

## Quantitative Paleozoology

R. Lee Lyman

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A more complete understanding of many major zooarchaeological issues is hindered by a simple lack of comparability between the data collection, analytical, and reporting procedures used by various researchers. *Cambridge Manuals in Archaeology* is a high-visibility reference series in a unique position to introduce a measure of much-needed standardization into a discipline where there is little unanimity on the 'best' current approaches to many important problems. This is clearly one of the goals of *Quantitative Paleozoology*, a recent addition to the series and the second such contribution by R. Lee Lyman after he authored *Vertebrate Taphonomy* in 1994.

*Quantitative Paleozoology* is practical and useful, and does exactly what it is meant to do—provide a clearly-organized and well-cited reference manual that both students and professionals in zooarchaeology and paleontology (collectively referred to as 'paleozoology') can pick up, understand, and implement. In the same style as *Vertebrate Taphonomy* (Lyman 1994), *Quantitative Paleozoology* takes an historical approach to many of the concepts covered in the book. Lyman introduces analytical methods with careful attention to their theoretical development in both the zooarchaeological and the paleontological literature. Indeed, drawing from both bodies of work is one of the pains Lyman has taken to ensure that *Quantitative Paleozoology* is more than simply an updated version of Grayson's (1984) classic book *Quantitative Zooarchaeology*.

Lyman's book is generally thorough and well-referenced, particularly considering the vast spread of literature it covers. It is not a comprehensive zooarchaeological text, but that is not its purpose. Instead, it provides appropriately-supported overviews of quantitative measures employed by paleozoologists and illustrates each measure with a brief literature survey and some specific examples. The volume is valuable as a teaching and learning tool because does not refer just to case studies but actually includes the relevant data (often in both tabular and graphic form). Before unfamiliar methods are applied to an assemblage, these examples can be worked out and tested for their suitability to a particular sample. Indeed, in many cases Lyman takes care to use these examples and literature reviews to indicate that the appropriateness of a given approach is often determined by the nature of the data rather than there being a single 'correct' answer.

However, as a practical guide to quantitative measures and methods, a certain degree of procedural recommendation is expected after a fair distillation of the complex

and often-conflicting literature. Lyman welcomes the opportunity to do so. Direct admonishments about how work *should be* done usually occur alongside a review of how work *has been* done. Zooarchaeology could use more firm and well-supported recommendations such as these, but in places Lyman's own work bleeds into discussions of particular approaches to quantification and analysis. This gives the (misleading) impression of a current professional consensus where in reality there is none. Drawing from one's own work is not a detriment *per se*, nor is it at all unique in archaeology. However, a reference series such as *Cambridge Manuals* is not the best venue to push one's own research agenda. Where a main component of the target audience is students who will become the next generation of archaeologists, it is critical to deliver information with the right mix of authority, clarity, and thoroughness, but it must be tempered with an extra dose of neutrality.

Despite this, *Quantitative Paleozoology* provides many valid points that students and professionals alike will do well to take to heart. In the first few pages, a plan is set forth to oust the "terminological ambiguity [that] seems to plague paleozoology" (pg. 3). This is a basic but critical step toward more effective methodological consensus and the production of comparable results between researchers. Lyman also asserts that, "Paleozoologists must learn more about statistical methods, and they must overcome about seven decades of disciplinary historical inertia that has focused on deterministic questions rather than probabilistic ones" (pg. 136). This is absolutely essential for the generation of robust inferences from paleozoological data.

In response to the argument against preferring one quantitative measure of taxonomic abundance over another based on the relative difficulties of using each method, Lyman scolds "[n]o one has ever said research of any kind was, or should be, easy" (pg. 46). This is true, and should be well-taken by zooarchaeologists who submit that procedures such as refitting or microscopic examinations of bone surfaces are unnecessary simply because they are time-consuming. Conversely, if one can employ a more cost- or time-effective method at the expense of another redundant one, then productivity can increase enormously. Reliably selecting such procedures is not possible for many zooarchaeological problems because the point of diminishing returns for the collection and analysis of data has not been systematically or satisfactorily established for most measured variables. *Quantitative Paleozoology* takes us several important steps in that direction.

With regard to the measurement of taxonomic abundances, *Quantitative Paleozoology* updates much of the material first explicitly summarized in a single volume by Grayson (1984). It includes cogent and detailed dissections of the most commonly-employed measures of taxonomic abundances and then provides sound recommendations, based on the intervening twenty-five years of research, as to which measures are most appropriate *and* time-effective. For example, Chapter Two ends with the reasonable but daringly simple conclusion that, “NISP [the number of identified specimens] is to be preferred over MNI [the minimum number of individuals] as the quantitative unit used to measure taxonomic abundances” (pg. 81). Similarly, Chapter Five ends with the assertion that “NISP is to be preferred over MNE [minimum number of elements] and similar units, especially when MNE provides abundance information that is redundant with NISP” (pg. 263).

A final important lesson from the book is the demonstration that taphonomy has a persistent and essential role in any paleozoological endeavor. For example, all discussions of taxonomic or skeletal element abundances must address the issue of fragmentation, which is a fundamentally taphonomic process. Also, the quantification and analysis of taphonomic modifications to bone surfaces had previously been treated in detail only in disparate journal articles. Because most of these methods have been developed (and debated) over the last fifteen years, there has not been a current overview available in a reference text format. *Quantitative Paleozoology* delivers this, also effectively updating *Vertebrate Taphonomy* (1994) in Chapter Seven. It also emphasizes the use of actualistic studies, or ‘fidelity studies,’ that provide an inferential link between archaeological traces (or measures of those traces) and the processes that underlie them.

Although it is an important stand-alone work with much to commend it, *Quantitative Paleozoology* is not without its omissions, peculiarities, and occasional false statements. For example, Chapter Three describes in detail the use of bone weight to provide estimates of taxonomic abundances but never mentions one obvious problem—that bones can be differentially mineralized even within the same site if there has been sufficient variability in horizontal or vertical micro-environments. This can lead to very different bone weights even within the same stratigraphic unit. Chapter Four, which covers the effects sampling and recovery procedures have on quantitative measures, includes a discussion of how hand-picking specimens from sediment or using screens with varying mesh sizes can result in a size bias both inter- and intra-taxonically (i.e., smaller animals or smaller elements from the same animal are less often recovered). However, it does not touch on the pernicious problem in zooarchaeology of excavator and analyst selection of *more identifiable* fragments, which can result in systematic bias against otherwise abundant fragment types such as long bone shafts (Bartram and Marean 1999).

Such selection also has a direct impact on the calculation of several measures of taxonomic and skeletal element abundance, including the NISP and MNE. Chapter Five

provides a thorough treatment of the MNE and its derivative Minimum Number of Animal Units (MAU), but only touches on the complications presented by sampling or analytical strategies. Both the MNE and MAU are quantitative units that have gained in popularity (and scrutiny) over the last two decades, but it is peculiar that the MNE is not treated earlier in the book—especially given that it forms the basis of the MNI (discussed in Chapter Two).

Finally, in Chapter Seven Lyman devotes much discussion to how bone surface modifications such as carnivore tooth marks, hammerstone percussion marks, or cut marks are tallied. Many workers analyze the number of fragments bearing a mark, but Lyman asserts that, “The relationship between the number of marked bones (measured variable) and the property or process of interest (target variable) is obscure” (pg. 292). It is odd that Lyman would come to this conclusion after citing a large proportion of the literature that demonstrates this relationship through the very same ‘fidelity studies’ he advocates. The example he employs to make this point uses cut marks, which of the three mark classes have been the topic of most intense debate—likely because the number of fragments in an assemblage that bear a cut mark is influenced by so many unknowable variables (Domínguez-Rodrigo and Yravedra 2009).

A question that might legitimately be raised is if an entirely new and separate volume on the quantification of paleozoological data is warranted. The related topics of zooarchaeology and taphonomy are already covered within the *Cambridge Manuals* series alone (Lyman 1994; Reitz and Wing 2008). Despite its problems with lack of neutrality and some key omissions and misrepresentations, *Quantitative Paleozoology* gives us this answer as a resounding ‘yes’. Twenty-five years after the publication of *Quantitative Zooarchaeology* (Grayson 1984) the study of animal bones from archaeological sites has grown into a vast area of research in its own right. Paleozoological interpretations require varying degrees of familiarity with disciplines other than archaeology or paleontology (e.g., ecology, ethnography, sedimentology, geochemistry), but the analyses that underlie these interpretations almost always require a quantitative component. This can be as simple as reporting a table with the NISP or as complex as a series of statistical assessments of taphonomic data. It is therefore entirely appropriate to separate out the quantitative aspects of zooarchaeology and provide a full treatment of current approaches to analysis.

*Cambridge Manuals in Archaeology* is designed to provide a convenient and up-to-date reference series for both professional archaeologists and students. Lyman accomplished this with *Vertebrate Taphonomy* (1994), which is a heavily-cited work and a key presence on the bookshelves of most zooarchaeologists. *Quantitative Paleozoology* has the potential to become the same. The book consolidates a vast spread of literature into carefully-traced methodological genealogies. It offers an updated view and sound recommendations for resolving real problems faced by zooarchaeologists and paleontologists. Most of these solutions are simple and clearly-illustrated with abundant examples,

and many of these examples derive from a lifetime of the author's own research. It is a valuable contribution to the zooarchaeological and paleontological literature, and I expect it will become a staple in the libraries of most such researchers.

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