NOMOGRAMS FOR ESTIMATING THE STAGE OF INCUBATION OF WADER EGGS IN THE FIELD

by Rhys Green

INTRODUCTION

Ornithologists sometimes want to know when the eggs in a nest found during incubation were laid, and when they will hatch. A commonly-used method for the estimation of stage of incubation is to combine the weight (W), length (L) and breadth (B) of the eggs in an index of specific gravity (W/LB^2) which declines with increasing incubation time because of water loss. In this note I describe formulae for calculating dates to hatching (D) from $W.LB^2$ for four wader species, and a simple method of estimating D in the field if you have left your micro-computer or programmable calculator at home.

METHODS

Eggs of Common Snipe *Gallinago gallinago*, Redshank *Tringa totanus*, Black-tailed Godwit *Limosa lapponica* and Lapwing *Vanellus vanellus* were weighed to 0.1g with a 50g Pesola spring balance and measured to 0.1mm with dial calipers when the nests were first found. Nests were then checked at 5-7 day intervals. I considered that I knew the date of hatching of a clutch in the following circumstances:

(a) if the nest was found during laying, the eggs were assumed to have been measured 24 (Redshank and Godwit), 19 (Snipe) or 28 (Lapwing) incubation days before hatching,

(b) if star-like cracks caused by the hatching chicks were seen, the eggs were assumed to have hatched two days later,

(c) if holes in the shell or exposed membrane caused by hatching chicks were seen, the eggs were assumed to have hatched next day,

(d) if chicks were found in the nest, they were assumed to have hatched on that day.

Once eggs have started to hatch they lose weight rapidly so clutches at this stage were excluded from analysis.

ANALYSIS

The mean W/LB^2 for a clutch was positively correlated with D to a similar extent in all four species (Table 1). The Redshank data were collected by three independent teams of observers on a saltmarsh, on a coastal grazing marsh and on inland water meadows in south-eastern England. Slopes and intercepts of linear regressions fitted separately to data from the three sources were closely similar and analysis of covariance revealed no evidence of differences (slopes $F_{(2,42)} = 0.23$; intercepts $F_{(2,44)} = 0.09$).

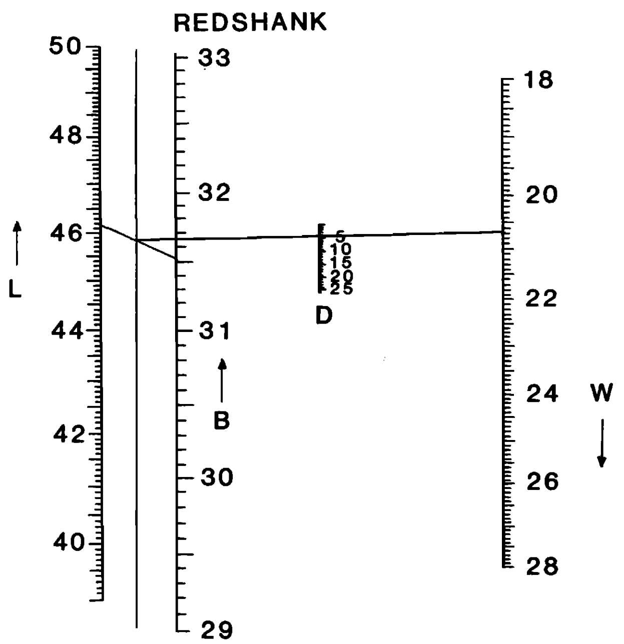


Figure 1. Using the nomogram.

1. mark the lengths, breadths and weights (L, B and W) on the 3 scales of the nomogram;
2. estimate by eye and mark the median or average values for L, B and W;
3. join median L to median B by a straight line. Where that line crosses the unmarked axis, mark the point and join it to the median W;
4. read off on the small scale (D), where this line crosses it, the number of days to hatching.

Table 1. Formulae for estimating days to hatching (D) from W/LB^2 (measurements in g and mm).

Species	formula	r	error S.D. (days)	mean error (days)	N (nests)
Common Snipe	$D=325945W/LB^2-145$	0.821	3.23	2.54	82
Redshank	$D=446508W/LB^2-197$	0.821	3.92	3.13	48
Black-tailed Godwit	$D=382819W/LB^2-165$	0.829	4.18	3.24	8
Lapwing	$D=321337W/LB^2-133$	0.924	3.21	2.18	25

Figure 2.

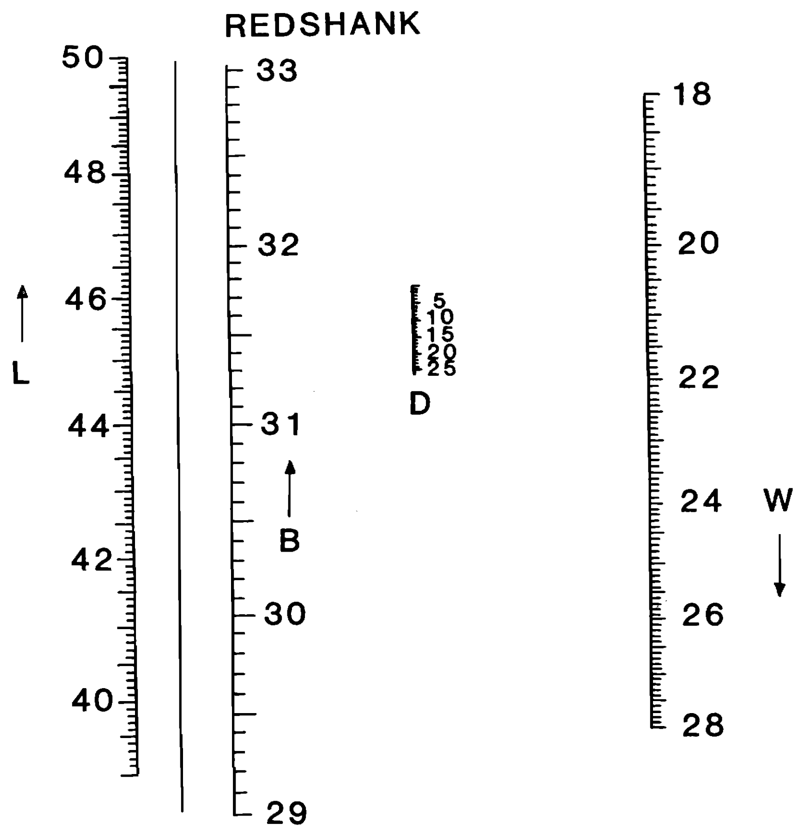


Figure 3.

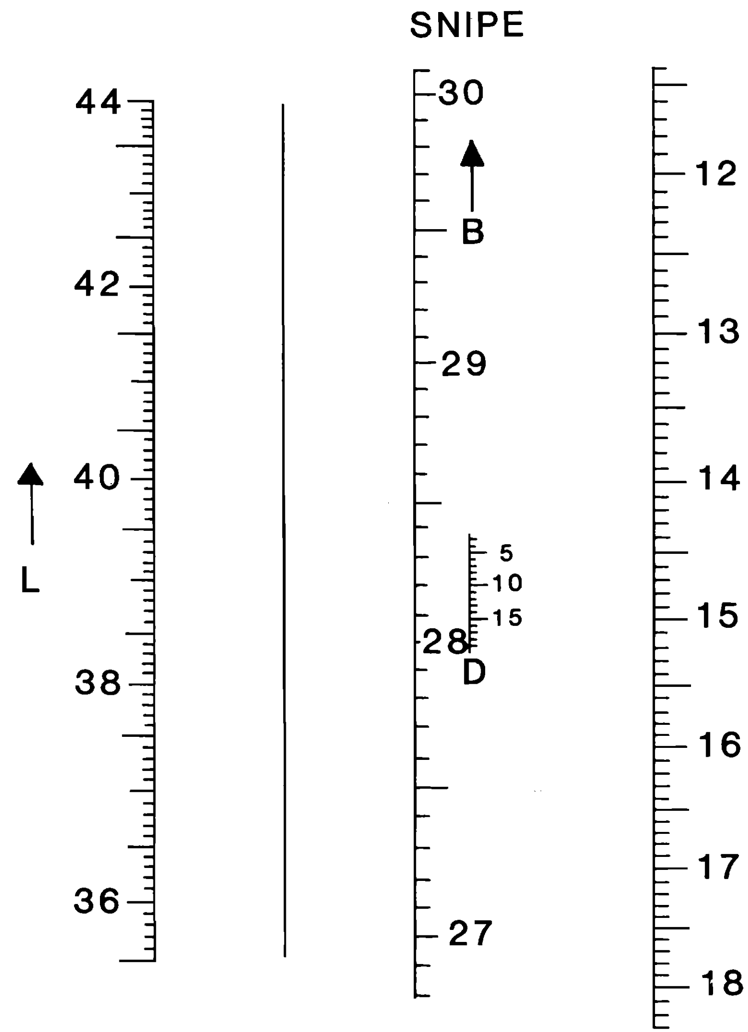


Figure 4.

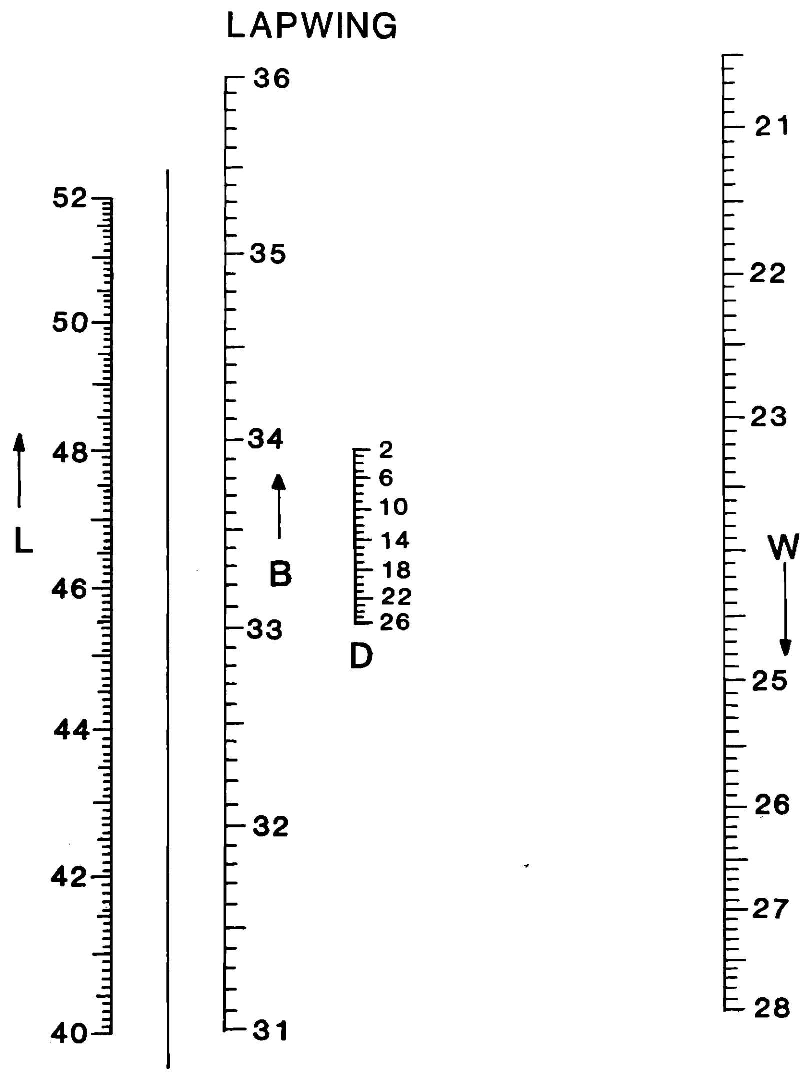
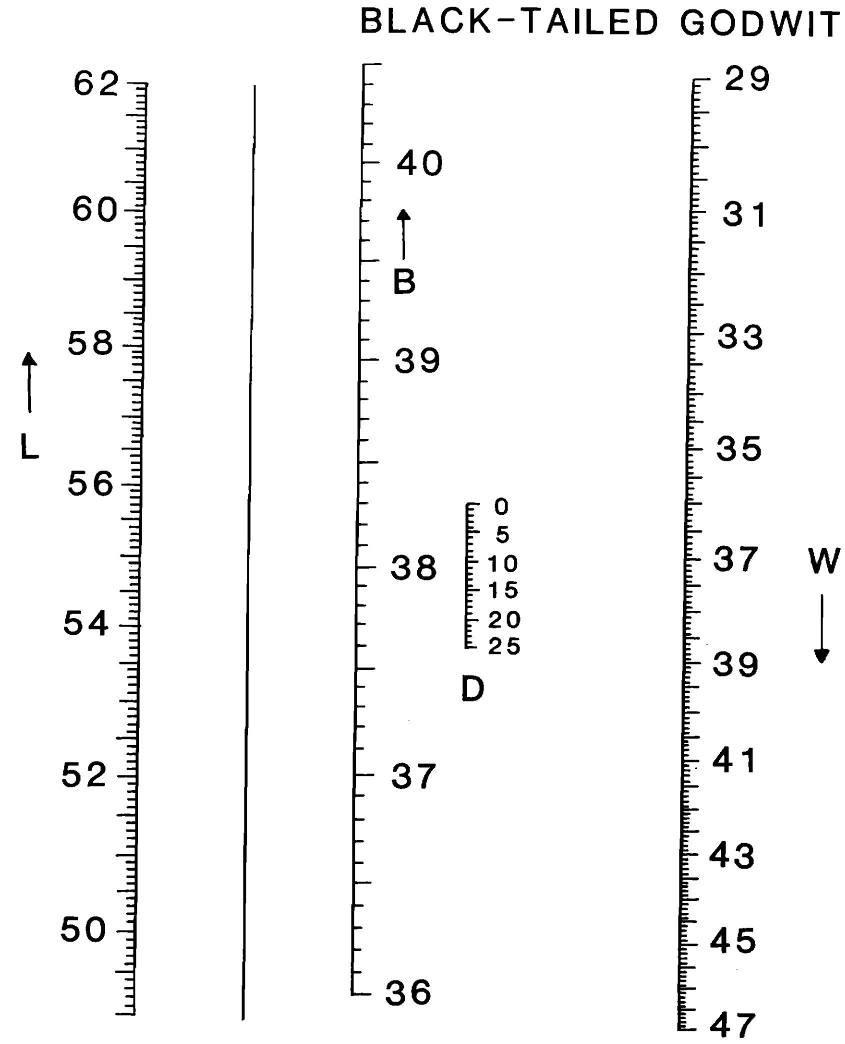


Figure 5.



Formulae for estimating D from W/LB^2 were obtained in two ways.
(1) W/LB^2 was regressed on D and the linear regression equation rearranged to predict D.
(2) D was regressed on W/LB^2 to give the estimation formula directly.

My statistics books tell me that I should use method (2) to predict D. However when the nest-ageing errors from method (2) were plotted against D, I found that there was a significant trend for estimates made early in incubation to be too short and those made later to be too long. There was no such trend for method (1), which I therefore preferred. Table 1 shows the formulae derived by method (1), the standard deviations of nest-ageing errors and the mean absolute errors.

NOMOGRAMS

Simple nomograms are diagrams for carrying out addition and subtraction. They are drawn in such a way that joining values on two parallel scales with a straight line gives the required quantity where the line crosses a third scale midway between the first two. If the scales are logarithmic they can be used for multiplication and division. For estimating the stage of incubation I used two overlapping logarithmic nomograms. The first nomogram calculates LB^2 and the second uses this result and W to calculate D. Figure 1 gives instructions for using the nomograms and Figures 2 - 5 show nomograms for Snipe, Redshank, Lapwing and Black-tailed Godwit. A copy of the nomograms of the size reproduced here can be covered with adhesive-backed transparent plastic film and inserted into a field notebook. The diagram can then be marked with a water-soluble overhead projector pen and wiped clean after each use. Nomograms used over 100 times are still in good condition. Estimating D from measurements on nest record cards (4 egg clutches) took me an average of 41 seconds per clutch (range 35-48, N=10) using a nomogram, compared with 40 seconds per clutch (range 38-42, N=10) using a micro-computer.

A good alternative method for estimating the incubation stage of wader eggs, which can give an instant result in the field, is to judge the degree of flotation of eggs in water in a transparent container (see Paassen, Veldman and Beintema 1984). This method is accurate and quick in experienced hands, but if eggs are being weighed and measured for other reasons then the use of the W/LB^2 nomogram will probably save time and inconvenience.

ACKNOWLEDGEMENT

I am grateful to Steve Carter for redrawing the nomograms.

REFERENCE

Paassen, A.G. van, Veldman, D.H. and Beintema, A.J. 1984. A simple device for determination of incubation stages in eggs. *Wildfowl* 35: 173-175.

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AGEING CRITERIA FOR DUNLINS

by Nigel Clark

Gromadzka and Przystupa's (1984) note poses several questions about ageing criteria for Dunlins *Calidris alpina*, which the following information may help to answer.

I have one skin of a Dunlin obtained in August in Schleswig-Holstein (F.R. Germany) which was aged Euring code 5 (ie. hatched definitely during the last calender year). It has buff tips to the inner, unmoulted median coverts. This bird has buff fringes (as described by Gromadzka and Przystupa) on all the greater coverts and a few of the median coverts adjacent to the greater coverts. These new feathers are distinctly different from juvenile coverts, as their buff fringe grades into the grey central portion of the feather whereas juvenile coverts have a distinct buff terminal band. This fits with Gromadzka and Przystupa's suggestion that birds with such buff coverts are in their second winter.

Out of 5000 adult Dunlins examined on the Severn Estuary, England in winter I found only 4 birds with "adult buff" coverts. Unfortunately none of these birds were retrapped in subsequent winters. Most second winter birds on the Severn do not have "adult buff" coverts: all juveniles that were retrapped in their second winter had "normal" grey coverts. Furthermore, over 1000 adults retrapped in subsequent winters were aged again on recapture as adults, suggesting that Dunlins were not moulting into "adult buff" coverts in subsequent years. Further large samples of Dunlins from the Firth of Forth, the Wash and Angelsey (North Wales) have not provided any more examples of "adult buff" coverts. It is still possible, however, that birds with buff coverts are wintering elsewhere in Britain (in areas where there has been little ringing activity), as Dunlin populations only a few miles apart may have different origins and migration routes (Clark 1983). I agree with Gromadzka and Przytupa that a careful check should be made of all Dunlins caught, so that the proportion of birds with "adult buff" coverts, compaired to those with "normal" grey coverts, can be found for as many sites as possible. This information may then lead to a better understanding of the identity of such birds as well as perhaps the migration routes and wintering areas of different populations.

REFERENCES

Clark,N.A. 1983. The ecology of Dunlin (*Calidris alpina* L.) wintering on the Severn Estuary. Ph.D Thesis, University of Edinburgh.
Gromadzka,J, & Przystupa,B. 1984. Problems with the ageing of Dunlins in Autumn. *Wader Study Group Bull.* 41:19-20

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