Table 1. Mean bill lengths of freshly collected and museum skins of Turnstone and Sanderlings from South Africa.

	Fresh		Museum skins		
	Mean±SD	n	Mean ± SD	n	
Turnstone					
Male	22.1±0.8	29	20.9±0.9	18	(t = 4.83, p < 0.001)
Female	22.6±0.8	26	21.6±1.0	35	(t = 4.43, p < 0.001)
Sanderling					
Male	25.0±1.1	52	24.6±1.4	8	(t = 0.97, p < 0.1)
Female	26.2±1.1	15	25.5±1.2	22	(t = 1.89, p < 0.05)

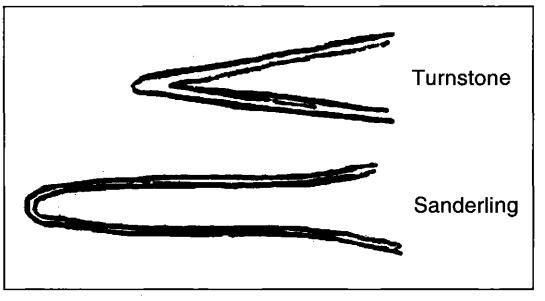

Figure 1. Dorsal views of the bills of Turnstone and Sanderling showing the outlines of the bone and rhamphotheca.

In conclusion, it appears that in the study of the biometrics of the Sanderling, and presumably other sandpipers, the problem of bill shrinkage in museum material will not be important when looking at gross differences but must be borne in mind when dealing with very small differences. However with the Turnstone, and perhaps other species, the bill lengths of museum specimens should not be used directly in biometric studies of live birds.

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Seasonal changes in bill lengths of Knots, and a comment on bill measuring techniques for waders

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The problem

Wing-lengths and bill lengths are the methods at present most used by ringers in order to attempt to separate wader populations. The difficulties in standardising wing measurements between different observers are notorious, and, even when this is overcome, there may be problems concerned with seasonal changes of wing-length in individual birds (Pienkowski & Minton 1973). The measurement of bill-lengths is possibly easier to standardise between observers, but little attention has been given to the possibility of seasonal changes in these, although White & Gittens (1964) subjectively considered seasonal changes in the bill shapes of Oystercatchers *Haematopus ostralegus*.

While attempting to separate Palearctic and Nearctic Knot *Calidris canutus* populations on the basis of bill-lengths (to be published elsewhere), William Dick and I found that, in most areas, the mean bill-lengths of the Knots caught varied cyclically (Figure 1).

It was clearly important to discover if the variations were due to changes in the racial composition of the flocks or to changes in bill-lengths of individuals. Fortunately, a large number of retraps within the same year had been accumulated by the Wash Wader Ringing Group and these data show that the seasonal changes in the population means were due to variations in the bill-lengths of individuals during the year.

Elsewhere, (Dick, Pienkowski, Waltner & Minton, in prep.), we have shown that the seasonal changes shown by retrap data are statistically significant.

We can suggest two possible explanations for a seasonal change in measured bill-length of an individual bird:

a. seasonal changes at the feather-margin at the base of the upper mandible associated with abrasion and moult; or
b. seasonal changes in the growth or wear (or, perhaps, the degree of compression) of the rhampotheca, perhaps related to feeding conditions.

Effect b. has been suggested for some birds, especially passerines (e.g. Davis 1951, Stettenheim 1972). It could possibly occur in Oystercatchers (White & Gittens 1964) and Turnstones *Arenaria interpres* (see Summers 1976), both of which have rhampothecae extending well beyond the bone structure; but this is not the case in the Knot and many other

Table 1. Comparison of bill lengths taken from feather margin to tip with those taken from rear of nostril to tip. m* = mean; v* = variance

	Sample size	Bill from feathers m*	(v*)	Bill from nostrils		Difference (mm)	Correlation coefficient
Turnstone	23	22.7	(1.57)	20.7	(1.04)	2.0	0.933
Redshank	32	41.4	(2.32)	38.3	(2.67)	2.1	0.863
Dunlin	80	33.3	(5.99)	30.6	(5.43)	2.7	0.978

waders (P.J.K. Burton *in litt.*), and so cannot cause the variation described above. Changes in the feather margin are a more likely cause as the apparent bill lengthening coincides with wear and loss of feathers prior to autumn and spring body moults.

A possible solution?

If the bill length variation is due to changes at the feather margin, then it ought to be eliminated by measuring from a more prominent feature on the bill. One possibility is measuring from the nostril to the tip, and the rear of the nostril may be the best point to use as this would keep the measurement to be taken as large as possible. I tried this measurement on a number of waders caught at Teesmouth in November and December 1975, and some of the results are shown in Table 1.

Not surprisingly, the two different types of bill measurements are well correlated for all three species, the mean measurement from the nostril being 2 to 3 mm shorter than that from the feather margin. It is also important to note that, at least for Redshanks and Dunlins, the variance has not been reduced by using the measurement from the nostril. This may indicate that taking the shorter measurement may not reduce the usefulness of bill-lengths for population separation.

It cannot yet be concluded whether or not the use of bill-lengths measured from the nostril will remove any cyclical effect, but I hope that this note will encourage ringers who catch waders – especially Knots – more regularly than I do to try this measurement. I should, however, stress that the bill-lengths from feathers should continue to be measured also; otherwise it would not be possible to make use of both old and new data.

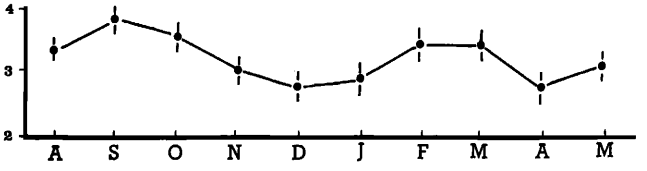

Figure 1. Monthly mean (I = one standard error) bill lengths of adult Knots at the Wash.

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