

UCL Institute of Archaeology

ARCL 0125

Zooarchaeology in Practice

MSc Option Module, 15 credits
2019



Coursework	Deadline	Target for Return
Essay	30 th November	14 th December 2019
Practical report	14 th Jan 2019	14 th Feb 2019
Lab book	17 th Jan 2019	14 th Feb 2019

Co-ordinator:
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Overview

This Zooarchaeology option module provides specialist postgraduate training in the methods of identification, analysis and interpretation of animal remains from archaeological sites. The module is open to students following MA/MSc degrees at the Institute of Archaeology.

Teaching consists of a **1 hour taught session 2pm – 3pm**, and a **2 hour practical session 3-5pm**. All sessions are held in **Room 308, Institute of Archaeology**. There will be a 10 minute break before the second session.

Week by Week Summary

1. 30th Sept Introduction: the mammalian skeleton; principles of Identification; taxonomy; terminology; quantification
Practical: Metapodials and phalanges
2. 7th Oct Bone: What is bone? Bone development, structure and growth
Practical: Upper Limbs /girdle bones (scapula, pelvis, humerus, femur)
3. 14th Oct Ageing I: Epiphyseal fusion and its use in zooarchaeology
Practical: Lower limbs (radius, ulna, tibia, fibula, astragalus, calcaneum)
4. 21st Oct Mammalian Dentition: structure & variation of adult teeth
Practical: Skulls, horn cores, antlers, vertebrae
5. 28th Oct Ageing II: Deciduous dentition and dental ageing in practice
Practical: Dental ageing and cull profiles in theory

READING WEEK (NO TEACHING)

6. 11th Nov Taphonomy and bone surface modifications
Practical: CSI IoA – animal forensics and pathology
7. 18th Nov Metrics & Taxonomic Identification: Animal size, sexual dimorphism, morphometrics, identification
Practical: Sorting and Identification
8. 25th Nov Small mammals in archaeology
Practical: Small mammals/ work on project
9. 2nd Dec Birds in archaeology
Practical: Bird bones/ work on project
10. 9th Dec Fish in archaeology
Practical: Fish bones/ work on project

Aims

The aim of the module is to introduce students to the practical and analytical aspects of vertebrate zooarchaeology, to encourage discussion and critique of current approaches, and to explore how zooarchaeological data can be analysed and interpreted. The focus is on **practical and laboratory experience**, where students learn identification and observation skills for a selected range of taxa. The module focuses on vertebrate remains, and students will become particularly familiar with issues and problems of mammalian zooarchaeology, with brief sessions on micro-mammals, birds and fish.

Topics to be included in laboratory sessions include: identification methods, ageing and sexing animal remains (dental eruption and wear, epiphyseal fusion, sexual dimorphism), osteometrics, body part analysis, quantification methods, bone modification/taphonomy, small mammals, birds and fish. Optional discussion of databases and recording systems, analysis and interpretation of data is available for those who will undertake their dissertation in a zooarchaeological topic.

Objectives

On successful completion of this module, students will:

- Have an overview of current approaches to practical zooarchaeology
- Be able to recognize and identify selected Eurasian vertebrate remains
- Be familiar with observational and analytical approaches for assessing taphonomy and potential for assemblage analysis
- Be familiar with biometrical methods in zooarchaeology
- Be familiar with body part analysis, and ageing and sexing methods in zooarchaeology, and the construction of cull profiles
- Have an understanding of interpretive potential of zooarchaeological data.

Learning Outcomes (and coursework used in their assessment)

1. Critical understanding of methods and approaches in practical and analytical Zooarchaeology (lab book, practical report and essay)
2. Critical analysis of laboratory practice (lab book)
3. Understanding of assessment of site formation/taphonomomic processes (practical report and some essay questions)
4. Understanding of the production of zooarchaeological data (essay)
5. Understanding of the analysis of zooarchaeological data (lab book, practical report and essay)
6. Development of interpretative abilities (essay).

Teaching Methods

Lab classes are in part taught – students are introduced to material and methods – and in part, students work through material independently (or in small groups), under guidance. The emphasis is on students learning not just identification methods, but also how to make observations, and to apply and critique analytical methods.

Prerequisites

Students with a background in archaeology, anthropology or the natural sciences will find this beneficial. For students taking the MSc Environmental Archaeology, the core module Resources & Subsistence (ARCL 0128) serves as a prerequisite for this Zooarchaeology module, but students from other degrees can on occasion take Zooarchaeology as a stand-alone option.

Workload

The total workload for this module is 150 hours, broken down in the following way:

Laboratory taught	10 hours
Laboratory guided	20
Private reading/preparation	60 hours
Independent Project work	20
Written work/essays	40
TOTAL	150

Assessment

This module is assessed by the following:

<i>Type of Assessment</i>	<i>Percentage of final module mark</i>
Standard Essay of 2,375-2,625 words	40%
Laboratory book (no limit)	15%
Practical Report (mainly tables/figures + c.500 words)	45%
TOTAL	100%

The Standard Essay is based upon a specific question and researched via a range of reading based on the reading lists given in this handbook, and beyond. Credit will be given to essays where there the author has sought sources beyond the reading lists, and where there is evidence of reasoned and critical assessment of multiple sources.

Laboratory Notebooks – Notes, observations (written and illustrative) on all aspects of laboratory work, including reflective writing on the lab experience. The aim of this assessment is for students to demonstrate how their knowledge-base grows, to keep their learning in one easy-to-consult form, and to include some compilation of interpretive frameworks.

Practical Report – A piece of written work relating to the analysis of a group of animal bone material, on which students have undertaken independent identification, observation and comment. The report should show clear presentation of datasets, including a table and graphics where necessary, and show any recording and analytical methods applied to the data.

If students are unclear about the nature of an assignment, they should discuss this with the Module Co-ordinator. The nature of the assignment and possible approaches to it will be discussed in class, in advance of the submission deadline.

Please note that in order to be deemed to have completed and passed in any module, it is necessary to submit all assessments.

The following should not be included in the word-count: title page, contents pages, lists of figure and tables, abstract, preface, acknowledgements, bibliography, lists of references, captions and contents of tables and figures, appendices.

Penalties will only be imposed if you exceed the upper figure in the range. There is no penalty for using fewer words than the lower figure in the range: the lower figure is simply for your guidance to indicate the sort of length that is expected.

In the 2019-20 session penalties for over-length work will be as follows:

- For work that exceeds the specified maximum length by less than 10% the mark will be reduced by five percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a Pass.
- For work that exceeds the specified maximum length by 10% or more the mark will be reduced by ten percentage marks, but the penalised mark will not be reduced below the pass mark, assuming the work merited a Pass.

Essay topics (40%)

The essay titles below can either be used literally, or can be taken as suggested areas for you to write on. If you want to formulate another essay question to cover a topic which you are particularly interested in, you must discuss this first with Kevin MacDonald; **please do not choose another title yourself without consultation, and please do not alter the titles below.** The titles below are intentionally broad, and designed to make you think across methodological and interpretive issues covered in the module. Ideally, essays will draw on topics covered in the first term of the module. It is expected that you will draw frequently on zooarchaeological/archaeological case studies and examples in your answers. **If you choose essay 4, please confirm the title with the module co-ordinator.**

- 1) Taphonomic analyses play a crucial role in zooarchaeology, not only in aiding understanding of assemblage bias, but in providing evidence for human-animal treatment. Discuss, with reference to experimental/ actualistic studies, and archaeological case-studies.
- 2) Discuss the use of 'standard' zooarchaeological approaches to livestock herd management alongside the more recent and novel archaeological science techniques and approaches to elucidating animal management in the past. What do, for example, the use of stable isotopes and dental microwear add? Use case studies in your answer.
- 3) In recent decades, zooarchaeologists have increasingly addressed the use of animals in complex societies, and employ zooarchaeological data alongside historical written sources to inform on human-animal interactions. Using case-studies, critically evaluate this approach.
- 4) Discuss and critique zooarchaeological methods and approaches in an area of your choice, using a good range of case studies. ['Area' can be geographically defined, or thematic e.g. the use of zooarchaeology in animal domestications, or in studies of modes of consumption, or animals in ritual etc]. **Please confirm your chosen title with the Module Co-ordinator.**

Practical Project Report (45%)

In the week after Reading Week in Term I you will begin identification, observation and recording of a small assemblage of archaeological animal bones. All students will use the same assemblage. The aim of this project is to identify, record and make brief comments on the material. The 'write-up'

will primarily consist of recording data onto a spreadsheet/ table, sketching or photographing specimens to show modifications and making comments, but students can also write more extensive notes if they wish.

The project is primarily methodological in scope, and aims to assess students' understanding of the practical and analytical aspects of zooarchaeology which they have developed during the module. It is not expected that students will undertake detailed interpretations. Further information on the project will be given at the appropriate stage of the module.

The Lab Book (15%)

An important part of learning any laboratory based discipline is to maintain your own personal record of knowledge acquisition, and to keep it in an easy-to-consult form. During the Zooarchaeology module, you will gather a large number of handouts (identification aids, analysis instructions, guidance on methods and approaches), and **one aim** of having an assessed Lab Book is to encourage students to keep these handouts, plus other sources that students add themselves, in an organized form for easy reference. It is hoped that this will provide a personal manual that can be used in the field or lab in the student's future career.

It is also *crucial* that students add to this basic Lab Book document, by showing they have made **independent observations** (e.g. about identifications, taphonomic modifications etc.), worked through examples of exercises, and **compiled some examples of interpretive frameworks** where appropriate.

The Lab Book is a record of the teaching and student-centred learning during the set 2-hour laboratory class, and it is strongly recommended that **students keep up their Lab Book on a weekly/class-by-class basis**. Photographs, sketches, hand-written comments are totally acceptable. It is NOT expected that students should re-write/ type up their notes from Lab classes for the Lab Book (although they are of module welcome, and encouraged, to add relevant material from their own searches).

Please bring your Lab Book to all classes, since in many we will be building on handouts given out in earlier classes.

The Lab Book should be submitted during Reading Week in Term I, so the module co-ordinator can make brief comments at an early stage (the lab book will not be formally assessed at this point). It will be returned after Reading Week, and finally submitted at the start of Term II in January for formal marking.

Assessment criteria include 4 main questions:

- 1) How complete a record is the Lab Book of the laboratory work and required independent work?
- 2) Does the organization of the Lab Book make it easy to consult?
- 3) Is there good evidence of the student making original observations of laboratory material, and the laboratory experience?
- 4) Is there any compilation of interpretive frameworks that can be applied in the analysis of data?

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Coursework submission procedures

- All coursework must normally be submitted **both as hard copy and electronically unless instructed otherwise** (However, portfolios and lab books are submitted as hard copy only.)
 - You should staple the appropriate colour-coded IoA coversheet (available in the IoA library and outside room 411a) to the front of each piece of work and submit it to the red box at the Reception Desk (or room 411a in the case of Year 1 undergraduate work)
 - All coursework should be uploaded to Turnitin by midnight on the day of the deadline. This will date-stamp your work. It is essential to upload **all parts** of your work as this is sometimes the version that will be marked. Instructions are given below...
 - **Please note that the procedure has changed for 2019-20, and work is now submitted to Turnitin via Moodle.**
1. Ensure that your essay or other item of coursework has been saved as a **Word doc., docx. or PDF** document, Please include the module code and your candidate number on every page.
 - 2.. Go to the Moodle page for the module to which you wish to submit your work.
 3. Click on the correct assignment (e.g. Essay 1),
 4. Fill in the "Submission title" field with the right details: **It is essential that the first word in the title is your examination candidate number** (e.g. YGBR8 Essay 1), **Note that this changes each year.**
 5. Click "Upload".
 - 6 Click on "Submit"
 - 7 You should receive a receipt – please save this.
 - 8 If you have problems, please email the IoA Turnitin Advisers on ioa-turnitin@ucl.ac.uk, explaining the nature of the problem and the exact module and assignment involved. One of the Turnitin Advisers will normally respond within 24 hours, Monday-Friday during term. Please be sure to email the Turnitin Advisers if technical problems prevent you from uploading work in time to meet a submission deadline .

Syllabus

The following is an outline for the module as a whole, and selected essential readings relevant to each session (denoted with an *). **Please bring this list with you to each practical session.** You are strongly recommended to search archaeological journals (online and in the library) for relevant and up to date case-studies: e.g. *Journal of Archaeological Science*, *International Journal of Osteoarchaeology*, *Antiquity*, *Medieval Archaeology*, *Post Medieval Archaeology*, *Environmental Archaeology* ...

It will also be useful if you find two or three recent zooarchaeological specialist reports from sites you are interested in to give you an idea of how they are written.

Key module textbooks (** Consider Purchase)

Albarella, U., Rizzetto, M., Russ, H., Vickers, K. and Viner-Daniels, S. eds., (2017). *The Oxford Handbook of Zooarchaeology*. Oxford: Oxford University Press. **Available online through the library**

Beisaw, A.M. (2013) *Identifying and Interpreting Animal Bones*. College Station: Texas A&M. **INST ARCH BB 3 BEI

Davis, S. (1987 or 1995). *The Archaeology of Animals*. Batsford: London **BB 3 DAV**

English Heritage (2014). *Animal Bones and Archaeology: Guidelines for Best Practice*. London: English Heritage **available online**

Klein, R.G. and Cruz-Urbe, K. (1984). *The Analysis of Animal Bones from Archaeological Sites*. Chicago: University of Chicago Press. **BB 3 KLE**

O'Connor, T. (2000). *The Archaeology of Animal Bones*. Sutton. **BB 3 OCO

O'Connor, T. (2003). *The Analysis of Urban Animal Bone Assemblages*. York: YAT. **DAA 410 Y.6 Series YOR 19/2**

Reitz, E. and Wing, E. (1999). *Zooarchaeology*. Cambridge: Cambridge University Press. **BB 3 REI**

General texts on human-animal relations

Albarella, U. and Trentacoste, A. (2011). *EthnoZooArchaeology: the present and past of human-animal relationships*. Oxford: Oxbow. **BB 3 Qto ALB**

Armstrong Oma, K. and Hedeager, L. (2010). *World Archaeology* 42:2 'Humans and Animals'

Mullin, M. 2002 'Animals in Anthropology' *Society and Animals* vol 10 (4) pp 378-393.

Pluskowski, A. (ed) (2005). *Just Skin and Bones? New Perspectives on Human-Animal Relations in the Historic Past*, BAR International Series 1410. **BB 3 Qto PLU**

Russell, N. (2011). *Social zooarchaeology: Humans and Animals in Prehistory*. Cambridge: Cambridge University Press. **BB 3 RUS**

Sykes, N. (2014). *Beastly Questions: Animal Answers to Archaeological Issues*. London: Bloomsbury Publishing. **BB 3 SYK**

Identification and laboratory manuals (largely for European fauna, inquire for other regions)

Cohen, A., & Serjeantson, D. (1996). *A Manual for the Identification of Bird Bones from Archaeological Sites*. Archetype Publications. **BB 3 COH**

France, D. (2008). *Human and Non-Human Bone Identification: A Color Atlas*. CRC Press. **ISSUE DESK IOA CD FRA (FOR USE IN LAB 308 ONLY)**

Hillson, S. (2005 2nd edition). *Teeth*. Cambridge: Cambridge University Press. **BB 2 HIL**

Hillson, S. (1992). *Mammal Bones and Teeth - an Introductory Guide to Methods of Identification*. London: Institute of Archaeology, UCL. **BB 3 Qto HIL**

Schmidt, E. (1972). *Atlas of Animal Bones - for prehistorians, archaeologists and quaternary geologists*. Amsterdam: Elsevier Publishing Company. **BB 3 Qto SCH**

von den Driesch, A. (1976). *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletin No 1. Harvard University. **BB 3 DRI** there should also be a copy in the lab

Sampling Bone Assemblages

Davis, (1987 or 1995) *The Archaeology of Animals*. Oxford: Blackwell, 28-32. **BB 3 DAV** reports Payne's famous sieving experiment

English Heritage (2011) *Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post Excavation*. London: English Heritage **available online**

English Heritage (2014) *Animal Bones and Archaeology: Guidelines for Best Practice*. London: English Heritage **available online**

Levitan, B. (1983) Reducing the workload: sub-sampling animal bone assemblages, *Circaea* 1/1, 7-12. [read alongside Turner 1984]

O'Connor, T. (2003). *The Analysis of Urban Animal Bone Assemblages*. York: YAT. pp. 93-112 **DAA 410 Y.6 Series YOR 19/2**

Turner, A. (1984) Sub-sampling animal bone assemblages: reducing the work-load or reducing the information? *Circaea* 2/2, 69-75.

Week 1: Introduction

This session begins with an introduction to Zooarchaeology – what it is and the basic principles of good practice. Some consideration is given to taxonomy, and how people may have viewed animals in the past. The focus then moves to the mammalian skeleton, introducing basic anatomy, principles of identification, terminology and issues of quantification.

An Overview

Brewer, D. (1992) Zooarchaeology: Method, Theory and Goals. *Archaeological Method and Theory*, 4: 195-244 **jstor**

Basic Osteology

Schmidt, E. (1972). *Atlas of Animal Bones - for prehistorians, archaeologists and quaternary geologists*. Amsterdam: Elsevier Publishing Company. **BB 3 Qto SCH**

von den Driesch, A. (1976). *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletin No 1. Harvard University. **BB 3 DRI**

Taxonomy

<http://animaldiversity.ummz.umich.edu/> for an explanation of taxonomy and the Linnean system.

<http://www.worldbirdnames.org/> for birds

Quantification

Klein, R.G. and Cruz-Uribe, K. (1984). *The Analysis of Animal Bones from Archaeological Sites*. Chicago: University of Chicago Press. **BB 3 KLE** for quantification **NISP/MNI**

Binford, L. (1984) Faunal Remains from Klasies River Mouth. New York: Academic Press. **DCE BIN** See for **MNE**

Dobney, K. and Riley, K. (1988) A method for recording animal bones. The use of diagnostic zones. *Circaea* 5(2): 79-96. **Available online**. See for **Zoning**

MacDonald, K. and R. Hutton MacDonald (2016) Mammalian, Avian, and Reptilian Remains, In R.J. McIntosh, S.K. McIntosh and H. Bocoum eds. *The Search for Takrur: Archaeological Excavations and Reconnaissance along the Middle Senegal Valley*, 311-334, New Haven: Yale University Press. **DCG MCI** See for discussion of quantification methods.

Weeks 2 and 3: What is Bone? Structure Growth & Epiphyseal fusion

These complimentary sessions give an overview of what bone is and how it develops and changes as animals grow. In week 3 the use of bone growth and development as a tool for ageing animals or animal populations is introduced.

Bone Structure

- *Cornwall, I.W., 1960. *Bones for the Archaeologist*. London: Phoenix. **BB 3 COR** chapter 3 for a good overview of comparative anatomy
- Hildebrand, M. (1974). *Analysis of Vertebrate Structure*. New York/London: John Wiley & Sons. **Science ZOOLOGY 25 a HIL**
- O'Connor, T (1984). On the structure, chemistry and decay of bone, antler and ivory. In Starling, K and Watkinson, D (Eds.) *Archaeological Bone, Antler and Ivory*. United Kindom Institute for Conservation Occasional Paper 5 6-8 **KB STA**

Bone Growth and Fusion

- Bull, G. and Payne, S. (1982). 'Tooth eruption and epiphyseal fusion in pigs and wild boar' in *Ageing and Sexing Animal Bones from Archaeological Sites* (eds) B. Wilson, C. Grigson and S. Payne. BAR 109, Oxford. **DAA Qto Series BRI 109**
- Davis, S.J.M. (2000). The Effect of Castration and Age on the Development of the Shetland Sheep Skeleton and a Metric Comparison Between Bones of Males, Females and Castrates, *Journal of Archaeological Science* 27, 373-390.
- *Popkin, P., P. Baker, F. Worley, S. Payne and A. Hammon (2012). The Sheep Project (1): determining skeletal growth, timing of epiphyseal fusion and morphometric variation in unimproved Shetland sheep of known age, sex, castration status and nutrition. *Journal of Archaeological Science*, 39, 1775-1792.
- *Silver, I.A (1969). 'The Ageing of Domestic Animals' in *Science in Archaeology* (2nd edition) (eds) D. Brothwell and E. Higgs, pp283-302. London: Thames and Hudson. **AJ BRO**
- Watson, J.P. (1978). 'The interpretation of epiphyseal fusion data' in *Research Problems in Zooarchaeology* (eds) D. Brothwell, K. Thomas and J. Clutton-Brock. Institute of Archaeology, Occasional Publication No 3 pp97-101. **BB Qto BRO**
- Zeder, M, Lemione, X and Payne, S (2015). A new system for computing long-bone fusion age profiles in *Sus scrofa*. *Journal of Archaeological Science* 55 135-150

Weeks 4 and 5: Mammalian Dentition, Dental Ageing and Cull Profiles

These lectures on dentition provide an overview of the anatomy and variation of mammalian teeth, and the sequence of eruption and wear. This is built upon in the second lecture by describing how mortality profiles can be calculated to help understand possible economic uses of animals within and between populations.

- Collier, S. and White, J. (1976). Get them young? Age and sex inferences on animal domestication in archaeology. *American Antiquity* 41/1, 96-102. (If you still need more convincing that age and sex patterns are not easy to use!)
- Farley, M and Jones, G G (2012). *Iron Age Ritual: A Hillfort and Evidence for a Minster at Aylesbury, Buckinghamshire*. Oxford: Oxbow **DAA 410 Qto FAR** [refined tooth wear ageing for sheep]
- *Grant, A. (1982) 'The use of tooth wear as a guide to the age of domestic ungulates' in (eds) Wilson, B *et al. Ageing and Sexing Animal Bones from Archaeological Sites* pp91-108. Oxford: BAR British Series 109. **DAA Qto Series BRI**
- Halstead, P (1998). Mortality models and milking: problems of uniformitarianism, optimality and equifinality reconsidered. *Anthropozoologica* 27 3-20
- Hillson, S. 2005 (2nd edition) *Teeth*. Cambridge: CUP. **BB 2 HIL**

- Jones, G.G. (2006). Tooth Eruption and Wear Observed in Live Sheep from Butser Hill, the Cotswold Farm Park and Five Farms in the Pentland Hills, UK. In D. Ruscillo (ed), 155-178, *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books. **BB 3 Qto RUS**
- Jones, G G and Sadler, P (2012). Age at death in cattle: methods, older cattle and known-age reference material. *Environmental Archaeology* **17(1)** 11-28
- Jones, G G and Sadler, P (2012). A review of published sources for age at death in cattle. *Environmental Archaeology* **17(1)** 1-10
- Lemione, X, Zeder, M A, Bishop, K J and Rufolo, S J (2014). A new system for computing dentition-based age profiles in *Sus scrofa*. *Journal of Archaeological Science* **47** 179-193
- Levine, M (1982). The use of crown height measurements and eruption-wear sequences to age horse teeth. In Wilson, B, Grigson, C and Payne, S (Eds.) *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford: Council for British Archaeology **109** 223-243 **DAA Qto Series BRI**
- Magnell, O. (2006). Tooth Wear in Wild boar (*Sus scrofa*), in D. Ruscillo (ed), 189-203. *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books **BB 3 Qto RUS**
- McGrory, S., E.M. Svensson, A. Götherström, J. Mulville, A.J. Powell, M.J. Collins and T.P. O'Connor (2012). A novel method for integrated age and sex determination from archaeological cattle mandibles. *Journal of Archaeological Science*, 39, 3324-3330.
- *Payne, S. (1973) 'Kill-off patterns in sheep and goats: the mandibles from Asvan Kale' *Anatolian Studies* 23 pp281-303.
- Payne, S. (1984). 'The use of early 19th century data in ageing cattle mandibles from archaeological sites, and the relationship between the eruption of M3 and P4' *Circaea* 2(2) pp77-82.
- Ruscillo, D. (2006). *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books. **BB 3 Qto RUS**
- *Worley, F, Baker, P, Popkin, P, Hammon, A and Payne, S (2016). The Sheep Project (2): The effects of plane of nutrition, castration and the timing of first breeding in ewes on dental eruption and wear in unimproved Shetland sheep. *Journal of Archaeological Science: Reports*, 6, pp.862-874
- Wilson, B., Grigson, C. and Payne, S. (1982). *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford: BAR British Series 109. **DAA Qto Series BRI** many relevant chapters in this volume

Practical: Skulls, Horns and Antlers, Vertebrae

- Albarella, U (1995). Depressions on sheep horncores. *Journal of Archaeological Science* **22** 699-704
- Armitage, P and Clutton-Brock, J (1976). A system for classification and description of the horn cores of cattle from archaeological sites. *Journal of Archaeological Science* **3** 329-348
- Clutton-Brock, J (1984). *Neolithic antler picks from Grimes Graves, Norfolk, and Durrington Walls, Wiltshire: a biometrical analysis*. London: British Museum Press **1**
- Goss, R. (1983) *Deer antler: regeneration, function and evolution*. London: Academic Press. **KB GOS**
- *Grigson, C. (1982). 'Sexing Neolithic domestic cattle skulls and horn cores' in Wilson *et al.* *Ageing and Sexing* ...
- MacGregor, A. 1985 *Bone, Antler, Ivory and Horn. The Technology of Skeletal Materials since the Roman Period*. London: Croom Helm. **KB MAC**
- *Sykes, N. & R.H. Symmons (2007). Sexing cattle horn-cores: problems and progress. *International Journal of Osteoarchaeology*, 17, 514-523.
- Wilson, B., Grigson, C. and Payne, S. (1982). *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford: BAR British Series 109. **DAA Qto Series BRI** many relevant chapters in this volume

Week 6: Taphonomy and Bone Surface Modification

Taphonomy is one of the most complex yet vital areas of zooarchaeology. It is basic to all subsequent interpretations of an assemblage at site level. This lecture considers some of the most common taphonomic factors affecting an assemblage, what this can tell us about site formation processes, and how it can affect the story of the past. The second session will investigate how the impacts of taphonomy can be visualized.

- Behrensmeyer (1974). For bone weathering, see ref. in Lyman 1994.
- Binford, L.R. (1981). *Bones - Ancient Men and Modern Myths*. Academic Press. **BB 3 BIN and issue desk**.
(have a quick skim through to see what's in there which might be useful).
- Bonnichsen, R. and Sorg, M. (1989). *Bone Modification*. Orono Maine: Centre for the Study of the First Americans. **BB 3 BON**
- Fisher, J. W. 1995. Bone surface modifications in zooarchaeology. *Journal of Archaeological Method and Theory*, 2.1, 7-68.
- Greenfield, H. 1988. Bone consumption by pigs in a contemporary Serbian village: Implications for the interpretation of prehistoric faunal assemblages, *Journal of Field Archaeology* vol 15, 473-479
- Huntley, J. and Stallibrass, S. 2000. *Taphonomy and Interpretation*, Symposia of the Association for Environmental Archaeology No.14. Oxford: Oxbow Books. **BB 3 Qto HUN**
- Klein, R. (1989) Why does Skeletal Part Representation Differ Between Smaller and Larger Bovids at Klasies River Mouth and Other Archaeological Sites? *Journal of Archaeological Science* 6:363-81.
- Lam, Y.M., O.M. Pearson, C.W. Marean & X. Chen (2003). Bone density studies in zooarchaeology. *Journal of Archaeological Science*, 30, 1701-1708.
- Lauwerier, R (1988). *Animals in Roman Times in the Dutch Eastern River Area*. Amersfoort: ROB Nederlandse Oudheden **12. DAHB LAU** (butchery templates)
- *Lyman, R.L. (1994). *Vertebrate Taphonomy*. Cambridge: Cambridge University Press. **BB 3 LYM**
- Madgwick, R and Mulville, J (2015). Reconstructing depositional histories through bone taphonomy: Extending the potential of faunal data. *Journal of Archaeological Science* **53** 255-263
- Marean, C.W. (1991). Measuring the postdepositional destruction of bone in archaeological assemblages. *Journal of Archaeological Science*, 18, 677-694.
- Marean, C.W. and Spencer, L.M. (1991). 'Impact of carnivore ravaging on zooarchaeological measures of element abundance', *American Antiquity* 56 (4), 645-658.
- Munson. P. (2000). Age-Related Differential Destruction of Bones and its Effect on Archaeological Mortality Profiles of Domestic Sheep and Goats, *Journal of Archaeological Science* 27, 391-407.
- O'Connor, T. (2005). *Biosphere to Lithosphere: new studies in vertebrate taphonomy*. Oxford: Oxbow. **BB 3 Qto OCO**
- *Orton, D. (2012). 'Taphonomy and Interpretation: an analytical framework for social zooarchaeology', *International Journal of Osteoarchaeology*, 22(3): 253-378
- Outram, A (2002). Bone fracture and within-bone nutrients: An experimentally based method for investigating levels of marrow extraction. In Miracle, P and Milner, N (Eds.) *Consuming Passions and Patterns of Consumption*. Cambridge: McDonald Institute for Archaeological Research 51-64 **Issue Desk IOA MIR**
- Payne, S. and Munson, P.J. (1985). 'Ruby and how many squirrels? The destruction of bones by dogs' in *Palaeobiological Investigations - research design, methods and data analysis* (eds) N. Fieller, D. Gilbertson and N. Ralph. Oxford: BAR International Series 266, 31-39. **BB Qto FIE**
- *Rogers, A. (2000) On Equifinality in Faunal Analysis. *American Antiquity*. 65 (4): 709-723.
- Russell, N., Martin, L.A. (2012). Cooking Meat and Bones at Neolithic Çatalhöyük, Turkey. In S. R. Graff and E. Rodríguez-Alegría (eds) *The Menial Art of Cooking: Archaeological Studies of Cooking and Food Preparation*, 87-97. Boulder: University Press of Colorado. **Online access through the library**

- Sampson, C.G. (1999). Taphonomy of Tortoises Deposited by birds and Bushmen, *Journal of Archaeological Science*, 27, 779-788.
- Serjeantson, D (1996). The animal bones. In Needham, S and Spence, T (Eds.) *Refuse and Disposal at Area 16 East Runnymede: Runnymede Bridge Research Excavations*. London: British Museum Press **2** 194-223 **DAA 410 S.8 NEE** (bone zones)
- Solomon, S., Davidson, I. and Watson, D. (1990). 'Problem Solving in Taphonomy'. *Tempus* Vol 2. University of Queensland, Anthropology Museum. **BB 3 Qto SOL**
- Speth, J.D. (2000). Boiling vs baking and roasting: a taphonomic approach to the recognition of cooking techniques in small mammals, in Rowley-Conwy, P. (ed), 89-105. *Animal Bones, Human Societies*. Oxford: Oxbow Books **Issue Desk**
- Symmons, R (2005). Bone density variation between similar animals and density variation in early life: implications for future taphonomic analysis. In O'Connor, T (Ed.) *Biosphere to Lithosphere. New Studies in Vertebrate Taphonomy*. Oxford: Oxbow 87-94 **BB 3 Qto OCO**

Diagenesis

- Conard, N., Walker, S. and Kandel, A. 2008. How heating and cooling and wetting and drying can destroy dense faunal elements and lead to differential preservation. *Palaeogeography, Palaeoclimatology, Palaeoecology* 266(3-4), pp.236-245.
- Jans, M., Nielsen-Marsh, C., Smith, C., Collins, M. and Kars, H. 2004. Characterisation of microbial attack on archaeological bone. *Journal of Archaeological Science* 31, 87-95.
- Koon, J., Nicholson, R. and Collins, M. 2003. A practical approach to the identification of low temperature heated bone using TEM. *Journal of Archaeological Science* 31, 1393-1399.
- Smith, C., Nielsen-Marsh, C., Jans, M. and Collins, M. 2007. Bone diagenesis in the European Holocene I: patterns and mechanisms, *Journal of Archaeological Science* 34(9), 1485-1493.
- Turner-Walker, G. and Syversen, U. 2002. Quantifying histological changes in archaeological bones using BSE-SEM image analysis, *Archaeometry*, 44(3), 461-468.
- Nielsen-March, C., Smith, C., Jans, M. Nord, A., Kars, H. and Collins, M. 2007. Bone diagenesis in the European Holocene II: taphonomic and environmental considerations. *Journal of Archaeological Science* 34: 1523-1531.

Week 7: Biometrical Analysis, Pathology and Body Parts

Emphasis this week is on biometrical analysis – the use of bone measurements to discern aspects of past animals such as size, shape, sex (male, female or castrate) and age. The second part of the session will incorporate an introduction to palaeopathology – how disease and trauma can be observed on animal bone. Following this is a seminar on how quantification of the skeleton is calculated.

Biometrical Analysis

- *Albarella, U (2002). Size matters: how and why biometry is still important in zooarchaeology. In Dobney, K and O'Connor, T (Eds.) *Bones and the Man: Studies in honour of Don Brothwell*. Oxford: Oxbow 51-62 **BB 3 Qto DOB**
- Albarella, U, Johnstone, C and Vickers, K (2008). The development of animal husbandry from the Late Iron Age to the end of the Roman period: a case study from South-East Britain. *Journal of Archaeological Science* **35(7)** 1828-1848
- Arbuckle, B. (2013). The late adoption of cattle and pig husbandry in Neolithic Central Turkey. *Journal of Archaeological Science*, 40, 1805-1815.
- *Davis, S (1996). Measurements of a group of adult female shetland sheep skeletons from a single flock: a baseline for zooarchaeologists. *Journal of Archaeological Science* **23** 593-612
- von den Driesch, A. (1976). *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Peabody Museum Bulletin No 1. Harvard University. **BB 3 DRI plus Issue Desk**

- Evin, A., Cucchi, T., Cardini, A., Strand Vidarsdottir, U., Larson, G. and Dobney, K. (2013). The long and winding road: identifying pig domestication through molar size and shape. *Journal of Archaeological Science*, 40, 735-743.
- Evin, A, Cucchi, T, Escarguel, G, Owen, J, Larson, G, Strand Vidarsdottir, U and Dobney, K (2014). Using traditional biometrical data to distinguish West Palearctic wild boar and domestic pigs in the archaeological record: new methods and standards. *Journal of Archaeological Science* **43** 1-8
- Holmes, M (2014). Does Size Matter? Changes in the size and shape of animals throughout the English Saxon period (AD 450-1066). *Journal of Archaeological Science* **43** 77-90
- Johnstone, C (1999). Looking a gift horse in the mouth: the problems of using archived and published biometrical data. *Current and Recent Research in Osteoarchaeology* **2** 48-50
- Meadow, R. (1999). The use of size index scaling techniques for research on archaeozoological collections from the Middle East, in *Historia Animalium ex Ossibus, Beitrage zur Palaeoanatomie, Archaeologie, Agyptologie, Ethnologie und Geschichte der Tiermedizin*, (eds) C. Becker, H. Manhart, J. Peters, and J. Schibler. Rahden: Verlag Marie Leidorf. **BB 3 Qto BEC** [See for an explanation of the Standard Animal scaling technique].
- O'Connor, T (2007). Wild or domestic? Biometric variation in the cat *Felis silvestris* schreber. *International Journal of Osteoarchaeology* **17** 581-595
- Payne, S and Bull, G (1988). Components of variation in measurements of pig bones and teeth, and the use of measurements to distinguish wild from domestic pig remains. *Archaeozoologia* **2** 27-65
- Popkin, P, Baker, P, Worley, F, Payne, S and Hammon, A (2012). The sheep project (1): determining skeletal growth, timing of epiphyseal fusion and morphometric variation in unimproved Shetland sheep of known age, sex, castration status and nutrition. *Journal of Archaeological Science* **39** 1775-1792
- Ruscillo, D. (2006). *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books. **BB 3 Qto RUS**
- Sykes, N and Symmons, R (2007). Sexing cattle horn-cores: problems and progress. *International Journal of Osteoarchaeology* **17** 514-523
- Thomas, R., M. Holmes and J. Morris (2012). "So bigge as bigge may be": tracking size and shape change in domestic livestock in London (AD 1220-1900). *Journal of Archaeological Science*, 40, 3309-3325.
- Zeder, M (2001). A metrical analysis of a collection of modern goats from Iran and Iraq: Implications for the study of caprine domestication. *Journal of Archaeological Science* **28** 61-79

Palaeopathology

- Albarella, U. (1995). Depressions on Sheep Horncores. *Journal of Archaeological Science*, 22, 699-704.
- Baker, J. (1984). 'The study of animal diseases with regard to agricultural practices and man's attitude to his animals'. *Animals in Archaeology: 4. Husbandry in Europe*, (eds) C. Grigson and J. Clutton-Brock. BAR is 277, 253-257. **BB 3 Qto GRI**
- *Baker, J. and Brothwell, D. (1980). *Animal diseases in archaeology*. London, New York: Academic Press. **Issue Desk**.
- *Bartosiewicz, L and Gál, E (2013). *Shuffling Nags, Lame Ducks: The Archaeology of Animal Disease*. Oxford: Oxbow **BB 3 BAR**
- Bartosiewicz, L., van Neer, W. and Lentacker, A. (1997). *Draught Cattle: their osteological identification and history*. Koninklijk Museum Voor Midden-Afrika Tervuren, Belgie, *Annalen Zoologische Wetenschappen* vol 281. **BB 3 Qto BAR**
- Clark, K (2009). Pathologies of the sheep. In Serjeantson, D and Rees, H (Eds.) *Food, Craft and Status in Medieval Winchester: The Plant and Animal Remains from the Suburbs and City Defences*. Winchester: Winchester Museums 158-165 **DAA 410 Qto SER**
- Davies, J, Fabis, M, Richards, M and Thomas, R (Eds.) (2005). *Diet and Health in Past Animal Populations. Current Research and Future Directions*. Oxford: Oxbow **BB 3 Qto DAV**

Dobney, K. and Ervynck, A. (2000). Interpreting Developmental Stress in Archaeological Pigs: the Chronology of Linear Enamel Hypoplasia, *Journal of Archaeological Science* 27, 597-607.

OR

Ervynck, A. and Dobney, K. (1999). Lining up on the M1: a Tooth Defect as a Bio-indicator for Environment and Husbandry in Ancient Pigs, *Environmental Archaeology*, 4, 1-8.

Groot, M (2008). Understanding past human-animal relationships through the analysis of fractures: A case study from a Roman site in The Netherlands In Miklíková, Z and Thomas, R (Eds.) *Current Research in Animal Palaeopathology*. Oxford: British Archaeological Reports International Series **1844** 40-50 **BB 3 Qto MIK**

Isaakidou, V. (2007). Ploughing with Cows: Knossos and the Secondary Products Revolution, in Serjeantson, D. and Field, D. (eds) *Animals in the Neolithic of Britain and Europe*, Neolithic Studies Group Seminar Papers 7, 95-112. Oxford: Oxbow Books **DA 140 SER**

Miklíková, Z and Thomas, R (Eds.) (2008). *Current Research in Animal Palaeopathology*. Oxford: British Archaeological Reports International Series **1844 BB 3 Qto MIK**

Noddle, B (1999). Bone defects in joint surfaces of intensively farmed livestock. In Anderson, S (Ed.) *Current and Recent Research in Osteoarchaeology 2*. Oxford: Oxbow 1-3 **JF Qto AND**

Noe-Nygaard, N. (1974). 'Mesolithic hunting in Denmark illustrated by bone injuries caused by human weapons', *Journal of Archaeological Science* 1, 217-248.

Vann, S and Thomas, R (2006). Humans, other animals and disease: A comparative approach towards the development of a standardised recording protocol for animal palaeopathology. *Internet Archaeology* **20**

Waldron, T (2008). *Palaeopathology*. Cambridge: Cambridge University Press. **Available online through the library**

Body part representation

Klein, R. (1989) Why does Skeletal Part Representation Differ Between Smaller and Larger Bovids at Klasies River Mouth and Other Archaeological Sites? *Journal of Archaeological Science* 6:363 81.

*Lyman, L (2008). *Quantitative Paleozoology*. Cambridge: Cambridge University Press **BB 3 LYM and online through the library.**

Marshall, F and Pilgram, T (1991). Meat versus within-bone nutrients: another look at the meaning of body part representation in archaeological sites. *Journal of Archaeological Science* **18** 149-163

Sykes, N (2007). Taking sides: The social life of venison in Medieval England. In Pluskowski, A (Ed.) *Breaking and Shaping Beastly Bodies: Animals as Material Culture in the Middle Ages*. Oxford: Oxbow 149-160. **Main Library HISTORY 82 CE PLU**

Watson, J.P.N. (1979). 'The estimation of relative frequencies of mammalian species: Khirokitia 1972'. *Journal of Archaeological Science* 6, 127 -137. **For the 'diagnostic zones' approach.**

Sexual dimorphism

Armitage, P and Clutton-Brock, J (1976). A system for classification and description of the horn cores of cattle from archaeological sites. *Journal of Archaeological Science* **3** 329-348

Clutton-Brock, T., Guinness, F. and Albon, S. (1982). *Red Deer: Behaviour and Ecology of Two Sexes*. Edinburgh: Edinburgh University Press. (see chapters 5, 6 and especially 7). **Science library ZOOLOGY 25 d CLU**

Davis, S (2000). The effect of castration and age on the development of the shetland sheep skeleton and a metric comparison between bones. *Journal of Archaeological Science* **27(5)** 373-390

Greenfield, H. 2006. Sexing Fragmentary Ungulate Acetabulae, in D. Ruscillo (ed), 68-86. *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books **BB 3 Qto RUS**

Hatting, T. (1975) 'The influence of castration on sheep horns', *Archaeozoological Studies* (ed) A.T. Clason. Amsterdam: N Holland Publishing Company. **BB 3 CLA**

- Horwitz, L.K., Cope, C. and Tchernov, E. (1990). 'Sexing the bones of mountain-gazelle (*Gazella gazella*) from prehistoric sites in the southern Levant', *Paléorient*, 16/2, 1-12.
- Grigson, C. (1982). 'Sexing Neolithic domestic cattle skulls and horn cores' in Wilson *et al.* *Ageing and Sexing ... DAA Qto Series BRI 109*
- Mayer, J J and Brisbin, I L (1988). Sex identification of *Sus scrofa* based on canine morphology. *Journal of Mammalogy* **69(2)** 408-412
- Payne, S. and Bull, G. (1988). 'Components of variation in measurements of pig bones and teeth, and the use of measurements to distinguish wild from domestic pig remains', *Archaeozoologia* 2 (1,2) pp27-66.
- Popkin, P, Baker, P, Worley, F, Payne, S and Hammon, A (2012). The sheep project (1): determining skeletal growth, timing of epiphyseal fusion and morphometric variation in unimproved Shetland sheep of known age, sex, castration status and nutrition. *Journal of Archaeological Science* **39** 1775-1792
- Ruscillo, D. (2006). *Recent Advances in Ageing and Sexing Animal Bones*. Proceedings of the 9th ICAZ Conference, Durham 2002. Oxford: Oxbow Books. **BB 3 Qto RUS**
- Sykes, N and Symmons, R (2007). Sexing cattle horn-cores: problems and progress. *International Journal of Osteoarchaeology* **17** 514-523
- Weinstock, J (2000). Osteometry as a source of refined demographic information: sex-ratios of reindeer, hunting strategies, and herd control in the late glacial site of Stellmoor, Northern Germany. *Journal of Archaeological Science* **27** 1187-1195
- Wilson, B., Grigson, C. & Payne, S. (1982). *Ageing and sexing animal bones from archaeological sites*. BAR British Series 109. **DAA Qto Series BRI 109**

Introduction to Identification (the example of separating sheep from goats)

- Boessneck, J., 1970. Osteological differences between sheep (*Ovis aries* Linné) and goats (*Capra hircus* Linné). In: Brothwell, D., Higgs, E. (Eds.), *Science in Archaeology*. pp. 331-358. New York: Praeger. *The classic*
- *Zeder, M. and H. Lapham (2010) Assessing the reliability of criteria used to identify postcranial bones in sheep, *Ovis*, and goats, *Capra*. *Journal of Archaeological Science* 37: 2887-2905

Week 8: Small Mammals in Archaeology

This is the first of three class-specific lectures, detailing the particular methods of identification and analysis that affects our understanding of small and micro mammals from archaeological sites.

- *Brothwell D.R. & Jones R. (1978). 'The relevance of small mammals to archaeology' in *Research Problems in Zooarchaeology*. D.R. Brothwell, K.D. Thomas & J. Clutton-Brock (eds). Institute of Archaeology Occasional Publication No. 3, 47-57. **BB Qto BRO**
- Hillson, S. (2005). *Teeth*. Cambridge: Cambridge University Press. **BB 2 HIL**
- Rackham D.J. (1982). 'The smaller mammals in the urban context: their recovery and interpretation from archaeological deposits' in *Environmental Archaeology in the Urban Context*. A.R. Hall & H.K. Kenward (eds). CBA. 86-93. **Online access through library**
- Stahl, P. (1996). The recovery and interpretation of microvertebrate bone assemblages from archaeological contexts. *Journal of Archaeological Method and Theory*, 3/1, 31-75.
- Yalden, Derek. (2010). *The History of British Mammals*. A&C Black. **Science library ZOOLOGY 25 d YAL**

Taphonomy and Palaeoecology

- *Andrews, P. (1990). *Owls, Caves and Fossils*. London: Natural History Museum Publications. **DAA 410 S.4 AND**

Andrews, P. (1983). 'Small mammal faunal diversity at Olduvai Gorge, Tanzania' in *Animals in Archaeology I: Hunters and their Prey*. J. Clutton-Brock and C. Grigson (eds). BAR International Series **163**, 77-84. **BB 3 Qto CLU**

OR

Fernandez-Jalvo, Y., Denys, C., Andrews, P., Williams, T., Dauphin, Y. & Humphrey, L. (1998). 'Taphonomy and palaeoecology of Olduvai Bed-1 (Pleistocene, Tanzania)'. *Journal of Human Evolution* **34**, 137-172.

Pleistocene Small Mammals and Dating the Earliest Occupation of Europe

Roebroeks W. & van Kolfschoten T. (1994). 'The earliest occupation of Europe: a short chronology'. *Antiquity* **68**(260), 489-503.

Stringer, C.B., Andrews, P. & Currant, A.P. (1996). 'Palaeoclimatic significance of mammalian faunas from Westbury Cave, Somerset, England'. In *The early Middle Pleistocene in Europe*. C. Turner (ed.). Balkema, Rotterdam. 135-143. **DA 4 TUR**

Commensalism

Armitage P.L. (1985). 'Small mammal faunas in later mediaeval towns. A preliminary study in British urban biogeography'. *Biologist* **32**(3), 65-71. (Journal in DMS Watson library)

Armitage P.L. (1994). 'Unwelcome companions: ancient rats reviewed', *Antiquity* **68**(259), 231-240.

OR

Armitage P.L. (1993). 'Commensal rats in the New World, 1492-1992'. *Biologist* **40**(4), 174-178.

Cucchi T. (2008). 'Uluburun shipwreck stowaway house mouse: molar shape analysis and indirect clues about the vessel's last journey'. *Journal of Archaeological Science* **35**(11), 2953-9

Cucchi, T., Vigne, J., Auffray, J., Croft, P., & Peltenburg, E. (2002). Passive transport of the house mouse (*Mus musculus domesticus*) to Cyprus at the Early Preceramic Neolithic (late 9th and 8th millennia cal. BC). *Comptes Rendus Palevol*, **1**(4), 235-241.

*O'Connor, T (2013). *Animals as Neighbors: The Past and Present of Commensal animals*. East Lansing (Mi): Michigan State University Press **BB 3 OCO and online through the library**

Week 9: Birds in Archaeology

The penultimate lecture considers particular methods of identification and analysis that affects our understanding of birds from archaeological sites.

Brothwell, D. (1993). 'Avian osteopathology and its evaluation' in *Archaeofauna 2*, pp.33-43.

Driver, J.C. (1982). 'Medullary bone as an indicator of sex in bird remains from archaeological sites'. in (eds) B. Wilson, C. Grigson and S. Payne *Ageing and Sexing animal Bones from Archaeological Sites*. Oxford: BAR British Series 109, pp.251-254. **DAA Qto Series BRI 109**

Ervynck, A. (1993). 'The role of birds in the economy of Medieval and post-Medieval Flanders: a diversity of interpretational problems' in *Archaeofauna 2*, pp.107-119. [quantification problems].

Gal, E. (2007). Fowling in Lowlands: Neolithic and Chalcolithic bird exploitation in South-East Romania and the Great Hungarian Plain. Budapest: *Archaeolingua*.

Goffette, Quentin; Ervynck, Anton; Van Neer, Wim; 2017. An evaluation of the contribution of avian species to the archaeozoological record of Belgium (Iron Age to recent times). *Archaeological and Anthropological Sciences*; 2017; pp. 1 – 16.

ICAZ Bird Working Group (1993). 'Archaeornithology: Birds and the Archaeological Record', *Archaeofauna Vol 2*. [the proceedings of the first meeting of the ICAZ Bird Working Group in 1992 - lots of interesting papers ... some listed separately here under author].

MacDonald, K.C. (1992) 'The Domestic Chicken (*Gallus gallus*) in Sub-Saharan Africa: A Background to its Introduction and its Osteological Differentiation from Indigenous Fowls (Numidinae and *Francolinus sp.*)', *Journal of Archaeological Science*, 19:303-318.

- MacDonald, R.H., MacDonald, K.C. and Ryan, K. (1993). 'Domestic geese from medieval Dublin', *Archaeofauna* 2, pp.205-218.
- MacDonald, K.C. (1997) The Avifauna of the Haula Fteah (Libya). *Archaeozoologia* 9: 83-102.
- Mannermaa, K. (2008). The Archaeology of Wings: birds and people in the Baltic Sea Region during the Stone Age. Unpublished dissertation: University of Helsinki. **Available online**
- Martin, L., Edwards, Y., and Garrard, A. (2013). Broad Spectrum or Specialized Activity? Birds and tortoises at the Epipalaeolithic site of Wadi Jilat 22 in the eastern Jordan steppe, *Antiquity*, Volume 87, Issue 337, 649-665.
- Serjeantson, D. (1998). Birds: a seasonal resource, *Environmental Archaeology* 3, 23-33.
- *Serjeantson, D (2009) *Birds*. (Cambridge Manuals in Archaeology) Cambridge University Press, Cambridge.
BB 3 SER
- Serjeantson, D. and J. Morris (2011). Ravens and crows in Iron Age and Roman Britain. *Oxford Journal of Archaeology*, 30, 85-107.
- West, B. (1982). 'Spur development: recognising caponised fowl in archaeological material' in (eds) B. Wilson, C. Grigson and S. Payne *Ageing and Sexing Animal Bones from Archaeological Sites*. Oxford: BAR British Series 109, pp.255-261. **DAA Qto Series BRI 109**
- West, B. and Zhou, B-X. (1988). 'Did Chickens Go North? New Evidence for Domestication' in *Journal of Archaeological Science*, 15, pp.515-533.
- Yalden, Derek William, and Umberto Albarella. (2009). *The History of British Birds*. Oxford: Oxford University Press. **Science library ZOOLOGY 25 c YAL**

Bird bone taphonomy

- Ericson, P.G.P. (1987). 'Interpretation of Archaeological Bird Remains: A Taphonomic Approach', *Journal of Archaeological Science*, 14, pp.65-75.
- Livingston, S.D. (1989). 'The Taphonomic Interpretation of Avian Skeletal Part Frequencies'. *Journal of Archaeological Science*, 16, pp.537-547.
- Lyman, R.L. (1994). *Vertebrate Taphonomy*. Cambridge: CUP. **BB 3 LYM and online through the library**

Eggshell

- Keepax, C.A. (1981). 'Avian Egg-shell from Archaeological Sites' in *Journal of Archaeological Science*, 8, pp.315-335.
- Presslee, S., Wilson, J., Woolley, J., Best, J., Russell, D., Radini, A., Fischer, R., Kessler, B., Boano, R., Collins, M. and Demarchi, B., (2017). The identification of archaeological eggshell using peptide markers. *STAR: Science & Technology of Archaeological Research*, 3(1), pp.89-99.
- Sidell, E.J. (1993). A methodology for the identification of archaeological eggshell. *Archaeofauna* 2, 45-51

Week 10: Fish in Archaeology

The final lecture considers particular methods of identification and analysis that affects our understanding of fish from archaeological sites.

<http://fishbone.nottingham.ac.uk/> Archaeological fish resource – a good selection of fish skeletal material

- Brinkhuizen, D. and Clason, A. (eds) (1986). *Fish and Archaeology*. Oxford: BAR International Series 294. **BB 3 Qto BRI** A useful compilation of case studies and taphonomic studies; see esp Jones, Van Neer.
- Casteel, R W (1976). *Fish Remains in Archaeology*. London.: Academic Press **BB 3 CAS**
- Colley, S. (1990). 'The analysis and interpretation of archaeological fish remains' in *Archaeological Method and Theory* vol 2, 207-253.

Grigson, C. and Clutton-Brock, J. (eds) (1983). *Animals and Archaeology: 2. Shell Middens, Fishes and Birds*. Oxford: BAR International Series 183. (papers by von den Driesch, Heinrich, Colley and Noe-Nygaard). **BB 3 Qto GRI**

Harland, J, Barrett, J H, Carrott, J, Dobney, K and Jaques, D (2003). The York System: An integrated zooarchaeological database for research and teaching. *Internet Archaeology* **13**

Jones, A. (1986). Fish bone survival in the digestive systems of the pig, dog and man: some experiments. In D. Brinkhuizen and A. Clason (eds) *Fish in Archaeology*, 53-61 **BB 3 Qto BRI**

Jones, A (1991). The fish remains from Freswick Links, Caithness. *Unpublished Thesis, University of York* **available online** particularly useful for measurements

Nicholson, R. (1993) 'An investigation into the effects on fish bone of passage through the human gut: some experiments and comparisons with archaeological material' *Circaea* 10(1) pp38-51.

Thieren, E., Wouters, W., Van Neer, W. & Ervynck, A. (2012). Body length estimation of the European eel *Anguilla anguilla* on the basis of isolated skeletal elements. *Cybium* 36: 551-562.

Van Neer, Willem; 2004. Evolution of prehistoric fishing in the Nile Valley. *Journal of African Archaeology*, 2(2): 251 – 269.

Wheeler, A. (1978). 'Problems of identification and interpretation of archaeological fish remains', *Research Problems in Zooarchaeology* (eds D. Brothwell, K. Thomas, J. Clutton-Brock), 69-75. London: Occasional Publication No 3 of Institute of Archaeology. **BB Qto BRO**

Wheeler, A. and Jones, A. (1989). *Fishes*. Cambridge: Cambridge University Press. (Best general text book). **BB 3 WHE**

Fish: Environmental and Seasonal Indicators

Casteel, R. (1976). *Fish Remains in Archaeology and Palaeo-environmental Studies*. London: Academic Press. **BB 3 CAS**

Brewer, D. (1991). 'Temperatures in Predynastic Egypt inferred from the remains of the Nile perch', *World Archaeology* 22, 287-303.

Brinkhuizen, D C (1997). Some remarks on seasonal dating of fish remains by means of growth ring analysis. *Internet Archaeology* **3**

Erlandson, J.M. & Rick, T.C. (2010). Archaeology Meets Marine Ecology: The Antiquity of Maritime Cultures and Human Impacts on Marine Fisheries and Ecosystems. *Annual Review of Marine Science* 2: 231-251.

Kettle, A.J., Heinrich, D., Barrett, J.H., Benecke, N. & Locker, A. (2008). Past distributions of the European freshwater eel from archaeological and palaeontological evidence. *Quaternary Science Reviews* 27: 1309-1334.

Mellars, P. and Wilkinson, M. (1980). 'Fish otoliths as indicators of seasonality in prehistoric shell middens: the evidence from Oronsay (Inner Hebrides)', *Proceedings of the Prehistoric Society* 46, 19-44.

Van Neer, W. (1987). A study on the variability of the skeleton of *Lates niloticus* (Linnaeus, 1758) in view of the validity of *Lates maliensis* Gayet, 1983. *Cybium*, 11: 411-425.

Van Neer, W., Lougas, L. and Rijnsdorp, A. (1999). Reconstructing Age Distribution, Season of Capture and Growth Rate of Fish from Archaeological Sites Based on Otoliths and Vertebrae, *International Journal of Osteoarchaeology* 9, 116-130.

Fish: Food and Trade

Barrett, J. (1997). Fish trade in Norse Orkney and Caithness: a zooarchaeological approach, *Antiquity* 71, 616-38. [good for understanding fish preservation]

Barrett, J., A. Locker and C. Roberts (2004). 'Dark Age Economics' revisited: the English fish bone evidence AD 600-1600. *Antiquity* 78, 618-636.

Carder, N. & Crock, J.G. (2012). A pre-Columbian fisheries baseline from the Caribbean. *Journal of Archaeological Science* 39: 3115-3124.

- Coy, J (1989). The provision of fowls and fish for towns. In Serjeantson, D and Waldron, T (Eds.) *Diets and Crafts in Towns: The Evidence of Animal Remains from the Roman to Post Medieval Periods*. London: British Archaeological Reports British Series **199** 25-37 **DAA Qto Series BRI**
- Enghoff, I.B. (1996). A medieval herring industry in Denmark - the importance of herring in Eastern Denmark. *Archaeofauna* 5: 43-47.
- Enghoff, I.B., MacKenzie, B.R. & Nielsen, E.E. (2007). The Danish fish fauna during the warm Atlantic period (ca. 7000-3900 bc): Forerunner of future changes? *Fisheries Research* 87: 167-180.
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- Lauwerier, R.C.G.M. & Laarman, F.J. (2008). Relics of 16th-century gutted herring from a Dutch vessel. *Environmental Archaeology* 13: 135-142.
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Online Resources

This handbook, all module information and an extended online reading list can be found on Moodle.

You may wish to join the ZOOARCH e-mail list, which is an international forum for discussing zooarchaeological issues, or just keying into debates or employment opportunities. To join the list, e-mail a message to jiscmail@jiscmail.ac.uk stating:

join zooarch firstname lastname

Libraries and other Resources

The Institute of Archaeology library provides much of the source material for this module, although UCL's Science Library (in particular, Zoology, Biology and Anthropology holdings) should also be consulted. The IoA library has developed a series of library skills videos, which can be found online: <http://www.ucl.ac.uk/archaeology/about/library/skillsinseconds>, or on the ipad in the IoA library.

For the practical element of the module students will primarily work with the Zooarchaeology Reference Collections, housed in room 308 of the Institute of Archaeology, although they are also encouraged to visit other collections (such as UCL's Grant Museum of Zoology, Royal College of Surgeons, Hunterian Collection, Natural History Museum), particularly to undertake focused projects.

Zooarchaeology at the Institute of Archaeology

The Institute of Archaeology has excellent facilities for studying zooarchaeology. The comprehensive teaching collections allow for the study of European vertebrate faunas, and more specialized research collections exist for Eurasian large mammals. The Grant Museum of Zoology in UCL also has extensive collections, and can be visited by arrangement. In addition, the major national research collections for all animal classes are housed in or near London (e.g. the British Museum - Natural History, the Natural History Museum Bird Section at Tring, the Ancient Monuments Laboratory collections at English Heritage – situated in Portsmouth); the Institute of Archaeology has close links with all of these institutions.

The Institute's laboratories provide a variety of equipment for application to zooarchaeology including light microscopes, SEM, LINK, Fourier-transform infra-red spectroscope (FTIR) and an electron microscope.

Information for intercollegiate and interdepartmental students

Students enrolled in Departments outside the Institute should obtain the Institute's coursework guidelines from Judy Medrington (email j.medrington@ucl.ac.uk), which will also be available on Moodle.

Health and safety

The Institute has a Health and Safety policy and code of practice which provides guidance on laboratory work, etc. This is revised annually and the new edition will be issued in due course. All work undertaken in the Institute is governed by these guidelines and students have a duty to be aware of them and to adhere to them at all times. This is particularly important in the context of the *laboratory/field/placement* work which will be undertaken as part of this module.

Institute of Archaeology Coursework Procedures

General policies and procedures concerning modules and coursework, including submission procedures, assessment criteria, and general resources, are available on the IoA Student Administration section of Moodle: <https://moodle.ucl.ac.uk/module/view.php?id=40867>. It is essential that you read and comply with these. Note that some of the policies and procedures will be different depending on your status (e.g. undergraduate, postgraduate taught, affiliate, graduate diploma, intercollegiate, interdepartmental). If in doubt, please consult your module coordinator.

GRANTING OF EXTENSIONS: Note that there are strict UCL-wide regulations with regard to the granting of extensions for coursework. Note that Module Coordinators are not permitted to grant extensions. All requests for extensions must be submitted on a the appropriate UCL form, together with supporting documentation, via Judy Medrington's office and will then be referred on for consideration. Please be aware that the grounds that are acceptable are limited. Those with long-term difficulties should contact UCL Student Disability Services to make special arrangements. Please see the IoA Student Administration section of Moodle for further information. Additional information is given here <http://www.ucl.ac.uk/srs/academic-manual/c4/extenuating-circumstances/>