Environmental archaeology and zooarchaeological research at Nogara, "Basso Veronese", Northern Italy

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Abstract
This paper focuses on the medieval site of Nogara in the "Basso Veronese" in Northern Italy. Environmental archaeology has been included in project planning from an early stage, ensuring establishment of rigorous recovery systems including wet-sieving and flotation for animal and plant remains. Nogara is a wet site, with excellent preservation due in some cases to waterlogging. Excavation of layers dating to c. 9th-11th c. has yielded many thousands of hand-collected bones and sieved fragments, including a large component of wild mammals birds, and fish. The settlement is documented in the ecclesiastical archives and of interest is the strong monastic influence in the area (in particular exploitation of the forest and wetlands), in addition to the process of "incastellamento". The site and preliminary faunal information are considered in relation to cultural influences and transformations and previous zooarchaeological research in the Veneto and across Northern Italy.

Introduction
Nogara is an early medieval site located in Northern Italy, in the "Basso Veronese", south of Verona. Systematic exploration and open area excavations have been undertaken since 2003 under the direction of Drs. Gianpietro Brogiolo (Scientific Director, Universita' di Padova), Fabio Saggioro (Universita' di Padova/Verona) and Alberto Manicardi (Societa' Archeologica Padovano, SAP). The excavations have yielded evidence of early medieval settlement, including buildings, hearths, enclosures, vines and numerous animal and plant remains, much of which is covered by thick layers of "dark earth". The site is almost unique in Italy as it is a wet site, and preservation is excellent due to water-logging in some parts. In addition, the settlement is referred to in numerous ecclesiastical archives of the 9th-11thcenturies (Saggioro 2003). These show the exploitation of woodland and wetlands surrounding Nogara in the early medieval period.

Environmental archaeology has been integrated into the project from an early stage. Hundreds of environmental samples have been recovered, yielding rich assemblages of plant and animal remains (Baker in prep). Two pits filled with fruit remains are of particular interest, as is the recovery of two intact gourds and the presence of a line of vines. Initial botanical analysis has also identified the possible use of leaf litter. In addition, in 2006 detailed geoarchaeological sampling and analysis was initiated, with the aim of understanding site formation, particularly the nature of the thick layers of dark organic soils. Thousands of animal bones have been recovered through hand-collection and wet-sieving from these layers and other features.

Fig. 1: Map of Northern Italy showing location of Nogara and other late Roman-early Medieval sites

The settlement: archaeological and historical information

The settlement is located on the banks of the ancient River Tartaro, in an area which would have been characterised by forest and marshland. The river was artificially moved and straightened in the 17th c. and the surrounding land is now cultivated, in particular with maize or sunflowers. The excavations have revealed various structures, possibly wharfs or quays, as well as buildings with hearths, and storage/rubbish pits. One working hypothesis is that initial use of the waterfront was associated with a nearby settlement, possibly a large agricultural estate, of which some of the buildings would have been a part. Later reorganisation of the area (possibly associated with the founding of the castle of Nogara, early 10th c.) led to subsequent changes in the settlement area, possibly including infilling of part of the wharves. Occupation appears to have continued intermittently as indicated by alternating layers of dark soils and occupation layers and hearths. The presence of slag and other waste indicates the practice of various industries. Abandonment of the area occurred gradually but by the 15th c., the structures and lands had been razed and the area put to a different use (Sggioro 2005; F. Saggioro, pers. comm. 2005).

Animal bones: Potential, provenance, phasing and recovery

The assemblage of animal bones will be invaluable for answering key questions about the site and about wider developments in the early medieval period. These include aspects of:

- the animal economy, including husbandry, hunting and fishing
- the use of woodland and wetlands as noted in the written record
- site status and socio-economic variation within the site
- site character, ie. producer, consumer, self sufficient
- animal economies and site type, ie. comparison to other urban, rural and monastic sites
- animal husbandry and evolution of animal size and shape in Northern Italy
-animal symbolism and early medieval hunting practices

Detailed assessment (English Heritage 2002) of the hand-collected material from the 2004-5 and 2006 (part) excavations has been undertaken, but analysis has not yet commenced. The assessment focussed on recording numbers of bones from the different taxa present, and also the numbers of potentially ageable and measurable bones and teeth, but not the detail of individual specimens. Nonetheless, it is possible to comment on species proportions, domestic animal ratios and some aspects of the wild fauna, and so explore some of the above questions.

The material selected for assessment is from phased contexts, based on dendrochronological and radiocarbon dates (F. Saggioro). To date the phased material is mainly from phases 3-4, 10th-early 11th c. (920 ca.-1080/90 ca.) and phase 5, 12th-early/mid 13th c. (1080/90 ca.-1230/50 ca.). The material is from a variety of contexts including pits, hearths, occupation layers, middens and from the layers of organic soils. Within the latter, there were successive phases of occupation and development of/filling with organic soils and peat, but the dating of subphases is pending (Saggioro pers. comm. 2006). In general, the tight dating of the spreads suggests that the useful information will be provided by species distributions, age profiles and biometric data. The remains considered in this report are hand-collected. In addition, many tens of thousands of fragments were recovered from over 350 samples from approximately 50 contexts. The organic layers were sampled extensively, hence the very large number of samples overall. The wet-sieved samples include a very large proportion of fish bones, but also larger and small mammals, birds, turtle, eggshell and mollusca.

The assemblage

Preservation, fragmentation, residuality and contamination

Preservation of the Nogara assemblage is excellent with little evidence for erosion or weathering. Dog gnawing was observed but not on a large scale. Butchery marks are present on a number of bones. The frequency of isolated teeth is relatively low compared to the number of mandibles with teeth suggesting that fragmentation is not pronounced. No evidence of mixed material was observed during the recording with all contexts appearing relatively homogeneous in their preservation characteristics.

Taxonomic distribution

The current data is based on number of bone fragments (NISP-Number of Identifiable Specimens) (Table 1). Fragments were considered to be recordable if they included the bone zones as defined by Serjeantson (1996). More than 50% of an individual zone or in the case of isolated teeth more than 50% of the crown has to be present to be counted. Mammals dominate thehand-collected assemblage, while birds and fish are underrepresented due to recovery bias. The preliminary data from the sorted samples (for all identifiable and unidentifiable fragments) shows that fish bones make up 25% to over 50% of total mammal and fish bones (excluding scales), while bird bones make up c. 3-5% of all mammal and bird bones. Bird bones would undoubtedly make up a higher proportion of just the identifiable fragments.

Mammals

The assemblage is dominated by the domestic livestock, cattle, sheep/goat and pig, which make up c. 85-91% of the assemblages (Table 1). This corresponds to the usual pattern for Early Medieval Italy and wider European area (Baker 2000). Of the main livestock pig is the most abundant (40%), followed by cattle and sheep/goat. A number of goat horncores and at least one postcranial element were observed in the assemblage. Goat remains are not uncommon on early medieval sites but they rarely match the frequency of sheep (Baker 2000; forthcoming). The horncores show signs of butchery, indicating the removal of horn for working. A few other domestic mammals are represented including equid, possible dog and cat. The equid remains include a very small bone which may be from a small pony or donkey. Canid gnawing on a number of specimens attests to the presence of dogs in the settlement and scavenging of bone is indicated by semi-digested remains also.

Taxon/taxonomic group English Name	Scientific name	Phase 3-4 10th-early 11th c.		Phase 5 12th-early/mid 13th c.	
		NISP	%	NISP	%
Cattle	*Bos taurus*	202	26	61	29
Sheep/goat	*Ovis aries/Capra hircus*	173	23	57	27
Pig	*Sus scrofa*	275	36	74	35
Equid	*Equidae*	2	0.3		
Dog?	*Canis familiaris*			1	0.5
Cat?	*Felis catus*	2	0.3		
Red deer	*Cervus elaphus*	18	2.3	6	2.8
Roe deer	*Capreolus capreolus*	1	0.1	1	0.5
Wild boar	*Sus scofa ferox*	2	0.3		
Fox?	*Vulpes vulpes*	4	0.5		
Dog/Fox	*Canis familiaris/Vulpes vulpes*	2	0.3		
Otter	*Lutra lutra*	1	0.1		
Mustelidae?	*Mustelidae*	1	0.1		
Beaver	*Castor fiber*			1	0.5
Small-medium carnivore	Carnivora	2	0.3		
Other wild mammal				2	0.9
Bird	Aves	62	8.1	4	1.9
Fish	Pisces	17	2.2	5	2.4
Turtle	Testudinidae/Emydidae	2	0.3		
Total		**766**		**212**	
Main domestic mammals					
		NISP		NISP	%
Cattle	*Bos taurus*	202	31	61	32
Sheep/goat	*Ovis aries/Capra hircus*	173	27	57	30
Pig	*Sus scrofa*	275	42	74	39
Total		**650**		**192**	
Wild vs domestic taxa			%		%
%deer/total mammal			2.8		3
%wild mammal/total mammal			4.5		4.9

Table 1: Species distribution in hand-collected assemblage by phase based on Number of Identifiable Specimens (NISP)

In total, wild mammals represent c.5% of mammal remains (Table 1). A range of species is present, of which the most numerous is red deer (identification based on size and Lister 1996). Additional wild mammals from phased contexts include roe deer, wild boar, beaver, otter, fox, and Mustelidae; in addition hare/lagomorph and possibly wolf have been observed in the contexts for which phasing is pending. All wild taxa are present in small numbers compared to red deer. Nonetheless their presence is of interest given their rarity in the zooarchaeological record and what they may indicate about the environmental and socio-cultural aspects of hunting practices. For example, beaver has been noted at only a few historic period sites, including Roman Calvatone (Baker and Di Martino 1996; Wilkens 1990), Monselice (6th- 7th c., Baker forthcoming), and early medieval Trento (Di Martino n.d.b.). Beaver is said to have been hunted for pelts and sex glands (for medicinal puposes) and Clark (1989) notes that in the late Medieval period hunting beaver was restricted to the nobility. An otter humerus (with cutmark) is a rarity also, this species having been identified only at Trino (Piedmont, 10th-

13th c.; Ferro 1992) (Fig. x). Ferro (1991) considers it to have been an occasional food source in the early Medieval period. Both species indicate the probable exploitation of surrounding wetlands.

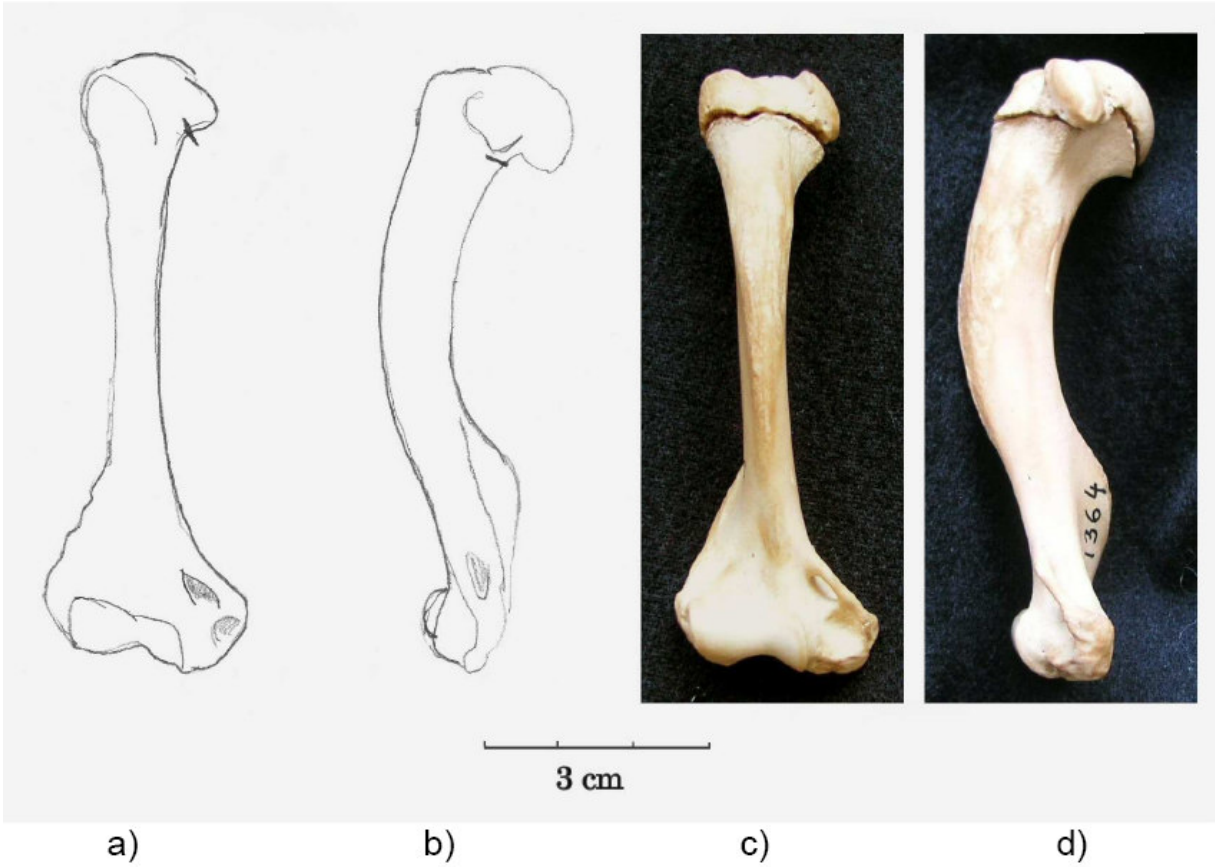

Fig. 2: (a, b) Field sketch of otter humerus (context 2045) showing location of cutmark, (a) anterior view, (b) lateral view. (c, d) Reference specimen, English Heritage #1364, subadult male, (c) anterior view, (d) lateral view

Numerous pieces of chopped/worked antler (large cervid) are present, indicating its use for the manufacture of various objects. However, in contrast to many sites, limbbones of red deer are better represented than antler fragments (shed/unshed), which suggests that animals were hunted and their carcasses, or parts thereof brought to the site (Riedel 1992; Baker 1993). Of a total of 69 fragments from the 2004-5 excavations only ten are antler, with only three antler fragments present in the securely phased portion (Phases 3 - 4 and 5, total NISP=23). The head, fore and hind limbs are all represented in the assemblage from Phase 3-4 (NISP=15).

Birds

The avifauna at Nogara is very varied, including domestic fowl (*Gallus gallus*), goose and goose size birds, duck species, Corvidae, waders, pelican and other identifiable taxa (Table 2). To the author's knowledge, the occurrence of pelican (*Pelecanus sp.*) is unique in the zooarchaeological record of medieval Northern Italy (Fig. 3). This and other waterfowl would have been attracted to the wetlands in the site area. No doubt a range of other taxa are represented in the sieved fractions. Some bones of domestic fowl/medium galliformes include medullary bone (Lentacker and Van Neer 1996), indicating the presence of hens in lay, and eggshell present in the samples also indicates the raising of fowl for eggs. Others were killed at a young age.

Fig. 3: Ulnare of pelican (*Pelecanus* sp.) from Nogara compared to reference specimens (Image pending)

Tortoise/Terrapin

Of interest is the presence of remains of tortoise/terrapin (Testudinidae/Emydidae). Few other records are available for Northern Italy including Luni (600-700AD; Barker 1977) and Roman Comacchio

(Farello 1990), but a recent study suggests that tortoise species were used as food in the late Medieval period, as indicated by presence of butchery marks on some bones (Crader, Rowe and Edwards forthcoming).

Fish

The Nogara assemblage (hand-collected and sieved) is particularly rich in fish remains, which probably originate from both natural death assemblages and food consumption. Spreads of fish remains were observed during excavation but it is not clear if these represent natural mortalities or butchery waste. Sampling of the dark layers was undertaken partly to determine the distribution of the fish bones, and from this their possible origin and aspects of site formation. The fauna appears to be from freshwater taxa, including eel, pike and different Cyprinids (including in the sieved samples rudd, *Scardinius erythrophthalmus*). The huge fish bone assemblage will add invaluable data for a little explored taxonomic group (Baker 1999, 2000, forthcoming; Di Martino 2001), informing on freshwater fish distributions (for example pike, Hoffman 1987 and (presence/absence of) carp, *Cyprinus carpio,* Hoffman 1994), environmental change or continuity of freshwater environments (Hoffman 1995, 1996) and human fishing ecology (eg. Carannante et al. 2006). It will also contribute to the study of food symbolism and Christian fasting practices in the Medieval period (eg. Barrett et al. 2004).

Discussion

In four years of exploration, of which two have consisted of open area excavation, the site of Nogara has yielded a large hand-collected assemblage and huge wet-sieved assemblage of animal bones. At present stratigraphic work and dating are in progress so only a small assemblage has been securely phased (NISP=c. 1000). Nonetheless, the hand-collected data shows the exploitation mainly of domestic livestock (in particular pig), but also a notable emphasis on red deer and wild birds, and the sieved fractions provide a huge assemblage of fish remains in addition to birds and smaller mammals. The data provide evidence of rare species, including beaver, otter, possible wolf (phasing pending) and pelican and no doubt the bird bones will add to an already rich faunal record for Northern Italy (Baker 2000).

Written records and the zooarchaeological record

The availability of written records referring to Nogara and to the allocation of rights to exploit woodlands and wetlands in the site vicinity allow the zooarchaeological data to be placed in a historical context (Saggioro 2003). Of particular interest in this respect are the predominance of pig and numerous remains of red deer and waterfowl and occurrence of beaver and otter. The abundance of freshwater fish further indicates the exploitation of local water courses and wetlands. Control and exploitation of the “Basso Veronese” during the 9th-11th c. was strategic politically and economically and at times contested between ecclesiastical and public/civic institutions. This is attested to in various documents including archives of the monastery of San Silvestro di Nonantola (Carrara 1992). The abundance of red deer and presence of skeletal elements from all bodyparts may indicate that the Nogarese inhabitants had rights to exploit the *paludibus*, which in reference to the not too distant Ostiglia Carrara (1992, 26) suggests would have formed a complement to other resources, “dove la palude rappresenta naturale, non intaccabile complemento dell’ambiente”.

Inter-site comparisons

The zooarchaeological record for Late Roman-Medieval Northern Italy is extensive (Table x; Baker 2000; Salvadori 2006; Riedel 1989, 1991, 1994b) but not all site types, discrete periods or geographical areas are equally represented. Consequently, synthesis of patterns on a regional or local scale is hampered by the limited datasets available and by the wide variation in strategies adopted (eg. Baker 2000, 2001). In Northern Italy, site location and environment undoubtedly plays a part in husbandry choices, as indicated by variation between Alpine and lowland assemblages (Baker 2000). Other patterns are more plausibly linked to site type, for example the late Roman - Early Medieval *castra* of the pre-alpine and Ligurian foothills (Baker 1991, 2000, 2001, forthcoming; Baker and Mocchiutti 2006; Giovinazzo 1992; Storck and Driesch 1987). Cultural shifts also appear to have led to changing economies; Salvadori (2006) has identified chronological variation in urban and rural animal economies in the late Roman-early Medieval periods.

The assemblage from the rural settlement of Nogara is unique for the local area, as the only other assemblages consist of individual animal skeletons from Povegliano and Bovolone (Riedel 1990, 1993). Furthermore, few regional comparative datasets are available. Looking further afield, the data is broadly similar to Trino (Piedmont, mid 10th-12th/13th c., Ferro 1991) and Torcello (8th-12th c., Riedel 1979a), both lowland sites, but differs markedly from the alpine rural settlements, for example Stufels (1979b) or San Valier (1987). In castle assemblages, the pig count is higher still but cattle are underrepresented compared to Nogara. It is interesting to note that the preliminary data from the Nogara “castello” proper also shows a high pig count. In comparison to the urban assemblage from Verona (Riedel 1994a), the distributions of the main domestic taxa do not differ markedly. Analysis of

rural-urban patterns will be explored further, including age distributions and skeletal element distributions.

Animal symbolism, hunting and status

To date, the significance of wild taxa in early Medieval sites in Northern Italy has been considered primarily from an economic viewpoint (eg. Riedel 1991; Baker 1991, 1993, 2000), although their significance as potential indicators of status has also been discussed. Wild taxa represent a very low proportion of individual assemblages, rarely exceeding 1-1.5% of total mammal counts (Riedel 1991, Baker 1993). The Nogara figure (5%) is thus high compared to other early medieval sites, apart from Trino (Ferro 1991), Filattiera (Biasotti and Giovinazzo 1982) and from high status/castle sites, where the relative proportion of wild mammals is higher still (Baker 1993, 2000, Riedel 1991; for Central and Southern Italy, De Venuto 2005, Salvadori 2005).

As noted above, in the securely phased assemblage from the settlement all bodyparts of red deer are present. In contrast, in the very small assemblage from the excavation of the "Castello" area itself, in addition to one antler fragment only parts of the hind limb have been noted, two tibia and an astragalus. While somewhat premature at this stage given that phasing of the castle contexts is not complete (and taphonomic analysis not yet undertaken), it is of interest to compare this pattern to data from England, where the preponderance of the hind limb in high-status sites suggests that haunches were gifted or retained for consumption by the elite (Albarella and Davis 1996; Thomas 2000; Sykes 2006). For Northern Italy, the previously mentioned studies and the data from Nogara suggest that it may be with the foundation of castles ("incastellamento"; the influence of Carolingian traditions needs also to be appraised), that wild taxa take on a new role, as symbols of prestige and power (eg. Sykes 2006). Wild birds no doubt played an important role also as social signifiers and this will be explored in future work (eg. Albarella and Thomas 2002; Sykes 2004; Serjeantson 2006).

Husbandry and animal biometry

The measurements of cattle, sheep/goat and pig will provide invaluable information regarding animal size and shape, and will be compared to datasets from other early medieval sites in Northern Italy. A decrease in size in cattle and sheep/goat has been observed from the Late Roman to early Medieval period, and in some cases the decrease is marked (eg. Lomello, Baker 2000; Brescia, Baker 2000, 2001; Verona, Riedel 1994). Possible explanations are explored in Riedel (1988, 1989, 1994b), Baker (1999, 2000) and more recently by Salvadori (2006). Biometric data provide an excellent means of exploring continuity or change in agrarian economies (Hammon 2005; in press; see Salvadori 2006 for a recent consideration of data from Central and Northern Italy).

References

Albarella, A., 2005 Alternate fortunes? The role of domestic ducks and geese from Roman to Medieval times in Britain, in *Feathers, Grit and Symbolism. Birds and Humans in the Ancient Old and New Worlds*, Grupe, G. and Peters, J. (eds), 2005, pp. 250-258. Rahden/Westfalia: Verlag Marie Leidorf GmbH.

Albarella, U., 2006b Pig husbandry and pork consumption in Medieval England, in C.M. Woolgar, D. Serjeantson and T. Waldron (eds), *Food in Medieval England*, pp. 72-87. Oxford: Oxford University Press.

Albarella, U and Davis, S 1994 *The Saxon and Medieval Bones Excavated 1985-1989 from West Cotton, Northamptonshire*. Unpublished report, English Heritage, Ancient Monument Laboratory Report **17/94**

Albarella, U., Thomas, R. 2002. They dined on crane. Bird consumption, wild fowling and status in medieval England. *Acta cracoviensia*, 45 (special issue): 23-38.

Baker, P forthcoming 'The Vertebrate Remains from Monselice (VE), VI-VII Centuries AD', *in* Brogiolo, G P (ed) *Scavi sulla Rocca di Monselice (1989- 1997)*. Mantova: Editore S A P

Baker, P 2001 'The Animal Remains from Strs. II-VII: Subsistence, Husbandry and Status', *in* Brogiolo, G P and Castelletti, L (eds) *Archeologia a Monte Barro. II. Gli scavi 1990-1997 e le Ricerche al S. Martino di Lecco*. Galbiate:Consorzio Parco Monte Barro. 249-268

Baker, P 2000 'Society and Economy in Northern Italy in the Early Medieval Period (c 6th-11th centuries): A Zooarchaeological Study'. Unpublished PhD thesis, University College London

Baker, P 1999 'The Vertebrate Remains from the Longobard and 9th-10th c. Occupations at S. Giulia, Brescia', *in* Brogiolo, G P (ed) *S. Giulia di Brescia, Gli Scavi Dal 1980-1992*. Florence: All'Insegna del Giglio. 425-449

Baker, P., 1993. Le rôle de la chasse comme moyen de subsistence durant le haut Moyen Age dans le Nord de l'Italie: une comparaison des sources zooarchéologiques et historiques, in *Exploitation des animaux sauvages à travers le temps*, *Actes du IVè Colloque International de l'Homme et l'Animal, Juan-les Pins, Antibes, Oct. 1992*, 505-516. Juan-les-Pins: Editions APDCA.

Baker, P., 1991a. La Fauna, in G. P. Brogolo and L. Castelletti (eds), *Archeologia a Monte Barro. Il Grande Edificio e le Torri*, 153-167. Lecco: Stefanoni.

Baker, P. and Di Martino, S., 1996, I reperti faunistici, in L. Passi-Pitcher (ed), *Bedriacum. Ricerche Archeologiche a Calvatone: 1.2*, *Il Campo del Generale: I materiali del Saggio 6*, 29-47. Milan: Edizioni Et.
Baker, P and Mocchiutti, I 2006 I reperti ossei animali, *in* Brogiolo G P (a cura di), *Scavi sulla Rocca di Garda (VR)*, editore Insegna del Giglio, Firenze. 132-138
Barker, G., 1977. L'economia del bestiame a Luni, in A. Frova (ed), *Scavi di Luni. Relazione delle campagne di scavo 1972-1973-1974*, 725-735. Rome: L'Erma di Bretschneider
Barrett, J., Locker, A, Roberts, C.M., 2004 'Dark Age Economics' revisited: the English fish bone evidence, in Bedini, E., 1989. I reperti faunistici della Rocca di Asolo (Campagna di scavo 1987). Nota preliminare, *Archeologia Medievale*, **16**, 331-346.
Biasotti, M. and P. Isetti, 1981. L'alimentazione dall'osteologia animale in Liguria, *Archeologia Medievale*, **8**, 239-246.
Boessneck, J., 1969. Osteological differences between sheep (*Ovis aries* Linné) and Goat (*Capra hircus* Linné), in D. Brothwell and E. Higgs (eds), *Science in Archaeology*, 331-358. London: Thames and Hudson.
Bokonyi, S., n.d. *I resti animali degli scavi del Castelàr di Rover a Posnago (TR)*. Unpublished manuscript.
Carannante, A., Chilardi S., Marazzi, F., 2006 Last dinner for the monks. Archaeozoological data from the kitchens complex of San Vincenzo al Volturno abbey (Molise, central Italy, 8th-9th century A.D.). Unpublished paper presented at the 10th conference of the International Council for Archaeozoology (ICAZ), Mexico 2006, August 23rd-28th.
Carrara, V. 1992 *Proprieta' e giurisdizioni di San Silvestro di Nonantola a Nogara (Vr) secoli X-XIII*. Bologna.
Clark, G., 1989 Faunal remains and historical archaeology; Larger mammals; Discussion; Conclusion, in G. Clark, L. Costantini, A. Finetti, J. Giorgi, A. Jones, D. Reese, S. Sutherland and D. Whitehouse, The food refuse of an affluent urban household in the late fourteenth century: faunal and botanical remains from the Palazzo Vitelleschi, Tarquinia (Viterbo), 202-232, 241-245, 255-279, 294-296, 302-318, *Papers of the British School at Rome*, **57**, 200-321.
Crader, D. C., Rowe, M. J., Edwards, T., forthcoming Cracking the Shell: The Use of Tortoises at Late Medieval Capalbiaccio, Italy", in J. Mulville and A. Powell (eds), *Wild things*. Oxford: Oxbow Press. De Venuto, G., 2005
English Heritage 2002 *Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation*. Portsmouth: English Heritage, Centre for Archaeology Guidelines **1**
Farello, P., 1990b. Reperti faunistici, in F. Berti (ed), *Fortuna Maris. La Nave Romana di Comacchio*, 117-130. Bologna: Nuova Alfa Editoriale.
Ferro, A. M., 1991. La fauna: informazioni sull'alimentazione e sull'economia, in M. M. Negro Ponzo Mancini, V. Calabrese, C. Joris, B. Rinaudo, A. M. Ferro, R. Carmiello, E. Zanini and T. Doro Garetto, L'insediamento romano e altomedievale di S. Michele a Trino (Vercelli). Notizie preliminari sulle campagne 1984-1990, 408-411, *Archeologia Medievale*, **18**, 381-428.
Galloni, P., 1993. *Il cervo e il lupo. Caccia e cultura nobiliare nel Medioevo*. Rome and Bari: Editori Laterza. Giovinazzo, R., 1992. Uno studio preliminare dei reperti osteologici, in G. Murialdo, E. Castiglioni, G. Cupelli, C. Falcetti, F. Ferretti, A. Fossati, R. Giovinazzo, T. Mannoni, P. Palazzi, M. Panizza, L. Parodi, R. Ricci and G. Vicino, Il *castrum* tardo-antico di S. Antonino di Perti, Finale Ligure (Savona): terze notizie preliminari sulle campagne di scavo 1982-1991, 339-354, *Archeologia Medievale*, **19**, 279-368.
Hoffman, R., 1987. The protohistory of the pike in western culture, in E. J. Crossman and J. M. Casselman (eds), *An Annotated Bibliography of the pike, Esox lucius (Ostheichthyes, Salmoniformes)*, vii-xvii. Toronto: Royal Ontario Museum.
Hoffman, R., 1994b. Remains and verbal evidence of carp (*Cyprinus carpio*) in medieval Europe, in W. Van Neer (ed), *Fish Exploitation in the Past. Proceedings of the 7th meeting of the ICAZ Fish Remains Working Group*, 139-149. Tervuren, Belgium: Musée Royal de l'Afrique Centrale.
Hoffman, R., 1995. Environmental change and the culture of common carp in medieval Europe, *Guelph Ichthyology Reviews*, **3**, 57-85.
Hoffman, R., 1996. Economic development and aquatic ecosystems in Medieval Europe, *The American Historical Review*, **101(3)**, 631-669.
Lentacker, A. and van Neer, W., 1996. Bird remains from two sites on the Red Sea coast and some observations on medullary bone, *International Journal of Osteoarchaeology*, **6**, 488-496.
Lister, A., 1996. The morphological distinction between bones and teeth of Fallow deer (*Dama dama*) and Red deer (*Cervus elaphus*), *International Journal of Osteoarchaeology*, **6**, 119-143. Riedel, A., 1979a. La fauna degli scavi di Torcello (1961-1962), *Atti del Museo Civico di Storia Naturale di Trieste*, **31(2,5)**, 75-154.

Riedel, A., 1979b. Die fauna einer frühmittelalterlichen Siedlung in Stufels bei Brixen, *Der Schlern*, **53(7)**, 3-23.
Riedel, A., 1987. Die fauna der Mittelalterlichen Fundstätte von San Valier im Trentino, *Atti dell'Accademia Roveretana degli Agiati*, **26**, 67-93.
Riedel, A., 1988. Evolution of the animal populations of northeastern Italy from the Late Neolitic to the Middle Ages, *Archaeozoologia*, **2(1,2)**, 319-328.
Riedel, A., 1989. Archéozoologie des animaux domestiques dans l'Italie nordorientale, *Etnozootechnie*, **42**, 23-29.
Riedel, A., 1990. Bemerkungen über Mittelalterliche Faunen Nordostitaliens, in *Festschrift für Hans R. Stampfli*, 197-203. n.p.: Helbing and Lichtenhahn.
Riedel, A., 1991. The wild animals of Northeastern Italy from Neolithic to Medieval times: an archaeozoological comment, *Natura Bresciana, Annali del Museo Civico di Storia Naturale di Brescia*, **26**, 311-330.
Riedel, A., 1993. Lo scheletro di Cavallo, *Quaderni di Archeologia del Veneto*, **9**, 90-91. Riedel, A., 1994a. The animal remains of Medieval Verona: an archaeozoological and palaeoeconomical study, *Memorie del Museo Civico di Storia Naturale di Verona (2a serie), Sezione Scienze dell'uomo*, **3**. Verona.
Riedel, A., 1994b. Archaeozoological investigations in North-eastern Italy: the exploitation of animals since the Neolithic, *Preistoria Alpina*, **30**, 43-94.
Saggioro, F., 2003 Insediamento e monasteri nella pianura veronese tra VIII e XIII secolo, in Francovich, R. e Gelichi, S. (ed), *Monasteri e castelli fra X e XII secolo*, pp. 169-182. Firenze: All'Insegna del Giglio.
Saggioro, F., date? Late Antique settlement on the plain of Verona, in Bowden, W., Lavan, L. and Machado, C. (ed), *Recent Research on the Late Antique Countryside*. Brill. Salvadori, F., 2005
Salvadori, F., 2006 Resti osteologici animali: elementi di continuita' e discontiuita' tra tardoantico e altomedioevo, in Serjeantson, D., 2006 Birds: Food and a mark of status, in C.M. Woolgar, D.
Serjeantson and T. Waldron (eds), *Food in Medieval England*, pp. 131-147.
Oxford: Oxford University Press. Storck, P. and Driesch, A. von den, 1987. Tierknochenfunde aus Invillino- Ibligo in Friaul/Italien, in Bierbrauer, V. (ed), *Invillino-Ibligo in Friaul. Die romische Siedlung und das spatantik-fruhmittelalterliche Castrum*, 453-484. (*Munchener Beitrage zur Vor-und Fruhgeschichte*, **33**). Munich: C.H. Bech'she Verlagsbuchhandlung.
Sykes, N., 2004 The dynamics of status symbols: wildfowl exploitation in England AD410-1550. *The Archaeological Journal*, 161: 82-105.
Sykes, N.J., 2006 The impact of the Normans on hunting practjces, in C.M. Woolgar, D. Serjeantson and T. Waldron (eds), *Food in Medieval England*, pp. 162-175. Oxford: Oxford University Press.
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, Volume 2*. London: British Museum Press. 194-223.