemned as failures when actually other factors are responsible. Today, I shall explain some of the reasons these discrepancies occur.

My observations, over a period of 15 years, reveal that birds' responses to alarm stimuli varies with environmental conditions, clocktime, physiological requirements, social structure, species, and other factors. All of the observations reported herein were made under natural conditions while researching methods to reduce bird depredations in agricultural crops, and to eliminate bird collisions with aircraft in or near airports and air bases. These problems have not been widely publicized but nevertheless are very real and, at times, quite serious.

Birds receive most of their information through the eyes and the ears, and these sensory mechanisms have been well studied. The avian tactile (touch) sense has received little attention and this may prove to be another important channel of information. The other two senses, smell and taste, are regarded by most authorities as being less well developed. Taste, however, is important to birds in that it allows them to discriminate between preferred foods and, in some species, to detect minute traces of foreign material, such as toxicants. In this paper, however, only visual and acoustic alarm stimuli are discussed.

ALARM STIMULI

What is an alarm stimulus?

An alarm stimulus is defined as a sight or sound which elicits an escape response from the recipients. The responses are usually manifested by efforts to evacuate the area or to attain safe cover. A few bird species freeze in place as a survival recourse, and with these, perfection of camouflage is a contributing factor.

An alert response is merely a low level alarm response in which the birds are alerted but remain in place or slowly move away. Whether an alarm stimulus elicits an alarm or an alert response depends chiefly on the proximity of the stimulus.

Avian and terrestrial predators usually constitute the alarm stimuli observed in nature, and to a bird, humans are bipedal predators.

Any strange sight or sound often elicits initial startle responses which resemble alarm responses but differ in that birds quickly habituate to these stimuli. Birds do not readily inure to valid alarm stimuli unless they are incessantly exposed to them with relatively little danger to themselves. (Boudreau 1968).

Unless otherwise noted, the acoustic stimuli mentioned in this paper are the target species' natural alarm sounds, reproduced on tape, and projected at the birds.

ALARM SUSCEPTIBILITY FACTORS

Environment. Environmental conditions are important influences in birds' susceptibility to alarm stimuli. Birds of the open prairie and fields, such as Horned Larks, Eremophila alpestris; Meadowlarks, Sturnella sp.; etc., rely mainly on visual information, as do pelagic species. Forest and brush species depend largely on acoustic warnings from conspecifics, particularly if they are a gregarious species. Numerous species, however, will not respond to acoustic warnings until they have confirmed the information visually.

A bird's sensitivity to alarm stimuli is closely related to its vulnerability to attack and is proportional to its distance from safety. For example, House Finches or linnets, <u>Carpodacus mexicanus</u>, readily respond to reproductions of their alarm sounds when they are feeding on the ground or in vineyards or orchards. After they attain the safety of a power line, however, the same sound moves them, but only when it is projected at greatly increased intensity, indicating that their sensitivity drops to very low levels once they feel they are safe. This same behavior pattern is observed with many other Fringillids.

An interesting example of environmental influence occurred on the rocket sled test track at Holloman Air Force Base, New Mexico. The track is similar to a railroad track but is secured atop concrete walls and is elevated about 73 cm. above ground level. The track is oriented north and south. A flat bottom trough, 65 cm. deep, separates the two rails and is used as a water reservoir for braking the rockets. After the water is drained off numerous small puddles remain which attract all the birds in this desert habitat. My observations were made in January, 1971, when the track was frequented mainly by Horned Larks and House Finches. When the birds were down in the trough, drinking or bathing, their visibility was limited to north, south, and vertical, and under these conditions they were denied visibility east and west. Brief reproductions of these species' alarm sounds never failed to elicit instantaneous responses when the birds were down in the trough. The birds immediately rose from the trough and flew to more open perches for better visibility. The same sounds, projected toward birds on the open ground nearby, brought responses in 80% of the projections and, with the Horned Larks, the responses were often delayed from three to five seconds.

These results are interesting in that they demonstrate the high level of sensitivity to alarm stimuli under unfavorable environmental conditions. They also revealed, in the Horned Lark, an ability to suddenly shift their reliance from visual receptors to acoustic sensory mechanisms for survival.

Another example of environmental influence may be observed when one attempts to evict birds from their established night roosts. Birds are careful to select night roosts that provide the ultimate in safety and comfort. Consequently, they are reluctant to leave these places, and here, their sensitivity to alarm stimuli drops to low levels. The same birds will readily respond to visual and acoustic stimuli in daylight away from the roost (Boudreau 1967). In some species, however, visual neural inhibitors prevent the birds from flying in darkness.

Clocktime. Observations in the field reveal a cyclic pattern in birds' susceptibility to alarm stimuli, which is related to the time of day. These cycles closely parallel the results reported by Schwab (1968) in susceptibility to toxicants. In both instances sensitivity is highest early in the morning and gradually decreases toward evening. In crop depredation studies I found Starlings, Sturnis vulgaris; Red-winged Blackbirds, Agelaius phoeniceus; and House Finches, often ignored alarm stimuli in the early evening hours while readily responding to the same stimuli during the day. The morning and evening tests were made with different flocks which precluded any incipient habituation to the stimuli. I attribute this behavior to their susceptibility cycles and also to the necessity of feeding well prior to roosting. It is possible that these susceptibility cycles may be related to birds' diurnal rhythms, which have not yet been well studied.

Physiological Requirements. Hunger and thirst often induces an audaciousness in birds which they do not ordinarily display. Band-tailed Pigeons, Columba fasciata, are a good example of this. In several experiments I was successful in repelling a flock of 75 inveterate pigeons from a choice Olallie berry field during the day, using both visual stimuli and noises. An Olallie berry is a boysenberry-blackberry hybrid relished by many bird species. The pigeons remained in the vicinity during the day and little feeding was observed. Specimens collected at various times during the day had little or no crop contents, indicating a condition of hunger late in the afternoon. About 30 minutes before their normal roosting time the pigeons descended into the berries and engaged in a feeding frenzy during which they ignored all efforts to evict them, including shotgun fire at close range. Several times I approached to within four meters of them before they moved short distances and resumed feeding. My assistants collected several specimens leaving the berries and flying to the nearby roost, and all had from 12 to 15 berries in their crops. These observations indicate it is imperative that Band-tails, at least, must enter the roost with full crops otherwise they may not survive the night in adverse weather. This degree of temerity, however, is not displayed by all species, but a reluctance to respond to normal alarm stimuli, and abnormal persistence in returning when evicted, is usually observed in feeding birds just prior to leaving for the night roost.

Birds frequenting isolated sources of food and water often become quite refractory to alarm stimuli unless the predator is very near, indicating that hunger and thirst take precedence over survival. In other words, the birds are willing to take calculated risks to obtain food and drink. My observations reveal that hungry birds do not respond as readily as do well fed individuals.

Social Structure. Gregarious species are much more susceptible to acoustic alarm stimuli than non-gregarious birds. Furthermore, gregarious species usually have well developed alarm sounds to which they readily respond.

Another interesting observation is that large flocks of a species respond much better than smaller groups and, in fact, groups of five or less often fail to respond. This is particularly noticeable in House Sparrows, Passer domesticus; House Finches, Band-tailed Pigeons, and certain species of blackbirds. Many times I have failed to elicit responses to alarm sounds from groups of three to five birds. After these were joined by several others the entire group always responded to the next sound projection. This behavior suggests that some individuals are more timid than others and respond more readily, and these trigger the response of the others in the group. Conversely, some individuals are more refractory and require the visual stimulus of a departing timid bird to reinforce the acoustic stimulus. The odds that a small group of birds will include a sensitive individual appear to be about six or seven to one. Obviously, the larger the flock the more sensitive individuals it will contain and the better will be the response. This applies to all alarm stimuli.

Nesting pairs are usually very reluctant to abandon their nests and territories in response to reproduced alarm sounds. Yet, the same species responds very well when they form into flocks later in the year. Robins, Turdus migratorius, are a good example of this. Thus, a seasonal factor is often involved in birds' susceptibility to alarm stimuli.

Incidently, I might mention that in two experiments, nesting starlings did abandon their nests and eggs after exposure to repeated projections of their alarm sounds.

Species. In working with birds' alarm sounds one quickly learns that some species respond very well, some moderately so, and some not at all. Species which are vulnerable to predation respond best. I use the size of the egg clutch as one indicator of the response to be expected. In general, species with large egg clutches are more vulnerable to predation and respond more readily. The Laysan Albatross, Diomedea immutabilis, which lays only one egg per year, has no known alarm sound, and ignores even humans. Like many other pelagic species they have few if any natural enemies and consequently they have never developed a fear complex. Conversely, many gallinaceous species such as quail, which lay eight or more eggs, have many enemies, use well defined alarm sounds and readily respond to them.

Other Observations. In addition to my studies with alarm sounds, I have investigated responses to other bird sounds such as feeding sounds and territorial songs. In all cases, the factors outlined above, plus several others, must be considered when evaluating experiments. A well fed bird cannot be expected to respond to its feeding sound, and, with many species, males will not be attracted to reproductions of their territorial songs except during their breeding season.

It follows then, that experiments with a specific alarm stimulus must be conducted at various times and under different conditions to arrive at definite conclusions.

I am hopeful the factors described above will be helpful to present and future investigators in evaluating responses to animal sounds.

LITERATURE CITED

BOUDREAU, GORDON W. 1967. Red-winged Blackbird responses to acoustic stimuli. U. S. Air Force Office of Scientific Research Documentary Technical Report.

. 1968. Alarm sounds and responses of birds and their application in controlling problem species. The Living Bird, VII, 27-46. Cornell Laboratory of Ornithology. Ithaca, N.Y.

SCHWAB, ROBERT. 1968. Daily and seasonal susceptibility cycles of the starling. Proc. Fourth Bird Control Seminar. Bowling Green State Univ., Bowling Green, Ohio.