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EDITORIAL NOTE: In the light of the importance of this subject to wader ringers, we would be especially pleased to publish other observations on the efficacy of Valium as a cure for leg cramp in waders.

Radio-tracking of Golden Plover *Pluvialis apricaria* chicks

D.W. Yalden

Yalden, D.W. 1991. Radio-tracking of Golden Plover *Pluvialis apricaria* chicks. *Wader Study Group Bull.* 63: 41-44.

A single brood of four Golden Plover chicks was tagged with 1g-radios, and followed for up to nine days by which time two had died, and the other two radio batteries failed. The technique enabled two chicks to be tracked over about 900 m, and their growth rate (c. 2.5g/day) and diet assessed. The technique has great potential for use on these and chicks of larger nidifugous birds.

D.W. Yalden, Department of Environmental Biology, University of Manchester, M13 9PL, U.K.

INTRODUCTION

All wader chicks are well camouflaged, highly mobile, and most of them are nidifugous, foraging for themselves. This makes it very difficult to follow individual chicks from hatching to fledging, so that there are very few studies of growth rates or mortality rates in field conditions. (Exceptions include studies of Lapwing *Vanellus vanellus* by Galbraith 1988 and Baines 1990, Redshank *Tringa totanus* by Thompson & Hale 1990, Snipe *Gallinago gallinago* by Green 1985 and Common Sandpiper *Actitis hypoleucos* by Holland & Yalden 1991).

These problems are particularly acute with Golden Plover *Pluvialis apricaria*; the chicks are certainly well camouflaged and highly mobile, but in addition the very open habitat, attentiveness of the adults and their overt alarming behaviour make it impossible to approach within 200 m of the chicks; the chicks stay hidden, and are invisible at that range, and the adults will not go back to their chicks while an observer remains in the area (Byrkjedal 1985; Yalden & Yalden 1989, 1990). Not surprisingly, there appear to be no published data on the growth rate of Golden Plover chicks, little on chick diet or early mortality, and not much on their habitat requirements (but see Parr 1980).

The use by Redmond & Jenni (1986) of small radio transmitters to mark chicks of Long-billed Curlew *Numenius americanus* enabled them to follow individual chicks, establishing both growth rates and causes of mortality. This prompted a limited trial of the technique on Golden Plover chicks in 1990.

METHODS

The smallest radio-tag made by Biotrack, the SS-1, was used It weighs 1g when complete, but has a battery life of only 6-7 days. The signal can be received up to 250 m away.

Practitioners recommend that radio-tags should not exceed 5% of the animal's weight (e.g. Kenward 1987). In our recent studies (Yalden & Yalden 1990) we found Golden Plover chicks, in or just outside their nest within 1-2 days of hatching, to average 22.3 g (n = 52 chicks in 20 broods, range 18.5-26.0g, s.e. 0.31). Thus the radios, at about 4.5% of body mass, are just within therecommended limit, but heavier radios (with longer field lives) would not be.

A nest was located on 20 April 1990 at the c/1 stage, and survived through incubation. None of the eggs was pipping on 23 May, but all had hatched by 10.40 hrs on 26 May, when the chicks were weighed and ringed. I returned at 15.00 hrs with the radios, which were glued to the down on their back, approximately over the centre of gravity, with eyelash cement.

The chicks were subsequently located, using an RX81 receiver (also from Biotrack) and hand-held H-aerial, once each day; mostly, visits were made at 19.00-20.00 hours, on the assumption that this late visit would minimise disturbance of their daily feeding activities, and would also ensure that there was no-one else on the moors to delay the parents' return to their chicks (cf. Yalden & Yalden 1990). In practice, I found it took from 45-60 minutes, from first disturbing the adults, to locate all the chicks, weigh them, and leave the moor. While searching for second to fourth chicks, I kept the earlier-found chicks, in a bird bag, within my shirt, to limit heat loss.

On releasing the chicks, I put a few mealworms (larvae of *Tenebrio molitor*) by each one, in the hope that this extra food would compensate for my intrusion, but of course they would not move while I was present and their parents were alarming, so I do not know if this was a successful strategy. Faeces were collected during handling of the chicks; there were mounted in a water soluble mountant to provide semi-permanent microscope preparations, and examined for fragments of invertebrates at x24 and x80 magnification.

RESULTS

Movements

The chicks were replaced in the nest cup after radio-tagging. The following day, all four were together, presumably being brooded until I arrived, on a clump of *Empetrum nigrum* 121 m west of the nest (Figure 1). On day two, they had moved further west, 263 m from the nest cup, and were scattered in a circle about 35 m diameter; they were still in the same area the following day. Due to equipment failure, I was unable to locate them on day four, but around midday on day five they were over 250 m away to the north east, and 367 m in a direct line from the nest cup; they were scattered in a 20 m circle on *Vaccinium/Empetrum/Eriophorum* heath. On day six, the three survivors were about 100 m further west, scattered in a 12 m circle, with the dead chick about half way between the two days' locations. On day seven, there were only two survivors, back about 100 m east and at the day five location; both were well tucked down between tussocks of *Eriophorum vaginatum*, about 18 m apart. On day eight, only one radio was still properly functioning; the chick had moved back 200 m westwards, and a fading signal from the other radio suggested that its sib was nearby. By day nine, the last radio was also failing, and neither of the chicks was located. In aggregate, the chicks had moved 900 m (straight line distance), or over 100 m per day, in their first eight days, though they were only about 500 m away from their nest (Figure 1).

Growth rates

The four eggs included three heavier ones (36.8, 37.0 and 37.2g on 27 April) and one much lighter (35.0g); not surprisingly, three of the chicks (27.0, 27.0 and 26.0 g) were much heavier than the fourth (24.0 g) on the day the were tagged (= day 0). All lost weight by the next evening, but the lightest one lost least (1.3 g, against 2.3-2.6 g for the others) (Figure 2). On day two, all had gained weight and were heavier than on day 0. On day three, which was cold and windy, only the lightest one had gained weight, but by noon on day five it had lost 2.0 g, while the other three had maintained or gained weight. It was cold and raining all that afternoon, so I was not surprised to find the lightest chick dead, lying in the open on the moor, on day six; it weighed only 0.3 g more than on day 0, despite being six days old.

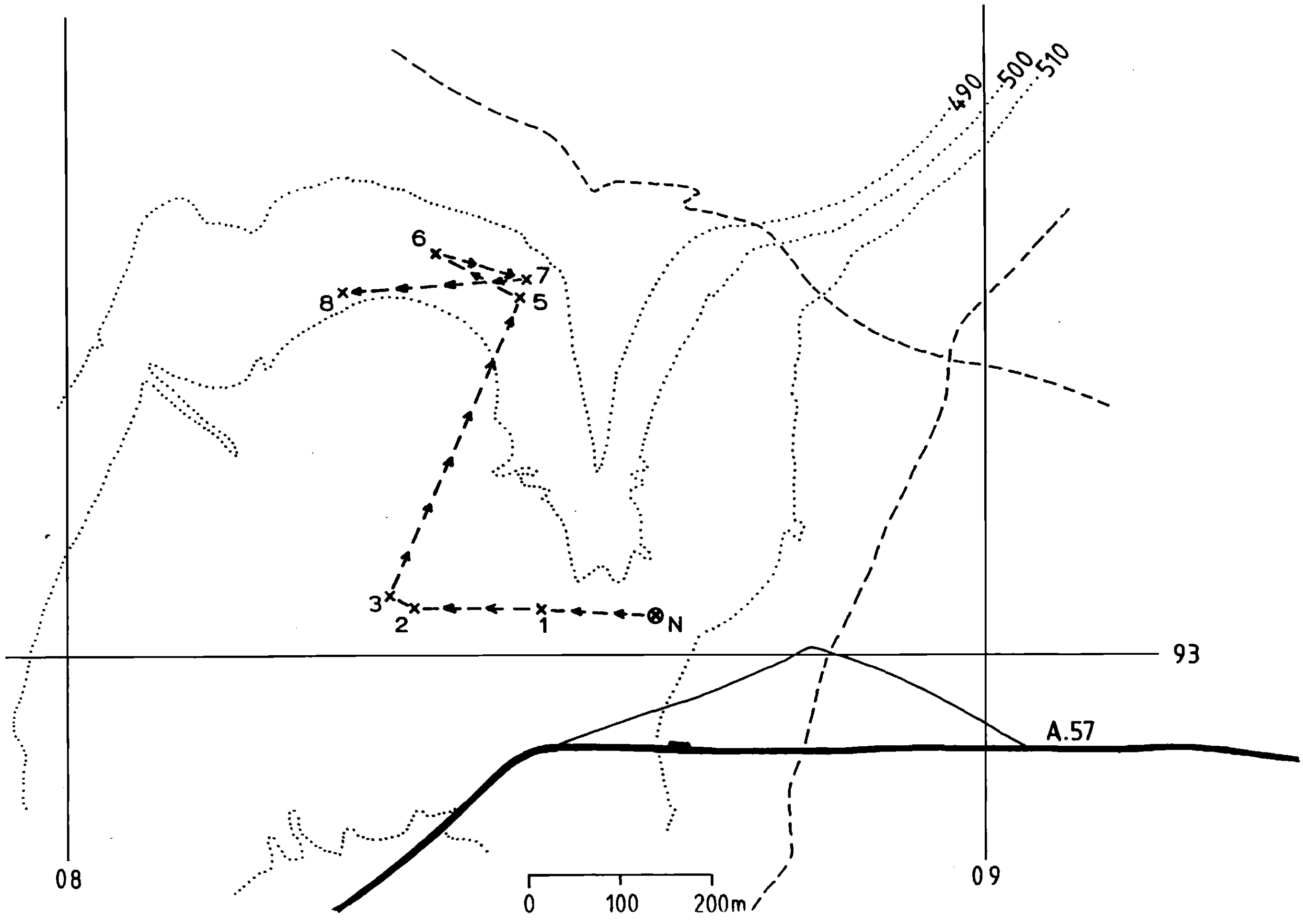

Figure 1. Sketch map of the study area, showing the movements of the brood of Golden Plover chicks, nest site; 1-8, position on days 1-8 post hatching. The A.57 is the main Manchester-Sheffield road; broken lines are main footpaths.

The other three had gained between 1.5 and 3.0 g, after a drier and warmer morning; one of them, the heaviest, was found just beside a deep hole in the peat, and with some trepidation I replaced it precisely where I found it. On day seven, it was located, dead, in the bottom of that hole. The other two had gained further weight, and so on the last day had the chick with the still-functioning radio; it then weighed 34.0 g (Figure 2).

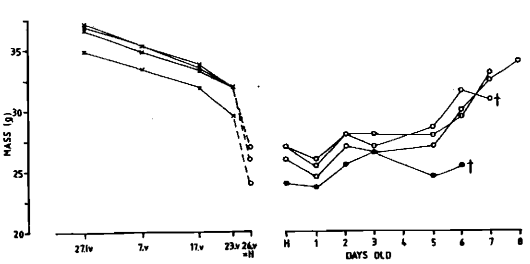

Figure 2. Weight changes of four Golden Plover eggs and chicks.

Averaged over all the days from day one to their last (live) weighing, the three largest chicks gained weight at 1.68 g /chick /day (n= 15 records, SD =1.62), this figure discounting both the weight loss in the first day, and the poor performance of the lightest chick. Probably their growth rate improves as they get older; for the last six records, for days seven-nine, the figure is 2.5 g/chick/ day. One other chick, in our earlier studies in 1987, was recaptured, fortuitously, 12 days after hatching; it weighed 50 g and had grown at 2.38 g/day. Adult Golden Plovers weigh around 215 g on the breeding grounds (Cramp & Simmons 1983), so if the rate of 2.5 g/day is a reasonable figure, their chicks only grow at 1.2% of adult body weight daily. This is a very low growth rate (cf. 3% for Common Sandpipers and Snipe) and puts them into the slow-growing group postulated by Visser & Bientema (1987), which included also the Lapwing. Over the first 10 days Lapwings seem to grow at only 2.4 g/day, 1.05% of adult weight daily (extrapolating from Galbraith 1988, Figure 1), but later at 4.7 g/day or 2.1%; probably older Golden Plover chicks also grow faster than these very young ones. If one extrapolates a 2.5g/day growth rate over the 30 days which is postulated to be the fledging period for Golden Plovers, they would only weigh 90-100 g at that point. Our censuses suggest that Golden Plovers actually require around seven weeks to fledge (Yalden & Yalden 1991) by which time they would be nearing 150 g, still rather light but approaching 75% of adult mass. Lapwings can fly at 35 days old and about 70% of adult mass (Galbraith 1988).

Diet

The faecal samples indicate that the chicks were feeding on weevils (five records), carabids (three) caterpillars (two), adult dipterans, mainly tipulids (in all seven samples), spiders (two), aphids (one) and chalcids (one).

DISCUSSION

Obviously this is a preliminary trial, and the sample size is too small to draw definitive conclusions, but it does demonstrate the validity of the technique. The radios stayed in place, and allowed the cause of death of two chicks to be determined. The survivors should have shed the defunct radios along with their down. In a definitive study, the radio-tags could have been replaced with larger, 1.7 g radios, which might have lasted through to fledging; at 7 days old, and 33g, these would have been just at the 5% tolerance level. The older chicks, at least, tolerated the daily interference, and there is no reason to believe that the death of the other two was due to handling. The experiment also confirmed the behavioural observations of Yalden & Yalden (1990) who described a brood, in 1987, apparently moving from virtually the identical nest site onto Coldharbour Moor, and reported four similar cases of broods moving (apparently away from human disturbance) in 1988. This radio-tracking confirms that Golden Plover chicks can undertake such long movements, which Parr (1980) also reported.

The technique could also be used to investigate the relationships between,habitat, food supply and diet. Its limitations are the expense (£50 per radio), the short life of the very small radios, which is all that young chicks can carry, and the necessarily small sample sizes

ACKNOWLEDGEMENTS

The radio-tags used in this work were bought by the Department of Environmental Biology, University of Manchester from departmental funds, and I thank Professor John Lee for his support and encouragement. I also thank the Licensing Section of the Nature Conservancy Council (per Peter Clements) for licensing this work. Biotrack Ltd, Roborough Croft, Furzebrook, supplied the equipment and Dr Robert Kenward and Brian Cresswell gave much help and advice on its use. I am very grateful to my wife (and former research assistant!) for her logistical support.

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