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Willow Ptarmigan remove broken eggs from the nest.—In the course of studies of the breeding behavior of Willow Ptarmigan (*Lagopus lagopus lagopus*) in northern Norway, we have now and again found single ptarmigan eggs lying near occupied nests. On Karlsøy Island, near Tromsø, an infertile egg with a hole in it was found some 80 cm from a nest containing newly-hatched chicks and several apparently infertile eggs. The hole might have been made by a bird's bill, and we assumed that the egg was removed by the hen. Jenkins et al. (1963) mention similar observations on Red Grouse (*L. l. scoticus*). During a study of egg and chick care by Willow Ptarmigan (Allen et al., ms.) at the University of Tromsø's Wildlife Station, cracked or broken eggs have occasionally been found on the floor of the observation rooms, beyond the nest scrape where a clutch was being assembled or incubated. Such eggs had thin, rough-surfaced shells, probably the result of dietary calcium deficiency (Roland et al. 1974). The contents of broken eggs were apparently sometimes eaten by the birds, which were certainly the only occupants of these rooms.

Detailed observations were made on a ptarmigan hen that began to lay on a scrape in some turfs placed on the observation room floor. Her first egg was rough-surfaced, and by the time she laid five more, it lay cracked about half meter from the nest. We replaced it in the nest and 3 days later found it smashed on the concrete floor, some 3 m from the nest. The next day the egg was completely eaten by one of the birds; no trace of the shell was found. The following day we marked two infertile eggs from another hen and added them to those in the nest, deliberately breaking one in the process. Three days later both eggs still lay with the clutch, which was covered with leaves and grass, although by now the broken egg was crushed. The following day it lay about a meter from the nest, almost empty; the hen subsequently incubated the other marked egg.

The hen of another pair incubated a clutch of only 3 eggs, one of which we found broken and encrusted with dried yolk, about 2 m from the nest on the 15th day of incubation. We replaced it in the nest which we watched by closed-circuit TV. After a few minutes the hen returned to the nest and resumed incubation. Twice in the next 2 hours she rose and turned the eggs as usual, but she pecked at them, apparently tasting and swallowing something, before settling again. The third time she rose she again pecked at the eggs, at first gently but then more violently. Within a few seconds she had speared the broken egg on her upper mandible and carried it out of the nest, dropping it about a meter away. We removed this egg, which contained only fluid and appeared to be infertile. We then broke an egg containing a dead, almost full-grown embryo, and placed it in the nest. The hen incubated this with her two remaining eggs, flattening it in the process, until we removed it for hygiene's sake a week later. Meanwhile one of her own eggs developed a longitudinal crack, probably from being incubated directly on the concrete floor, but the shell membranes did not rupture and the egg did not leak. The hen continued incubating until we removed her from the room 8 days later, well after the remaining eggs should have hatched.

This series of chance observations and opportunistic experiments can only partly explain how the hen recognizes and removes nonviable eggs. We suggest tentatively that the hen removes only broken, leaking eggs, recognizing the taste, smell, or texture of the dried matter sticking to the shell, as she turns them. Since such matter is easily transferred to other eggs, she may test the integrity of individual egg-shells by pecking at them, as we saw one hen do. The only hen we saw actually removing an egg, did so by "spearing" it, but others we have seen may have been pushed out of the nest with the bill, or simply kicked, as they were not holed. One captive hen was once seen catching up an egg between the underside of her bill and her neck, and moving it thus (Myhre, pers. comm.).

Broken eggs are non-viable, and there is good reason for the hen to clear them out of the nest; they are unnecessary burdens on her capacity to transfer heat to the clutch, and are possible sources of infection.

Once out of the nest they are a useful source of food for the hen but may also attract predators. Tinbergen et al. (1964) describe how Black-headed Gulls remove egg-shells after hatching, and show that such behavior reduces predation. Perhaps the hen ptarmigan eats her broken eggs as an alternative to carrying them far from the nest. This behavior may offer a partial explanation for the claim that extremely few ptarmigan eggs fail to hatch (Johnsgard 1973, Myrberget 1975). A small proportion of eggs laid may be nonviable because of a thin, deficient shell. At the Wildlife Research Station these are all mechanically incubated, but some do not hatch, reducing our success rate. In the wild, they are more likely to be broken, removed, and eaten, never appearing on anybody's records.

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Altruism in nesting Yellow-Bellied Sapsucker.—Power (1975, Science 189: 142) presented the theory of altruism in describing experiments designed to test it on wild Mountain Bluebirds (*Sialia currucoides*). He considered his results negative, but they are pertinent to observations I presented briefly (Kilham 1971, Wilson Bull. 83: 159) but not in detail, on a natural experiment that involved another hole-nesting bird, the Yellow-bellied Sapsucker (*Sphyrapicus varius*). By Power's criteria, the outcome of this 'natural experiment' could be construed as evidence for altruism. My observations were as follows:

The male of a pair of sapsuckers (pair C) was killed on the night of 27 June 1967, seemingly by a raccoon (*Procyon lotor*) as evidenced by a pile of his feathers where he had been plucked and eaten just below the nest hole. The hole itself remained intact, although well gnawed by the raccoon. Female C (FC) now fed her well-grown nestlings alone at a rapid rate of 14 feeding visits in 30 min, but with only small amounts of prey in each visit. The begging notes of the young were feeble.

On the following day, 28 June, FC began a new type of behavior. In spite of the intense pace of her efforts to feed the young, she paused occasionally to give "kwee-urk" breeding calls. I wondered whether she was seeking a mate when I discovered that a new male had already arrived. I was soon watching him make repeated visits to the nest hole, not to feed the young, but to percuss the tree here and there as if prospecting a new nest site and to tap within the entrance when FC approached, then fly away in a winnow or courtship flight when she arrived, these activities all being characteristic of early courtship behavior (Kilham 1962, Auk 79: 31).

The courtship of the two sapsuckers progressed rapidly. By the following morning I heard displays soon after dawn when the new male drummed, then flew to FC, who flew away in courtship flight. These pairing activities were against a background of loud "chick-chick-chick" vocalizations coming from the nestlings. FC now fed her young at a slower rate of twice in 30 min, and by 0540 the new male, only 2 days after the death of the original one, was bringing food to the nest. This was to the nestlings, for there is no courtship feeding among sapsuckers. It now appeared as if FC would finish her nesting successfully, but the raccoon returned and killed both the new male and the nestlings on the following night.

Power (op. cit.) states that his male bluebird consorts were "reproductively selfish." They did not feed the young, they took no risks, and they were "clearly not altruistic." The male sapsucker consort, in contrast, not only fed the young at his adopted nest, but risked his life in doing so. By one hypothesis his chances of being killed were high. Male sapsuckers, like males of other woodpeckers, spend the night on nests. When a predator attacks, they stay by the young and, when striking out through a small hole in tough living wood