ZOOARCHAEOLOGY

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Contents

Summary

Zoo archaeology is the study of animal remains from archaeological sites. This brief review of the science defines animal remains and the research methods used to derive basic zooarchaeological data. Special attention is given to zooarchaeological interpretations and the many factors that bias those interpretations. An overview of the theoretical directions of zooarchaeological research, a very brief history of the science, and a comment on current research contributions, provides important background information. The review finishes with a discussion of one research area of particular importance to conservation efforts: the study of human impact on animals and environments and the utility of zooarchaeology as a source of data in the race to preserve biodiversity and environments.

1. Introduction

Zooarchaeology, or the study of archaeological animal remains, offers an important perspective on the very long history of human-animal and human-environment interactions. Habitats and biodiversity are at high risk today and conservationists struggle to protect our environment. Archaeological remains provide data on the complex relationship between human activities and landscapes, allowing a better understanding of baseline conditions and the effects of changing cultural and ecological systems. Zooarchaeology provides, in essence, a laboratory of past experiments in

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human-environmental co-habitation—experiments that have both succeeded and failed and that therefore provide important lessons for today.

2. Defining Zooarchaeology

Zooarchaeology is traditionally defined as the study of non-human animal remains from archaeological sites but is more broadly interpreted as the study of the complex ancient relationship between humans and other animals. This science is one part of environmental archaeology, an interdisciplinary approach to understanding past human interactions with the natural world. Environmental archaeology combines zooarchaeology with archaeobotany (the study of archaeological plant remains) and geoarchaeology (the study of the archaeological abiotic landscape). Zooarchaeological methods are reviewed in many excellent publications and several important texts are available for additional information on the larger science of environmental archaeology (see publications list at the end of this entry).

The human-animal relationship is fundamental to human culture since animals provide food, medicine, and raw materials for manufacture of everything from shelter to clothing to tools. They are a means of transport, are assistants in various occupations, and act as companions during and after life in many cultures. As symbols and totems they represent families, status and ethnic groups, and relationships to the gods. They play important roles as offerings, sacrificial victims, and actors in the theatrical performance of ceremony at the public and private level. Animals also represent important proxy information about the habitats within which they live and the ecological communities of which they are a part.

They reflect the changing condition of the landscape around them. Humans have significantly transformed animal biology, taxonomy, and ecology through hunting, domestication, and habitat transformation. Animals as resource, environmental modifier, and closest counterpart to humans, have significantly transformed human culture. It is this complex co-evolution between humans and animals that is at the heart of any zooarchaeological study. Zooarchaeology combines questions of biology (emphasizing zoology) with anthropology (emphasizing culture), and includes studies of animal/human interactions from perspectives of both ancient data (in archaeozoology) and modern data (in studies of paleoethnozoology). Faunal remains provide a proxy for the reconstruction of ancient environments, allowing us to describe landscapes, natural resources, and ecological settings, as well as evaluate human-caused and natural environmental changes.

Faunal remains and associated behavioral evidence for human/animal interactions are used to trace the complex relationship between ancient peoples and the animals around them by detailing dietary and other subsistence patterns, the economics of animal resource control and trade, and the complex politico-religious meanings ascribed to different animals and represented by their use in ritual. Most recently, zooarchaeologists have been called on to apply their science to issues of conservation and sustainable environmental management, providing large-scale historical records on past effects of human activity on animals and habitats, and behavioral models for predicting future interactions.

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3. Zooarchaeological Remains

Zooarchaeological information comes from two main sources, physical and behavioral evidence. Physical evidence, excavated from archaeological sites, includes the material remains of animals comprising artifacts (anything modified by humankind) and the biological remains themselves. The physical remains are diverse, ranging from macro- to microscopic. The most commonly recognized are the hard remains of both vertebrates and invertebrates, including bone, teeth, antler/horn, and shell, because these are the most likely to preserve in archaeological deposits. However, also included in the zooarchaeological arsenal are less well-recognized remains including egg-shell from birds and reptiles, and insect and crustacean remains (exoskeletons), as well as various microscopic and molecular remains including those of ostracods (microscopic calcareous-shelled crustaceans), foraminifera (marine protist tests), parasites (eggs and cysts found in faeces), and various biomolecules including DNA, chemical isotopes and elements, and other residues such as lipids, carbohydrates.

Behavioral evidence, less commonly discussed as part of zooarchaeology but equally essential to the science, is gleaned from a combination of sources. These include (a) ethnographic and historic information on specific indigenous or traditional activities with relation to animals, (b) behavioral ecology, or models of human behavior such as optimization strategies and foraging ecologies that are derived from modern human behaviors (recent and traditional cultures alike), and (c) information on perceived or cognized environments and animal relationships that generally include oral/written beliefs, and both consciously transmitted knowledge (instructions) and unconscious perceptions as described by folk taxonomies and symbolism. These data are often discussed in reference to the related study of ethnozoology.

4. Zooarchaeological Research Methods

Zooarchaeological methods are as diverse as the study materials themselves and the questions asked by the researcher, but traditional zooarchaeological investigations rely on an understanding of the conditions under which the zooarchaeological sample was created (pre and post-depositional processes including taphonomy), precisely controlled recovery methods (both archaeological and during zooarchaeological subsampling), taxonomically accurate identifications, and careful quantification and interpretation of the results. Sample formation processes and zooarchaeological recovery methods are themselves the subject of considerable zooarchaeological research and are discussed in the section "**Zooarchaeological Interpretation**".

Animal biology is such that different species can be identified by comparison of characteristics of the basic skeletal anatomy. Evolution provides the basic link between taxonomic groups because biologically related taxa have similar elemental features, while animals with similar behavioral traits also have important physical similarities. These clues allow the zooarchaeologist to decipher the relatedness and behaviors of the species from which the specimens originated and to arrive eventually at an identification of the specific taxonomic group of the original animal. Specimen identification requires considerable experience and a comprehensive taxonomic comparative or reference collection. The reference collection should represent the full range of possible

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taxonomic diversity and preferably includes data on individual specimen age, sex, size, and biomass. These data allow the zooarchaeologist to accurately identify specimens by direct comparison to a known modern exemplar. Zooarchaeological remains are first identified as to their taxon, skeletal element, specific element portion, and side. These are the basic data required to quantify the number of specimens represented in the collection of each taxonomic group and body portion. Specimen sex and age at death are then determined using diagnostic markers on the skeletal element. These provide additional detail for estimating the number of individuals of each taxonomic group that were present in the assemblage. They also allow a description of population dynamics, mortality patterns, and season of capture. Skeletal elements are often weighed and measured to allow the calculation of individual size and in some cases morphology (often used to answer questions of human impact and animal domestication for example).

Modifications to the element are also recorded. These modifications include pathologies which are used to determine injury or disease and the life history of the individual animal, population disease load and health, as well as the effects of zoonoses (diseases passed from animals to humans) in co-evolutionary processes. Other modifications are those made by animals and natural forces which are used to determine the process of deposition and post-depositional deterioration, part of taphonomy discussed below. Finally, human modifications (caused by butchering, cooking, production of artifacts, or secondary uses) allow descriptions of direct human activity.

The collected information is quantified to estimate the number of specimens, skeletal elements, body portions, or individuals represented in the collection. Quantification can be very direct, somewhat interpretive, or heavily based on assumptions specific to the culture and animal group under investigation. It is a very controversial subject that is discussed further below and is reviewed in several excellent works by such authors as Donald Grayson and Elizabeth Reitz and Elizabeth Wing. The most common and direct measure is a count of the number of identified specimens or NISP. Slightly more interpretive calculations include estimates of the minimum number of elements or MNE, minimum number of body portions (anatomical units or MAU), and most commonly, minimum number of individuals or MNI. Many other interpretive quantification methods are also used that rely more heavily on cultural and biological analogies and therefore must be carefully linked to the specific assemblage under investigation. These include such measures as biomass (this assumes a known biological correlation between some measure of the faunal assemblage and the live weight of the animal as well as a correlation between cultural practices and the resulting faunal assemblage) and indices of animal body portion utility including edible biomass (that further assume that modern cultural values are appropriate analogies for past body part or food selection).

5. Zooarchaeological Interpretation, Understanding Bias

Zooarchaeologists interpret taxonomic and skeletal element identifications, along with the other observed characters on the archaeological remains, to understand ancient environments and human activities. However, zooarchaeological specimens are only proxies for these reconstructions because they are not a full representation of ancient

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animal populations or of human activities associated with animals. How effective the remains are as proxies is determined by their past pre-depositional, post-depositional, and archaeological recovery history, the assemblage "life cycle" (a term first used by Klein and Cruz-Uribe in 1984), or first- and second-order processes according (the term used in the 2008 text by Reitz and Wing. First-order processes are defined as those that occur during and after deposition, and second-order processes are defined as those associated with recovery, quantification, and interpretation. Interpretation of zooarchaeological remains therefore requires careful attention to these factors.

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Links

ICAZ or the International Council of Archaeozoology was founded in the early '70s and is now the main international organization for the study of animal remains from archaeological sites. It hosts international conferences held every 4 years and meetings of its various working groups every two years. http: / / w w w. alexandriaarchive . org / icaz /

The Association of Environmental Archaeology promotes the advancement of the study of human interaction with the environment in the past through archaeology and related disciplines. The organization holds annual conferences and other meetings, produces a quarterly newsletter for members, and publishes conference monographs and the journal Environmental Archaeology: The journal of human palaeoecology. http : // www .envarch .net /

The Professional Zooarchaeology Group (PZG) was founded by members of English Heritage, the Department of Archaeology, University of Nottingham, and Wessex Archaeology to bridge the gap between animal bone specialists based within and outside academic establishments. They host meetings twice-yearly that include a mixture of thematic discussions and practical workshops. http : // w w w . english-heritage . org . uk / server / show / nav. 9066

Archéozoo: Collaborative Website of Archaeozoology: A website created for access to tools and information about zooarchaeology and also a place for collaboration and information exchange. http : / / w w w .archeozoo . org / en

Journals

Environmental Archaeology: The journal of human palaeoecology. http : // w w w. envarch. Net / publications / envarch / index . html

International Journal of Osteoarchaeology http : // www3. interscience.wiley.com / journal/5488 / home
Archaeofauna http : // w w w. uam.es /otros / paleofau / RevistaArchaeofauna.htm

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Biographical Sketch

Kitty F. Emery is Associate Curator of Environmental Archaeology at the Florida Museum of Natural History, University of Florida where she curates zooarchaeological, archaeobotanical, and archaeopedological collections from over 600 circum-Caribbean archaeological sites, and over 1000 zoological and botanical comparative specimens. She is also Affiliate Associate Professor of Anthropology at the University of Florida where she teaches Environmental Archaeology, Lessons from Ancient Environments, and Zooarchaeology of Central America. Previously she was Assistant Professor of Anthropology at the State University of New York at Potsdam and Social Sciences and Humanities Research Council Postdoctoral Fellow at the Royal Ontario Museum in Toronto, Ontario, Canada. Emery studies ancient animal and plant remains recovered from archaeological deposits in Central America to understand how the ancient Maya used, and sometimes abused, their natural world. She has received funding from the National Science Foundation, Wenner Gren Foundation, and other organizations to support her research. She has published two books (one edited) and over 30 peer-reviewed articles and book chapters on Maya environmental archaeology.

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