Weights of female Barnacle Geese during breeding

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Introduction

Among arctic geese the females rely heavily on body reserves during the early stages of the breeding cycle; the birds often arrive on their arctic breeding grounds before suitable feeding vegetation is exposed by snow-thaw, and as a result the materials for the production of eggs and energy for egg-laying and incubation must be drawn from body reserves (e.g. Ankney and MacInnes 1978). The size of these reserves, and the rate at which they are depleted during incubation, must therefore play an important role in the evolution of their reproductive strategy.

Previous studies have measured body reserves and their depletion by removing successive samples of birds from more or less homogeneous populations, but no study has previously reported weights taken at intervals from the same individuals. This paper presents such unique weight data derived from a pilot study in which weights were obtained, without the birds being trapped, using nest balances.

The study was carried out in 1978 on the colony of free-flying Barnacle Geese *Branta leucopsis* breeding at the Wildfowl Trust's reserve at Slimbridge, Gloucestershire.

Methods

Females were weighed on the nest using balances designed by R. M. Sibly (1979), originally for use on Herring Gulls *Larus argentatus*. These balances enable the weight of the nest and its contents, including the female if present, to be measured at a point remote from the nest. The weight is determined from the resistance of a linear potentiometer incorporated into the balance mechanism. In this study, the weights of females were obtained by taking resistance readings with the female on the nest, then approaching the nest slowly until the female stepped off the balance, and taking a second resistance reading with the female off the nest. In some cases it was possible to take further readings when the female stepped back onto the balance. The weight of the female was derived from the maximum difference between these two readings (malfunction of the balance mechanism leads to an underestimation of weight), thus controlling for day to day variations in nest weight due to changes in moisture content, clutch weight, and the amount of nest material. Using this method weights can be obtained to an estimated accuracy of 20 grams.

Balances were installed under the nest from before the first egg until between the second and third eggs, a time when desertion was less likely. Resistance measurements were taken with a Sinclair DM2 portable multimeter every day during laying, and at six day intervals during incubation. All measurements were taken between 1100 and 1700 hours, and the majority between 1200 and 1400.

The dates of laying and mean weight of eggs in each clutch were also recorded. The weight at the start of laying was estimated from the mean of two estimates derived from the first measured weight and either the weight loss per egg or weight loss per day during laying.

Additional weights were obtained when the females were subsequently caught during the moult.

Results

Balances were installed under six nests. Two females responded by completing their clutch in a second nest, while weights were obtained from the other four females (Figure 1).

Females lost weight during both laying and incubation. During laying, weight losses amounted to 72–94 gm/egg or 36–87 gm/day, the difference being due to the days on which no egg was laid. On these days, females tended to either gain weight or at least lose weight more slowly. Mean weight loss/egg does not correlate with the mean egg weight of a clutch, but the variance in mean egg weight was small (98, 104, 105, and 107 gm). The percentage of the initial weight (1·83–2·69 kg) lost during laying varied from 9·8–18·0%, but for three of the females the weight loss varied only between 16·0 and 18·0%.

Weight was lost throughout incubation, except by 'AQ' who left the nest towards the end of incubation in order to feed; in the wild such temporary desertion would very

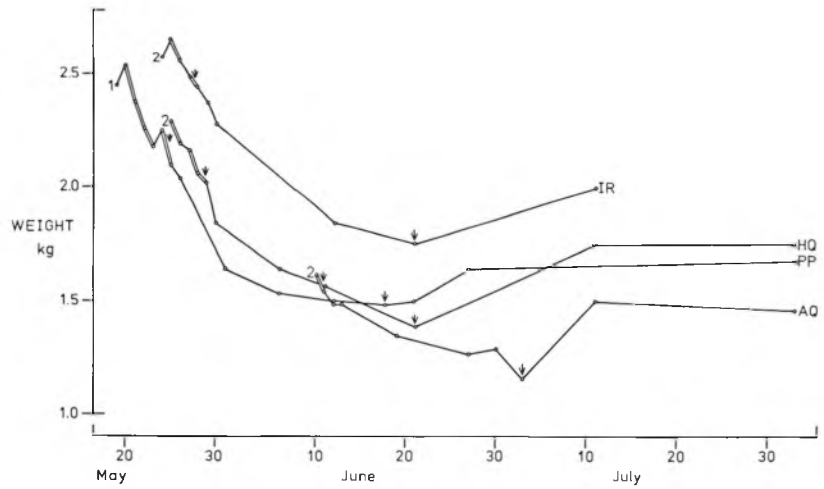

Figure 1. Weights of female Barnacle Geese during breeding. The number of eggs already laid is given at the beginning of each record. Double lines denote days on which eggs were laid. Vertical arrows indicate the extent of incubation. Female colour ring identification is given at the end of each record.

Figure 2. Female Barnacle Goose standing beside her nest which is supported on a nest balance. (*Kelvin Portman*)

probably lead to predation of the exposed clutch (Harvey 1971). Weight loss during incubation varied from 24·6–31·4% (27·7–31·4% excluding 'AQ'). Total percentage weight loss, from the commencement of laying to the completion of incubation, ranged from 34·8 to 43·5%.

All females gained weight post-hatching.

Discussion

The weight loss curves are similar to those already reported for other geese during laying and incubation (e.g. Barry 1962; Ryder 1967; Ankney and MacInnes in press). However, a comparison with these studies underlines the usefulness of the nest balances in obtaining weight data; whereas the weight curves published here were obtained from only four birds, the other studies, requiring the sacrifice (or at least time-costly trapping) of a large number of birds, produce weight data of far poorer definition; inevitably, the confidence limits placed on data from single individuals are much tighter than those on data from series of samples of different individuals. The usefulness of the nest balances extends beyond the mere production of weight curves, to use in observational and experimental studies that would require prohibitively large samples if attempted by successive sampling; as a method of obtaining an estimate of calorific cost, they could play an important role in behavioural studies of the costs and benefits of different activities, and also in studies of reproductive strategy—for instance the apportionment of reserves between egg production and incubation, or the personal risk that a female is prepared to accept (the weight to which she will drop) before desertion.

Acknowledgements

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Summary

A pilot study of free-flying Barnacle Geese *Branta leucopsis* shows that nest-balances may be used to obtain series of weights from individual females during laying and incubation. The four individual weight curves obtained are similar to those already reported from successive sampling of populations of arctic geese, but the nest balances may be used in studies in which it would be difficult or impossible to obtain the data required by successive sampling.

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