Redshank cont...

DS78642 4	13.09.69	Sheppey, Kent 51 22'N 0 55'E	x Whitstable, Kent 51 22'N 1 2'E	30.01.82
DA01010 5	03.03.71	New Brighton, Merseyside 53 27'N 3 3'W	x Wirral, Merseyside	30.01.82
DR08811 3J	23.08.78	Portsmouth, Mapshire	x Weston-super-Mare, Avon	30.01.82
CK94853 4	08.01.70	Snettisham, Wash	x Wainfleet, Wash 53 1'N 0 10'E	31.01.82
DR76528 3	15.07.79	Brough, Cumbria 54 32'N 2 19'W	v Bangor, Gwynedd	07.02.82
DR76369 4	27.09.80	Dundee Airfield, Tayside	v Saltburn, Cleveland	14.02.82
DS20664 4	03.09.67	Snettisham, Wash	x Snettisham, Wash	27.02.82
XE97455 1	18.06.79	North Uist, Western Isles	x Wainfleet, Wash	28.02.82
FR24473 1	23.06.81	Cunningsburgh, Shetland 60 2'N 1 12'W	x Fort William, Highland Region 56 43'N 5 14'W	01.03.82
DA06135 4	01.09.73	Wirral, Merseyside	x Wirral, Merseyside	10.03.82
DS36892 2	23.11.68	East Tilbury, Essex 51 28'N 0 26'E	x Dunslane, Tayside 56 14'N 3 55'W	01.04.82
DR43848 4	25.08.80	Wadebridge, Cornwall	x Connah's Quay, Clwyd, Wales, 53 13'N 3 3'W	01.04.82
DS98767 3	12.12.71	Butley River, Suffolk 52 5'N 1 30'E	x Butley River, Suffolk	07.04.82
DR67800 4	08.03.81	Weston-super-Mare, Avon	x Rotherham, South Yorkshire 53 32'N 1 19'W	11.04.82
DS76321 2	05.10.79	Southampton, Hampshire	x Ilkley, West Yorkshire 53 57'N 1 53'W	15.04.82
DS64025 4	23.03.74	Bangor, Gwynedd	x Bowland, Lancashire 53 55'N 2 40'W	02.05.82
DR91202 4	16.10.81	Bangor, Gwynedd	x Kirriemuir, Tayside 56 45'N 2 56'W	04.05.82

Greenshank Tringa nebularia

DR87398 3	04.10.81	Redcar, Cleveland 54 38'N 1 8'W	+ Minho, Portugal 41 42'N 8 46'W	08.11.81
DR32377 4	29.07.76	Wolferton, Wash	x Morocco 33 4'N 7 37'W	25.03.82

Wood Sandpiper Tringa glareola

BV81610 3	21.10.78	Somercotes, Lincolnshire 53 27'N 0 9'E	x Lincoln, Lincolnshire 53 15'N 0 28'W	01.11.81

Turnstone Arenaria interpres

$<$500 days 1, 500-999 days 2, 1,000-1,999 days 5.

CC65659 4	08.05.71	Barrow-in-Furness, Cumbria	x Aberlady, Lothian Region 56 1'N 2 53'W	30.07.81
CC55170 4	19.04.80	Walney, Cumbria	v Caernarvon, Gwynedd 53 7'N 4 18'W	21.02.82
CK95631 4	28.09.69	Heacham, Wash	x Skegness, Lincolnshire 53 6'N 0 20'E	07.03.82
CC65666 4	08.05.71	Barrow-in-Furness, Cumbria	x Fleetwood, Lancashire 53 54'N 3 2'W	07.03.82

WEIGHT-WATCHERS OF THE WORLD UNITE: YOU HAVE NOTHING TO LOSE BUT POOR DATA

by J. Wilson and N. C. Davidson

Loss of weight during short periods of captivity, such as between capture and ringing, has been well known for some time. For several waders, rates of weight loss after capture have been documented by OAG Münster (1975, 1976), Lloyd, Pienkowski & Minton (1979) and Davidson (1981). These last two studies have shown that rates of weight loss are highest shortly after capture, rather than being constant with time. In this paper we give an example of a study where failure to allow for weight losses in captivity would result in a different interpretation of the weights from a single cannon-net catch. We use this example to emphasise the need for collecting accurate information on the rates of weight loss, particularly in large cannon-net catches, and where mist-net catches are held (e.g.) overnight before processing. The use of accurate weights is especially important where the dynamics of fat storage are studied from catches of different sizes and with different processing times.

Results

For our example we used a sample of 182 adult Knots Calidris canutus cannon-netted in S.W. Iceland on 12 August 1970 (Pienkowski et al. 1971). Figure 1 shows the mean weights of successive groups of 30 birds in this catch. Actual times of weighing after capture were not recorded. The data suggest an overall weight loss of about 13g during the period of captivity.

Before correction, the distribution of weights appears bimodal (Figure 2a). Use of the probability paper method shows a light group, with a mean of 120.6g ± 7.7S.D., forming 40% of the sample. The other, heavy, group (60% of the sample) averaged 144.0g ± 14.4S.D. The distribution of weights conform closely to the expected bimodal distribution derived from these means and standard deviations (x^2_{12} = 11.5 P$>$0.50), although the distribution did not differ either from a normal distribution (x^2_{13} = 13.8 P$>$0.10).

Weights were then corrected for weight loss by the addition, to the recorded weights, of the average weight difference between the first 30 birds and each subsequent group (dotted line in Figure 1). The distribution of the corrected weights (Figure 2b) is less obviously bimodal than before correction, although it is still easy, using probability paper, to distinguish two groups: a lighter one with a mean of 127.3g ± 7.3S.D., forming 44% of the sample, and a heavier one with a mean of 152.8g ± 13.1S.D. (56% of the sample). However, as before, the weight distribution did not differ from either a bimodal ($\bar{x}^2_{11}$ = 12.4 P$>$0.10) or normal (x^2_{12} = 14.0 P$>$0.10) distribution. The reduction of the original bimodality is most clearly shown by plotting weights in 10g categories (Figure 2 inset), which also illustrates the effect that the manner of plotting can have on the appearance of results. The corrected weight distribution of the whole sample is very similar to that of the unadjusted weights of the first 60 birds.

Discussion

This sample of Knots was caught in Iceland in August, during their southward migration. One explanation of the bimodal weight could be that the catch comprised two groups of birds which had arrived at the staging post at different times, and had subsequently stored fat reserves for further migration. A further inference from the uncorrected sample would be that the lighter group had arrived very recently, since their average weight is very low (120.6g) and probably close to fat-free weight.

After correction for weight loss, the evidence for two groups in the sample is weaker. However, in this particular sample it is probable that two groups were present. The weight difference between the means of the two groups remained similar (24g before, 25.5g after correction), as did the standard deviations and the proportion of the sample formed by each group. However, the higher average weights after correction mean that each group had probably either arrived earlier (and since then put on fat) or with higher weights than would previously been assumed from the uncorrected weights.

Knots, like most shorebirds, are sexually dimorphic in size, (but only slightly so). Another explanation of the bimodality is, therefore, that the lighter group are males (which are smaller than females), and the heavier groups are females. Variation in weight due to differences in body size can be removed by correcting weights to a standard body size. We standardised weights in this sample, after their correction for weight loss in captivity, to that of a bird of average bill-length (32.5mm), using a formula relating the bill-length and lean weight of Knots (Davidson 1983). The probability paper method showed very much reduced evidence of bimodality after weights had been standardised, and weights were distributed normally (Figure 3). We conclude that the bimodality in this sample of Knots is a consequence of sexual size dimorphism. There is considerable overlap in the bill-lengths (and wing lengths) of male and female Knots (pers. obs.), so we cannot confirm this interpretation by seperate examination of the weights of each sex. We will discuss the effect on weight of variations in body size in more detail in a future article.

The weights in this sample were re-examined during a study of the energetics of waders migrating between Iceland and Britain. Not correcting weight loss in captivity in this type of study can result in misinterpretations of the timing of migrations, and in arrival and departure weights and fat loads carried. Any study of weights and fat reserves that compares samples that had been kept in captivity for different durations is subject to this kind of error.

How can problems of this kind be avoided? The best solution is, for each catch, to ring and weigh a small sample of each species immediately after capture. These can then be fully processed and reweighed after all others of that species have been processed. This yields information on the rate of weight loss of individuals. This is much better than calculating weight loss from the means of successive groups in the catch because it avoids the complications of body size differences. (For example, the "weight gain" by group six in Figure 1 must be an artefact caused by larger or fatter birds being processed in this group than group 5.) The time after capture recorded on the new style WSG forms can then be used, in conjunction with the overall weight loss, to correct the weight of each bird, assuming a linear weight loss. In fact, the rate of weight loss gradually decreases during captivity (Lloyd, Pienkowski & Minton 1979, Davidson 1981), but is approximately linear over the periods of less than eight hours it takes to process most catches. Even where a sample cannot be retained for reweighing, time after capture should always be recorded, so that some correction can be made later.

The actual amount of weight loss could vary between catches depending on several factors such as temperature, exposure to wind and the number of birds kept together, as well as the initial weight and physiological state of the bird (resident, migrant, moulting, etc.) in addition to its variation with time. However, for Dunlins Calidris alpina the rates of weight loss during the first eight hours of captivity were very similar under a variety of conditions (Davidson 1981). If this is the general case, then it should be possible to derive a single weight loss curve for for each species. Otherwise, rates of weight loss will need to be found for a range of conditions.

Rates of weight loss have been calculated so far for only Dunlins (OAG Münster 1976, Lloyd, Pienkowski & Minton 1979, Davidson 1981), Knots (Davidson 1981) and Common Snipe Gallinago gallinago (OAG Münster 1975). Many ringers must already have the data to do the rather crude analysis used in the above example. More reliable rates of weight loss, calculated from reweighing individual birds, under various conditions could easily be obtained, particularly if ringers combined to supply data on weight loss from different catches. We would be willing to collate the data to produce correction values for each species, covering as wide a range of conditions as possible. Weight loss data could be sent in on WSG green forms as usual. Any such reweighings should carry the code 'W' in the status column, and a separate note indicating the presence of reweighings should be included. Even if reweighings cannot be made, we would stress the value of always recording time after capture for weights.

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References

Davidson,N.C. 1981. Seasonal changes in nutritional condition of shorebirds (Charadrii) during the non-breeding seasons. Ph.D.Thesis: University of Durham.

Davidson,N.C. 1983. Formulae for estimating the lean weight and fat reserves of live shorebirds. Ringing and Migration: in press.

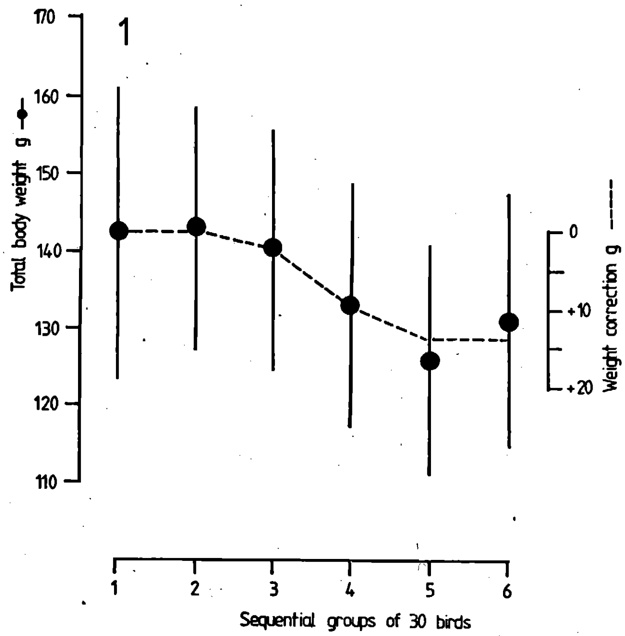
Lloyd,C.S., Pienkowski,M.W. & Minton,C.D.T. 1979. Weight loss of Dunlins while being kept after capture. Wader Study Group Bull. No.26:14.

OAG Münster. 1975. Zug, Mauser und Biometrie der Bekassine (Gallinago gallinago) in den Rieselfeldern Münster. J.Orn. 116: 455-487.

OAG Münster. 1976. Zur Biometrie des Alpenstrandlaufers (Calidris alpina) in den Rieselfeldern Münster. Vogelwarte 28: 278-293.

Pienkowski,M.W., Morrison,R.I.G. & Stanley,P. 1971. Cambridge/London Iceland Expedition 1970. Report.

J.Wilson, 4-784, 2050 Jessheim, Norway.
N.C.Davidson, Department of Zoology, University of Durham, Science Labs., South Road, Durham, DH1 3LE, UK.



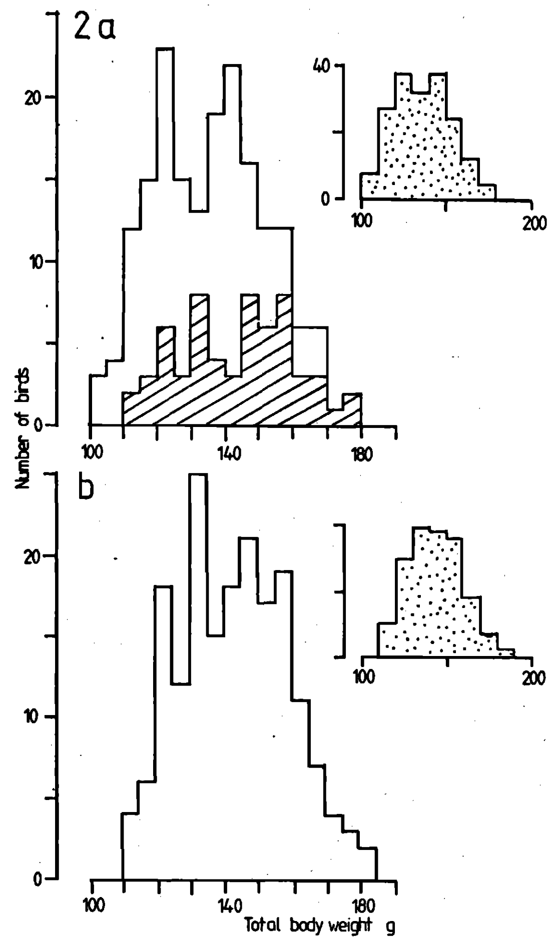


Figure 1. Mean weights (± 1 standard deviation) of successive groups of 30 adult Knots caught in Iceland on 12 August 1970. The dashed line shows the weight difference used to correct for weight loss.

Figure 2. Weights of adult Knots caught in Iceland on 12 August 1970, plotted in 5g (main histograms) and 10g (inset, stippled, histograms) groups a) before, and b) after correction for weight loss in captivity. The weights of the first 60 birds weighed are shown by cross-hatching.

Figure 3. As Figure 2, but weights corrected for weight loss and variation in body size.