

BEHAVIOURAL AND PHYSIOLOGICAL TEMPERATURE REGULATION IN YOUNG CHICKS OF THE WILLOW GROUSE (*LAGOPUS LAGOPUS*)

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Abstract—1. The length of brooding and foraging periods was measured for a brood of eight grouse chicks and parents kept in a 255 m² open air enclosure.

2. The chicks had shorter foraging periods and longer brooding, the poorer the weather.

3. Foraging periods became longer and brooding shorter as the chicks grew older.

4. At 8 days of age the heaviest chick was thermally independent at ambient temperatures above 15°C.

5. The duration of foraging appears to be determined by the degree of hypothermia.

The willow grouse lives above the tree-line in the Scandinavian and Alaskan mountains. The eggs are hatched in late June or early July when the weather is often cold, windy and rainy. The new-born chicks have only little ability to maintain a normal body temperature (Aulie & Moen, 1975), but rely instead on brooding periods under their mother between foraging trips. This pattern of behavioural thermoregulation is modified by climatic conditions. Theberge & West (1973) found that rock ptarmigan (*Lagopus mutus*) had longer brooding periods and shorter foraging periods the poorer the weather. They also found that brooding periods became shorter with age; at 1 week the chicks would normally be independent of maternal brooding.

In this paper, we report on the brooding-foraging behaviour of a willow grouse family that was kept in an enclosure from before egg-laying until the chicks were 4 weeks of age. We have recorded climatic conditions as well as the duration of brooding and feeding at various ages of the chicks.

MATERIAL AND METHODS

The study was carried out at the Wildlife Research Station, University of Tromsø, during June and July 1974.

A pair of willow grouse (*Lagopus lagopus*) was placed in a 255 m² enclosure of typical grouse habitat. The enclosure was not covered, but we had clipped the wing feathers of the birds. The hen selected a nesting place and laid nine eggs, of which eight hatched on June 26.

Although the birds were used to our presence, we wanted to observe them as undisturbed as possible. We therefore built a burlap blind on a hillock just within the enclosure. The air temperature was recorded in the shade 25 cm above ground. Rainfall, cloud conditions and wind were recorded. The grouse family was observed almost around the clock from hatching until the chicks were 1 week old. The duration of foraging periods was determined as the time from when the first chick left the hen until the last one had returned.

RESULTS AND DISCUSSION

At 3 hr after hatching, the first dry chick peeped out through its mother's plumage. 12 hr later the brood left the nest, the chicks closely following the hen. From now on we observed the regular pattern of alternating periods of brooding and feeding.

The climatic conditions were rather stable throughout the observation period. Table 1 shows the general weather conditions and Fig. 1 shows the average of the hourly air temperatures and the range of ambient temperature throughout the day.

Table 1. Weather conditions during the experiment

Age of chicks (days)	Cloud cover	Duration of rain (min)	Other notes
1	Cloudy	18	Damp
2	Partly cloudy	0	
3	Partly cloudy	0	
4	Cloudy	0	Very humid
5	Partly cloudy to clear	0	Clear during warmest part of day
6	Partly cloudy to cloudy	158	Strong wind
7	Partly cloudy to clear	132	Clear during warmest part of day

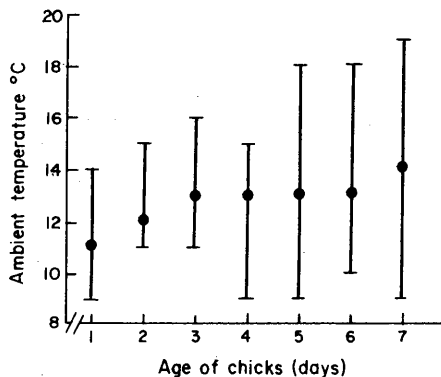


Fig. 1. Average and range of ambient temperature. The average temperature is based on temperature taken every hour.

The alternating periods of brooding and feeding are synchronized within the brood. All the chicks leave and return to the mother at about the same time. Apparently, the hen frequently did not call her chicks in, rather they returned quite voluntarily. We noticed

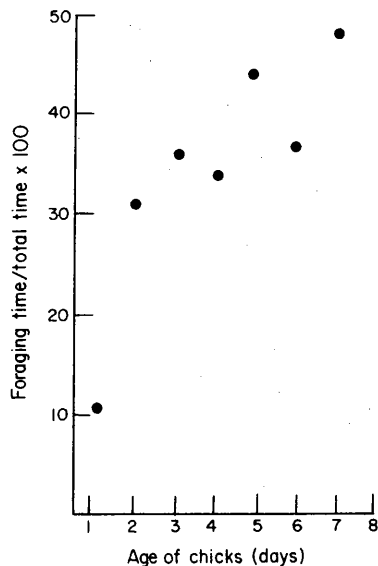


Fig. 2. Percentage of time the chicks spent away from the female.

that the smaller chicks were the first to return and the last to leave their mother.

Figure 2 shows that the proportion of the total observation time that the chicks spent away from the hen increased with age. This is consistent with the observation of Aulie & Moen (1975) and Aulie (1976) that the capacity of the chicks for endogenous heat production improves with age. We also observed that feeding time increased during the warmer periods of the day. At the age of 7 days, some of the chicks appeared to have achieved thermal independence of their mother at air temperatures above 15°C since they stayed away from her for hours at this temperature. Although we did not weigh the chicks, these particular chicks appeared to be the heaviest of the brood.

Insufficient ability to maintain normal body temperature during cold stress is found in almost all newborn homeotherm animals. As compensatory mechanisms, some have brown adipose tissue but most are kept warm by their parents. In grouse, as in other precocial birds whose young have to find their own food from the day of hatching, a pattern of alternating brooding and feeding has developed. The duration of each period depends on the ambient weather conditions, as well as on the age and the stage of development of temperature regulation of each chick. Recent studies by Pedersen (unpublished) indicate that the length of the feeding period is ultimately determined by the degree of hypothermia, since the chicks always return to their mother when their body temperature approaches 35°C.

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