

Nestling Necrophagy in Tawny Owls

Strix aluco

J.C. Van Veen

SUMMARY

The first records of nestling necrophagy were video-filmed, as well as a case of handling a dead hatchling during a systematic investigation by a videocamera-recording system to monitor the complete nesting process in Tawny Owls, including prey provisioning. This study was undertaken because there still exists a gap in the knowledge of the nesting process of Tawny Owls. Further questions of the cause of death and the fate of dead nestlings were still unanswered, because nestling mortality is rare (approx. 6%) and difficult to observe. For this purpose specially designed nestboxes for video-recording and automatic registration of nest visit activity were installed in haylofts of cowsheds in well-known Tawny Owl territories. During the longterm study death or disappearance of the youngest nestling was always preceded by a visual lag in growth and activity as compared to the next youngest sibling. Besides, it invariably happened during poor food conditions. No behaviour that might be interpreted as Cainism was ever observed, even under poor nutritional conditions with brood reduction. Neither between parents nor between parents and nestlings was any aggressive behaviour ever observed during ten breeding cases. The mechanism of competition between nestlings was based on the discrepancy in size between nestlings, determined by asynchronic hatching and enforced by poor food rates.

INTRODUCTION

In many bird species nestling mortality is not always caused by interspecific factors and bad weather conditions. Sometimes the death of nestlings is caused by intraspecific factors such as infanticide and fratricide, not necessarily followed by devouring the victims (cannibalism) (Tinbergen *et al.* 1962; O'Connor 1978; Clark & Wilson 1981; Viegas 1990).

I prefer to follow McNicholl (1977) in distinguishing scavenging (i.e. the eating of a previously dead item including conspecifics, dead from other causes than infanticide/fratricide) and cannibalism (i.e. killing and subsequently eating a conspecific) rather than lumping the two instances under cannibalism, as apparently most authors do following Ingram (1959).

So far there exist no reports about infanticide among diurnal raptors and owls as for example observed in the White Stork *Ciconia ciconia* (Schüz 1984). In contrast there are numerous records about observations of fratricide in diurnal raptors, known as the "Cain and Abel battle".

However, there exist no records about firsthand observations of fratricide among owls. Reports of supposed cannibalism (infanticide/fratricide) in tytonine and strigine owls are mostly based on

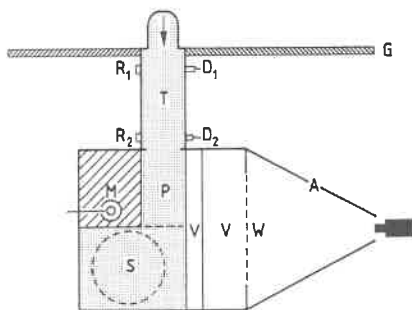
often meagre circumstantial evidence, as for example the disappearance of the youngest nestling. In other cases remains were found, a few times in pellets, in or near the nest.

The aim of this report is to give a complete firsthand description and analysis of the video-recorded events of nestling necrophagy and the handling of a dead hatchling by a brooding hen owl. Finally, nestling mortality and the fate of the dead nestlings in some owl species is discussed.

STUDY AREA AND METHODS

The study area is located in the middle of the Netherlands approx. 52° 02" N, 05° 25" E. A number of specially designed nestboxes for video-monitoring and automatic registration of nestvisit activity were installed at the gable end of cowsheds (Fig. 1). The selected territories have been well-known for more than 50 years; territory sizes vary between 17 and 35 ha. The territories are patches of mixed forest surrounded by vast meadow land. To achieve the best possible undisturbed breeding conditions adult owls were never caught. They were gradually habituated to light conditions.

Figure 1. Diagram of observation-nestbox, final state of improvement 1989. Tunnel (T) connects the nestbox with the wall (G) of the gable end of the cowshed. Arrow on the landing board, also provided with an infrared (Ir) detector (not visible), indicates the entrance. D1, D2 and R1, R2 are Ir-sensors and reflectors resp. The male usually transfers its prey from the platform (P) to the female or the nestlings the nest (S). M = compartment with microphone connected with audiorecorder; A = camera-adaptor; W = window and V = space necessary for videorecording, filming or photography.



RESULTS

Events in nestling necrophagy

The following description was made from a video-recording in the night of 13/14 April 1985 at site 2 in the middle of brooding time. Five eggs were laid and five hatchlings emerged. During a temporary decrease in prey deliveries the youngest nestling starved to death. The start of the description was arbitrarily chosen approx. 4 min before the nearly dead or dead nestling was pulled out from between its nestmates.

The hen owl was brooding her chicks in the left corner of the nest. After some minutes the oldest chick, 16 days old, came into view and began to stumble around the nest, occasionally uttering begging cries and starting to nibble at the dried remains of a frog. The hen owl followed the movements of the brooded nestling, adapting her position from time to time to the gentle movements or discomfort calls of the other nestlings. One nestling, however, could be seen lying between her legs. This was quite an abnormal posture. After some time the hen owl looked down at the chicks for about 20 sec, gave a soft contact call and resumed brooding. Some 30 sec later this

behaviour was repeated, but now she began to palpate the dead nestling energetically with her bill for about 5 sec and then resumed brooding. 1 min 20 sec later this behaviour was repeated but now the hen owl pulled the dead chick out from between the other ones.

The apparently dead chick hung motionless from her bill for some 7 sec and she started to nibble it. She then laid it down on the nestrim and put her right claw carefully around its body, while energetically palpating the whole body with her bill. Then her left claw was put around the body and again her right one, while she was still palpating the chick carefully. From time to time she started nibbling it. She looked about with the right claw around the body and all of a sudden plucked a tiny piece of down and skin from the hind end of the chick. She waited some seconds.

Suddenly she started to utter her feeding calls. Immediately all nestlings reacted with vigorous begging and commenced to search for food in her bill. Soon she plucked a second larger piece. The hind part was first fed in 9 plucks (1 min 21 sec), followed by the midpart, breast and wings in 10 plucks (1 min 40 sec). All nestlings got some pieces, but unequal rations. There was neither severe competition nor any aggressiveness between them. The head with the neck was fed in 19 plucks (approx. 8 min). The skull was attempted to be swallowed by two nestlings, but was regurgitated twice. The hen owl had to tear the head into pieces for feeding. Ultimately she cleaned up the plucking site and the bills of the nestlings and resumed brooding.

Analysis of the behaviour

Three distinct phases could be distinguished. (1) The brooding phase (approx. 4 min) which was considered interrupted by the perception of deviant stimuli in the dying chick. The hen owl gradually reacted to the stimuli by looking down, uttering contact calls, preening the chick, which soon turned into palpating energetically. (2) The ambivalent phase (approx. 2 min) starts with the pulling out of the chick. The hen owl showed two contrary trends, tending the chick again or handling it as a prey. It is assumed that she tried to evoke reactions of a live chick, for example discomfort cries. Then the preening gradually turned into energetically palpating the whole body of the chick, followed by the claw activity, at first carefully and later more firmly, ultimately ending in the first pluck of a tiny piece of down. (3) The last or plucking phase (approx. 12 min) is considered to be started with the uttering of the feeding calls of the hen owl.

Feeding a dead nestling

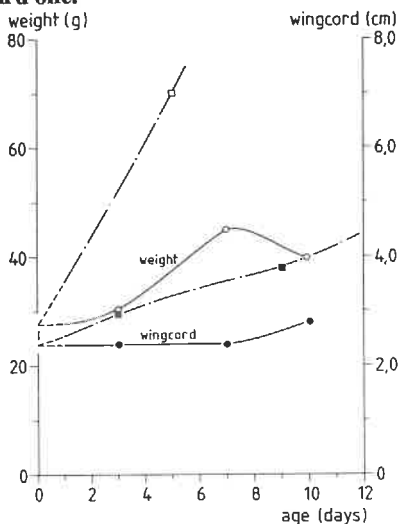
A second case of nestling necrophagy, also at site 2, was video-recorded in 1991 after brooding time. Five eggs were laid. Four eggs hatched successfully, one egg/hatchling disappeared unobserved. It was evident that the fourth nestling was developing slowly during the first seven days of its life. It showed the typical lag in growth, activity and also competitive ability at the moments of food deliveries. The nestling was weighed for the third time at the beginning (19.50 hr) of the night (April 2 1991) of its tenth and last day of life (Fig. 2). That night it must have died between 22.14 and 23.35 hr. It was moribund but still moving a little when the hen owl arrived with a Great Tit (*Parus major*) at 22.14 hr, but by the next preyvisit, a Woodmouse (*Apodemus sylvaticus*) at 23.35 hr, it was flattened against the bottom of the nest, lifeless.

The hen owl arrived with a frog (*Rana temporaria*) at 01.25 and left the nestbox immediately after. During the last two visits she appeared not to notice the dead nestling.

At 04.13 hr the hen owl arrived with a decapitated frog, which was quickly seized by the oldest nestling and swallowed within 15 sec. At this moment it was observed that the fourth nestling was lying in the bottom of the nest, trodden under foot. Thereupon the hen owl looked down, without hesitation picked up the dead young and immediately started to pluck it.

For about 4 min 30 sec she stood with her back to the camera. During that period about 30 pluck-feeding actions could be counted. The begging frequency was high, 4.6 calls per 10 sec. The third nestling got most of the food, the first nestling got less and the second was apparently continuously begging but got nothing. Then the hen owl turned her face to the camera and picked up the remains of the fourth nestling. Only two legs and a small part of the hind end was left. Again she started to pluck and feed small pieces. After 14 plucks only the legs were left. These were presented at least 6 times and regurgitated in all instances. They were then crushed by the hen owl and swallowed by the nestlings. The begging frequency was still high. This second phase (in front of the camera) lasted about 5 min. Finally the hen owl searched with her bill for prey remains on the bottom of the nest, but did not find any. She preened the nestlings and left the nestbox.

Figure 2. Typical lag in development between the starving youngest nestling (drawn line) and its next youngest nestmate. In this case (site 2, 1991) a fourth nestling is compared with a third one.



Analysis of the second case

There is no doubt that the hen owl recognized the subject on the bottom of the nest as prey at 04.13 hr. Except for the white colour, given she can distinguish a white colour, there seemed to be no stimuli to remind her of a live nestling. It is noteworthy that she plucked the victim in 47 very tiny pieces. These did not weigh more than one gram on average (weight of victim about 40 g). Besides, the handling time was very long: 9 min 30 sec as compared to the handling time of a mouse or frog prey, which could be swallowed in 15 sec to maximally 30 sec at this age.

Handling of a dead hatchling

In 1985 at site 1 a breeding attempt, five eggs, five hatchlings, soon ended in complete failure, most probably due to bad weather during hatching. It was observed, after the hen owl had left the nest, that two hatchlings had emerged and one must have died soon after. There was no prey available. After the break the hen owl resumed brooding. About 1 min before the dead hatchling was pulled out of the scrape, the hen owl had turned to the right, bowed in the direction of the dead chick and, as soon as she had touched it, began to palpate the whole body energetically and ended up with nibbling it. Then she pulled it out by its hind end. She held it head downward for some 10 sec and then laid it on the rim of the nest. Again she started to palpate the whole body and rearranged the eggs while the other hatchling was peeping. She picked up the dead hatchling again, nibbled at it shortly and laid it down. Then the right claw was carefully put round the body. She looked round for some seconds and again started to palpate it energetically. The same pattern was repeated once more and both processes lasted for in total 1 min 30 sec. Thereupon she preened it briefly, pushed it back for brooding and again further back carefully, and resumed brooding. This tending process lasted about 1 min. The whole event lasted 4 min 10 sec.

That night the hen owl handled the dead hatchling several times in a similar way. The next night it had disappeared.

Analysis of handling a dead hatchling

It is clear that a brooding hen owl continuously keeps in close contact with her young from her immediate responses to stimuli (peeping calls from the egg, discomfort cries, begging calls). In this case the hen owl must have perceived the deviant stimuli (motionless, silent, flabby, cold) from the dead hatchling and responded with typically energetic examination behaviour followed by characteristic ambivalent behaviour, which this time ended with tending a dead hatchling, repeated several times. There were no begging nestlings that forced her to feed and most probably this postponed the ultimate moment of turning into prey handling and eating the dead hatchling.

DISCUSSION

Necrophagy in Tawny Owls

Tending behaviour. Nesting activity was observed at least three whole nights a week. The pairs at site 1 and 2 were studied for two and seven breeding seasons respectively. It was obvious that the brooding hen owl was continuously in touch with her nestlings. Even during post-brooding her prey visits lasted three times longer than the male's, because they usually ended up in preening the chicks and searching for prey remains. Even after fledging she mostly uttered the alarm calls and often attacked the predator/human being approaching her fledglings (Wallin 1987 and my own observations). The behaviour of all the hen owls so far observed can be described as persistently and prudently tending her brood under all conditions. No tendencies that might be interpreted as infanticide-like were ever observed.

Mechanism of competition. During brooding competition could not be assessed, because the nestlings could not be observed. My few clear observations suggest that begging intensity is an important component of competitive capability beneath hatching order. At the sound of the arrival of a parent, the relatively larger and more agile nestmates monopolized access to the food as long as they were not satiated. Ultimately the smallest (1984, 1985, 1991) or the smallest and next smallest (1986) showed a visible lag in development (growth, weight) and activity (competition for food). Asynchronous hatching, approx. 1 day between first and second nestling and usually 2, seldom 3, between the others, determined the hierarchy of competitive capability by size and agility. No behaviour between nestmates was ever observed that might be interpreted as inter-sibling strife or Cainism.

Cause of nestling death. The mortality of Tawny Owl nestlings is low, approx. 6%, as compared to the loss of eggs, approx. 26% (my unpublished review of 14 authors: 76% of eggs laid hatched, $n=256$; 94% of the hatchlings fledged, $n=195$). These figures are comparable with the observations of Lundberg (1981) for the Ural Owl *Strix uralensis*. The death cause of the hatchling in this study was unknown.

The death of all the youngest nestlings (1984, 1985, 1991) and of the youngest and next youngest (1986) was always caused by starvation, preceded by a visible lag in development and activity.

Deviant stimuli. It was evident that in the first case described the hen owl had perceived deviant stimuli from the brood, when she responded with her uncommon behaviour. These deviant stimuli can probably be ascribed to the flabby body gradually sinking between its sturdy nestmates and the lack of activity. It is supposed that the hen owl may also have perceived differences in temperature between the dead and the other siblings. After perception of these stimuli it apparently took some time before a certain threshold was passed and she finally pulled out the dead nestling.

Ambivalent behaviour. This was characterized by a typically energetic examination of the body of the dead nestling and by a gradually stronger nibbling or claw activity, presumably in search for cues of a live chick. The longer the hen owl failed to perceive such stimuli the sooner she reached the point of recognizing it as a prey item. This process was assumed to be enhanced by her awareness of the nutritional state of the brood. Probably she herself was hungry too and was losing weight. The former supposition was in agreement with the immediate and vigorous begging response of all the nestlings, when she started to utter the first feeding calls after the second pluck. During brooding time the hen owl is continuously in touch with her nestlings and the most pronounced ambivalent behaviour was observed. During post-brooding this bond is less direct and the response to a dead nestling less immediate. Although I suppose that she must have noticed the death of the nestling, she did not respond directly. She picked it up as if she had one of her usual search actions for prey remnants. Then she dismembered the dead chick without any hesitation. I have no video-registrations of nestlings devouring or plucking a dead nestmate, but Haller (1939) reported one case.

Haller's observation. Haller (1939) gave a first hand observation of a Tawny Owl nestling devouring a dead nestmate. He observed a 4-brood at a Buzzard nest from a distance of 3 m for more than 3 hr and lit the scene if necessary with a torch. When he started the observation there were two well fed nestlings (31 and 30 days old), a third one visibly smaller (28 days) and a fourth one (26 days) with a considerable lag in growth and activity as compared to the third. Prey was delivered at 03.45 and 06.45 hr, a mouse and a large Song Thrush nestling *Turdus philomelos*. The

mouse was immediately swallowed by the first or second nestling, but not by the third. the thrush was dismembered by the first and second nestling. During this activity the fourth nestling, that had lain on the floor of the nest during the whole time, was tipped over. The third owlet was attracted by the dead or moribund nestmate, now lying on its back, and started to devour it.

I have no difficulty in accepting this case as nestling necrophagy because the fourth nestling must have lain with its eyes closed for at least 3hr as can be concluded from Haller's description.

Secondly there must have been a considerable difference in size between the third nestling and its victim for it successfully to devour it. That indicates a poor season too, as was also noted by Haller. These few observations suggest that necrophagy in Tawny Owls seems to be rather the rule than the exception.

Nestling mortality in other owls

The fragmentary records suggest that there has not yet been found evidence of infanticide or fratricide in other owl species. If fresh dead nestlings were found, no injuries were observed that might have caused their death. The disappearance of owlets by supposed cannibalism in Short-eared Owls *Asio flammeus* are insufficiently investigated by Ingram (1959, 1962) to be discussed here.

In Barn Owls it is widely observed that the youngest or youngest and next youngest often disappear before fledging. Marti 1989 (North America) and Wilson *et al.* 1985 (Africa) reported that hatching order affected significantly the loss of nestlings. They found little or no evidence for Cainism in Barn Owls. In some cases they found evidence that dead nestlings had been eaten by siblings. De Jong, who studied the breeding biology of Barn Owls in the north of the Netherlands for over twenty years, could confirm these findings (pers. comm. 1991). He added that usually the chicks disappear during early nestling time (hatching to approx. 40 days) and occasionally he had evidence for nestling necrophagy. During the wandering phase (after approx. 40 days of age) they were mostly found dead near the nest site. Such nestlings apparently died from starvation or an accident.

Preliminary conclusions

The observations about the mechanism of competition and necrophagy indicate similar processes in tytonine and strigine species. The competitive capability is determined by the size and agility of the nestling without any aggressiveness towards nestmates. Size in turn is determined by hatching order and enforced by poor food rates. During brooding the mechanisms of competition are not yet assessed because of observation difficulties. But the few accurate observations suggest that hatching order determines the begging loudness and intensity and also capability to seize the pieces fed. It is generally accepted that owls, feeding on "cyclic" fluctuating small rodents, adjust their clutch size to prevailing prey abundance and profitability during prelaying time. A temporary decrease in catchability by weather when brood demand is high can cause an accidental brood reduction. Evidence for food limitation of brood size in owls as well as in diurnal raptors is rare. However when an unpredictable decrease in prey abundance occurs, brood reduction should be considered as an adjustment of brood size to prevailing prey abundance. In this sense the observations are consistent with the idea of maximization of lifetime reproductive output of the parents (Lack 1966, 1968). The mechanism of competition is consistent with diurnal raptor species with variable clutch sizes of a relatively large range, 0-6 and more eggs. Intersibling strife or Cainism only occurs in diurnal raptors with small and less variable clutch sizes: 2-3 eggs. Although Cainism is a well-known phenomenon, its selective advantage is not yet fully understood (Stinson 1979; Brown *et al.* 1977).

ACKNOWLEDGEMENTS

I thank Zomer Bruyn for his field assistance in the first years of the study (1984-1986) in particular for the video-registration of nestling necrophagy in 1985 when he was accidentally at the spot. Special thanks must go to Ellen ten Broeke and Lodewijk Koster for their field work and patience to get the second video-registration of nestling necrophagy during postbrooding in 1991 when I was studying Tawny Owls in the Châtillon Forest.

REFERENCES

- BROWN, L.H. *et al.* 1977. Breeding success in some African Eagles related to theories about sibling aggression and its effects. *Ostrich* 48: 65-71.
- HALLER, W. 1939. Ueber einen Fall von Kannibalismus beim Waldkauz. *Beitr. Fortpfl. Biol. Vögel* 15: 29-31.
- INGRAM, C. 1959. The importance of juvenile cannibalism in the breeding biology of certain birds of prey. *Auk* 76: 218-226.
- INGRAM, C. 1962. Cannibalism by nestling Short-eared Owls. *Auk* 79: 715.
- LACK, D. 1966. *Population studies of birds*. Clarendon Press, Oxford.
- LACK, D. 1968. *Ecological adaptations for breeding in birds*. Methuen, London.
- LUNDBERG, A. 1981. Population ecology of the Ural Owl in Central Sweden. *Ornis Scand.* 12: 111-119.
- MARTI, C.D. 1989. Food sharing by sibling Common Barn Owls. *Wilson Bull.* 101: 132-134.
- McNICHOLL, M.K. 1977. Usage of the term "cannibalism" and "scavenging" in ecological literature. *Canadian Field-Nat.* 91: 416.
- SCHÜZ, E. 1984. Ueber Syngenophagie, besonders Kronismus, ein Beitrag zur Ethologie speziell des weiszstorchs. *Oekol. Vögel Ecol. Birds* 6: 141-158.
- STINSON, CH.H. 1979. On the selective advantage of fratricide in raptors. *Evolution* 33: 1219-1225.
- WALLIN, K. 1987. Defense as parental care in Tawny Owls *Strix aluco*. *Behaviour* 102: 213-230.
- WILSON, R.T. *et al.* 1985. Breeding biology of the Barn Owl *Tyto alba* in central Mali. *Ibis* 128: 81-90.

J. C. Van Veen
Owl Research Project
Agricultural University
Ritzema Bosweg 32a
6703 AZ Wageningen
The Netherlands

