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## A method for the preparation of very small animal skeletons

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David and Payne (1992) describe a variety of methods by which the skeletons of animals can be prepared. These include maceration, simmering in water and, in one instance, immersion in the waters of a Greek harbour, where small carnivorous organisms will deflesh the specimen. This is reminiscent of Bolin's method (quoted by Casteel 1976) in which marine isopods of the American Pacific coast would clean a fish in only 24-42 hours.

At the risk of spoiling the opportunities that zooarchaeologists have to claim travel grants to Greek harbours and the Pacific USA for specimen preparation, I have found that other, more local organisms can be used to achieve an excellent result in cleaning the skeletons of very small animals. While simmering or burial work well for larger specimens, small fish of <15 cm length, or small birds or mammals, present a tedious job in extracting the small bones from fish or vole soup. To avoid this, it is worth enlisting the help of tadpoles.

Tests were made in a small garden pond which contained an abundant spring population of both common frog (*Rana temporaria* L.) and common toad (*Bufo bufo* L.).

The tadpoles of each species emerge from the spawn in spring, and soon become enthusiastic carnivores. A small specimen of the gudgeon, *Gobio gobio* L., measuring 10 cm from the nose to the tail fork, was perfectly prepared in about 10 days. Similarly, small birds robin or sparrow size are quickly cleaned. In the case of birds and mammals, an additional incentive can be given to the tadpoles by skinning the specimen; in the case of small fish, the abdominal cavity can be opened. The specimens are placed in a small metal container such as a food tin, with its sides perforated with 6-8 mm holes above the level of the specimen. A small piece of 10 mm mesh prevents the specimen from floating. The container is suspended a few centimetres below the water surface. Tadpoles locate this food source within a few minutes. The skeletons are thoroughly cleaned by these industrious amphibians, and by observing the process frequently, perfectly clean but articulated skeletons can be obtained. These are easily disarticulated if separated bones are needed.

Tadpoles feed with horny jaws, though the microscopic examination of very small fish bones does not show any abrasion to the bone surface. The rate of growth and subsequent metamorphosis in tadpoles are both food- and temperature-dependent. At high populations densities, metamorphosis takes several months, though it is probable that an abundant food supply in the form of your comparative specimens would shorten this time. The desired small animals could be stored in a freezer until the processing season.

By this method, the zooarchaeologist may save much frustrating work in cleaning small specimens, and assist, too, in the propagation of our increasingly urbanised amphibians.

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## What are we measuring?

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When I began studying animal remains from archaeological sites it was common for archaeologists to keep only a few examples of any bones found for identification and subsequent listing in the excavation report.

The amount of information that could be gained from the wider studies of bones that are now routine was not appreciated. I was an early advocate of more detailed study including, of course, the measurement of bone remains from livestock (Ryder 1958), but later, daily contact with animal geneticists, who commonly held the view that archaeozoology was impossible (because one could not replicate the findings), led me gradually to question the way in which bone measurements could be interpreted.

In a discussion of the problem (Ryder 1982, 21), I pointed out that there have been virtually no studies of variation in the size and proportions of the skeleton either between or within modern breeds of livestock, and I cautioned that it is going to be an enormous task to distinguish differences in size that reflect breed from within-breed variation related to sex, diet or genetic variation. Ten years on, Geist (1992) makes the same point more strongly, and in a more sophisticated way, in order to stress the difficulty of using metrical criteria to identify animals suspected of being killed in contravention of conservation laws. The fact that his discussion refers to wild animals strengthens rather than weakens the argument. I quote his statement in full:

*'A fatal flaw in much large-mammal taxonomy is the use of comparative morphometrics as a taxonomic tool. Comparative morphometrics of crania or skeletons of free-living populations can no more be used to measure taxonomic (genetic) differences than a rubber band can be used to measure distance. Every set of comparable measurements conceals genetic, epistatic, environmental and statistical variation. That is, the gross variation is a mixture of different types of variation, within which the genetic variance is undefined. It remains indefinable, despite various approximations. Comparative morphometrics as a taxonomic tool is logically flawed. It confuses phenotype with genotype, analogy with homology, ecotype with taxon, and does not reveal the taxonomic and evolutionary differences between the populations compared. The origins of the differences revealed remain obscure.*

*This flaw is not uncommon in other branches of biology when quantitative comparisons between populations are used to bolster evolutionary analysis. Such comparisons are futile if the proportion of variance attributable to heredity is unknowable. The closer the relationship between populations of a given form, the more speculative must be the conclusions about evolutionary*

*relationships, because large phenotypic differences can arise from closely related phenotypes in different environments. Taxonomic or evolutionary differences in close relatives should be studied experimentally provided [the] different variables affecting ontogeny are subject to effective control.'*

This does not mean that we should stop measuring bones—remember all those frustrating reports from the early years in which no measurements were given—but rather that we should be more cautious about how we interpret changes in animal size between periods. Some people might prefer a genetic explanation resulting from a change of breed. Others might think that a change in the plane of nutrition was the cause. The true reason is likely to be more complicated. The application of statistics to archaeozoology is in its infancy. The investigation of biochemical polymorphisms (blood types and DNA) in bones is only just beginning. A full interpretation of metrical variations in bones must await evidence from these and other techniques as yet undiscovered.

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## Sheep fleece and bird legs: a pathological observation

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### Introduction

In a recent systematic programme to improve and enlarge the comparative collections of the Environmental Archaeology Unit, numerous specimens of mammals and birds have been