

FEATHER-EATING AND PELLET-FORMATION IN THE GREAT CRESTED GREBE

By K. E. L. SIMMONS

IN a recent account (Simmons, 1955) of an eight-year study on the life-history of the Great Crested Grebe (*Podiceps cristatus*), the habit of eating feathers was briefly reviewed in the light of new anatomical information collected by Hanzák (1952) in Czechoslovakia, which suggests a connection between feather-eating and pellet-formation. It seems worth while extending this account here in the hope of stimulating further observation. Hanzák's paper, that of Harrisson and Hollom (1932) and my own work are the chief sources of information utilized in this paper; no attempt has been made to review all the literature of the subject.

I am indebted to Dr. R. W. Storer of the Museum of Zoology, University of Michigan, for first pointing out to me the mystery of the elusive grebe-pellet, and to Major Maxwell Knight whose interesting talk to the Reading Ornithological Club on bird-pellets in general directly led to the present paper.

The habit of feather-eating itself is well-known though its documentation is rather scattered. More observations are still needed, especially on the quantity of feathers consumed. Adult Great Crested Grebes seldom, if ever, deliberately pluck feathers for their own consumption though they sometimes do so when giving feathers to the young. Most are swallowed incidentally during preening, when loose ones get detached by the nibbling bill or float in the water. Drifting feathers are sometimes picked up at other times, too. The young grebes receive feathers regularly from their parents, from the day of hatching onward. Indeed, at a nest watched by Rankin (1947), a feather was the very first item given to the first-hatched chick and, later, the second received one only two minutes after its initial meal (a small insect). The parents sometimes deliberately soak the feathers before presenting them to the chicks. The only indication of the daily total of individual feathers given to a chick is Harrisson and Hollom's record of 14 to a four-day-old one. While the adults continue to present feathers to the chicks for several weeks after hatching, they do so more frequently during the first two weeks and especially during the "guard-stage" (see Simmons, 1955), when the parents take it in turn to remain with the brood while the other forages for food. Feathers are most often given during preening bouts, the hunting adult seldom bringing them. For example, on 29th

and 30th April 1954, I watched Pair A₅₄ for just under 5 hours while the birds took turns in feeding their three chicks. The male brought food 28 times, the female 22. Only four feathers were given: two while the guarding adult preened and two after a feed of fish-fry and water-insect respectively. In addition, one of the downy young picked one off the surface of the water.

The chicks soon learn to pick up floating feathers for themselves and occasionally pluck them from the adults. When their own feathers replace the down, they swallow these as well. Thus the grebe is "capturing" and eating feathers long before it gets true food for itself.

The majority of feathers consumed are those short, satiny white ones from the under-parts. Hanzák (1952) confirms this from examining stomach contents, though he also found feathers from all parts of the body, including the tippets.

All the other grebes on the British List are known to eat feathers, the Little Grebe (*Podiceps ruficollis*) probably less frequently than the others (see *The Handbook*, Vol. IV). As long ago as 1813 Montagu recorded the habit for the Red-necked Grebe (*P. griseigena*) as well as for the Great Crested. Munro (1941) observed that the young of the American race of Red-necked Grebe plucked and ate their own down. He also reported 40 adult feathers in the stomach of a downy chick of the Western Grebe (*Aechmophorus occidentalis*), but much larger numbers were found by Chapman (1908): 238 in one, 331 in another!

The function of feather-eating, reviewed by Harrison and Hollom (1932) and by Hanzák (1952), has caused much discussion. The former authors could find no evidence for any connection with pellet-formation. They suggested, tentatively, that: (1) the congestion of whole feathers in the stomach might partly help in protecting the walls of the digestive organs from sharp fish-bones, adding that such a precaution seemed hardly necessary in view of the strength and thickness of these organs; (2) the decomposing feathers might aid digestion in some way, though this too seemed unnecessary. Hanzák questioned the first of these on the grounds that the swallowed feathers do not line the stomach at all and thus cannot protect it in the manner indicated.

Other explanations of the behaviour reviewed by Harrison and Hollom included: (3) the Vitamin-D theory of Rowan (1931), and (4) the "strainer-effect" theory of several writers that feathers in the stomach prevent harmful fish-bone and the like, and also hard-to-digest but useful food, from entering the intestine before being satisfactorily broken down. Hanzák also criticized this latter, considering that the net of feather "thorns" in the stomach near the pylorus probably arises by chance and in any case can "only have a subsidiary function in keeping back rough parts of the food".

Harrison and Hollom (1932) finished their remarks with: "On the whole we are inclined to believe that the habit of eating

feathers is partly a psychological one, a development of preening and perhaps of the curious weed-presentation phases in display (we have seen a male Grebe give one of his breast feathers to his mate in July)". While the connection with preening is a certain one, I found no indication of any link with display in my own work on grebe behaviour.

In his review, Hanzák (1952), apart from the remarks already mentioned, also showed that the ball of feathers in the stomach is too soft and non-resistant to aid digestion in the same way as grit does. His positive contribution to the problem consisted in proving Jirsik's (1929) suggestion that the feathers produce a felt-like substance which envelopes the sharp items *ejected* from the stomach. Hanzák states: "In each opened analysed stomach we find a certain quantity of a special mush-like substance, which under the microscope proves to be composed of fragments of radia and cilia of the swallowed feathers. Jirsik's finding that the mush-like substance envelopes bones and chitinous remains and thus makes possible their easier ejection I can also confirm. It is often rather difficult to clean bones thus enveloped. The swallowed feathers have thus really the task to help in forming the ejections, but do not take part in this in their whole form; instead they produce a felt-like substance and only this takes an active part in ejection".

Thus, it seems inescapable to conclude that grebes eat feathers for the main purpose of pellet-formation. In further support Hanzák found microscopically no trace of either bone or feather in the intestine and stated "Thus it is clear that neither the feathers nor undigested roughage pass the pyloric stomach". However, he gives no actual record of a grebe pellet, the pellet itself is unknown and no observer seems as yet to have witnessed the actual oral ejection of one. Thus the final and concrete proof of the connection between feather-eating and pellet-formation is still lacking.

The idea that grebes swallow feathers to aid the formation of their pellets was independently advanced by Knight (1948) who shows that many pellet-ejecting birds have an essential need for rough material of various sorts to assist this production and soon lose condition if denied it. While many species, notably birds-of-prey, normally obtain the necessary material incidentally from their victims, other species have to make special effort to obtain it just as the grebe does. Thus Herons (*Ardea cinerea*) at times eat a great deal of vegetable matter for this purpose (Lowe, 1954). A further class of birds form their pellets in yet another manner. Van Dobben's (1952) detailed study on the food of the Cormorant (*Phalacrocorax carbo*) was partly based on pellet examination. Each pellet is encased by a mucous membrane which, judged from the section of a large young bird, is in fact the pituitary lining of the gizzard which envelopes the undigested meal.

SUMMARY

Adult Great Crested Grebes eat feathers, mainly when preening, and also give them to the young. In the stomach these feathers break down into a special mush-like substance which envelopes fish-bone, etc., apparently to form ejectable pellets. As yet, no one seems to have seen the actual ejection of such a pellet and the pellet itself is unknown.

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