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A METHOD OF DETERMINING SHELL SIZE FROM FRAGMENTS

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INTRODUCTION

When documenting the relationships between prehistoric man and his environment, the prehistorian can profitably study the population structures of the species which received the impact of human predators. Ever since the Man-Moa controversy in Von Haast's day, the impact of prehistoric Maori's economic activities on the New Zealand fauna has been the subject of scholarly interest. Recent interest in midden analysis has concentrated attention on these problems, and Anderson's (1973) study of prehistoric communities in the Black Rocks area of Palliser Bay is a good example of current trends.

One problem faced by the archaeologist is the often fragmentary condition of faunal remains in middens which inhibits the metrical analysis necessary for the reconstruction of the size frequency distribution of the original species population. In the case of bivalve molluscs the hinge portion of the shell is fairly resistant to destruction and the present study was undertaken to determine how accurately the overall dimensions of the shell could be reconstructed from measurements taken in the hinge region.

MATERIALS AND METHOD

The bivalve *Paphies subtriangulatum* (tuatua) was chosen for study because shells of this species were commonly found in a fragmented state in archaeological sites on the Chatham Islands. Any useful results, therefore, would find immediate application in the current research programme in that area.

In 1974 a sample of these shells was collected from Spit Beach at the entrance to Otago Harbour; this consisted of 50 right and 50 left valves.

Two measurements were made which are generally used to define the shell shape and overall size - the maximum length, and the maximum height at right angles to the length measurement (see Figure 1). In addition, three measurements were made on the actual hinge of each shell. These were the resilum height, and both the anterior and cardial hinge widths as indicated in Figure 1.

The data thus obtained were investigated by linear regression analysis (q.v. Moroney, 1956: 293) in an attempt to predict the length and height of the shell from the hinge measurement.

RESULTS

These are given in Table 1. As can be seen, the highest correlation coefficients were obtained between the resilum height on the hinge and the main size measurements of the shell. The 95% confidence limits of the 4 correlation coefficients do not fall below 0.7, and are all fairly reliable. The lateral hinge width is a poor second choice in terms of the correlation coefficients, and the cardial hinge width poorer again. These fluctuations in reliability are reflected in the standard error of the estimates for each regression equation.

An example of the use of the table may be illustrated as follows: we have a left valve fragment which has the resilum intact and this measures 7.6mm. After consulting the table we find that:

$$m = 5.03$$
$$k = 27.13$$
$$SE = 4.82$$

The equation relating the two measurements is therefore:

$$LA = 5.03 \times C + 27.13 \pm 4.82 \text{ (65\% probability)}.$$

In our case where C = 7.6mm, the shell is estimated as measuring 65.4mm. The standard error of the estimate tells us how reliable this estimation is. In this case we can be 65% certain that the correct value was within 4.82mm of the estimated value; or 95% certain that the correct value is within 9.64mm of the estimated value.

CONCLUSION

The biometric relationship between the overall size of this bivalve and measurements on the durable hinge area has been demonstrated.

Regression equations linking these measurements are fairly reliable, sufficiently so for archaeological purposes. The standard errors are less than 5mm for estimations made from the resilum, and somewhat higher for the case of both anterior and cardial hinge width. The resilum height therefore should be the preferred measurement wherever possible.

ACKNOWLEDGMENTS

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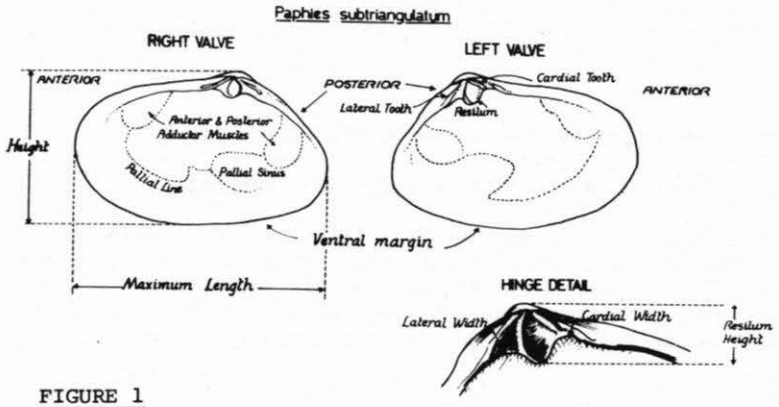

FIGURE 1

TABLE 1

N.B. In this table R = Right valve, L = Left valve.

A = Maximum length, B = height, C = resilum height,

D = lateral hinge width, E = cardial hinge width.

r = the correlation coefficient, m = the regression coefficient,

k = the intercept coustant, SE = the standard error of the estimate.

		C	D	E
RA	r	0.90	0.76	0.71
	m	6.02	14.54	12.92
	k	16.87	15.57	27.48
	SE	5.20	7.96	8.51
LA	r	0.81	0.57	0.48
	m	5.03	7.22	5.32
	k	27.13	40.76	52.99
	SE	4.88	6.83	7.32
RB	r	0.86	0.75	0.73
	m	4.39	10.99	10.14
	k	9.19	6.60	14.21
	SE	4.71	6.18	6.33
LB	r	0.87	0.66	0.64
	m	3.92	6.11	5.21
	k	13.27	21.40	28.45
	SE	3.02	4.53	4.65