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1. Zooarchaeology in the 21st century: where we come from, where we are now, and where we are going

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Abstract

After more than a century of steady growth, zooarchaeology has finally started fulfilling its full potential. The recognition of the centrality of zooarchaeological investigations in archaeology represents the most important, and hopefully enduring, development. Zooarchaeology remains, however, ultimately inter-disciplinary and cannot be pigeon-holed within either Science or Humanities. Zooarchaeologists use a multitude of approaches, and can contribute to virtually all aspects of our investigations of past human life, ranging from social structure, to economy, diet, ecology, ideology and religion. The discipline has now developed a set of well-established methods, whose widespread use enhances data comparability. It is, however, important that the research strategies and approaches of zooarchaeologists remain dynamic and open to constant scrutiny. Zooarchaeology is today also highly international, enjoying a very healthy level of open communication and exchange of ideas. There is, however, the need to reach out to areas where the discipline is still underdeveloped, as those will generate new stimuli as well as research opportunities.

Keywords: Zooarchaeology, Archaeozoology, Archaeology, Inter-disciplinarity, Methodology, Internationality, ICAZ.

Introduction

Zooarchaeology is today a thriving area of archaeological research, well recognised for the vitality of its community of researchers and the depth and breadth of its approaches. A long and bumpy road had, however, to be negotiated to get to that point and there is still some way to go. This chapter introduces a volume that is intended to present an overview of world zooarchaeology, covering a multitude of geographic areas, cultural periods, approaches and themes. In this introduction I will present my personal view on the current state of play in zooarchaeology, with some considerations regarding the nature of the discipline, its roots and its potential.

What is zooarchaeology?

Definitions never work entirely, but it is probably not outrageously wrong to consider zooarchaeology as 'the study of animal remains from archaeological sites'. Exceptions can of course exist - e.g. animal footprints should be considered within the remit of zooarchaeology, some non-anthropogenic sites may also produce relevant finds - but the bulk of zooarchaeology is probably covered by that definition. What is more interesting of the ultimate definition is, however, a consideration of what that implies. 'Animal remains' are hugely varied in their nature, size and composition, yet a lot of zooarchaeology deals with just bones and teeth - the remains of vertebrates. It would, however, be wrong to confine the discipline to such finds, as invertebrates are also animals, and have an important potential in archaeology. Nevertheless, traditions and thematic investigations inevitably contribute to shape a discipline, so you will find that entomological studies only feature marginally in this volume, as they tend to be more commonly associated with more strictly palaeoenvironmental investigations. The same is the case for the study of land snails, but marine molluscs - part of the same phylum - are more commonly studied in conjunction with

vertebrate remains. Consequently, they contribute significantly to this volume, and not just as a potential source of food (see for instance Daniela Klokler's chapter).

As important as the consideration regarding what actual material zooarchaeologists study is the concept that the zooarchaeological evidence derives from 'archaeological sites'. Zooarchaeology is no more (and no less) than one aspect of archaeology (O'Connor, 1998). Archaeology deals with the physical remains of our past, and zooarchaeology analyses the remains of animals that contributed to characterise human life. As such the distinction between the sister disciplines of palaeontology and zooarchaeology is obvious - while palaeontologists will focus on the animals themselves, zooarchaeologists investigate their relationships with humans.

It is for this reason that we have chosen, for the title of the book, to use the term 'zooarchaeology', rather than 'archaeozoology', as the former places its emphasis on the archaeological side of the discipline, and therefore more properly defines it. The issue of which is the better term has been lingering long in the literature (e.g. Legge, 1978) but, in reality, both expressions are widely accepted and used, and their adoption is mainly the result of different scholarly traditions (cf. Bartosiewicz, 2001; Steele, 2015). It would have been churlish to be strict about the adoption of a single term, and it is therefore appropriate, for a volume that intends to promote diversity, that contributors were given the freedom to use 'zooarchaeology' or 'archaeozoology' as they saw fit.

It is also useful, and far more than a merely semantic exercise, to reflect on the position of zooarchaeology within archaeology. There is no question that animal remains represent what is left of what once were living organisms, and it is therefore appropriate to consider zooarchaeology within the realm of 'bioarchaeology'. The categorisation is, however, not particularly useful, and is made more problematic by the common, and unfortunate, use in American literature of the term 'bioarchaeology' to indicate the study of

human bones from archaeological sites (e.g. Spencer Larsen, 1999; Martin et al., 2013). Humans are of course animals and the study of their remains has much to share with zooarchaeology, but in terms of approaches and nature of the evidence, zooarchaeology and 'human osteoarchaeology' (a better term than 'bioarchaeology') tend to represent separate, although related, sub-disciplines.

More problematic is the frequent categorisation of zooarchaeology as part of 'environmental archaeology', particularly, but not only, in British literature. The understanding and reconstruction of palaeoenvironments where people lived is well within the remit of zooarchaeology, but there is much more to zooarchaeology than environmental analysis, and therefore the classification of zooarchaeology as part of environmental archaeology is misleading; it is rather the product of a common misconception regarding what environmental archaeology is (cf. Albarella, 2001; Thomas, 2001; Wilkinson and Stevens, 2003). As mentioned above, aspects of zooarchaeology that are more strictly palaeoenvironmental have had a tendency to develop into independent research strands.

If we accept the definition found in the Encyclopaedia Britannica of science as "knowledge of the world of nature" then it necessarily follows that zooarchaeology is a scientific discipline. The investigation of the natural world, of which human communities are part, is central to the concern of zooarchaeologists, but they also investigate the cultural attitude and behaviour of human societies towards animals - and therefore they operate within the realm of 'humanities'. Zooarchaeology represents a primary example of the inter-disciplinarity of archaeology, a discipline that constantly operates at the intersection between nature and culture. Some of the chapters of this book may lean more towards a scientific or a humanities approach, but never exclusively so.

Animals are a ubiquitous and important presence in all aspects of human life and, consequently, zooarchaeology can contribute to almost any strand of archaeological

investigation (Steele, 2015). Although this should be obvious, this is a concept that has proven strangely difficult to put across, with zooarchaeology often ghettoised to rather limited (and limiting) research themes. Although animal remains had already caught the interest of archaeologists already by the 19th century, the persistence of an antiquarian tradition in archaeology meant that, for many decades, there was limited interest in zooarchaeology, particularly as concerned the historical periods. Zooarchaeology, like other bioarchaeological disciplines, was relegated to the notorious 'appendix'. The emergence of the so-called 'processual', or 'new', archaeology in the late 1960s and 70s, with its focus on human behaviour and an anthropological approach to archaeology, led to an enhanced attention to the role that animals played in human societies. The downside was the frequent excessive focus on taphonomic (e.g. Binford, 1981) and/or economic and ecological (e.g. Higgs, 1972; 1975) aspects, to the detriment of other lines of investigation (and interpretation). Other research schools that started emerging in the 1980s (broadly defined as 'post-processualism') pointed out this fault of the New Archaeology, and emphasised the need to pay greater attention to the social and ideological components of human society. Paradoxically, and unnecessarily, this became a battle between 'nature' and 'culture' approaches to archaeology, with zooarchaeology becoming sidelined, or even ending up being considered some kind of backwards burden to the development of this new conceptual approach in archaeology (cf. Thomas, 1990). Zooarchaeologists reacted rather slowly to this new challenge, but eventually the concern caught up with them and the last decade has seen a new strand of zooarchaeology focusing more on social aspects (e.g. Marciniak, 2005; Russell, 2012; Overton and Hamilakis, 2013). Commendable as such attempt it is, it also carries the risk of re-emphasising once again the old and false dichotomy between 'nature' and 'economy' on the one hand and 'culture' and 'society' on the other - merely seen from the opposite viewpoint.

The warning of the post-processualists to avoid purely mechanistic interpretations in zooarchaeology was welcome, but the reality is that the portrayal of the zooarchaeologist as an environmental determinist is largely caricatural. Examples of zooarchaeological approaches - even from decades ago - which, in addition to the ecological and economic elements, deal with issues related to the structure of a society, as well as its cultural preferences, religion and ideology, abound (e.g. Reitz, 1987; Grant, 1988; Ijzereef, 1989; Meniel, 1989). A mere browse of the chapters included in this book will demonstrate that ecological, economic, social and ritual elements cannot be neatly separated in archaeological interpretations, as they all play a role in the shaping of human societies. Animals contribute to all of them and zooarchaeology today is at the forefront of a new integrated approach to archaeological interpretation, which will hopefully once and forever overcome the artificially constructed divisions of the past.

The reason why zooarchaeology can be in this prime position is due to its inter-disciplinary nature. Zooarchaeologists have familiarity with both biological and cultural phenomena and, as such, feel at ease in communicating with scholars across different disciplines. It is not uncommon for zooarchaeological interpretations to consider evidence from disciplines as disparate as ethnography, history, architecture, arts, genetic, bio- and geochemistry and many others (for a range of interesting examples see Maltby, 2006; more evidence can be found in this volume).

What has also been emerging more and more powerfully in the past few years is the potential of zooarchaeology to inform on issues of relevance to the contemporary world. The volume by Lauwerier and Plug (2003) is a prime example of how nature conservation and heritage management issues can be productively informed by zooarchaeological evidence, but there are other cases in point (e.g. Lyman, 1996; Lyman and Cannon, 2004). Additionally, ethnographic work, aimed at addressing zooarchaeological questions, is

highlighting the cultural and ecological merits of various forms of traditional husbandry, as well as the value of traditional domestic breeds, many of them today rare or on the verge of extinction (Albarella et al., 2007; Albarella et al., 2011; Hadjikoumis, 2012).

Zooarchaeology: methods and approaches

In order to address broader research enquiries in archaeology, zooarchaeologists have had to develop methods and research strategies to answer questions relevant to the more specific evidence they analyse. Although these questions have been refined and developed over the years, the core lines of investigations have remained the same. Like in the earlier days of the discipline, zooarchaeologists will want to know about which animals are represented in a certain assemblage, which parts of their carcasses, the age and sex make-up of the populations, the size and shape of the animals, the occurrence of any pathological conditions, and the evidence of human-induced modifications of the bones, such as butchery or burning. A more recently developed technique, tooth microwear analysis (e.g. Mainland, 1998), has also provided the opportunity to collect some evidence regarding the nature of animal diet, which can be very useful for a better understanding of the forms of animal management, as well as the range of habitats used by both domestic and wild species. Examples of all, most, or at least some, of these investigations can be found in all chapters in this book. The diversity of emphasis that is placed on different strands of evidence in each chapter typifies geographic regions, chronological and cultural periods, research themes and/or the interests and expertise of different contributors.

Although the issue was neglected in the early days of zooarchaeology (and can still be, in some unfortunate situations) zooarchaeologists have for quite some time been aware that their interpretations must rely on an understanding of the processes that led to the formation of the assemblages they study (Schiffer, 1987). Therefore, modifications of the

animal remains, such as those caused by scavengers and various natural agents before and after burial, are also important to observe and record systematically. Evaluations of issues such as preservation and fragmentation can be important for a reconstruction of the history of an assemblage, as well as an understanding of the biases that will affect the evidence. Since the pioneering work carried out by Payne (1975) there has also been increasing awareness of the effect that recovery bias can have on the frequency of species, body parts, age and sex categories (e.g. Gamble and Bailey, 1994). Potentially this is the greatest bias that can affect an assemblage. In theory it can be controlled during archaeological excavation, for instance through a carefully considered sieving programme, but, in practice, it only occasionally is. Zooarchaeologists, however, have developed various systems that allow them to assess the degree of recovery bias. They cannot retrieve information that has been lost but they can at least assess the magnitude of the error. There are still unfortunate cases in which the issue is entirely ignored - inevitably leading to spurious interpretations - but is heart-warming to see how strongly a discussion of recovery bias features in many chapters of this book.

The maturity of the discipline cannot be better demonstrated than by the availability of not one, but a plethora of textbooks outlining the key principles and methods of zooarchaeology (Cornwall, 1956; Ryder, 1968; Chaplin, 1971; Klein and Cruz-Uribe, 1984; Hesse and Wapnish, 1985; Davis, 1987; Rackham, 1994; Reitz and Wing, 1999; O'Connor, 2000; De Grossi Mazzorin, 2008; Matsui, 2008; Beisaw, 2013). Some of these have also been translated in other languages - for instance Davis' book, originally in English, has long been available in a Spanish version and recently has been translated into Korean. In addition, zooarchaeology has benefitted from a number of papers highlighting the main potential pitfalls in the interpretation of animal remains (e.g. Payne, 1972; Uerpmann, 1973; Meadow, 1980), which have been instrumental for the appropriate methodological development of the discipline. Identification atlases have long been available - e.g. Schmid (1972) and Hillson

(1992) for European mammals, Miles Gilbert (1993) for American mammals, Walker (1985) for African mammals, Cohen and Serjeantson (1996) for European birds, Miles Gilbert et al. (1985) for American birds - and have now been supplemented with new productions (e.g. Yamazaki and Uyeno, 2008; Bocheński and Tomek, 2009; Plug, 2014a) as well as web-based online sources (e.g. ArchéoZooThèque http://archeozoo.org/archeozootheque for mammals, Aves 3D http://aves3d.org/ for birds and the Archaeological Fish Resource http://fishbone.nottingham.ac.uk/). None of these can of course replace skeletal reference collections, whose importance is widely acknowledged (e.g. Coy, 1978; Henry, 1991), and which represent key magnets of activity for some institutions, despite the challenge of ever shrinking research budgets.

In other areas of investigation zooarchaeology has also well-established methodological procedures. For tooth ageing the works of Payne (1973) and Grant (1982) are widely used and new methodological developments have also been put forward (e.g. Jones and Sadler, 2012; Lemoine et al., 2014; Wright et al., 2014). Biometrical analysis has hugely benefitted from the standardisation of measurements proposed by von den Driesch (1976) for mammals and birds, and Morales and Rosenlud (1979) for fishes. Both are almost universally used, without, however, stifling further considerations regarding which measurements should be taken and why (e.g. Payne and Bull, 1988; Wheeler and Jones, 1989; Davis, 1996; 2000; Albarella and Payne, 2005; Popkin et al., 2012). In terms of biometrical data analysis, the current easy access to statistical and graphics computer packages has immensely facilitated the work of the zooarchaeologist, and the ever growing application of scaling index techniques (Ducos, 1968; Uerpmann, 1979; Meadow, 1999; Albarella, 2002) is contributing to address the common problem of small sample size. Shape analysis in the form of the so called ‘geometric morphometrics’, a technique long used by biologists and palaeontologists (e.g. Bookstein, 1991), has made some inroads in zooarchaeology (e.g. Bignon and

Eisenmann, 2006). Useful as it is, this method is time-consuming and requires expensive equipment. Most importantly it needs to be built on a solid understanding of the potential of linear measurements, something that current scholarship has often shied away from - see Rowley-Conwy and Zeder (2014) for an effective critical analysis of the risks of a superficial application of the technique, combined with palaeogenetics, with insufficient understanding of basic biometry.

In palaeopathology, the classic work of Baker and Brothwell (1980), which has been intensively used by generations of zooarchaeologists, has now finally been complemented by a new textbook on the subject (Bartosiewicz with Gal, 2013), which undoubtedly will prove to be equally useful. Miles and Grigson's (1990) survey of tooth conditions represents a very useful reference for the identification of dental pathologies.

In summary, the literature on zooarchaeology methods that exists today is vast, and students and new trainees are spoilt for choice in terms of accessible resources. This is all made easier by the availability of much information through 'open access' and, in general, on the web. In fact, the young zooarchaeologist has today the opposite problem to that faced by my generation - rather than a scarcity of information, over-abundance. It is therefore necessary to skilfully plough your way through an extensive literature, applying critical thinking in the distinction of what is useful from what is redundant.

Further indication that the discipline of zooarchaeology has now reached its full maturity is demonstrated by the fact that debate on the adoption of 'minimum standards', which still raged in the late 1980s, now appears to be a thing of the past. Data comparability is very important, but this cannot be achieved through the imposition of standard methods of recording and analysis that would stifle creativity and reduce the work of the zooarchaeologist to that of a mere technician. Rather, we need to carry on refining our methods, making them accessible and affordable to as many practitioners as possible.

Comparability can also be greatly enhanced by the constant encouragement to fully explain the adopted methods, to improve both accountability and the opportunity to compare datasets appropriately. Assemblages of animal remains are hugely varied in their composition and may require substantially different approaches, which are also dependent on logistic conditions such as available time and money. It should also be right for a zooarchaeologist to approach the study of an assemblage in an original and personal way, driven by specific research interests and questions. The study of a zooarchaeological assemblage represents an intellectual undertaking rather than a mechanical collection of data. It is for this reason that it is essential that assemblages are preserved for future use - they can be read in a number of different ways, emphasising either one aspect or the other. The notion that an assemblage, once studied, can be preserved by record is not only wrong, but supremely arrogant.

It is with such awareness that the International Council of Archaeozoology (ICAZ) drafted a "professional protocol", which is represented by a set of useful recommendations rather than prescriptive or detailed procedures (Reitz, 2009 http://alexandriaarchive.org/icaz/pdf/protocols2009.pdf). New systems for the recording and analysis of animal remains keep being published (e.g. Schibler, 1998), and this is to be welcomed, as it provides opportunities for new researchers to get a starting point, and for experienced ones to reconsider their systems and priorities. What remains essential is that diversity of approaches is not sacrificed on the altar of data comparability.

One methodological area in which more reflection is required in zooarchaeology regards the only apparently simple task of counting and recording. I am carefully using my words here as I do not mean 'quantification', which has, conversely, been amply debated (e.g. Grayson, 1984; Lyman, 2008). All quantification systems, however, rely on what is recorded and counted and in that area we still have a great level of ambiguity in zooarchaeology. It may be useful to debate about the virtues and problems of systems such as

the Number of Identified Specimens (NISP) and the Minimum Number of Individuals (MNI), but if we are not sure about what a 'specimen' is, the whole quantification edifice collapses. Many years ago Watson (1979) tried to circumvent this problem by proposing the recording of 'diagnostic zones', a system that, with substantial differences and modifications, has been adopted by many zooarchaeologists (e.g. Serjeantson, 1991; Davis, 1992; Albarella and Davis, 2010), who still, however, probably represent a minority. This is not the place to go into a detailed discussion of this issue, but I remain disconcerted by the fact that a discipline that has made such huge progress in the critical evaluation of how it operates, is prepared to leave the definition of what it records and counts to the vagaries of variables such as the skill of the researcher, time pressure, light conditions, tiredness, completeness of a reference collection, the identifiability and preservation of the material, and many others.

Today zooarchaeologists can also benefit from a level of analysis that goes beyond the macroscopic level. The study of amino acid peptides has proved its usefulness in taxonomic identifications (Buckley et al., 2010) and it is developing as a valuable technique to use in conjunction with macroscopic identifications. Isotopic studies are helping in clarifying issues associated with animal diet (e.g. Pearson et al., 2007), seasonality (e.g. Balasse, 2003), palaeoclimates (e.g. Stevens and Hedges, 2004) and mobility (e.g. Towers et al., 2010; Viner et al., 2010; Minniti et al., 2014), all areas in which traditional zooarchaeological approaches can helpfully be integrated by other lines of evidence.

Studies of the DNA of modern animals have contributed to our understanding of the variability of animal species and populations (Luikart et al., 2001; Larson et al., 2005; Bruford and Townsend, 2006), therefore throwing some light also on their evolution and past history. Palaeogenetic applications are more problematic due to potential issues of preservation and contamination (Geigl, 2008; Pruvost et al., 2008), but can be very effective as they will offer direct evidence of the genetic make-up of past animals. The volume by

Zeder et al. (2006) provides a good summary of the interplay between zooarchaeologists, geneticists and palaeogeneticists in tackling the study of animal domestication. This is an area of research that has seen rapid development, but has its downside too. The broad scale approach that is often characteristic of palaeogenetics may lead to the risk of over-simplifications, and much genetic work has been insufficiently or inappropriately integrated with archaeological analysis. We must also be careful not to rush to conclusions that may be a consequence of erratic sampling. For instance, the issue of the nature of the introduction of cattle domestication into Europe, which appeared to have been solved through palaeogenetic analysis, has then proved to be far more complex than originally thought, once the sample size was increased (cf. Troy et al., 2001; Beja-Pereira et al., 2006; Edwards et al., 2007; Mona et al., 2010).

Most of the palaeogenetic work carried out so far in zooarchaeology deals with mitochondrial DNA, which is present in greater abundance in a cell, and it has therefore better chances of survival. Improvements in extraction and replication techniques have, however, meant that palaeogeneticists have also, in some cases, managed to access nuclear DNA. In addition to further information on the characteristics of an animal genotype (which, unlike mitochondrial DNA, is not transmitted exclusively matrilinearly) the nuclear DNA can also help in sexing specimens, a highly valuable type of information, when coupled with morphometric analysis (for applications see Svensson et al., 2008; Davis et al., 2012).

In order to adhere to the principle of integration, for this volume we did not commission any chapter to deal specifically with biochemical evidence. The evidence from DNA and isotopes is, however, discussed in many contributions, in conjunction with the rest of zooarchaeology.

The internationality of zooarchaeology

One of the most impressive achievements of zooarchaeology has been its ability to develop as a worldwide discipline, with a high level of exchange and communication between researchers from all corners of the world. This internationality has been promoted, to a substantial extent, by the work of the International Council of Archaeozoology (ICAZ), which is an important reference organisation for zooarchaeologists. With its quadrennial international conferences, the meeting of its Working Groups, and a plethora of other activities, ICAZ has for many years guaranteed that zooarchaeologists from across the world had a common house, which would support the exchange of data and ideas, as well as diversity and inclusiveness. It is such internationality that this book wants to celebrate.

ICAZ has a very interesting history and, by following it, we can gain a sense of the overall development of zooarchaeology as a discipline. The first ICAZ international meeting was held in Budapest in 1971 (Grigson, 2014), which may mean little to researchers of the latest generations, but it is very significant when one thinks that this was the time of the 'Iron Curtain' when communication between the East and West of Europe (and, to some extent, the world) could be strained. Hungary was of course under Soviet influence but this did not prevent western researchers from attending and contributing to the take-off of the organisation. Thus, from its early days, zooarchaeologists demonstrated their determination to join forces despite the many economic, cultural and political barriers that existed between them. The following years would see many more examples of such attitude.

For several decades ICAZ kept to a relatively small scale but the London 1982 conference organised by Juliet Clutton-Brock and Caroline Grigson was attended by more than a hundred delegates (Grigson, 2014). By the time of the 1994 conference in Constance (Germany), it was clear that the organisation had grown to the point that the informality of its early days had become insufficient to guarantee transparency and efficiency. A more formal structure, with proper membership, elected officers and committee members, had to be set up.

Over the years, the composition of the committees has invariably been highly international, with representation from all continents. The main conferences have also moved around across the continents, with two of the last three being held in Latin American countries, and the next one (2018) planned to take place, for the first time, in Asia.

Another important milestone of the 1994 conference was the move away from the adoption of ICAZ 'official languages'. It became clear that the concept was impractical and unsuited to the ethos of inclusiveness that ICAZ was increasingly keen to promote. This idea took a further step forward when Keith Dobney, Peter Rowley-Conwy and myself organised the 9th ICAZ conference in Durham (UK) in 2002. It was decided that the conference itself would not have official languages, with contributors free to speak in whatever language they preferred, ranging from Swahili to Urdu (as long as the paper abstract was in the same language, to warn the audience of what to expect). Eventually, several hundred presentations were delivered - all in English - a triumph for freedom of expression, respect of other cultures and … common sense! The 2002 conference also saw the introduction of the concept that conference sessions would be centred on research themes, rather than chronological periods or geographic areas, in order to promote greater exchange between researchers from different parts of the world. The idea was so successful that it has become a constant feature of all successive ICAZ conferences.

The ICAZ 2010 Paris conference organised by Jean-Denis Vigne, Christine Lefèvre and Marilène Patou became the largest aggregation of zooarchaeologists ever known, with more than 700 delegates from 56 countries (Vigne and Lefèvre, 2010). Equally impressive was the achievement of the 2014 ICAZ conference in San Rafael (Argentina), which, despite being held in what by many would be regarded as a remote place (on the verge of Patagonia), still attracted a large international crowd. Personally, I regarded the conference in Argentina as a triumph. In the occasion of the Durham conference I had become extremely impressed

by the very good number of Argentinian colleagues who had attended, in the very year - 2002 - the country had experienced a serious economic crash. Once again, zooarchaeologists had shown great resilience in the face of adversity. That experience convinced me that sooner or later a conference in Argentina was due.

ICAZ alone cannot sustain full responsibility for the internationalisation of zooarchaeology and it is, fortunately, well supported by other initiatives, which facilitate exchange and communication. Prominent among these is the role carried out by BoneCommons (http://www.alexandriaarchive.org/bonecommons/). Part of the Alexandria Archive Institute and managed by Sarah Whitcher Kansa, BoneCommons, as specified in its heading, is "an online community, building and sharing resources for archaeozoology". Working in close collaboration with ICAZ, this resource has, for many years, proven its worth, once again encouraging participation and promoting a sense of mutual aid in zooarchaeology.

Complementary to BoneCommons is the email discussion list Zooarch (https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=ZOOARCH). Founded in 2000 by Jacqui Mulville and myself, and counting almost 1,200 subscribers, Zooarch was regarded to be the most valuable communication tool in zooarchaeology in a survey undertaken by Jim Morris (Morris, 2010). In addition, Morris himself has created the zooarchaeology version of a social network (http://zooarchaeology.ning.com/), which has also proven to be most helpful, and it is widely used, especially by the younger generation of zooarchaeologists. What is heartening is that all these resources operate in an excellent spirit of collaboration, helping and supporting each other, and joining forces in promoting zooarchaeology worldwide.

Despite there is much to be cheered regarding the huge forays that zooarchaeology has made in guaranteeing participation from all areas of the world, there are still considerable challenges ahead. However widespread zooarchaeology is, the bulk of its practitioners are

still concentrated in the wealthiest areas of the world, with the north-south divide being particularly striking. Progress has been made, particularly in South America, but large parts of Africa (cf. Plug, 2014b) and Asia still lag behind, inevitably as a consequence of the inequality of wealth distribution in the world. Although we may have come to accept this as normality, there is something disturbingly wrong with the notion that countries such as France or the UK have many dozens of active researchers in zooarchaeology and Nigeria and Bangladesh, which are about three time as populous, have none, or at least very few (no ICAZ members). We are moderately satisfied with the fact that two of our eight chapters dealing with Asia and three of eight dealing with Africa are written by researchers based in those continents, but, sadly, our book also reflects the imbalance in the distribution of research and researchers across the globe.

An additional, and increasingly serious, obstacle to international participation is represented by limitations that may occur in crossing borders. In the age of free circulation of goods ('free trade'), it is ironic that more and more barriers exist in the movement of people between countries. The Middle East, a traditional area of prime zooarchaeological research, is ravaged by wars, which generate constant misery in the local populations and prevent them from becoming engaged in academic activities. Several countries in that part of the world (and others) are today no-go areas, preventing therefore the promotion of cultural activities, with the consequent risk that their future is jeopardised too. The zooarchaeological community has come of age also in dealing with these issues. Conferences have in some cases provided restricted or no access to delegates of certain nationalities - which is very much against the spirit of free circulation of ideas that our research community endorses. Once again the zooarchaeological community has responded to these challenges with maturity and, rather that burying its head in the sand, has been prepared to discuss these issues openly, trying to find reasonable solutions to intractable problems. A robust discussion

was held on Zooarch (see archives at https://www.jiscmail.ac.uk/cgi-bin/webadmin?A0=zooarch) regarding the organisation of the meeting of the Archaeozoology of Southwest Asia (ASWA) ICAZ Working Group, first in Abu Dhabi and then Israel. The debate continued for several years and was also featured in ICAZ newsletters, which can be downloaded from the ICAZ webpage at http://www.alexandriaarchive.org/icaz/publications-newsletter (Bartosiewicz, 2011; Kolska Horwitz, 2011; Albarella, 2012).

The future

Zooarchaeology has a rich history, a bright and exciting present, and an unpredictable future. Zooarchaeologists have come a long way from the days when their research was just regarded as an addendum to the core of archaeological investigations, as can be attested, in a diversity of styles and approaches, by contributions to this book. It would be unwise, however, to rest on our laurels, as there are many important challenges that still need to be tackled. Below is a very personal excursus of some of the areas in which, for the better or worse, I think the future of zooarchaeology will be decided:

- The excitement associated with the opportunities offered by new, lab-based, sophisticated techniques should not make zooarchaeologists neglect the roots of their original work, and the constant methodological advances that it requires.
- Zooarchaeologists have been excellent at providing - as much as the context allowed them - equal opportunities to their practitioners. The overwhelming majority of zooarchaeological work is today still undertaken on very limited budgets. To develop zooarchaeology in directions that are unaffordable to most would mean to create a fracture in the research community between the elected few and a majority left behind - ironically replicating the current ills of world society. This would be regrettable and inconsistent with the aims of a discipline that claims to be inclusive.

- The current world economic creed is unsympathetic to research that does not have direct application to industrial production or other money-making enterprises. The expectation is that the years ahead will be lean, with many academic departments, museums and commercial units likely to close their business. Solidarity and reciprocal support, rather than competition, can help us in getting through such difficult times. Zooarchaeologists have done it before.
- Training in zooarchaeology will remain a challenge, with some countries imposing enormous tuition fees, which are increasingly unaffordable for many. It will be important to fight this trend and provide opportunities outside the more traditional academic courses. Community-based learning has great potential and may develop well beyond the training of amateurs.
- Large-scale skeletal reference collections are essential for good quality zooarchaeology work, but they require such a huge investment in time and money that is impracticable to think that there can be very many of them. Those institutions holding reference collections have the opportunity to promote them as regional centres of research, where zooarchaeologists can congregate and contribute to their development in exchange for freedom of access. Charging for the use of reference collections goes against this spirit, and should be resisted.
- Zooarchaeologists should continue championing inter-disciplinarity by maintaining a good level of communication with other archaeologists, as well as scholars from other disciplines. For this to be sustained it is also important that the community of zooarchaeology will preserve its diversity in terms of both backgrounds and interests. Zooarchaeology has now rightly affirmed its position at the core of archaeological enquiry, but this should not occur at the expenses of a loss of biological knowledge. Zooarchaeologists with a biological background remain an important asset in

zooarchaeology and the risk for animal remains to be interpreted devoid of the living creatures they once belonged to should definitely be avoided.

- Zooarchaeologists should continue exploring the impact they can make on our understanding of contemporary society, making clearer that they possess unique and essential information on the history and composition of the world in which we live.
- Zooarchaeology needs the intellectual and cultural input that comes from the developing world, as well as from the least privileged members of society. Much of the future of the discipline will depend on its ability to fight the tyranny of the direct proportionality currently existing between monetary wealth and intensity of research. As a generous, inclusive and supportive community of researchers, zooarchaeologists are in a prime position to achieve that objective.

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