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Some Practical Applications of Behavioral Principles to the Trapping of Birds

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In this paper we discuss some behavioral principles that apply to the trapping of birds. Our purpose is threefold: First, we attempt to explain some of the behavior a bander is likely to see when watching birds respond to traps. Second, we provide some ideas on how banders may increase trapping success and reduce potential trapping bias. Finally, we present several untested hypotheses and ideas in the hope of stimulating further research on behavioral responses to trapping in various species of birds.

Initial response to a trap

Birds that first encounter a trap probably view it as a novel object rather than a mechanism for their capture. An animal's response to a strange object may be determined by both proximate and ultimate factors (discussed by Barnett 1963:32-33). Logically, those animals that usually are rewarded for investigating novelty should be likely to explore unfamiliar objects (either natural or man-made), whereas those that are punished for such behavior should avoid them. One might, for example, expect corvids accustomed to scavenging from campgrounds in a national park to investigate a strange object more readily than individuals of the same species that have been persecuted by humans in agricultural areas. For the same basic reason, one might expect species that have evolved in environments where there are few or no natural enemies (e.g. the birds of certain oceanic islands) to exhibit less fear of strange objects than species that have been subjected over the long term to heavy predation pressure. Moreover, species that have evolved in environments where resource availability varies unpredictably should, we suspect, investigate novel stimuli more readily than species that have evolved in relatively stable environments.

Environmental context plays a role in some animals' response to novelty. Studies on wild Norway Rats (*Rattus norvegicus*) (Barnett 1963:28-30) and Coyotes (*Canis latrans*) (Hibler 1977) suggest that these animals tend to avoid novel objects in a familiar setting but approach them in an unfamiliar setting. We speculate that the adaptive advantage of this behavior may be associated with a shift in relative risk. An animal in a strange area lacks information about the location of resources necessary for its survival. Although there is some risk in investigating novelty, to remain ignorant about the environment poses a still greater risk. In contrast, an animal in a familiar setting is at no such disadvantage, so that it can afford to respond to novelty with some caution. By the same token, we predict that a bird should be less wary of a newly introduced trap if the bird is a transient in the area or is at the periphery of its home range than if it is at the center of its home range.

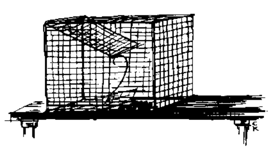
Of animals that we have observed, birds show less *overt* curiosity than mammals when first encountering an unbaited trap. Rodents, for example, often move close to an unbaited trap, probe at its sides, and enter the trap (Balph 1968). We have not seen such behavior, however, in passerine birds. We hypothesize that this difference of response may stem from differences in how mammals and birds usually perceive the external world. Many mammals rely heavily upon their tactile and olfactory senses and therefore must move close to a strange object to explore it effectively. In contrast, birds may rely primarily upon their keen eyesight to investigate unfamiliar objects. A bird should have little to gain by approaching a trap closely if it can explore the trap satisfactorily by viewing it at a safer distance.

Food as an attractant

As discussed above, birds are unlikely to enter unbaited traps; thus it generally is necessary to use an attractant (most commonly food) to capture them. The relative attractiveness of bait is determined, first, by food preferences. Dietary preferences can be estimated by observing birds select items from a variety of available foods, although an accurate assessment requires rather sophisticated techniques (Miller 1976). Bait attractiveness also is associated with the availability of natural foods and with factors that affect a bird's energetic requirements. Thus, as many banders proba-

bly are aware, one often can increase capture success by (1) using a highly palatable food as bait, (2) trapping in an environment where there are few alternative sources of food, and (3) trapping at times when birds' energetic needs are greatest (e.g. just before or after an overnight fast or when ambient temperatures are low).

An additional factor that under certain circumstances influences the attractiveness of bait is conditioned aversion. If a bird becomes ill after eating, it is likely subsequently to avoid the sight and/or taste of novel or recently eaten foods and to prefer familiar foods that have proved "safe" in the past. Learned aversions have, for example, been documented in Blue Jays *(Cyanocitta cristata)* fed toxic Monarch Butterflies *(Danaus plexippus)* (reviewed by Brower 1969) and in Red-winged Blackbirds *(Agelaius phoeniceus)* exposed to food treated with an emetic (Rogers 1978). Logically, a bander trapping in an area where emetics are used to repel depredating birds should use a type of bait that (1) differs in appearance from that used in the control program and (2) is familiar to the birds he or she hopes to capture.



Birds that approach a baited trap for the first time may be attracted by the bait, but at the same time they may have some fear of the trap as a strange object or be reluctant to enter the trap. The behaviors are incompatible, producing typical symptoms of behavioral conflict. For example, we have seen wintering finches inspect a newly-introduced trap from a nearby tree, slowly approach the trap (often making flight-intention movements as they do so), hesitate next to the trap, and suddenly flee, only to return to the trap site a short time later. Studies on Uinta Ground Squirrels *(Spermophilus armatus)* suggest that individuals exhibiting such ambivalence are more likely ultimately to be caught than those that appear to ignore a trap (Balph 1968).

It often is desirable to prebait (i.e. to place bait initially in nonfunctional traps) for a few days prior to trapping birds. A bird that obtains food in a nonfunctional trap habituates to the trap and learns to enter the trap directly, so that later when the trap is set the bird is readily caught. A further potential advantage is that prebaiting may increase the probability of recapturing a bird once it has been captured and banded. Eating bait repeatedly without capture rewards the behavior of entering a trap, so that after capture the tendency to enter the trap should remain strong despite the perceived punishment of the capture experience. Although to our knowledge this latter phenomenon has not been studied in birds, it has been documented experimentally in free-living Uinta Ground Squirrels (Balph 1968). Laboratory rats exhibit a comparable tendency to approach a food goal despite an aversive stimulus, if previously they have been conditioned to move toward the goal (Kaufman and Miller 1949).

Social factors associated with trapping

At least two important social factors can influence the probability that a bird will approach or enter a trap. The first of these is the social attraction that some birds have for one another. In flocking species, the presence of birds in or near a trap may serve as an attractant to other birds. Our qualitative observations of winter-flocking finches suggest that individual birds are less wary of traps when in groups than when they are alone. Moreover, we have seen Pine Siskins *(Carduelis pinus)* so reluctant to leave the vicinity of a trap containing conspecifics that we could approach within 1-2 m of them. However, we also have noted that when feeding flocks become large, false-alarm panics are more likely to occur than when flocks are of moderate size (see also discussion by Lazarus 1979). The gregariousness of flocking birds often makes a large, repeating trap (e.g. Hill 1976) a particularly efficient means of capture.

A second factor that can affect trapping success is social intolerance. Banders sometimes exploit this behavior during the breeding season by using a live decoy male to capture territorial males (e.g. Bray et al. 1975). Among flocked birds, dominance-subordination relationships potentially can affect capture probabilities. Dominant species, age/sex classes, or individuals may keep less dominant birds away from the immediate vicinity of baited traps, so that subordinates are less likely to be caught. The strength of this effect, however, may vary depending upon the number and dispersion of traps relative to particular birds' distances of intolerance. Trapping bias should be most evident under conditions that foster severe competition (e.g. if food is spatially clumped and in short supply). Among wintering Evening Grosbeaks *(Hesperiphona vespertina)*, we found that sex ratios were slightly biased in favor of females in nonfeeding flocks or in groups at a 0.74 m^2 food patch but shifted significantly to favor males at a 0.07 m^2 food patch (Balph and Balph 1976). Males, which are socially dominant to females in this species, apparently tended to exclude females from the smaller food patch (see Figure 1). Thus, it may be important for banders of flocking birds to take social dominance into account when using trapping results to estimate population parameters.

Mechanics of capture

An animal that encounters a baited trap may not immediately perceive the correct route to the bait. It may be necessary for the animal to move around a barrier presented by the sides of the trap to reach the trap entrance. This is called a detour problem, and many animals, including birds, cannot solve it without prior experience (discussed by Ramsey 1978). Typically, an animal that cannot solve the problem moves back and forth along one side of the trap attempting to reach the bait. The most likely explanation of this behavior is that, as the animal moves along the side of the trap, it moves farther away from the bait. The animal repeatedly corrects what it perceives to be movement in the wrong direction and returns to the area nearest to the bait. Among Uinta Ground Squirrels, such behavior reduced the likelihood of capture for individuals that were intent upon obtaining bait (Balph 1968). Our qualitative observations of wintering finches point to a similar conclusion.

Obviously, it is to a bander's advantage to attempt to minimize detour problems. Theoretically, the best trap design is one that presents no such problem (e.g. a trap that drops over a bird). A single-entrance, circular trap with bait placed in its center presents a detour situation but one that should cause no major difficulty in trapping birds. A bird is likely to move around the circumference of the trap in one direction (since in doing so it does not move farther away from the bait) and eventually encounter the entrance. In using three-cell Potter traps, we have obtained good results by placing two traps back to back so that doors are present on all exposed sides, thus eliminating the detour problem (Figure 2).

We sometimes find it worthwhile to place bait outside of traps to guide birds to trap entrances. However, food scattered in the general vicinity of traps potentially can cause birds to acquire habits that reduce the probability of their capture. A bird that obtains food in areas away from a trap entrance may learn to return to those areas for food instead of entering the trap. To prevent birds from being conditioned to obtain bait at inappropriate locations, we use bait as a "guide" only sparingly, and we repeatedly clean up any bait that becomes scattered about the trapping area.

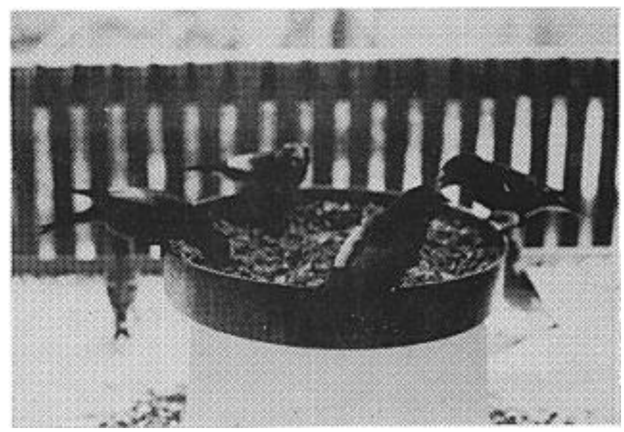


Figure 1. Effect of social dominance on sex ratio of Evening Grosbeaks at a small food patch. Three males and one female feed at an elevated, 0.07 m² pan of sunflower seeds, while two females stand in background beneath feeder.

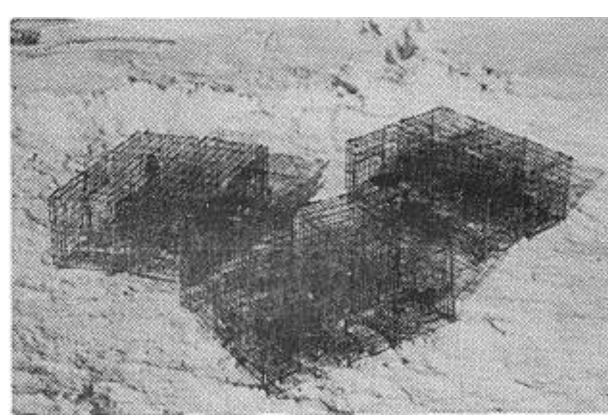


Figure 2. Three-cell Potter traps arranged to minimize detour problem. Traps of each pair are placed back to back so that entrances are present on all exposed sides.

Subsequent responses to traps

The experience of capture both rewards a bird (usually with food) and punishes it (with confinement and handling). Logically, a bird's perception of the capture experience influences whether or not the bird will return to the trap site. Presumably individuals that do

return perceive the bait to be more important than confinement or handling. However, such birds sometimes exhibit behavioral conflict. Their behavior is similar to that shown when they initially approach a trap, except that fear of a strange object now is fear of the capture experience, and the ambivalence exhibited may be more intense than earlier.

If a bander wishes to increase the probability of subsequent capture, we suggest that he or she attempt to decrease the punishment relative to the reward aspect of a bird's initial capture experience. This perhaps can be accomplished in three general ways. First, as discussed earlier, it may be helpful to prebait traps, allowing birds to use traps as feeding stations prior to the time of initial capture.

Second, it may be desirable to take steps to reduce the association that a bird makes between its approach and entry into a trap and subsequent confinement and handling. For example, the trap door should be made to close as quietly and unobtrusively as possible to avoid startling the bird as it enters the trap (e.g. by affixing bits of sponge rubber to the leading edge of the door of a drop-door trap or by closing the gates gradually when using a string-operated shelf trap). Once a bird is captured, we suggest allowing it to feed undisturbed for a few minutes rather than removing it immediately from the trap for processing. Traps that are relatively large in size may lessen the punishment of confinement, as well as reduce learned associations between entry and perceived capture (see Burtt 1980).

Third, we hypothesize that a bander may increase the likelihood of recapturing a bird by moving the trap in which the bird was caught to a new location a few meters distant. In certain rodents, changing the location of a trap can increase a previously captured animal's tendency to approach relative to its tendency to avoid the trap (see discussion by Balph 1968). Further study is needed to determine whether or not, or to what extent, this response occurs in birds.

Summary

This paper discusses some behavioral principles that apply to the trapping of birds. Topics considered include (1) factors affecting a bird's response to a trap as a novel object, (2) factors affecting the reward value of bait, (3) social behavior in relation to trapping success and trapping bias, (4) behavioral problems associated with the mechanics of capture, and (5) the relationship of a bird's initial capture experience to probabilities of subsequent capture. Practical suggestions are offered throughout for increasing trapping success.

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