

Egg retrieval by Blue Geese.—Lorenz and Tinbergen (1938) used egg-retrieval behavior of Greylag Geese (*Anser anser*) to study simple instinctive motor patterns with an orienting component (taxis). They considered that such innate motor patterns "may have great taxonomic value for a species, a genus, or even for a whole phylum." Poulsen (1953), finding the behavior to be present in several distinct systematic groups concluded that egg-retrieval behavior had evolved convergently in these groups and could not be used as a taxonomic character. He listed 42 species representing 12 orders that rolled displaced eggs back into nests and only 2 orders (Pelecaniformes, Passeriformes) that did not. There was no variation between species within an order; either all species tested retrieved eggs or none did. Poulsen (1953: 32) and Sowls (1955: 101–102) together list 12 species of Anseriformes that retrieved eggs (*Cygnus* 2, *Anser* 4, *Tadorna* 1, *Anas* 3, *Aythya* 2). It is thus of interest that no female Blue Geese (*Anser caerulescens*) of 10 tested by Cooch (1958: 102) retrieved displaced eggs. As Cooch pointed out, the absence of egg-retrieval behavior in the Blue Goose, a species that has been included in the New World genus *Chen* (A.O.U., 1957) might have taxonomic significance at the generic level. The observations reported here show that the proclivity and ability to retrieve eggs is well-developed in Blue Geese. Several authorities (e.g. Delacour and Mayr, 1945; Johnsgard, 1965) have regarded *Chen* as invalid, placing it in *Anser*. Both Blue and Lesser Snow Geese are regarded in this paper as color phases of the polymorphic subspecies *Anser c. caerulescens* (after Cooch, 1961).

While studying nesting Blue Geese at the McConnell River, N.W.T. (60° 50' N, 94° 25' W), we often saw eggs lying outside nests. In 1969 a series of nests was visited each day and in two instances females rolled nearby eggs into their nests. One bird (female A) laid an egg daily until four were present in the nest on 16 June. On 18 and again on 19 June an additional egg was deposited and abandoned by another female, approximately 55 cm from and 12 cm below the nest, which was situated on a small, elevated hummock. On 23 June we were surprised to find that the four eggs and nest material had been moved 25 cm to the base of the hummock and were now just 30 cm distant from the two abandoned eggs. Also, one of the "dumped" eggs (presumably, as the egg was not marked) had been moved 30 cm into the new nest. By the next visit, on 27 June, the remaining egg was also inside the nest. The original four eggs hatched on 10 July but the other two showed no signs of pipping. They contained well-developed, living embryos approximately 3–4 days from hatching stage.

A second bird (female B) incubated two eggs until 10 July when we placed two additional eggs, taken from a nearby deserted nest, 15 cm from the lip of the nest. Both of these eggs were inside the nest when it was next visited on 11 July.

These observations led us to test egg retrieval experimentally in 1970. Marked eggs from 42 different nests were removed and placed varying distances from the nest. Vegetation cover and slope of ground around the nests was variable. Snow and blue-phase females were tested during early (11–19 June) and late (27–30 June) stages of incubation but no pipped eggs were used. All 42 females rolled eggs back into their nests. Not all retrieved eggs from the initial location; 2 of 19 females did not retrieve an egg from 45 and 70 cm, but did so when that egg was placed at 30 cm (all 23 females retrieved eggs placed within 30 cm of the nest lip). Similarly three of five eggs placed 90 to 95 cm from the lip of the nest remained in the same position 24 hours later but were quickly rolled back into the nest when moved to 60 cm. Apparently 95 cm is approaching the critical distance beyond which most female Blue Geese will not retrieve eggs. In Poulsen's (1953) experiments, Bean Geese (*Anser fabalis*) and White-fronted Geese (*Anser albifrons*) did not retrieve



Figure 1. Female "snow" phase *Anser caerulescens* rolling egg into nest at McConnell River, N.W.T.

eggs placed more than 70 cm from the center of the nest. Using this measurement, two female Blue Geese rolled eggs 100 to 105 cm.

The type of terrain between the egg and the nest appeared not to influence success. Eggs were rolled back through thick clumps of dwarf birch (*Betula glandulosa*) and up steep inclines of nest lips up to 18 cm high. One female tried unsuccessfully 13 times in 10 minutes to roll an egg up the 12 cm high incline over the lip of her nest. Next day the egg was in the nest.

In the few cases that the rolling movement was watched, it appeared very similar to that described for the Greylag Goose (Lorenz and Tinbergen, 1938) (see Figure 1).

There were no differences between blue and snow-phase females in the tendency to retrieve eggs ($P > 0.25$) or between females early or late in the incubation period ($P > 0.20$).

The contrast between Cooch's (1958) and our results is puzzling. Cooch (pers. comm.) indicated that his experiments at the Boas River colony on Southampton Island ($63^{\circ} 42' N$, $85^{\circ} 45' W$) were conducted in an area where considerable numbers of "dump" eggs had been laid near active nests, and hence may not have been valid tests. Possibly the tendency to retrieve eggs varies with attachment of females to the nest and begins with laying of the last eggs or onset of incubation, when attentiveness to the nest is nearly constant. Habituation to the sight of dislodged eggs or eggs laid indiscriminately by other females near a nest where a female has not begun to incubate might inhibit egg-rolling behavior during subsequent incubation. This could have accounted for the lack of response of some of the females Cooch (1958) tested and for eggs occasionally seen lying near nests up to the end of the incubation period in the McConnell River colony. Five of our experiments involved females that did not yet have complete clutches, but in each of these cases the female was present near the nest and returned to it soon after we left. It would be interesting to test retrieval by more females that had not begun to incubate, particularly before a close attachment to the nest had been formed, and also by incubating females on nests with nearby abandoned eggs.

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Shrike prey selection: Color or conspicuousness?—The behavior of the Loggerhead Shrike (*Lanius ludovicianus*) in attacking and killing its prey, including mice, is well-known and was summarized in Bent (1950), but no information is available for comparison of prey selection by shrikes for two or more types of mice. My objective was to test for differential predation on white and agouti mice (*Mus musculus*) by Loggerhead Shrikes and thereby to measure the effectiveness of selection against a conspicuous prey (white) under natural conditions. This approach utilized wild shrikes in a natural situation rather than under laboratory conditions. The selection index (Dice, 1947) was used to measure the effectiveness of selection. Selection indices range from -1.0 when all conspicuous prey are taken to +1.0 when all nonconspicuous prey are taken and equal 0.0 when same number of both prey are captured.

Experiments were conducted to test the response of shrikes to pairs of laboratory-raised house mice (1 albino and 1 agouti) simultaneously released near the predator. Differential activity of the two phenotypes of mice is negligible for this type of experiment (Kaufman, 1971). Mice in the first experiment (Exp. 1) were released on a background with little or no vegetation. Visibility of the prey was decreased in the second experiment (Exp. 2) by releasing the mice in dense vegetation within 50 m of the predator or on bare substrate 60-100 m from the shrike. Experiments were conducted on the Atomic Energy Commission's Savannah River Plant near Aiken, South Carolina during January-May 1971.

During each trial, mice were released from a slow-moving or stopped vehicle. The vehicle was then moved 50-100 m from the point of release and shrike and mice observed. Trials were repeated for each shrike when possible; 10 to 15 different shrikes were tested. The phenotype of the first mouse killed, time from