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SHELL MIDDENS: WEIGHTS OR NUMBERS? - A PROBLEM NOT SO EASILY RESOLVED

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Nichol and Williams' (1981) experimental approach to a discussion of the relative merits of using minimum numbers or weights when quantifying shell midden sites is appealing in its simplicity and their results are of considerable interest. However their discussion is then extended to the conclusion "that 'weight of shell' should be abandoned as a method of quantifying shell midden". It is this conclusion that I take exception to.

As pointed out by Nichol and Williams there is clearly some disagreement expressed in the literature on the relative values of using minimum numbers and/or weights. The implication that can be drawn from this is that various workers have found difficulties with both methods which they evaluate differently. The reason for these different evaluations seem clearly related to the research interests of the various investigators.

Firstly, however, it seems to me there is some confusion as to which is the more fundamental of two methodological issues in quantification of shell middens raised by Nichol and Williams. The real issue is not a question of whether to use weights or numbers but how to achieve maximum information while not incurring excessive costs in time and labour in the analysis. I would maintain as previously (Rowland, 1977a:227) that results expressed both by percentage numbers and weights are to be preferred as at least they provide independent checks on the data. Furthermore shell weights provide useful descriptive information in some situations such as those I discuss below.

In the Australian literature Nichol and Williams would find support for their position in a survey of midden analysis by Sandra Bowdler (n.d.). She concluded:

> that if time is at a premium, minimum numbers only are estimated, and the weight method might be used in addition, if time is available. The weight method ... is prodigal of time and effort yet provides less accurate information
>
> (Bowdler,n.d.:17; italics mine)

She goes on to stress the time saving aspect of estimating minmum numbers only. Again it is clear that the real issue is not

whether it is preferable to use weights or numbers but which can be achieved without excessive costs in time and effort.

Bowdler recognised that she was in disagreement with Coleman (1966:37) who carried out analysis on midden samples from West Point Midden, Tasmania and who concluded that both weights and numbers were necessary where there were a few large and many small shellfish in a site (cited in Bowdler, n.d.:16). However Bowdler also points out that when Coleman compared midden samples with live shellfish she concluded that the weight method was a large underestimate of the actual meat represented and that the individual method provided a much truer estimate of meat values (in Bowdler, n.d.:16; see also Bowdler's 1979 Ph.D. thesis for similar methodological arguments and detailed application to samples from Cave Bay Cave, Hunter Island).

My own experience suggests that it is not always possible to identify minimum numbers as easily as might be implied by Nichol and Williams and Bowdler. It is apparent that not all people use the same criteria and often criteria are not reported, so that one wonders to what extent various studies are comparable. In many cases one suspects that 'identifiable specimens' should read 'specimens that a particular investigator was able to identify.' (In fairness, Nichol and Williams clearly state their criteria as does Bowdler (1979:204ff)).

However Nichol and Williams have given themselves an easy job in distinguishing between the whorls of Amphibola and the hinges of Chione.

In contrast, Callaghan (1980:69ff) analysing midden samples from the Macleay River, New South Wales, found it very difficult to estimate minimum numbers for some species and for species that fragmented easily in a midden. He suggested a certain amount of subjectivity must be inherent when estimating minimum numbers from such easily fragmented species as rock oysters. Given the degree of fragmentation and the lack of easily diagnostic parts Callaghan suggested one could conceivably spend a week doing a minimum numbers count on a fragmented oyster shell sample of 3000 - 4000 gm from a single spit of a column sample. While this is perhaps an exaggeration it nevertheless underlies the problem that estimating minimum numbers in some cases is not easy and may be only marginally less time saving than sorting all shell. I would be interested if Nichol and Williams again put on their 'flat rubber-soled shoes' and did a 'sedate walk' over the New Zealand species of limpet Cellana denticulata that I previously had problems with (Rowland, 1977a:227) or the Australian species

of Pearl Shell Pinctada fulcata that I am currently having difficulties with. Neither species has easily diagnostic pieces when highly fragmented.

It is probably not impossible to estimate minimum numbers (though I found it was in the case of Cellana and Pinctada, but it is not easy with all species, nor is it easy with very fragmented samples. Estimating minimum numbers will not always be as easy, objective, accurate or time saving as implied by Nichol and Williams.

The time-saving achieved by Nichol and Williams must be due in part to their selection of two species with easily identifiable diagnostic parts, they had only two things to look for and knew in advance what these were. At the moment I am analysing midden samples from the Keppel Islands, Queensland which involves looking for at least 16 species of shellfish, bone fragments, fish otoliths, stone, coral, pumice and charcoal. I also allow some search time for the unexpected. In this situation search time is considerable and frequently it is no more time consuming to sort at least the largest pieces (if only to get them out of the way) of undiagnostic shell at the same time. Incidentally, two 'undiagnostic' pieces of Pinctada fulcata proved to be of major importance. One was a fishhook blank, the other a completed fishhook!

It is apparent that Nichol and Williams and Bowdler prefer minimum numbers because they give more accurate information about diet or more specifically meat weights. However, as will be pointed out below, although estimation of meat weights is a major reason, it is not the only one for quantifying shell middens.

It perhaps needs to be stressed that neither minimum numbers nor weights are likely to produce an accurate representation of reality. Callaghan (1980:73), for example, has observed that with oysters young individuals often attach themselves to older and dead animals as a substrate. Callaghan thus raises the problem of which shells were brought into the site and eaten and which simply entered attached to other shells. He suggests in fact that it may be necessary to ignore some small specimens and assume they were not eaten. Likewise shells that were used as tools or ornaments, unless recognised will give deceptive results whether by numbers or weights. Bailey (1975:51) was faced with a similar problem in analysis of the Ballina middens where he identified 'empty' shells and stunted and juvenile specimens. Bowdler (1979:202, footnote) has rightly pointed out that since she was able to identify these, there was all the more reason to use minimum number estimates (excluding the non-economic shells) than to use weight estimates.

Nevertheless, the fact remains that unless uneconomic shells are identified and accounted for, neither minimum numbers nor weights will give an accurate estimate of meat weights.

The level of aggregation of samples may also have a significant effect on minimum number estimates. This is a complex problem developed more fully in relationship to vertebrate faunas by Grayson (1979). Here I provide a good example. From an excavation we have a species of shellfish which can be identified by either an operculum or the whorl. The site was dug in 5 cm spit levels. Spit 1 contains 50 opercula and 55 whorls thus a minimum number of 55 shells. Spit 2 has 80 opercula and 70 whorls. Do we now stick with the whorls in which case the minimum number is 70 and gives a total of 125 for the two spits. Or can we switch to using opercula in Spit 2 thus giving a minimum number of 80 or a minimum number of 135 for the 2 spits. To complicate the problem further assume the excavation was not in two 5 cm spits but instead involved one 10 cm spit. For this spit we would then have 130 opercula and 125 whorls or in other words a minimum number of 130. Hence it is possible to generate three different results from these data. Obviously this is simplistic and can be partly resolved by standardising criteria and interpreting results in terms of a sites' stratigraphy. Nevertheless minimum numbers are not as easy to derive nor as representative as might be inferred from Nichol and Williams' attempt to give them the status of the only means of quantification.

Against the use of weights Nichol and Williams offer the suggestion that "it leaves out of the reckoning the fact that prehistoric shell will have been soaking in a dilute solution of carbonic acid ever since its deposition" (p.90). Despite this however they are able to quote Shawcross who estimated weight loss of about 20%. Bailey (1975:51) for the Ballina middens was able to estimate this to be about 10% and Callaghan (1980:70) for the Macleay sites to be less than 10%. As Callaghan points out this figure is likely to vary on the basis of a number of factors but what is clear is that it can be estimated and hence included in calculations.

Another criticism, offered by Nichol and Williams, against using weights is again related to estimating meat weights. They show that "if the intention is to establish the relative contributions of different species to meat weight consumption, it will be necessary to make allowance for variation in meat weight/shell weight ratios within each species" (p.90). Shawcross' attempt to do this they see as "needlessly complicated". They suggest instead that "if size frequency distribution is available what

would be simpler than using this and an experimentally derived relationship between shell length and meat weight to produce an estimate of meat weight" (p.90). The problem however is that where a sample is highly fragmented it may not be possible to estimate a size frequency distribution. Indeed, for a highly fragmented sample perhaps the only way to achieve some idea of 'the average size of individuals' would be to count diagnostic pieces and compare this with the weight of undiagnostic pieces.

Finally, I would like to offer some suggestions in favour of retaining weights as a method of quantifying shell middens. Firstly, as just noted, where coupled with minimum number estimates it may provide some idea of the average size of individuals in the sample.

Secondly, as some South African midden workers (Speed, 1969; Voigt, 1975) have recognised, although the mechanisms of shell fragmentation are not well understood they deserve more attention than they have received since they may be used to support or supplement stratigraphic information. By weighing undiagnostic shell fragments I was able to make some suggestions in this direction for the Tairua site (Rowland 1977a:229-230) confirming Jones' suggestion of spatial specialisation within the site. In line with these comments it would have been of interest if Nichol and Williams had recorded patterns of breakage caused by their 'sedate walking'. This sort of information would be of value for comparison with other forms of fragmentation caused by different factors.

Thirdly, and perhaps most importantly I am interested in any method or technique which adds to the overall description of a site and weight is certainly one such descriptive device. For any site I would wish to know the variation in the amount of shell, stone, bone, etc. This is most easily achieved by weight estimates. Such data could provide information on the morphology of sites. For example, using both weights and numbers at Tairua I was able to describe a clear difference between layer 6 which was composed of a variety of components and patches of highly fragmented shell (Rowland, 1977a). Thus it was possible to describe one as a 'shell dump' the other as an occupation site. Obviously it may have been possible to arrive at this same conclusion on the basis of visual criteria alone. However for the purpose of inter-site variation in these characteristics on a broad scale some form of quantification would seem to be necessary.

Shell middens are not one type of site. They need to be seen as different 'types' within different functional systems. It might be possible to think of several different 'types' e.g.

shell dumps, long-term occupation sites, 'dinner-time camps' (see Meehan, 1977) and so on. Any method which enables us to get a better hold on this sort of variation is to be welcomed not thrown out. With increasing calls for a move away from studies that describe sites in isolation to ones where the relationship between sites in a region is given fuller consideration in terms of the annual economy of groups (Bowdler, 1981; Mazel and Parkington, 1981; Rowland, 1977b) any technique which helps to discriminate between various sites has to be considered of value and weight estimates of all components are certainly one such device.

In conclusion where information about diet is required then clearly minimum numbers are desirable as pointed out by Nichol and Williams. Minimum numbers, however, are not always easy to derive and there is an inherent subjectivity in their estimation. In terms of consistency, as pointed out by Bowdler (1979:202-204; n.d.,16) it is also desirable to estimate minimum numbers since this is the usual procedure with other faunal remains. Equally however since one normally uses weights for other components like stone, charcoal, pumice,coral, etc. then it would also be preferable to use shell weights.

Shell midden material can be used for purposes other than estimating meat weights, though this may be a primary concern. Shell weights could provide a means of describing the morphology of a site and would enable comparisons to be made between a number of sites. In archaeological research where we are constantly encouraged to produce more and more detailed analysis; where quantification of faunal remains has only recently replaced 'laundry lists', it is unacceptable to advocate the non-use of an important descriptive device.

The problem of rationalising information gained with time and effort spent remains largely unresolved by Nichol and Williams otherwise valuable little experiment.

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