HERPETOLOGICAL JOURNAL. Vol. I. pp. 246-247 (1988)

SHORT NOTE:

ALLOMETRY IN *TESTUDO SULCATA*: A REAPPRAISAL

R. MEEK[1] AND R. A. AVERY[2]

[1] 8 Mountfield Road, Waterloo, Huddersfield. UK.: [2]Department of Zoology, University of Bristol. U.K.

(Accepted 20.1.87)

INTRODUCTION

In a recent paper published in this Journal, Mahmoud. Naiem and Hamad (1986) described the relationship between selected shell dimensions and body mass in the desert tortoise, *Testudo sulcata* from Sudan. After transforming their data into logarithmic form they presented their results for the relationship between carapace length and body mass as model I allometric equations of the form,

$$y = ax^b$$

where carapace length y is related to body mass x by the intercept a and exponent b (b describes the slope of the log transformed data). Their analysis for two groups of captive *T. sulcata* produced exponents of 1.81 and 1.66. In addition, they quantified a set of measurements of carapace length and body mass given by Cloudsley-Thompson (1970) for *T. sulcata* and calculated an exponent of 0.91. Their equations for *T. sulcata* are thus significantly different from those previously described in the literature for this type of information (e.g. Meek, 1982; Iverson, 1984); indeed the differences are of such a magnitude that they prompted us to re-examine Cloudsley- Thompson 's (1970) data.

METHOD

Model I allometric equations were obtained from the data by least squares regression after transformation to logarithmic form (Bailey, 1981). As in Mahmoud *et al.* (1986) carapace length has been treated as the dependent variable *y* and body mass the independent variable *x.* Model 2 regression would be a more appropriate analysis for this data since body mass may be subject to error (Sokal & Rohlf, 1981) but the correlation coefficients *(r)* for the data are high and thus there would be no difference in the exponents between the two methods (Alexander, Jayes, Maloiy & Wathuta, 1979). The *t*-distribution has been used to Calculate 95 per cent confidence intervals for the exponents (Bailey, 1981).

RESULTS AND DISCUSSION

Fig. I shows the measurements of carapace length (mm) and body mass (g) from Table I of CloudsleyThompson's (1970) paper plotted on logarithmic coordinates, with an additional data point taken from a juvenile *T. sulcata* mentioned on page 19 of his paper. The line taken through the data is derived from the equation.

$$y = 13.5X^{0.36\pm0.01} \ (r = 0.99, n = 8) \qquad [1]$$

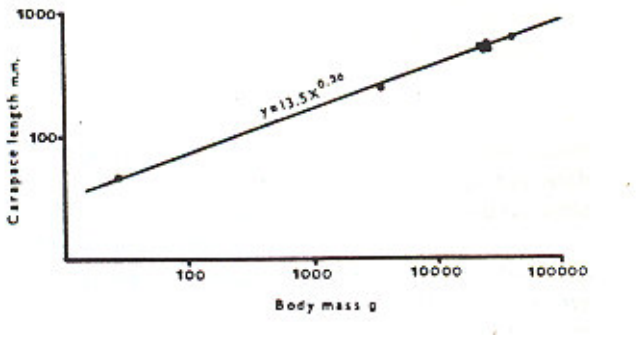

Fig. I A graph on logarithmic coordinates of body mass plotted against carapace length in *Testudo sulcata.* The line taken through the data was calculated using equation [I] as shown.

However, Mahmoud *et al.* used only the data from Cloudsley-Thompson's Table I but this makes little difference between the equations giving,

$$y = 10.05X^{0.39\pm0.02} \ (r = 0.99, n = 7) \qquad [2]$$

Mahmoud *et al.* analysed their data in units of cm and kg but this makes no difference to the value of b in the equations. Equation [I] is probably the more accurate description of the relationship since the measurement of the juvenile considerably extends the range.

As can be seen, these exponents are significantly different from the exponent of 0.91 calculated by Mahmoud and his co-workers for the Cloudsley-Thompson data; indeed they are in much better agreement with the 0.33 required for geometric similarity and exponent of 0.34 for four species of chelonians given in Meek (1982) which implies a retention of shape as growth proceeds. It would appear that Mahmoud *et al.* have committed errors in calculation, at least for Cloudsley-Thompson's measurements since as can be clearly seen in Fig. I. an exponent of 0.36 is in good agreement with Cloudsley-Thompson's data. Equation [I] would therefore disagree with the conclusion of Mahmoud and his co-workers that 'the exponents for *T. sulcata* are higher than the exponents given for other tortoises'. An interesting point concerns the slope predicted by equation [I]. This would be in good agreement with the slope of Mahmouds *et al's* data in their Fig. I (at least in comparison to the slope for group B) if the labelling on their Figure was reversed - that is, if the horizontal axis was labelled as body mass and the vertical axis as carapace length. A further error is the incorrect plotting of variables in Figs. 2a and 2b, since the variables on which the plots are based are logarithmic (Tables I and 2) the arithmetic plots in the Fig's cannot give linear relationships as drawn.

REFERENCES

Alexander, R. McNeill, Jayes. A. S., Maloiy. G. M. 0: and Wathuta, E. M. (1979). Allometry of the limb bones of mammals from shrews *(Sorex)* to elephant *(Loxodonta). Journal of Zoology*: *London* **189**, 305-314.

Bailey, N. T. J. (198 I). *Statistical Methods in Biology.* London*;* English Universities Press.

Cloudsley-Thompson. J. L. (1970). On the biology of the Desert tortoise *Testudo sulcata* in Sudan. *Journal of Zoology*: *London* **160**. 17-33.

Iverson, J. B. (1984). Proportional skeletal mass in turtles. *Florida Scientist* **47,** I-I I.

Mahmoud.Z.N., EI Naiem. D. A. and Hamad, D. M. (l986). Weight and measurement data on the grooved tortoise *Testudo sulcata* (Miller) in captivity. *Herpetological Journal* **1** (**3**), 107-110.

Meek, R. (1982). Allometry in chelonians *British Journal of Herpetology* **6**, 198-199.

Sokal. R. R. and Rohlf, F. J. (1981). *Biometry(2nd* edn), San Francisco. Freeman.