The importance of aging in zooarchaeology

Zooarchaeology is the study of animal remains at archaeological sites. There is a lot we can learn about people from the animals near them. Faunal remains can indicate hunting patterns, animal husbandry, and wealth distribution. The age-at-death of the animals is important because it helps determine whether animals were domesticated; in a population of domestic animals kept for meat, there will usually be a lot of young animals that are killed, especially males. Also, aging can highlight seasonal feasts by revealing times of year where more animals were killed. Many aging methods in zooarchaeology are from the 1970s-80s, and have not been replaced by any newer science. The aim of this internship was to assess whether these methods are scientifically sound, or if they should be retired.

Identifying bones

A diagram of deer carpal that I made to help myself learn the different bones

The beginning of my internship was spent learning all of the bones in the body, focusing on mammals. Despite looking very different, most mammals have the same bones. The area with the most variation is the feet, with animals having anywhere from one to five toes. Not all mammals have claws, and some species have lost their lower incisors.

I used UVic’s zooarchaeology teaching collection to get acquainted with the skeleton. As many bones found in archaeological assemblages are broken, I also practiced identifying broken bones. I compared the broken fragments to the set of complete deer bones and the articulated deer skeleton that UVic has. I completed this section by doing the practical exam from the Zooarchaeology course (ANTH 360), in which I had to identify 25 bones with only 30 seconds for each.

Replicating the aging of goats from Çatalhöyük

To exercise my new knowledge of aging methods and the general principles of zooarchaeology, I attempted to replicate the aging done on goats found at an archaeological site named Çatalhöyük in Turkey. I found that even though I used the same aging system (Silver, 1969) as the original authors of the dataset (Orton et al., 2013), the ages I produced were somewhat different. This is likely because I couldn’t see the bones in person, and so couldn’t adjust the ages based on the bones’ size, shape, or texture. This evidence shows that although online databases are much more accessible than collections of physical bones, sometimes studies are not replicable without the nuance that comes from seeing the bones themselves.

The Çatalhöyük section of my project also highlighted the importance of making terminology clear for people in the future. The problems I had with fusion zones and undefined age categories could have been eliminated if the original researchers clarified what they were talking about. The meaning of something might seem obvious to the author in the moment, but language changes quickly and if variables and terms are not explicitly defined, future researchers can find themselves unable to understand their most valuable resources.

The qualities of various aging systems

(Thanks to Nat Weiland for this graphic)

Assessing zooarchaeological aging systems

The two main zooarchaeological aging methods are tooth eruption and wear, and epiphyseal fusion. The timing of animals’ tooth eruption is largely genetically determined; how fast their teeth wear down depends on both genetics and diet. There are epiphyses, also called growth plates, at the end of animals’ long bones. When the animal is young, these separate bones held onto the main cartilage. As the animal matures, the epiphyses fuse onto the main bone.

There are a number of factors which make it difficult to accurately age animals’ remains. One is that there is always going to be some variation in how quickly animals mature, based on their breed, the climate they live in, what they eat, any diseases they have, and random genetics. Another problem is that the bones of young animals are smaller, more fragile, and less likely to survive taphonomic processes, which are things like being saturated with water or weathered by the wind. This means that kill-off profiles are often biased towards showing a larger number of mature animals. It is not usually possible to determine animals’ ages to the exact month or year. However, in archaeology, knowing even relative ages such as “young”, “adult”, and “old” is useful in creating and interpreting kill-off patterns. Specifically to the year is often unnecessary.

Some aging methods are subjective, meaning that two people could produce different ages for the same specimen. For example, one method depends on which diagram someone thinks teeth look more like (Grant, 1982). Many studies try to draw conclusive results from a sample size which is small or is missing animals from certain age groups; these studies are not necessarily reliable for an entire species. One reason that aging methods from 40 or 50 years ago are still used is that it’s easier for researchers to use a system well if they already understand it, rather than learning a new one and making a lot of mistakes in their work. It is also important for age profiles from different sites to be comparable. And for sites where the original bones or data are lost or inaccessible, people might have to use the same aging system on the second site in order to compare the age profiles.

With these things in mind, the most influential aging methods for pigs, goats, sheep, and cows, which are some of the main domesticates from the Eastern Hemisphere. Summaries of the quality of each method are found in the timeline below.

Reconciling the aging of animals with genetics

Some studies on the aging of animals have been carried out using DNA analysis. The most common method is to use a method called “mismatch analysis,” which involves counting the number of mismatches between two DNA sequences. This can be used to estimate the age of an animal at death, and also to estimate population size.

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The key to understanding age profiles is understanding the age structure of the population. This can be done by examining the fusion of epiphyses or the wear on teeth. However, these methods are only applicable to certain species, such as cattle and horses. In general, when looking at age profiles, it is important to consider the context of the site. For example, a site with a high number of animals in their 3rd or 4th year may suggest that the site was used for a long period of time.