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The Faunal Remains from the Cistercian Nunnery of St Theodore in Nicosia, Cyprus

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Abstract

The study of the faunal assemblage from St Theodore Abbey provides an opportunity to explore human–animal interactions in the context of a Cistercian nunnery in Cyprus functioning from ca. 1230 to ca. 1550. Within the limitations of a modest sample size, the analyses provide valuable insights into animal-related economic activities, diet, and status at the nunnery. The main components of the animal economy were pig and goat husbandry, while donkeys, horses, and possibly cattle were used in transportation and agricultural work. Besides pork and goat meat, the diet was complemented with chicken rearing and the secondary products of goat and sheep, as well as the occasional wild hare, fish, and birds. With the data at hand, it is difficult to elucidate the diet of different groups of people at the nunnery. Nevertheless, there are indications of high economic and social status in the form of tender meat (kids/lambs, piglets, young chicken, and possibly imported fish).

Keywords

Zooarchaeology – monastic communities – diet – status – Lusignan and Venetian Cyprus

1 Introduction

Cyprus lacks zooarchaeological studies of medieval faunal assemblages, although there is some activity underway.[1] The site of the Cistercian nunnery of St Theodore in Nicosia was excavated in 2004-2005 and provided the first zooarchaeological assemblage from a monastic community, of any Christian denomination, in Cyprus. Based on the material culture recovered and historical sources, the nunnery was long-lived, founded around 1230 and dissolved around 1550.[2] The historical context of St Theodore Abbey is presented thoroughly elsewhere, including the history of the Cistercian Order in Western Europe and its subsequent spread to the East.[3] In the broader European context, published faunal assemblages from Cistercian nunneries are scarce[4] and St Theodore Abbey is the only case so far in the Latin East. This renders the present study more challenging, but also valuable, as a first step towards building a corpus of related research.

The overall aim is to provide the first insights into human–animal interactions in the context of a Cistercian nunnery operating in Nicosia, Cyprus between the early thirteenth and mid-sixteenth centuries. In addition, there are also a number of specific research goals. The overall faunal composition is analysed to elucidate which animals were kept or at least consumed at the nunnery, as well as the abundance of each taxon. The age-at-death and sexing data analyses allow a discussion on how animals were used at St Theodore Abbey, considering on-site production, external provision, and consumption.

1 The only other studied assemblages are a late-sixteenth-/early-seventeenth-century dog skeleton in A. Hadjikoumis and P. Christofi, "A Dog's Life and Violent Death in Late Medieval Nicosia, Cyprus," *Journal of Archaeological Science: Reports* (forthcoming), and the Frankish/Ottoman site of Pano Pyrgos-Avli in A. Hadjikoumis, "Μελέτη των ζωοαρχαιολογικών καταλοίπων από τη θέση Πάνω Πύργος-Αυλή: Ανασκαφικές περίοδοι 2008-2011," in *Πρακτικά Β΄ Συνεδρίου. Τηλλυρία, Μνήμες, Ιστορία και Αρχαιολογία,* ed. S. Perdikes (Nicosia: Museum of the Holy Monastery of Kykkos, forthcoming 2023).

2 W. Duba and C. Schabel, "The White Nuns in Outremer: A Documentary History of St Theodore Abbey in Nicosia, Cyprus, the Longest-Lived Cistercian Monastery in the Latin East, ca. 1230-ca.1550," *Frankokratia* 4/1 (2023), 1-57.

3 Duba and Schabel, "The White Nuns in Outremer."

4 For Belgium, see A. Ervynck, "Following the Rule? Fish and Meat Consumption in Monastic Communities in Flanders (Belgium)," in *Environment and Subsistence in Medieval Europe*, eds. G. De Boe and F. Verhaeghe (Zellik: Instituut voor het Archeologisch Patrimonium, 1997), 67-81; for England, see R.J.A. Thomason, "Hospitality in a Cistercian Abbey: The Case of Kirkstall in the Later Middle Ages," PhD dissertation (University of Leeds, 2015).

Given that this is the first study of a faunal assemblage from a Cistercian nunnery in the East, an attempt is also made in the discussion to integrate its findings with the available archaeological knowledge from Cyprus, as well as from Cistercian nunneries in Western Europe.

2 Materials and Methods

The faunal assemblage was hand collected. Hand collection introduces a size bias favouring larger species and larger anatomical parts; hence, small mammals, birds, and fish are expected to be negatively affected by this bias. Surface-collected specimens were excluded from the analyses. This, combined with the history of the nunnery itself (i.e., absence of a Byzantine or Lusignan-period predecessor, dismantling in the 1560s), generates confidence that the faunal assemblage derives from human activity at the nunnery between the early thirteenth and mid-sixteenth centuries. The assemblage (Appendix 1) is small, but in good condition, making the identification relatively easy and reliable. The extent of erosion on the faunal assemblage of St Theodore does not pose serious problems for taxonomic identification but hinders the quantification of data such as burning and butchery marks. Moreover, it introduces a bias against the more fragile remains of young mammals, birds, and fish.

For mammals and birds, the anatomical units systematically recorded are listed in Appendix 1. These anatomical elements were selected because of their easier and more reliable identifiability at both anatomical and taxonomic levels, as well as their potential to yield information on human-animal interactions. For fish, all identifiable fragments have been recorded. For identifications, the author's personal reference collection was used, as well as osteological atlases.[5] For the distinction between goat and sheep remains, published

5 For mammals, R. Barone, *Anatomie comparée des mammifères domestiques* (Paris: Vigot Frères, 1976) and E. Schmidt, *Atlas of Animal Bones* (New York: Elsevier, 1972); for birds, Z.M. Bocheński and T. Tomek, *A Key for the Identification of Domestic Bird Bones in Europe: Preliminary Determination* (Krakow: Institute of Systematics and Evolution of Animals, 2009).

criteria were used for both postcranial[6] and dental[7] elements. Distinguishing horse from donkey is possible only on few specific anatomical elements and the potential presence of mule makes distinction even more challenging. Distinction on morphological grounds was attempted only on equid mandibular teeth that could be reliably positioned (i.e., P2-M3).[8] Distinction between European hare and rabbit was also attempted on all lagomorph remains.[9] For the identification of bird remains, besides the reference collection, relevant atlases were also used.[10] For mammals and birds, quantification of anatomical elements, taxa, age, and sex is based on the minimum numbers of anatomical units (MinAU hereafter) and of butchery and taphonomy on the maximum numbers of anatomical units (MaxAU hereafter).[11] To account for species with different numbers of foot bones, pig metapodia and phalanges were divided by two and goat/sheep phalanges also by two, thus becoming proportionate to the equid single main metapodium, first, second, and third phalanx per foot. No adaptations were necessary for any other species due to the absence of these elements.

6 J. Boessneck, H.-H. Müller, and M. Teichert, "Osteologische Unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Ziege (*Capra hircus* Linné)," *Kühn-Archiv* 78/1-2 (1964), 1-129; W. Prummel and H.-J. Frisch, "A Guide for the Distinction of Species, Sex and Body Side in Bones of Sheep and Goat," *Journal of Archaeological Science* 13 (1986), 567-577; M.A. Zeder and H.A. Lapham, "Assessing the Reliability Criteria Used to Identify Postcranial Bones in Sheep, *Ovis*, and Goats, *Capra*," *Journal of Archaeological Science* 37 (2010), 2887-2905.

7 M. Balasse and S.H. Ambrose, "Distinguishing Sheep and Goats Using Dental Morphology and Stable Carbon Isotopes in C4 Grassland Environments," *Journal of Archaeological Science* 32 (2005), 691-702; P. Halstead, P. Collins, and V. Isaakidou, "Sorting the Sheep from the Goats: Morphological Distinctions between the Mandibles and Mandibular Teeth of Adult Ovis and Capra," *Journal of Archaeological Science* 29 (2002), 545-553; S. Payne, "Morphological Distinctions between the Mandibular Teeth of Young Sheep, *Ovis*, and Goats, *Capra*," *Journal of Archaeological Science* 12 (1985), 139-147.

8 For example, S.J. Davis, "Late Pleistocene and Holocene Equid Remains from Israel," *Zoological Journal of the Linnean Society* 70 (1980), 289-312.

9 C. Callou, *Diagnose différentielle des principaux éléments squelettiques du lapin* (*genre Oryctolagus*) *et du lièvre* (*genre Lepus*) *en Europe occidentale* (Valbonne: APDCA, 1997).

10 Bocheński and Tomek, *A Key for the Identification of Domestic Bird Bones in Europe*; A. Cohen and D. Serjeantson, *A Manual for the Identification of Bird Bones from Archaeological Sites* (London: Archetype Publications, 1996); T. Tomek and Z.M. Bocheński, *A Key for the Identification of Domestic Bird Bones in Europe: Galliformes and Columbiformes* (Krakow: Institute of Systematics and Evolution of Animals, 2009).

11 According to P. Halstead, "The Faunal Remains," in *Nemea Valley Archaeological Project 1: The Early Bronze Age Village on Tsoungiza Hill*, ed. D.J. Pullen (Princeton, NJ: The American School of Classical Studies at Athens, 2011), 741-800.

Age-at-death was estimated based on dental eruption/wear[12] and post-cranial epiphyseal fusion state.[13] During quantification, teeth attributable to more than one age interval were proportionately assigned.[14] Goat and sheep pelves were sexed, whenever possible,[15] and the same was done with pig lower canines.[16] Concerning bird remains, the presence of medullary bone (i.e., egg-laying female) was recorded in cases where long bones were broken, rendering observable the interior of the shaft.[17] Butchery marks were recorded and attributed, wherever possible, to skinning, dismembering, or filleting.[18] Fragmentation state and taphonomy were also recorded,[19] as well as biometric measurements.[20]

12 For sheep/goat: S. Payne, "Kill-off Patterns in Sheep and Goats: The Mandibles from Aşvan Kale," *Anatolian Studies* 23 (1973), 281-303; E. Deniz and S. Payne, "Eruption and Wear in the Mandibular Dentition as a Guide to Ageing Turkish Angora Goats," in *Ageing and Sexing Animal Bones from Archaeological Sites*, eds. B. Wilson, C. Grigson, and S. Payne (Oxford: British Archaeological Reports, 1982), 155-205. For cattle: C. Grigson, "Sex and Age Determination of Some Bones and Teeth of Domestic Cattle: A Review of the Literature," ibidem, 7-23; P. Halstead, "A Study of Mandibular Teeth from Romano-British Contexts at Maxey," in *The Fenland Project: Archaeology and Environment in the Lower Welland Valley, Volume 1*, eds. F. Pryor, C. French, D. Crowther, D. Guerney, G. Simpson, and M. Taylor (Cambridge: The Fenland Project, 1985), 219-224. For pigs: A. Grant, "The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates," in *Ageing and Sexing*, eds. Wilson, Grigson, and Payne, 91-108; G. Bull and S. Payne, "Tooth Eruption and Epiphysial Fusion in Pigs and Wild Boar," ibidem, 55-71.

13 I.A. Silver, "The Ageing of Domestic Animals," in *Science in Archaeology*, eds. D. Brothwell and E. Higgs (London: Thames and Hudson, 1969), 283-302.

14 According to Payne, "Kill-off Patterns in Sheep and Goats," 293.

15 Boessneck, Müller, and Teichert, "Osteologische Unterscheidungsmerkmale," 78-95.

16 J.J. Mayer and L.I. Brisbin, "Sex Identification of *Sus scrofa* Based on Canine Morphology," *Journal of Mammalogy* 69 (1988), 408-412.

17 W. Van Neer, K. Noyen, and B. De Cupere, "On the Use of Endosteal Layers and Medullary Bone from Domestic Fowl in Archaeozoological Studies," *Journal of Archaeological Science* 29 (2002), 123-134.

18 L.R. Binford, *Bones: Ancient Men and Modern Myths* (New York: Academic Press, 1981), 105-177.

19 According to Halstead, "The Faunal Remains," 745-750.

20 According to A. von den Driesch, *A Guide to the Measurement of Animal Bones from Archaeological Sites* (Cambridge, MA: Peabody Museum, 1976), with some additional measurements from Boessneck, Müller, and Teichert, "Osteologische Unterscheidungsmerkmale," 59; S. Payne and G. Bull, "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 (1998), 27-66, at 42; S.J.M. Davis, "Measurements of a Group of Adult Female Shetland Sheep Skeletons from a Single Flock: A Baseline for Zooarchaeologists," *Journal of Archaeological Science* 23 (1996), 593-612, at 597; S. Payne, "A Metrical Distinction between Sheep and Goat Metacarpals," in *The Domestication and Exploitation of Plants and Animals*, eds. U.P. Ucko and G. Dimbleby (London: Duckworth,

3 Results

3.1 *Taxonomic Composition*

The assemblage is dominated by goat (*Capra hircus*)/sheep (*Ovis aries*) and pig (*Sus domesticus*), which amount to around 90% of MinAU (Fig. 1). The most abundant single species is pig (40%), surpassed only by goat and sheep combined (51%). Within the goat/sheep taxon, goat is much more abundant than sheep. Equids such as horse (*Equus caballus*), donkey (*Equus asinus*), or their hybrid, the mule, were less abundant with 5% (Fig. 1). Despite the difficulties in the distinction between equid species and the small number of such remains at St Theodore Abbey, there is evidence that more than one equid species were present. Donkey was certainly present, as a lower third molar could be reliably attributed to that species. Moreover, two of the equid first phalanges are so different in size that they most likely belonged to different species or breeds of very different size (Fig. 2). Although the presence of mule cannot be excluded, the small slender first phalanx is too small to belong to one. The large one is also unlikely to belong to a mule, as it is quite robust and the palmar muscle scars are not as pronounced as they usually are on mule first phalanges.[21]

Cattle (*Bos taurus*) were also present with 3%, but their role, at least in meat provision, was marginal (Fig. 1). Lagomorphs are represented by the European hare (*Lepus europaeus*) (Fig. 1), although the presence of rabbit (*Oryctolagus cuniculus*) cannot be entirely excluded. Out of eleven MinAU (2%), three belong to hare and the remaining eight could not be attributed to species. A species of rodent, possibly the house mouse or a rat, is merely present in the assemblage (0.4%). Moreover, a canid skull fragment has been noted and photographed (but excluded from quantification), which suggests the presence of either a small dog (*Canis familiaris*) or a fox (*Vulpes vulpes*) (Fig. 3).

Besides mammals, the remains of birds (MinAU= 74) were also identified (Appendix 1). Taking into account their underrepresentation due to preservation and recovery biases, birds were important at St Theodore Abbey, although still secondary to mammals. The overwhelming majority of bird remains belong to chickens (*Gallus gallus*) or "chicken-sized" birds (Appendix 1). Besides chicken, the only other species of bird positively identified is pigeon (*Columba livia*) or woodpigeon (*Columba palumbus*), both of which could be purchased

1969), 295-305, at 296; U. Albarella and S. Payne, "Neolithic Pigs from Durrington Walls, Wiltshire, England: A Biometrical Database," *Journal of Archaeological Science* 32 (2005), 589-599, at 591.

21 According to J. Peters, *Römische Tierhaltung und Tierzucht: Eine Synthese aus archäozoologischer Untersuchung und schriftlich-bildlicher Überlieferung* (Rahden/Westfalen: Marie Leidorf, 1998), 162-163, 407-412.

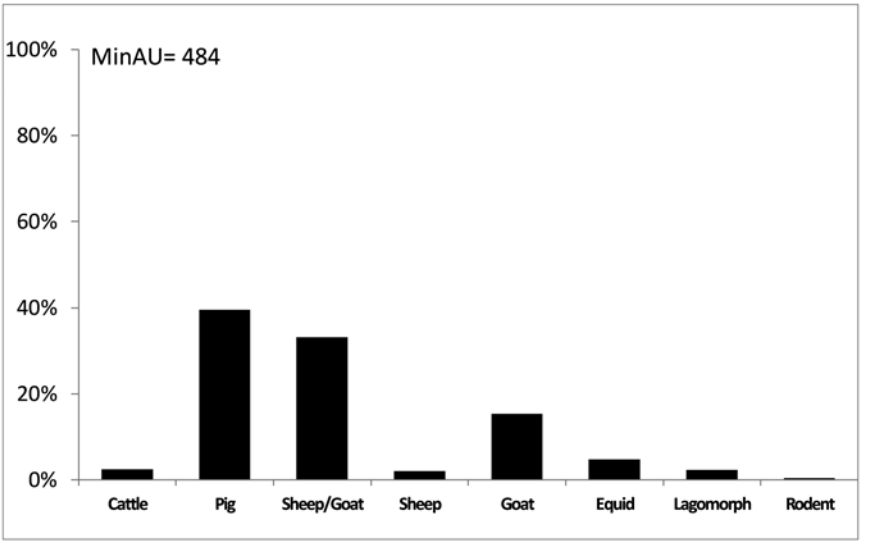

FIGURE 1 Species composition at St Theodore Abbey, all contexts combined. Horncores are excluded to ensure comparability with species that lack those elements. See also raw data in Appendix 1
GRAPH: AUTHOR

FIGURE 2 Equid first phalanges of strikingly different size belonging to different species, probably donkey (left) and horse (right)
PHOTO: AUTHOR

FIGURE 3 Canid skull fragment belonging to either a small dog or fox
PHOTO: AUTHOR

in the markets of Cyprus, at least in the sixteenth century.[22] Also, very few remains of small (possibly passerine) and large (larger than chicken) birds were recorded.

Fish remains have also been recorded (MinAU= 9) in small numbers (Appendix 1). Most belonged to relatively large specimens, which strengthens the impression of their underestimation due to recovery bias. Most remains belonged to catfish (MinAU=5), but it is difficult to specify whether they belong to the African catfish (*Clarias gariepinus*) or the mudfish (*Clarias anguillaris*). The former is found in rivers and estuaries in Africa and the Levant,[23] while the latter is nowadays rarer and found only in Africa.[24] Regardless of the exact species, the presence of catfish is intriguing as it is not found naturally in Cyprus. Hence, if not reared in fishponds within Cyprus, it must have been transported from North Africa or the Levant. As far as marine fish are concerned, the meagre

22 See Elias of Pesaro's letter in C.D. Cobham, *Excerpta Cypria* (Cambridge: Cambridge University Press, 1908), 76.

23 A. Konings, J. Freyhof, FishBase team RMCA, and D. Geelhand, *Clarias gariepinus. The IUCN Red List of Threatened Species 2019* (available at: https://www.iucnredlist.org/species/166023/155051767, accessed May 2023).

24 P. Lalèyè, A. Azeroual, T. Bousso, A. Getahun, and T. Moelants, *Clarias anguillaris. The IUCN Red List of Threatened Species 2020* (available at: https://www.iucnredlist.org/species/182189/134907945, accessed May 2023).

(*Argyrosomus regius*) was represented by two remains (Appendix 1). Today, meagre is found mainly in the Mediterranean, Black Sea, and eastern central Atlantic.[25] Moreover, a dentary bone belonging to a species of the sparid (e.g., sea bream) family and another large fish bone remain unidentified.

3.2 *Anatomical Representation*

The assemblage is too small to allow detailed analysis of the anatomical representation in different taxa. For the most abundant pig and goat/sheep, no pattern indicating a selection of particular body parts can be observed (Appendix 1). Pig and goat/sheep mandibles and teeth are slightly underrepresented, compared to postcranial remains, but not to such an extent that cannot be accounted for by recovery or preservation biases acting against the smaller-sized teeth. Moreover, small foot bones (astragalus, calcaneus, and phalanges) are also underrepresented, especially in the case of goat/sheep (Appendix 1). Nonetheless, it cannot be specified whether this is human interference or recovery bias. The anatomical representation of chicken suggests that entire carcasses were deposited at the site (Appendix 1). Overall, anatomical representation data suggest that mostly entire carcasses were consumed and deposited at the site. Whether all or some of these animals were reared at the nunnery itself or were obtained from outside cannot be entirely resolved with the available data.

3.3 *Age-at-Death*

Age-at-death data are scarce for most taxa. Only the samples of goat/sheep and pig are large enough to allow exploration of trends in their mortality profiles. For goat and sheep combined, the analysis of epiphyseal fusion data shows that 36% were slaughtered before the age of 6-10 months (Fig. 4). Moreover, the presence of nine MinAU belonging to both foetal and neonatal animals suggests that some lambs/kids were culled at the nunnery. The dominant peak in mortality, however, is observed in the 18-28 months interval, when it reaches almost 80%. By 42 months of age, mortality reached 91% and thus very few animals (9%) survived beyond that age.

The analysis of dental eruption and wear data for goat/sheep also suggests high mortality (almost 40%) in the first year (Table 1). Mortality was at 11% for the second and 20% in the third year. The two mandibles in the 2-6 months interval have their deciduous fourth premolars lightly worn only on their

25 D.A. Pollard and K. Bizsel, *Argyrosomus regius. The IUCN Red List of Threatened Species 2020* (available at: https://www.iucnredlist.org/species/198706/130099146, accessed May 2023).

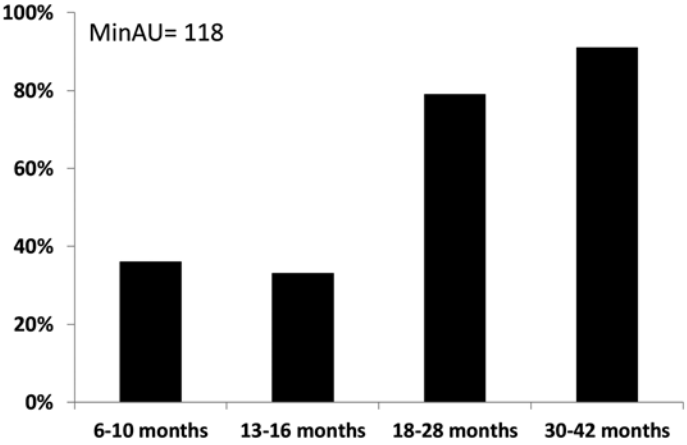

FIGURE 4 Mortality data for sheep and goat (combined) based on epiphyseal fusion
GRAPH: AUTHOR

TABLE 1 Mortality data for goat and sheep (combined) based on dental eruption and wear

Stage	A	B	C	D	E	F	G	H	I	Total
Age	0-2 months	2-6 months	6-12 months	1-2 years	2-3 years	3-4 years	4-6 years	6-8 years	8-10 years	
MinAU	0	2	2.7	1.3	2.4	0	3.6	0	0	12
%mortality	0%	17%	22%	11%	20%	0%	30%	0%	0%	100%

anterior cusp and are thus likely to represent animals at the younger end of the interval. Overall, mortality amounts to 70% of the population by the end of the third year. In contrast to epiphyseal fusion data (Fig. 4), dental eruption and wear shows higher survivorship among adults (30% in contrast to 9%). This discrepancy may be explained by the small samples involved and the mismatch between the age intervals used. For this reason, the results should be viewed just as a general picture of sheep/goat mortality, with dental eruption being more detailed.

Pig epiphyseal fusion data exhibit a clear pattern, with half the animals slaughtered when younger than 12 months and the other half when younger

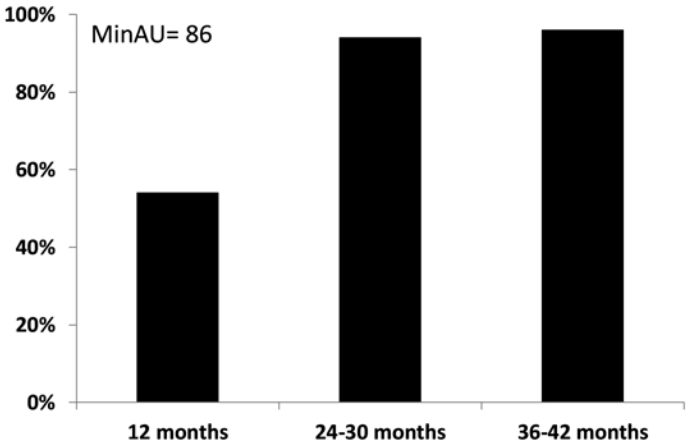

FIGURE 5 Mortality data for pig based on epiphyseal fusion
GRAPH: AUTHOR

than 24-30 months (Fig. 5). Very few pigs (4%) reached ages older than 42 months. Four anatomical units belonged to neonatal piglets, suggesting the rearing of pigs at the nunnery and the consumption of piglets. Dental eruption and wear data include only four aged specimens, one at 0-2 months, one at 2-6 months, one at 6-12 months, and one at 12-24 months. These ages corroborate the pattern observed with the epiphyseal fusion data for mortality in the first and second years for pigs.

For cattle, only three anatomical units yielded age-at-death data and all were fused by the age of 18 months. Moreover, a loose mandibular third molar belonged to an animal older than 36 months. For equids, all anatomical units with age-at-death information (MinAU= 12) were fused, indicating that most animals were adults. The same is suggested by a single donkey mandibular third molar that was already in wear. Concerning lagomorphs, a pelvis and a humerus were fully fused.

Bird remains are dominated by chicken and "chicken-sized" birds. The category "chicken-sized" is likely to consist mostly of chicken remains. In the majority of such cases, specimens could not be reliably identified as chicken due either to their immature state or to fragmentation. Better-preserved bones were safely identified as chicken. Assuming that most "chicken-sized" specimens belonged to chicken, the relative abundance of adult to immature anatomical units can be estimated (Table 2). Adults are more abundant, but there is an important component of immature chicken represented in the assemblage.

TABLE 2 Numbers of adult and immature chicken remains (MinAU), chicken and "chicken size" remains combined

Age stage	Chicken	"Chicken size"	Total
Adult	23	0	23
Immature	6	11	17

Judging by the size and overall appearance of the specimens, these immature chickens likely represent subadult chicken that were consumed, rather than the natural mortality of newly-hatched chicks.

3.5 *Sex Ratios*

Due to the small sample size, male:female ratios cannot be reliably established, even for the most abundant taxa. Nevertheless, the few indications that exist are presented. Two goat/sheep and three goat pelves belonged to female animals and none to male. This does not necessarily imply the absence of male animals, as some particularly large goat/sheep metapodia indicate their presence. The fact that some of them are unfused or fusing suggests that many males were slaughtered at a young age. The presence of some males within the goat/sheep remains is also suggested by the broad range of some of the biometrical measurements (Appendix 11). Concerning pigs, only male canines were recorded (MinAU= 6). Due to the small numbers involved and a recovery bias against the much smaller female pig canines, the presence of female pigs cannot be excluded.

Chicken remains yielded evidence for the presence of both cocks and hens. The presence of hens is confirmed by the occurrence of several long bones filled with medullary bone (Fig. 6). In hens, medullary bone accumulates in the cavities of several bones but most commonly the femur, before, during, and for a short period after laying eggs.[26] At St Theodore Abbey, four out of the five chicken femora contained medullary bone, while two "chicken-sized" femora had no evidence of medullary bone. This evidence should not be taken at face value in terms of hen:cock ratios. It does confirm, however, the presence and majority of hens.

26 Van Neer, Noyen, and De Cupere, "On the Use of Endosteal Layers," 129-132.

FIGURE 6 Chicken femur with medullary bone in the cavity of the bone (indicated by arrow)
PHOTO: AUTHOR

TABLE 3 Frequencies of old fresh and new breaks on cattle, pig, and goat/sheep (combined)

Fragmentation time	Cattle		Pig		Goat/Sheep		Total
	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
Old fresh	9	90%	82	58%	121	55%	212
New break	1	10%	60	42%	99	45%	160
Total	10	100%	142	100%	220	100%	372

3.6 *Fragmentation and Taphonomy*

Most specimens were fragmented in the past as fresh bones (Table 3). Very few are complete (Table 4), mainly small bones such as phalanges and astragali. Analysis of the types of fragmentation (Table 4) suggests that, for the most abundant taxa (goat/sheep and pig), the most common type of fresh break is "end & shaft." In pigs, the second most common type are "shaft cylinders" followed by "shaft splinters," while for goat/sheep this order is inverted.

The taphonomic analysis of the assemblage (Table 5) provides possible explanations for some of the fragmentation patterns identified above. The common characteristic of the assemblage is the low occurrence of discernible signs of taphonomic processes, also compounded by erosion on bone surfaces. The occurrence of gnawing marks from carnivores (or pigs) is at its highest among pig remains and barely present on goat/sheep remains, while cattle bones were not gnawed. The presence of gnawing marks (punctures, pits, scores, and furrows) constitutes indirect evidence for the presence of dogs at the site, although dog remains were absent besides a possible skull fragment (Fig. 3).

TABLE 4 Frequencies of different fragmentation types for cattle, pig, and goat/sheep (combined)

Fragmentation shape	Cattle		Pig		Goat/Sheep		Total
	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
Whole/almost whole	2	33%	15	17%	22	17%	39
End & shaft*	0	0%	28	32%	50	38%	78
Shaft splinter	4	67%	17	20%	40	30%	61
Shaft cylinder	0	0%	27	31%	21	16%	48
Total	6	100%	87	100%	133	100%	226

* also includes "end splinters" and "shaft & end splinters"

TABLE 5 Incidence of taphonomic processes on the remains of cattle, pig, and goat/sheep combined

Taphonomic condition	Cattle		Pig		Goat/Sheep		Total
	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
None	11	84%	189	83%	279	92%	479
Carnivore gnawed	0	0%	34	15%	13	5%	47
Rodent gnawed	0	0%	0	0%	3	1%	3
Burnt	1	8%	4	2%	6	2%	11
Bronze staining	1	8%	0	0%	1	0%	2
Total	13	100%	227	100%	302	100%	542

3.7 *Butchery*

Butchery marks are present on cattle, pig, goat/sheep, and lagomorph remains (Table 6). Their frequency on medium and large mammals (excluding lagomorphs) reduces with body size. Cattle are more butchered than pigs, and pigs more butchered than goat/sheep. Beyond mammals, chicken remains yielded a single butchery mark. As is also the case for lagomorphs, small-sized animals require less butchery than cattle, pig, goat, and sheep.

The types of butchery marks on the most common taxa include chopping, sawing, percussion, dismembering, filleting, and skinning (Table 7). The sample for cattle is small but indicates that chopping and sawing were common. The samples of goat/sheep and pig indicate a similar approach to butchery. For both taxa, chopping and percussion play a main role in the dismembering

TABLE 6 Incidence of butchery on mammal remains

Butchery	Cattle		Pig		Goat/Sheep		Lagomorph		Total
	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
Not butchered	6	46%	146	63%	220	71%	10	91%	410
Butchered	7	54%	85	37%	90	29%	1	9%	183
Total	13	100%	231	100%	310	100%	11	100%	593

TABLE 7 Frequencies of different types of butchery marks on the remains of cattle, pig, and goat/sheep (combined)

Butchery	Cattle		Pig		Goat/Sheep		Total
	MaxAU	%MaxAU	MaxAU	%MaxAU	MaxAU	%MaxAU	
Chopping	5	50%	64	48%	42	29%	111
Percussion	0	0%	33	25%	46	31%	79
Dismembering	0	0%	9	7%	34	23%	43
Filleting	0	0%	22	17%	25	17%	47
Skinning	0	0%	4	3%	0	0%	4
Sawing	5	50%	0	0%	0	0%	5
Total MaxAU	10	100%	132	100%	147	100%	289

of carcasses and access to marrow. Dismembering cut marks are also present, more frequently on goat/sheep than pig bones, although the higher occurrence of chopping marks on pigs is also due to dismembering. For both goat/sheep and pig, filleting was also relatively common (17%) and indicates yet another aspect of carcass processing. In addition to those, one hare and one chicken bone were recorded with one dismembering mark each.

3.8 *Biometry*

The few available biometric measurements are listed in Appendix 11. The potential for comparisons with sites in Cyprus is limited due to lack of published data. To provide a general idea of the body size of some of the animals, withers heights were calculated for pig and sheep (Table 8). Despite goat remains being more abundant than sheep, none yielded the measurements necessary for withers height calculation. Pigs ranged at 73.3-83.2cm and sheep

TABLE 8 Withers heights for pig and sheep at St Theodore Abbey and Pano Pyrgos-Avli, calculated according to Teichert[a]

St Theodore

Species	Element	Fusion	Withers height (cm)
Pig	Metatarsus IV	Fused	73.3
Pig	Astragalus	Indeterminate	78.6
Pig	Astragalus	Indeterminate	79.4
Pig	Astragalus	Indeterminate	83.2
Sheep	Astragalus	Indeterminate	69.2
Sheep	Astragalus	Indeterminate	67.4

Pano Pyrgos-Avli

Species	Element	Fusion	Withers height (cm)
Pig	Metacarpus III	Fusing	68.7
Pig	Calcaneus	Fused	69.3
Pig	Astragalus	Indeterminate	68.5
Sheep	Metacarpus	Fused	73.4
Sheep	Metatarsus	Fused	70.5
Sheep	Calcaneum	Fused	65.0
Sheep	Calcaneum	Fused	64.9
Sheep	Astragalus	Indeterminate	69.4

a For pigs, M. Teichert, "Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei vor- und frühgeschichtlichen Schweinen," *Kühn-Archiv* 83 (1969), 237-292; for sheep, M. Teichert, "Osteometrische Untersuchungen zur Berechnung der Widerristhöhe bei Schafen," in *Archaeozoological Studies*, ed. A.T. Clason (Amsterdam – Oxford: North-Holland Publishing Company, 1975), 51-69.

at 67.4-69.2cm. The only broadly contemporary assemblage, involving probable admixture with material of the Ottoman period, is from Pano Pyrgos-Avli (80km west of St Theodore).[27] The pigs at St Theodore Abbey were smaller than those at Avli, while sheep were of similar size at both sites (Table 8). Goat size was explored through analysis of two distal humerus measurements. The result shows that goats were also of similar size at both sites (Fig. 7). The large

27 Hadjikoumis, "Μελέτη των ζωοαρχαιολογικών καταλοίπων από τη θέση Πάνω Πύργος-Αυλή."

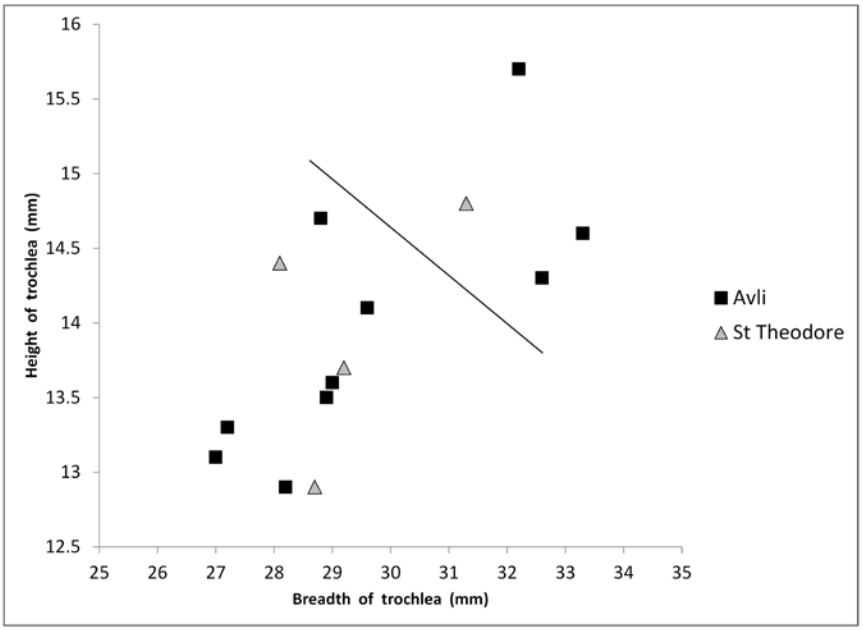

FIGURE 7 Scatterplot with distal humerus measurements of goats from St Theodore Abbey and Pano Pyrgos-Avli. Only fully fused specimens are included
GRAPH: AUTHOR

group of smaller and the small group of larger animals likely represent the more numerous females and the less numerous males respectively. Beyond Avli, the chronologically nearest available comparison derives from late-sixth-/early-seventh-century wells at Amathus port.[28] A sheep metacarpus and an astragalus from that sample yields withers heights of 56.5cm and 59.0cm respectively. If representative, they indicate a considerable increase in sheep size between the Early Christian and late medieval periods.

4 Discussion

The presented analyses shed light on a wide range of human–animal interactions at St Theodore Abbey and, thus, enable the discussion of several aspects

28 A. Hadjikoumis, "A Late Roman Faunal Assemblage Found in Amathus Harbour," in *The Hellenistic Harbour of Amathus Underwater Excavations, 1984-1986. Volume 2: Artefacts Found during Excavation*, ed. J.-Y. Empereur (Athens: École française d'Athènes, 2018), 197-210.

of life at a Cistercian nunnery. These aspects mainly pertain to economic and social practices.

4.1 *Animal Economy*

The assemblage of St Theodore Abbey is dominated by sheep/goat and pig remains. Sheep and goat combined are the most numerous taxon, representing slightly more than half of the mammal remains recovered. Between the two caprines, goats were much more common than sheep (Fig. 1 and Appendix 1). In Western Europe, Cistercian monasteries were renowned for their sheep management, especially for wool, leather, and parchment production and trade.[29] While in Northwest Europe goats were practically absent,[30] in Southwest Europe some Cistercian monasteries managed large numbers of goats as well.[31] This geographical pattern suggests that a drier environment with poorer pasture is a contributing factor towards increased goat numbers in Southwest Europe. Palaeoenvironmental studies in the Eastern Mediterranean show an overall wetter climate after around 1000 BCE.[32] Local climatic and land-use conditions, however, have been found to override broader climatic trends in western Cyprus.[33] Moreover, several travellers to the island report that summers were still hot, dry, and long, and lack of water was a constant problem.[34] Such conditions would have provided incentive for goat herding, as goats have lower water and more flexible food requirements. Besides environmental conditions, other incentives for a strong preference for goats at St Theodore Abbey are provided by higher milk yields and reproduction rates, lower labour

29 E.g., for England, R.A. Donkin, "Cistercian Sheep-Farming and Wool Sales in the Thirteenth Century," *Agricultural History Review* 6 (1958), 2-8; for Denmark, C. Yoder, "Diet in Medieval Denmark: A Regional and Temporal Comparison," *Journal of Archaeological Science* 37 (2010), 2224-2236; for Southern France and Spain, C. Berman, *Medieval Agriculture, the Southern French Countryside, and the Early Cistercians: A Study of Forty-Three Monasteries* (Philadelphia, PA: American Philosophical Society, 1986), 126.

30 For example, C. Yoder, "The Late Medieval Agrarian Crisis and the Black Death Plague Epidemic in Medieval Denmark: A Paleopathological and Paleodietary Perspective," PhD dissertation (Texas A&M University, 2006); R.A. Donkin, "Cattle on the Estates of Medieval Cistercian Monasteries in England and Wales," *The Economic History Review* 15 (1962), 31-53.

31 Berman, *Medieval Agriculture*, 96.

32 M. Bar-Matthews and A. Ayalon, "Speleothems as Palaeoclimate Indicators, a Case Study from Soreq Cave Located in the Eastern Mediterranean Region, Israel," in *Past Climate Variability through Europe and Africa*, eds. R.W. Battarbee, F. Gasse, and C.E. Stickley (Dordrecht: Springer, 2004), 363-391.

33 K. Deckers, "Post-Roman History of River Systems in Western Cyprus: Causes and Archaeological Implications," *Journal of Mediterranean Archaeology* 18/2 (2005), 155-181.

34 See the account of Johannes Cotovicus (Van Kootwyck) in Cobham, *Excerpta Cypria*, 199.

requirements, and possibly local or introduced cultural traditions. More data from coeval faunal assemblages are required to test whether the preference for goats observed at St Theodore was universal for medieval Cyprus or varying based on environmental, social, economic, or other conditions.

Besides meat, goat and sheep also produce secondary products such as milk, wool, and manure, thus adding to their overall economic potential. For goat/sheep combined, some mortality among animals younger than six months old (including neonatal) (Fig. 4 and Table 1) and the predominance of adult females (Fig. 7) suggest that the potential for dairying was present. Even in the absence of age-at-death and sex data specific to sheep, wool harvesting constitutes another possible economic activity given the fame of Cistercians in wool production. As to where the goats and the sheep were herded, only guesses can be made. Early Cistercian monastic communities in rural areas usually engaged in agricultural and pastoral activities through a system of granges worked by *conversi*.[35] St Theodore Abbey, however, was an urban nunnery founded in the thirteenth century for which no evidence exists as to whether or not it operated such a system. The limited evidence available indicates that the abbey worked its rural holdings in the areas of Malounda and Pharmakas with serfs and slaves, but also maintained extensive gardens at the nunnery.[36] Its location at the edge of medieval Nicosia is more compatible with a scenario of managing goats and sheep outside the nunnery in the agricultural hinterland. The possibility of keeping small numbers of animals seasonally at the nunnery (e.g., lactating females and their lambs) is also plausible. The data at hand cannot resolve the question, but the presence of all anatomical elements (Appendix 1) suggests that goat and sheep were brought entire to the nunnery, either on the hoof or as complete carcasses.

Pig is the most abundant species in the assemblage, excluding goat and sheep when grouped as a single taxon. Due to its larger body size, the pig was just as important as goat/sheep in meat production, if not more. The relatively balanced anatomical representation (Appendix 1), the presence of piglets and older pigs, as well as the presence of all types of butchery, suggest that at least some of the pigs were reared at or near the nunnery. Independently of the origin of the pigs consumed at St Theodore Abbey, age-at-death (Fig. 5) shows that more than half were slaughtered at variable ages within their first year. The remainder were slaughtered within their second and early third year, with very few pigs (probably kept for reproductive purposes) surviving into adulthood.

35 L.J. Lekai, *The Cistercians: Ideals and Reality* (Kent, OH: Kent State University Press, 1977), 26-27.

36 Duba and Schabel, "The White Nuns in Outremer," 30-31.

Such a mortality pattern is more compatible with small-scale local pig rearing. Pigs kept in pens at or near this monastic community could have benefited from domestic waste produced by the community of nuns and agricultural waste produced by the extensive vegetable and fruit gardens maintained by the nunnery.[37] If pigs were indeed kept at the nunnery, besides meat, they also improved the hygienic conditions by consuming most types of waste. The fact that only male canines were recovered at St Theodore cannot be objectively evaluated, as it might be the result of a recovery bias against the significantly smaller female pig canines.

Cattle remains are scarce and thus played a secondary role in the site's economy, with all possible roles remaining open (meat, milk, draught, and manure). Although biometric measurements of cattle remains are scarce, the overall impression is that they were of medium to small size, which agrees with Cotovicus' description of a captain buying "eight oxen, small but fat" in Limassol in 1598.[38] With the scarcity of published late medieval faunal assemblages in Cyprus it is impossible to confirm whether low cattle numbers were the norm. At Frankish – Ottoman (thirteenth – eighteenth century) Pano Pyrgos-Avli, cattle were slightly more abundant[39] than at St Theodore Abbey (Fig. 1) but still played a marginal role in diet. Cattle were also scarce in recent Cypriot farming practices, as they were kept mainly for ploughing.[40] Traditionally, beef was rarely consumed in Cyprus and even avoided by many farmers due to emotional bonds forged over years of work with the same animals. Low cattle numbers at St Theodore Abbey raise the possibility of a late medieval, and possibly much earlier, origin of the use of cattle almost exclusively for draught power in Cyprus.[41] A geographically and culturally relevant parallel is the Cistercian monastery of Zaraka in the thirteenth-century Frankish Peloponnese, where very few cattle remains were recovered.[42]

Besides pig, goat, sheep, and cattle, smaller animals were also managed or acquired for consumption at the nunnery. Chicken was economically the most important of these, although the presence of other bird species (e.g., pigeons,

37 Duba and Schabel, "The White Nuns in Outremer," 29-30.

38 Cobham, *Excerpta Cypria*, 188.

39 Around 7% of mammal MinAU; see Hadjikoumis, "Μελέτη των ζωοαρχαιολογικών καταλοίπων από τη θέση Πάνω Πύργος-Αυλή."

40 D. Christodoulou, *The Evolution of the Rural Land Use Pattern in Cyprus* (Bude: Geographical Publications, 1959), 182.

41 L. de Mas Latrie, *Histoire de l'île de Chypre sous le règne des princes de la maison de Lusignan*, 3 vols. (Paris: Imprimerie impériale/nationale, 1852-1861), 1:222.

42 D. Ruscillo, "The Faunal Remains: Daily Life and Environment in Medieval Zaraka," in *The Cistercian Monastery of Zaraka, Greece*, ed. S. Campbell (Kalamazoo, MI: Medieval Institute Publications, 2018), 175-192.

pheasants, peacocks) cannot be excluded.[43] The frequency of medullary bone confirms the presence of laying hens (Fig. 6) and, in combination with the bones of immature chicken (Table 2), suggests that chickens were reared at the nunnery, as they were at other Cistercian nunneries in Europe.[44] Even if chicken remains are underestimated due to recovery and preservation biases, their abundance shows that chicken was of considerable importance at the nunnery due to providing meat and eggs, as well as improving hygienic conditions through the consumption of most waste. Chickens are reared easily and could have been kept in a coop within or attached to the nunnery, thus being protected from predators and thieves.

The smallest consumed mammalian species at St Theodore was the European hare. Its importance was marginal, as evidenced by its scarce identified remains (Fig. 1). The presence of rabbit among the lagomorph remains is unlikely. If they were reared at the nunnery, due to the high fecundity of rabbits, their remains would have been more abundant. High fecundity is accompanied by relatively high mortality among immature rabbits[45] but no such evidence was recovered. Moreover, as with most domestic animals reared primarily for their meat, rabbits are slaughtered as subadults or younger. In contrast, hunted free-living animals such as hares are consumed at variable ages, with most being adults. Consequently, the few remains of hares represent animals occasionally brought to the nunnery after being captured in the countryside, perhaps with the use of dogs, traps, or projectile weapons. The hare was certainly hunted by the nobility of Cyprus during the Lusignan period. On one occasion in January 1396 King James I sent his guest, Ogier VIII, lord of Anglure, a present of "one hundred partridges, sixty hares, and five wild sheep."[46] It remains unknown how hares ended up in the nunnery, but there are two plausible options. First, they could represent occasional presents from hunting expeditions by members of the local nobility. Second, they could have been captured by someone tending crops or animals on behalf of the nunnery. The presence of hunted animals in monastic contexts in late medieval Europe

43 Cf. Mas Latrie, *Histoire de l'île de Chypre*, 1:586.

44 Such as at Clairefontaine Abbey in Belgium: M. Court-Picon, Q. Goffette, and S. Preiss, "Arlon/Autelbas: consommation et modes de vie à l'abbaye de Clairefontaine d'après les restes biologiques des cuisines (13e-16e siècles)," *Chronique de l'Archéologie wallonne* 21 (2014), 223-226.

45 A.A. Rashwan and I.F.M. Marai, "Mortality in Young Rabbits: A Review," *World Rabbit Science* 8 (2000), 111-124.

46 Ogier d'Anglure, *The Holy Jerusalem Voyage of Ogier VIII, Seigneur d'Anglure*, trans. R. Browne (Gainesville, FL: University Press of Florida, 1975), 70.

is common[47] and in some cases it has been connected to sites of high status. Such an interpretation for St Theodore would require higher frequencies of hunted animals, additional information such as textual evidence of hunting rights, and differences in faunal composition between sites of different status in Cyprus, as it has been done for areas in Northwest Europe.[48]

The fish remains in the assemblage were the result of fishing in Cyprus, as well as imports. Their low frequency suggests that fish was rarely consumed, although their numbers are underestimated to an unknown degree due to recovery biases. The identified marine species (meagre and sea bream) probably derived from the sea around Cyprus. Their consumption in Nicosia would require swift transportation of fresh fish or preservation through salting or smoking. Textual sources from the sixteenth century reveal that fishing was a common activity in coastal towns, which logically also satisfied the needs of inland markets such as those at the capital. Elias of Pesaro wrote in 1563 that in Famagusta fish could be bought "as cheaply as in Italy."[49] The presence of large specimens of catfish is even more intriguing, as these freshwater fish are not naturally found in Cyprus. Catfish remains have been identified in earlier periods on the island[50] but have been interpreted as rare imports from neighbouring areas.[51] Cistercian and other monastic orders owned fishponds and fishing rights in Europe[52] and such a connection is also documented in Cyprus in at least two cases. The monastery of St Nicholas at Akrotiri had a legal share in fish

47 E.g., Court-Picon, Goffette, and Preiss, "Arlon/Autelbas."

48 A. Ervynck, W. Van Neer, H. Hüster-Plogmann, and J. Schibler, "Beyond Affluence: The Zooarchaeology of Luxury," *World Archaeology* 34 (2003), 428-441; A. Ervynck, "*Orant, pugnant, laborant*. The Diet of the Three Orders in the Feudal Society of Medieval North-Western Europe," in *Behaviour behind Bones. The Zooarchaeology of Ritual, Religion, Status and Identity*, eds. S.J. O'Day, W. Van Neer, and A. Ervynck (Oxford: Oxbow Books, 2003), 215-233.

49 Cobham, *Excerpta Cypria*, 75.

50 M. Waelkens, J. Poblome, G. Mumford, R. Friedman, O. Lernau, and W. Van Neer, "Fish Remains from Archaeological Sites as Indicators of Former Trade Connections in the Eastern Mediterranean," *Paléorient* 30 (2004), 101-147.

51 A. Arndt, W. Van Neer, B. Hellemans, J. Robben, F. Volckaert, and M. Waelkens, "Roman Trade Relationships at Sagalassos (Turkey) Elucidated by Ancient DNA of Fish Remains," *Journal of Archaeological Science* 30 (2003), 1095-1105.

52 T. Salminen, "Fishing with Monks – Padise Abbey and the River Vantaanjoki from 1351 to 1429," in *Colonists on the Shores of the Gulf of Finland: Medieval Settlement in the Coastal Regions of Estonia and Finland*, ed. M. Poutanen (Lahti: Vantaa City Museum Publications, 2011), 37-64; S. Tobin, *The Cistercians: Monks and Monasteries of Europe* (London: Herbert Press, 1995); M. Shackley, J. Hayne, and N. Wainwright, "Environmental Analysis of Medieval Fishpond Deposits at Owston Abbey, Leicestershire," in *Medieval Fish, Fisheries and Fishponds in England*, ed. M. Aston (Oxford: British Archaeological Reports, 1988), 301-308.

caught at the nearby salt lake[53] and there is also evidence that the Cistercian monks at Pyrgos near Limassol constructed and operated a fishpond.[54] Catfish does not appear to have been kept in fishponds at St Theodore Abbey, based on the available evidence. It is more likely that it was imported to Cyprus, alive or preserved, through trade with Egypt or the Levant.

Only animals that were consumed as food have been discussed so far. Some of the identified taxa, however, appear to have played different roles. Equids were more numerous than cattle (Fig. 1) and the fact that they were not consumed indicates that they were used in the transportation of people, products, and other goods to and from Nicosia's markets, as well as for agricultural work.[55] Limited data on age-at-death suggest that most were adults, which is compatible with roles in transportation and agricultural work. The presence of both donkey and horse (Fig. 2), if not also mule, suggests that each species might have served different purposes. Donkeys and horses have different advantages and requirements. Both are used in transportation, but, at least until recently in Cyprus, donkeys were more likely to be used in carrying heavy loads (e.g., harvested crops) and turning mill stones and water wheels, while horses were more appreciated for their speed and for breeding mules.[56] Horses and donkeys would have been essential in the management of the vegetable/fruit gardens[57] and land holdings,[58] as well as for trips to the market.

Besides food and draught animals, very few remains of other animals were present. Dogs were tentatively present at the nunnery, the only indications for such presence being a possible cranial fragment (Fig. 3) and carnivore gnawing marks on bones. The complete or near-absence of dogs and other potentially commensal animals and pets (e.g., cats) may be due to their disposal in different areas than that of food waste.[59] If the nunnery owned dogs, it is also likely that most would have roamed in its rural holdings, possibly guarding agricultural lands and herds of sheep and goat. Beyond dogs, the presence of rodent remains is not surprising as the nunnery must have offered ample feeding and nesting opportunities.

53 Cobham, *Excerpta Cypria*, 172.

54 C. Schabel, "Frankish Pyrgos and the Cistercians," *Report of the Department of Antiquities, Cyprus* (2000), 349-360; P. Benoit and K. Berthier, "Le système hydraulique du moulin de Pyrgos," *Report of the Department of Antiquities, Cyprus* (2002), 407-411.

55 Cf. Mas Latrie, *Histoire de l'île de Chypre*, 1:222.

56 Christodoulou, *The Evolution of the Rural Land Use Pattern in Cyprus*, 183-184.

57 Duba and Schabel, "The White Nuns in Outremer," 30.

58 Duba and Schabel, "The White Nuns in Outremer," 29-36.

59 Hadjikoumis and Christofi, "A Dog's Life."

4.2 *Diet and Cuisine*

Besides the frequencies, management strategies, and roles of each identified taxon discussed above, this zooarchaeological study also contributes insights into diet and cuisine at St Theodore Abbey. Diet and cuisine are important aspects of monastic life that attract intense zooarchaeological interest.[60] This is the first opportunity to discuss late medieval diet in a Cistercian nunnery in Cyprus based on the actual remains of food.

Meat consumption at the nunnery consisted predominantly of pork and goat meat, as well as mutton, while beef was rarely consumed. Chicken meat and eggs also formed an important part of the diet. Beyond domestic animals, wild animals such as hare and fish were only rarely consumed. The Cistercians were supposed to abstain from meat and lard in their monasteries, although this remained a contentious issue with legislation issued and evaluated both locally and internationally.[61] In Cistercian monasteries in the West, abstinence from meat consumption appears to have been strictly observed in the twelfth and thirteenth centuries, but the discussion became more "heated" during the fourteenth century, and by the fifteenth century such decisions devolved upon abbots and abbesses.[62] In Flanders, at least, there is irrefutable evidence that meat was consumed within all monasteries (including Cistercian) from the twelfth and thirteenth centuries onwards, although fish always predominated, which underlines the compatibility of fish consumption with fasting.[63] St Theodore Abbey was still functioning in the fourteenth and fifteenth centuries, which makes the consumption of pigs, goats, sheep, cattle, hare, and chicken by the nuns possible, at least for parts of the year or under certain circumstances (e.g., sickness or in the presence of guests). Most likely, however, animals were also consumed by guests and hired craftspeople. The frequency with which St Theodore Abbey entertained such visitors remains unknown. As in Western Europe, the spatial patterning of animal remains at St Theodore would be key for elucidating who consumed the meat. This, however, remains impossible because they were recovered as a single general sample.

Independently of who was consuming the animals deposited at the nunnery, the picture painted by the analyses is one of a good-quality and diverse diet, although comparative data from Cyprus are still lacking. The consumption of young animals constitutes a luxury, since they could have potentially

60 E.g., C. Polet and M.A. Katzenberg, "Reconstruction of the Diet in a Mediaeval Monastic Community from the Coast of Belgium," *Journal of Archaeological Science* 30 (2003), 525-533; Ervynck, "Following the Rule?."

61 Thomason, "Hospitality in a Cistercian Abbey," 263-273.

62 Thomason, "Hospitality in a Cistercian Abbey," 268-270.

63 Ervynck, "Following the Rule?," 73-77.

provided more meat if slaughtered at higher weights. However, it can also be explained by reasons other than the wish for luxury, such as boosting milk production, adapting to seasonal shortages of animal fodder, and natural mortality. Beyond the consumption of tender meat, age-at-death data suggest that milk and dairy products could also have been produced and consumed at the nunnery.

Concerning the preparation for consumption of foodstuffs, the analyses support limited insights. Carcass size played a crucial role in the intensity of butchery, with cattle being more butchered than pigs and pigs more than goat and sheep. This pattern is compatible with an effort to produce portions of similar size. The most common type of butchery on large and medium mammals (Table 7) is chopping/percussion, mainly to dismember for further processing (i.e., filleting) or further chopping into the desirable portion size. Chopping and percussion also provided access to bone marrow and this is also supported by the fragmentation analysis (Table 4). Combined with the scarcity of burning marks on bones, the butchery patterns are compatible with dishes containing boiled or roasted meat. Moreover, the scarcity of butchery marks on chicken, hare, and fish remains suggests that they may have also been boiled or oven-cooked. In the context of a Cistercian nunnery, soups and stews or oven roasts seem more compatible than grilled meats. For fish specifically, it is impossible to know if they arrived fresh or salted. It is also plausible that cured meats were produced or consumed, given the high frequency of pig remains at St Theodore. Literary sources are silent on the diet at the nunnery, but they do inform us that the Frankish nobility of Cyprus tended to emulate their European counterparts, with adaptations to the animal species available in Cyprus (e.g., mouflon rather than deer species), although this information concerns banquets following hunting expeditions rather than everyday consumption.[64]

4.3 *Religion and Status*

Beyond the economic and dietary aspects of the human–animal relationship, the results also shed light on religion and status. The inclusion of fish in diet, even if rarely, can now also be confirmed for the Cistercians in the East. Fish is a source of protein compatible with fasting and abstinence from "four-legged" meat. Acquiring large meagre and sea bream specimens from the Cypriot sea and catfish from abroad at a site in the dry interior can be viewed as an

64 N. Coureas, "For Pleasure and Profit: The Recreational and Fiscal Exploitation of Animals in Lusignan and Venetian Cyprus (1192-1570)," *Journal of Mediterranean Studies* 25 (2016), 33-50.

indication of the nunnery's status and ability to acquire good-quality food items. Moreover, the evidence for the consumption of piglets, lambs, kids, young chicken, eggs, cheese, and probably a variety of vegetables, greens, and cereals produced at or bought by the nunnery suggest a respectable economic and social status.[65] This is compatible with the fact that the nuns were members of noble families, sometimes leading ones.[66] Some of these more "expensive" food items could have been remains of meals with important guests or simply a reflection of the nunnery's ability to feed its occupants. Donations from Cypriot and foreign nobility and royalty remain open possibilities since members of this monastic community belonged to such families. Moreover, there is textual evidence to indicate that many of the kings of Cyprus were frequently hunting and distributing their prey to guests, other people, and institutions.[67] Yet another indication of the nunnery's respectable economic and social status is the ownership of more than one species of equid (horse and donkey). These animals are relatively expensive to keep and their ownership requires a certain volume of available work to become economically viable. Moreover, such animals extended the agricultural and trading range of the nunnery, as well as increased the mobility of its members.

5 Conclusions

The zooarchaeological study of St Theodore Abbey sheds the first light on several aspects of life in a Cistercian nunnery in late medieval Cyprus. Due to the absence of relevant studies and the modest sample size, the conclusions remain tentative until the findings are compared and integrated with future studies.

The nunnery consumed domestic goat and pig, but also sheep, cattle, chicken, and possibly other species of birds. From these, pigs and chicken appear to have been reared within or very near the nunnery, while the rest were managed at variable distances in the agricultural hinterland outside Nicosia. It cannot be confirmed whether all animals were reared at or acquired by the nunnery. A combination of these two provision modes was more likely. The nuns also produced vegetables and fruits in large gardens at the abbey and possessed rural properties that they exploited through serfs or rented out to individuals. All these types of holdings would have been suitable places, at least seasonally,

65 Ervynck, "Following the Rule?," 78-79.

66 Duba and Schabel, "The White Nuns in Outremer," 29.

67 Anglure, *The Holy Jerusalem Voyage*, 70.

for animal pasture, thus increasing the degree of the nunnery's self-sufficiency. Not only could this monastic community feed itself but most probably also generated surpluses that allowed it to trade and obtain more goods. Beyond meat, the nunnery also produced a variety of secondary products such as eggs, likely dairy products, and wool. Such products could be traded for others that were lacking at the nunnery such as fish, game, and other, archaeologically untraceable provisions. Its likely connections to the nobility of Cyprus further enhanced its provision through possible donations in kind and currency.

Diet at the nunnery may have differed between various groups of people (abbess, nuns, guests, visitors, and possibly servants), based on social, financial, religious, medical, and perhaps other criteria. Nevertheless, the faunal assemblage derives predominantly from generic food waste deposited in the cloister garth, thus precluding the attribution of specific diets to specific groups. The overall picture painted by the analyses reveals a good-quality diet based on pork and goat meat, with an important component of chicken meat and occasionally mutton, beef, eggs, and possibly dairy products. Most meats were cooked in pots or ovens and butchered to render bone marrow accessible for consumption. Fish was also possibly important in this context where fasting was considered a virtue, but this food resource is underestimated both in quantity and diversity due to recovery bias.

The use of horses, donkeys, and plausibly oxen improved considerably the nunnery's efficiency and range of operations concerning agricultural work, transportation of products, and mobility of people. The presence of these animals can also be read as an indicator of high economic and social status. Other attributes of the assemblage that can be read as indicators of high status are the capacity to import large fish in the interior of Cyprus and the consumption of immature animals and secondary products. The consumption of small game constitutes another potential marker of high social status, if it is confirmed in future excavations that such remains have been underestimated due to lack of sieving. The same holds true for the extent to which fish was consumed at the nunnery as well as its taxonomic composition.

The findings of this study contribute to a long-established discussion in Western and Central Europe about monastic communities and diet, status, religion, economy, and society. Given the absence of relevant studies in Cyprus and their scarcity in the broader Eastern Mediterranean, this study will hopefully help kindle further discussion of these themes in the region. At the same time, it will also hopefully promote the consistent collection of faunal remains and sieving to enable more detail in addressing these questions and many more.

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Appendix 1: Abundance of Recorded Taxa at St Theodore in Minimum Anatomical Units.

(Raw Maximum Anatomical Units is indicated in parenthesis if different from MinAU)

Taxon / Body part	Cattle	Pig	Sheep/ Goat	Sheep	Goat	Equid	Horse	Donkey	Lago-morph	Hare	Rodent	Total
Horncore	0	N/A	0	0	2	N/A	N/A	N/A	N/A	N/A	N/A	2
Mandible/	1	11	2	3	7	0	0	1	0	1	0	26
loose teeth		(13)				(3)						(31)
Atlas	0	4	0	0	0	0	0	0	0	0	0	4
Axis	0	0	3	0	0	0	0	0	0	0	0	3
Scapula	0	9	6	1	0	3	0	0	0	0	0	19
		(13)	(7)									(24)
Humerus P	0	13	10	0	0	0	0	0	0	1	0	24
		(15)	(14)		(2)							(32)
Humerus D	0	23	12	1	14	0	0	0	0	1	0	51
		(26)	(16)									(58)
Radius P	0	12	9	1	4	1	1	0	0	0	0	28
		(14)	(16)		(5)	(2)						(39)
Ulna	0	11	1	0	4	2	0	0	2	0	0	20
		(18)										(27)
Radius D	0	3	11	0	4	1	1	0	0	0	0	20
		(4)	(12)			(2)						(23)
Metacarpus P	0	10	12	1	5	0	0	0	0	0	0	28
Metacarpus D	0	5	6	0	5	0	0	0	0	0	0	16
		(6)	(8)	(1)								(20)

(*cont.*)

Taxon / Body part	Cattle	Pig	Sheep/ Goat	Sheep	Goat	Equid	Horse	Donkey	Lago-morph	Hare	Rodent	Total
Pelvis	1	9 (12)	9 (17)	0	4	2	0	0	1	0	1	27 (38)
Femur P	2	6 (9)	18 (30)	0	1 (2)	3	0	0	0	0	1	31 (47)
Femur D	1	10	16 (20)	0	1 (2)	1	0	0	0	0	1	30 (35)
Tibia P	1	20 (22)	18 (22)	0	0	1 (2)	0	0	1	0	0	41 (48)
Tibia D	2 (3)	20	12 (14)	0	1	1 (2)	0	0	2	0	0	38 (42)
Astragalus	1	5	0	2	3	0	0	0	0	0	0	11
Calcaneus	0	14	0	0	0	1	0	0	0	0	0	15
Metatarsus P	0	7	6	1	4	1 (2)	0	0	1	0	0	20 (21)
Metatarsus D	1	3	7	0	6	1 (2)	0	0	1	0	0	19 (20)
1st Phalanx	0	10	4 (6)	0	13	0	1	1	0	0	0	29 (31)
2nd Phalanx	3	0	0	0	5	0	0	0	0	0	0	8
3rd Phalanx	0	2	0	0	1	0	0	0	0	0	0	3
Total	13	207 (237)	162 (213)	10 (11)	84 (89)	18 (27)	3	2	8	3	3	513 (610)

Body part / Taxon	Chicken	*Columba* sp.	Small	Chicken size	Large	Total
Coracoid P	5	0	0	0	0	5
Coracoid D	2	0	0	0	0	2
Scapula	4	0	0	0	0	4
Humerus P	5	0	1	3 (4)	0	6 (7)
Humerus D	4	0	1	2	0	7
Radius P	1	0	0	1	1	3
Radius D	0	0	0	2	1	3

(*cont.*)

Body part \ Taxon	Chicken	*Columba* sp.	Small	Chicken size	Large	Total
Ulna P	3	1	0	2	0	6
Ulna D	3	0	0	2	0	5
Carpometacarpus P	1	0	0	0	0	1
Carpometacarpus D	1	0	0	0	0	1
Sternum	0	0	0	1	0	1
Pelvis	1	0	0	0	0	1
Femur P	5	0	0	1	0	6
Femur D	4	0	0	2	0	6
Tibiotarsus P	2	0	0	3	0	5
Tibiotarsus D	1	0	0	4	0	5
Tarsometatarsus P	2	0	0	0	0	2
Tarsometatarsus D	2	0	0	0	0	2
Total	46	1	2	23 (24)	2	74 (75)

Note: "P" = proximal half, "D" = distal half. Scapula, sternum, and pelvis were recorded only as proximal. *Columba* sp. remains belong to either pigeon or wood pigeon. "Small" is roughly pigeon size or smaller and "Large" is larger than the chicken remains in this assemblage.

Body part \ Taxon	*Clarias* sp.	*Argyrosomus regius*	*Sparidae*	Large	Total
Neurocranium	2 (3)	0	0	0	2 (3)
Dentary	0	0	1	0	1
Pectoral spine	1	0	0	0	1
Quadrate	1	0	0	0	1
Premaxilla	0	1	0	0	1
Vertebra	0	1	0	0	0
Articular	1	0	0	0	
Supracleithrum?	0	0	0	1	
Total	5 (6)	2	1	1	9 (10)

Note: All fish remains were recorded as NISP.

Appendix 11: Biometric Measurements from St Theodore Abbey

Scapula	Fusion	Measurements				
Species	proximal	SLC[a]	GLP[a]	BG[a]	LG[a]	ASG[b]
Pig	Fused	21.1	31.5	21.3	26.5	
Sheep	Fused	21.5				
Sheep/goat	Fused	18.0	32.0	21.2	20.6	26.8
Equid	Unknown			34.1		

Humerus	Fusion		Measurements				
Species	proximal	distal	Bd[a]	BT[a]	HTC[c]	HT[b]	SD[a]
Pig	Unfused	Fusing			19.4		
Pig	Absent	Fusing			19.6		
Sheep	Absent	Fused		31.1	15.5		
Goat	Absent	Fused		28.7	12.9	16.9	
Goat	Absent	Fused	31.0	29.2	13.7	18.0	
Goat	Absent	Fused	29.7	28.1	14.4	18.6	
Goat	Absent	Fused		31.3	14.8		
Goat	Absent	Fused		28.7			
Goat	Absent	Fused		27.8		17.3	16.0
Hare	Unknown	Fused	10.5		5.8		

Radius	Fusion		Measurements			
Species	proximal	distal	Bp[a]	BFp[a]	Bd[a]	SD[a]
Horse?	Absent	Fused				25.7
Pig	Fused	Absent	26.2			
Pig	Fused	Absent	26.4			
Pig	Fused	Absent	28.2			
Pig	Fused	Absent	28.7			
Pig	Fused	Absent	30.4			

(*cont.*)

Radius	Fusion		Measurements			
Species	proximal	distal	Bp[a]	BFp[a]	Bd[a]	SD[a]
Sheep	Fused	Absent	31.0	27.0		
Goat	Fused	Unknown	27.4	27.2		17.9
Goat	Fused	Absent	33.6	33.1		
Goat	Fused	Absent		30.9		
OC	Absent	Fused			33.3	

Ulna	Fusion	Measurements		
Species	proximal	BPC[a]	DPA[a]	SDO[a]
Pig	Fused	21.4	35.8	25.9
Pig	Fusing	21.8		
Goat	Fusing			20.4
Lagomorph		7.6		

Metacarpus	Fusion	Measurements			
Species	distal	Bd[a]	BFd[d]	WCM[e]	WCL[e]
Goat	Fused	25.0	26.0	11.9	11.3

Pelvis	Fusion	Measurements	
Species	proximal	LA[a]	LAR[a]
Pig	Fused		33.9
Goat	Fused	25.9	
Goat	Fusing	32.4	

(*cont.*)

Tibia	Fusion		Measurements	
Species	proximal	distal	Bd[a]	Dd[d]
Pig	Absent	Fusing	25.8	21.8
Pig	Absent	Fusing		22.2
Goat	Absent	Fused	26.7	19.1

Calcaneus	Fusion	Measurements	
Species	proximal	GB[a]	GD[f]
Pig	Fusing	26.6	31.6

Astragalus	Fusion	Measurements			
Species		GLl[a]	GLm[a]	Bd[a]	Dl[a]
Cattle	Indeterminate	60.7	56.8	37.4	32.7
Pig	Indeterminate	42.6	38.4	24.1	23.2
Pig	Indeterminate	45.2	41.2	27.7	20.6
Pig	Indeterminate	43.1	39.9		
Pig	Indeterminate		35.6		20.4
Sheep	Indeterminate	30.5	28.1	18.6	16.5
Sheep	Indeterminate	29.7	27.7	18.4	
Goat	Indeterminate	27.2	25.2	16.6	14.4
Goat	Indeterminate	33.1	30.0	22.5	17.5
Goat	Indeterminate	31.4	32.9	20.0	

(*cont.*)

Metatarsus	Fusion	Measurements									
Species	distal	GL[a]	SD[a]	Bd[a]	BFd[d]	WCM[e]	WCL[e]	DVM[b]	DVL[b]	DEM[d]	DEL[d]	Ll[a]
Pig (IV)	Fused	83.4	13.1	15.6	14.0							
Goat	Fused			24.0	22.7	10.6	10.0			8.8	9.4	
Goat	Fused			24.2	23.8	10.9	10.3			9.0	9.3	
Goat	Fused				22.5	10.4	9.8					
Goat	Fusing						11.0		16.8		10.6	
Goat	Unfused epiphysis				27.1	12.7	12.3	17.9	16.9	9.9	10.0	
OC	Fusing						11.0		16.3			
Equid	Fused			46.4								38.0

1st Phalanx	Fusion	Measurements			
Species	proximal	GLpe[a]	Bp[a]	SD[a]	Bd[a]
Horse	Fused	82.9	53.2	34.0	45.0
Donkey	Fused	58.1	31.8	19.7	26.7
Pig	Fusing	37.1	16.8	14.1	16.8
Pig	Fusing	35.6		13.0	14.9
Pig	Fusing			12.3	13.7
Goat	Fused	36.7	10.9	8.7	10.7
Goat	Fused	36.9	13.1	11.4	13.6
Goat	Fused	42.1	15.4	12.1	14.0
Goat	Fused	42.0	14.6	13.3	15.4
Goat	Fused			9.2	
Goat	Fused	36.6	12.3	11.8	
Goat	Fused				10.9
Goat	Fused			11.4	13.6
Goat	Fusing	35.9	12.9	10.6	13.2
Goat	Fusing			13.3	14.9
OC	Fused	39.3	13.5	11.4	
OC	Fused			9.2	10.9
OC	Fusing			8.8	10.9

(*cont.*)

2nd Phalanx	Fusion	Measurements			
Species	proximal	GLpe[a]	Bp[a]	SD[a]	Bd[a]
Cattle	Fused	34.2	23.7	17.8	18.2
Cattle	Fusing		27.0		
Goat	Fused	25.9		8.0	9.6
Goat	Fused		14.1	10.9	
Goat	Fusing			7.9	

a Von den Driesch, *A Guide to the Measurement of Animal Bones*.
b Boessneck, Müller, and Teichert, "Osteologische Unterscheidungsmerkmale," 59.
c Payne and Bull, "Components of Variation," 42.
d Davis, "Measurements of a Group of Adult Female Shetland Sheep Skeletons," 597.
e Payne, "A Metrical Distinction," 296.
f Albarella and Payne, "Neolithic Pigs," 591.