Notes on night–time activity of Golden Plover *Pluvialis apricaria* chicks in the north Pennines.

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A single Golden Plover *Pluvialis apricaria* chick from each of four broods was fitted with a position–sensitive transmitter. Records were obtained from 12 days in May and June 1995. All records of chicks during daylight hours indicated they were active. Some records from older chicks (> 6 days) showed they were also active at night. A significant amount of residual variance in night–time activity was explained by both age of chick and minimum temperature in a 24–hour period. The effects of these two variables could not be separated and so one, or both, may be important in determining activity of chicks at night.

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INTRODUCTION

A wide variety of birds are active both during the day and at night, including many species of wader (McNeil *et al.* 1992). For example adult Golden Plover *Pluvialis apricaria* have been recorded feeding at night during the breeding season (Whittingham, Brown & Percival unpublished MS) and Lapwing *Vanellus vanellus* during the winter (Milsom, Rochard & Poole 1990).

Many wader chicks forage for themselves within hours of hatching but there are very few reports of their activity at night. Grant *et al.* (1992) found Whimbrel *Numenius phaeopus* chicks fed throughout the day and night, though the study was conducted in Shetland when there was daylight throughout the 24 hour cycle. During a study of Curlew *Numenius arquata* in Teesdale, northern England, radio–tagged Curlew chicks were not found to be active at night from the sample of 10 records from 4 broods with tagged chicks ranging from 1–24 days in age (Murray Grant, in litt). The present study, which took place in the same part of the country, aimed to investigate whether Golden Plover chicks were active at night, for which we can find no previous published evidence. In addition, we aimed to identify the factors or variables that explained chick activity.

METHODS

Data were collected from four broods in May and June 1995 from Widdybank Fell, part of Teesdale National Nature Reserve, (54°40'N, 2°16'W). Transmitters were used to investigate activity rates during both night and day. 1.35g BD–2 transmitters with activity switches (from Holohil systems, Ontario, Canada) were used. These transmitters were attached after the chicks had reached 24g in weight (so that the transmitter represented <6% of the body weight) by replacing a lighter transmitter. Some chicks were heavy enough at one day old and others at two or three days. These lighter transmitters were either 0.8g SS–2 button cell transmitters (supplied by Biotrack, Wareham, Dorset) or 0.9g BD–2 transmitters (supplied by Holohil systems). There has been no effect found by glue mounted transmitters on behaviour and survival in studies of various other species (Kenward *et al.* 1993, Whittingham 1996, Hill & Talent 1990, Kalas *et al.* 1989). Chicks with transmitters were as likely to reach the end of the fledging period as were controls (Whittingham, Percival & Brown in press). Further details about the attachment of transmitters can be found in Whittingham, Percival & Brown (in press).

It was only possible to obtain data from chicks within transmitter range of the road both because access to the moorland was not allowed at night and due to the dangers of mine shafts present on one of the sites! One sample of pulse rate was taken during the day, between 06.50 & 21.00, and one sample at night, between 23.00 & 02.00, to determine whether chicks were active (pulse pattern not constant) or not active (pulse pattern constant). It was dark for approximately five hours at this time of year between the hours of 2300 and 0400. Pulse pattern has previously been successfully used to discriminate between feeding and non–feeding in adult Golden Plover (Whittingham 1996). Observations of chicks during the day showed that when they were being brooded, hiding in the grass, standing or sitting motionless the pulse pattern was constant. Each sample consisted of five one–minute records. A comparison was made between night and day of numbers of records in which chicks were recorded as active.

Ambient light at the time the samples were taken was scored as (1) cloud cover less than 75% with half the moon or more

Table 1 Activity of tagged chicks during night and day. *Note: the minimum temperature during each day is shown as the lower figure in the air temperature column.*

Brood name	Date of record (all 1995)	Ambient light conditions	Air temperature – range on day of recording in °C.	Age of chick (days)	Proportion of five minute sample active during DAY	Proportion of five minute sample active during NIGHT
Valley	16/05	Low	0.9-4.5	1	1	0
Valley	17/05	Low	0.6-5.1	2	1	0
Valley	18/05	High	1.2-8.7	3	1	0
Valley	22/05	Low	6.9-13.6	7	1	0
Red Sike	19/05	High	1.1-11.0	2	1	0
Whitepost	23/05	Low	6.0-15.6	3	1	0
Whitepost	25/05	Low	5.4-13.9	5	0.6	0
Whitepost	26/05	Low	6.3-13.7	6	1	1
Whitepost	29/05	Low	7.0-11.7	9	1	1
Whitepost	30/05	Low	6.5-13.3	10	1	0.8
Red Sike Old	05/06	High	6.5-11.8	Estimated at 21 days	1	1
Red Sike Old	06/06	Low	7.2-12.5	Estimated at 22 days	1	1

visible and (2) greater than 75% cloud cover with moon in any state. Weather data for Widdybank were available from an on–site meteorological station.

A logistic regression model was used to test for the effects of various predictors on feeding by chicks at night. Feeding at night (1) or not feeding at night (0) was set as a binary dependent variable with brood and ambient light specified as factors and age and minimum air temperature as variables. Brood was always included in the model to test for effects beyond those caused by within brood variation. The effects of each predictor were measured by deleting them from a model including all predictors. Non–significant effects were excluded from the model and those that had a significant effect on residual deviance were placed back in the model. GLIM (Version 3.77, Royal Statistics Society) was used to carry out the analysis. Note that the feeding time observed from Whitepost chick (80% of the time was spent feeding, see Table 1) was rounded up to 100% to permit a binary analysis to be carried out.

RESULTS

Data from 12 days (both during night and day) were collected from four broods and are presented in Table 1. The chick caught at Red Sike Old (see Table 1) weighed 122g and was estimated to be approximately three weeks old (based on unpublished growth rate data). In the analysis of feeding at night presented below the age of the chick was set at 21 days. All the chicks tagged were active during the day. There were eight records of chicks up to seven days old, of which all were inactive at night except one six day old chick. The four records of chicks of nine days old or more were all active at night.

The model fitted to the data attempted to explain the variation in feeding behaviour at night. Ambient light was confounded with the effect of brood and so it was not possible to distinguish between the effect of brood and ambient light. However, when brood was eliminated from the model the amount of ambient light measured did not significantly decrease the deviance in the data from feeding behaviour of chicks at night (DD = 0.12, d.f. = 1, $p>0.05$). The minimum air temperature during the 24 hour period (the best measure of temperature at night available) accounted for a significant decrease in the deviance in the amount of feeding which occurred at night (DD = 6.71, d.f. = 1, $p<0.01$), with brood included in the model. However, age accounted for marginally more of the variation than temperature (DD = 6.72, d.f. = 1, $p<0.01$), with brood in the model. Both temperature and age were positively associated with feeding activity at night. Neither age nor minimum air temperature accounted for a significant amount of residual deviance when deleted from the model when both were in the model. These two effects were therefore highly intercorrelated. It is possible to determine which of the two effects were the greater by looking at the amount of residual deviance explained. However, in this case the difference in the proportion of variation explained between age and temperature was so small, that we considered it was not safe to distinguish between the two effects. Therefore either one or both variables, age and temperature, were important in explaining activity of chicks at night, but it was not possible to distinguish between the two. The analysis was repeated with the data obtained from the oldest chick removed (because age could only be estimated for that chick) and very similar results were obtained.

DISCUSSION

Both age and temperature have been found to have an important effect on the amount of time spent foraging by wader chicks of several different species (Beintema & Visser 1989). The latter study found the percentage of time available for feeding increased with age and with ambient temperature and that above a threshold temperature brooding ceased altogether. As chicks age their ability to thermoregulate

improves. O'Connor (1984) reported the most rapid improvement occurred between 25–75% of the way through the fledging period for two passerine species. This study could not distinguish between the effects of age and the measurements of temperature obtained on activity at night. This was largely a consequence of nearly all records from young chicks coinciding with a cold period of weather from 16–19th May. However, one or both variables were found to have a significant effect on activity at night.

We suspected that younger chicks, at least, were being brooded at night because of two casual records at night. The first involved an adult flushed from where a chick was located (age of chick was 2 days) and another where the adult was within 5 metres of the chick (age of chick was 5 days). In both cases the chicks were very warm suggesting they had been brooded very recently. It is possible that older chicks may be more active at night because they need less brooding, which may explain the pattern observed. Other studies on wader chicks have observed brooding up to about 65% of fledging age in the Semipalmated Sandpiper *Calidris pusilla* (Ashkenazie & Safriel 1979) and in the Ringed Plover *Charadrius hiaticula* until 75% (Pienkowski 1984) but not in chicks older than that.

Personal observations showed that chicks were generally active throughout the day, except when danger threatened and they hid in the vegetation. This was backed up by data from the tagged chicks during the day that showed they were active for the majority of the time. This note highlights the fact that Golden Plover chicks are sometimes active at night but does not indicate why this should be. Wader chicks appear very vulnerable to predation until they are able to fly. It may therefore benefit chicks to maximise their feeding opportunities so that they can reach fledging as quickly as possible. Night–time activity would enable them to achieve this goal.

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