"ALEXANDRU IOAN CUZA" UNIVERSITY OF IAȘI
FACULTY OF BIOLOGY
DOCTORAL SCHOOL OF BIOLOGY

Bioarchaeological indicators of the human-animal relationship in some prehistoric communities from the Mureș Valley

DOCTORAL THESIS SUMMARY

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IAȘI
2024

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Abbreviations

Aprox. – Approximately

MBA – Middle Bronze Age

LBA – Late Bronze Age

LBA I- Late Bronze Age, phase I

LBA II – Late Bronze Age, phase II

C – Castrated

CA – Correspondence Analysis

Cca. – Circa

CE. – Common era

F – Female

H` – Diversity index

BCE – Before common era

Kcal – Kilocalories

Km – Kilometers

m - meters

M – Male

M_1 – First lower molar

M^3 – Third upper molar

M_3 – Third lower molar

Max. – Maximum

MCDR – Museum of Dacian and Roman Civilization Deva

Min. – Minimum

LN – Late Neolithic

MNI – Minimum number of individuals

NISP – Number of identified specimens

EN – Early Neolithic

S – Abundance

St. Criș – Starčevo-Criș culture

S.u. – Sheep units

V` – Uniformity

W II – Wietenberg culture, phase II

W III – Wietenberg culture, phase III

Abbreviations of measured parameters, according to Von den Driesch (1976).

Abbreviations	**Measured parameter**
Bd	Breadth of the distal end
BFd	Breadth of the Facies articularis distalis
BFp	Breadth of the Facies articularis proximalis
BG	Breadth of the glenoid cavity
Bp	Breadth of the proximal end
BT	Breadth of the trochlea
DLS	(Greatest) diagonal length of the sole
GL	Greatest length
GLP	Greatest length of the Processus articularis
L	Length (tooth)
LA	Length of the acetabulum
LG	Length of the glenoid cavity
SD	Smallest breadth of diapysis

Introduction

Archaeozoology is a complex and interdisciplinary field of research that studies faunal remains resulting from archaeological excavations. The focus is on animals whose remains inform us about the relationship between humans and their natural and social environments, particularly site formation processes, subsistence strategies, domestication processes, and palaeoenvironments (Reitz and Wing, 2008).

The research project is based on the study of faunal remains from various prehistoric sites in the Mureș Valley: Șoimuș-*Teleghi*, Șoimuș-*Lângă sat,* Uroi-*Sigheti*, and Vețel-*Luncă* (Hunedoara County), which are important sites for understanding the Neolithic Revolution (the beginnings of plant cultivation and animal husbandry) and the transition to the Bronze Age of the human communities in the Mureș Valley.

The period covered by this study spans from the Early Neolithic to the Late Bronze Age, approximately dated between 6080/5850–1150/1050 BCE. This work addresses communities in the Mureș Valley belonging to the Starčevo-Criș and Vinča cultures (Neolithic), the Tiszapolgár culture (Chalcolithic), the Wietenberg culture (Middle Bronze Age), and the Bădeni III-Deva and Susani-Simeria cultural horizons (Late Bronze Age).

We want to express our gratitude to everyone who assisted in completing this work. Special thanks to the coordinator of this work, Professor Habil. Luminița Bejenaru, for her patience and kindness in guiding us, for her information, suggestions, and observations, and for the bibliographic material she provided.

We thank Associate Professor Simina Margareta Stanc, a member of the advisory committee, for her advice, suggestions, information, and observations, as well as for her assistance in procuring the studied faunal material. We also extend our gratitude to the other members of the advisory committee, Associate Professor Carmen Gache and Associate Professor Ion Cojocaru, for their advice, suggestions, information, and observations.

We thank the archaeologists from the Museum of Dacian and Roman Civilization Deva, Dr. Marc Antoniu and Dr. Alexandru Bărbat, for providing the unpublished osteological material, as well as for their continuous collaboration in offering bibliographic resources, information, and suggestions.

Motivation, aim, and objectives of the thesis

Motivation. The communities along the Mureș Valley have been selected as case studies for reasons that offer significant advantages for the proposed research:

Strategic Location: The Mureș Valley serves as a corridor for the spread of the first Neolithic (agro-pastoral) groups that entered southwestern Transylvania in the 7th and 6th millennia BCE, coming from the south of the Danube, from the Balkans.

Multicultural Nature: The Mureș Valley is characterized by its multicultural aspects, presenting numerous Neolithic and Bronze Age sites.

Aim. The aim of this work is to contribute to the understanding of the palaeoeconomy and palaeoecology of communities in the Mureș Valley, spanning from the Neolithic period to the Bronze Age.

Objectives. This study aims to evaluate the animal resources utilized by prehistoric communities in the Mureș Valley and, based on these indicators, describe the natural landscape of the region. The objectives of this research include: assessing the strategies for exploiting animal resources (age and sex selection, skeletal frequencies, butchery techniques, etc.), providing a morphometric description of the animal species used by these communities, evaluating the dynamics of regional palaeoeconomics and palaeoecology (Mureș Valley), both synchronically and diachronically.

CHAPTER 1: Current state of knowledge on the addressed topic

1.1 Context of archaeozoological research in the study region

Archaeozoological research in Transylvania began at the end of the 19th century when G. Téglas analyzed avian remains discovered in the "Peștera Curată" cave at Nandru (Bindea, 2008). At the Museum Țării Crișurilor from Oradea, T. Jurcsák and E. Kessler focused on the ancient bird fauna of Romania. They conducted extensive studies on the evolution of avifauna in Romania, including descriptions of the morphology of fossil species and addressing issues related to phylogeny and systematics (Jurcsák and Dumitrașcu, 1974; Jurcsák and Kessler, 1973, 1986, 1987, 1988). For the Starčevo-Criș culture, recent studies on avifauna have been conducted by Gál et al. (2021) at the site of Alsónyék-Bátaszék in Hungary. In Cluj-Napoca,

faunal analyses of materials from archaeological excavations have been carried out at the Faculty of Veterinary Medicine by P. Georoceanu and M. Georoceanu, later joined by C. Lisovschi and A. Gudea. Their studies are almost exclusively focused on the Roman period (Blăjan et al., 1978; Georoceanu et al., 1979a, 1979b), the Hallstatt period (Blăjan et al., 1979), or the Dacian period (Gudea and Gudea, 1999) (Bindea, 2008). Other notable authors include O. Necrasov, S. Haimovici, G. Gheorghiu, and M. Bulai-Știrbu, who conduct systematic research on Holocene fauna in southeastern Romania. For the regions of Oltenia and Muntenia, Al. Bolomey has conducted archeozoological studies on Neo-Eneolithic fauna (El Susi, 1996). Additionally, G. El Susi completed an archeozoological synthesis for the Banat region in 1996, based on faunal materials from the 6th millennium BCE to the 1st century CE, including analyses for Transylvania (El Susi, 1996). A series of studies on fauna and tools made from bone or deer antlers have been conducted for the sites of Kaposújlak-Várdomb (Gál, 2009, 2011) and Kakucs-Turján (Gál, 2018). Archeozoological syntheses for the Romanian space have also been conducted by L. Bejenaru and S. Stanc in collaboration with M. Popovici and A. Bălășescu on the Neolithic period in eastern and southeastern Romania (Bejenaru and Stanc, 2013), and by L. Bejenaru in 2003 for the medieval period in Romania (Bejenaru, 2003). D. Bindea published a doctoral thesis in 2008 focused on Transylvanian area, analyzing material from the Early Neolithic up to the La Tène period (Bindea, 2008). A. Bălășescu, in collaboration with V. Radu and D. Moise, conducted a study on the south and southwest regions of Romania, examining archeozoologically settlements dated between the 7th and 4th millennia BCE. This work includes some Starčevo-Criș and Vinča-type settlements (Bălășescu et al., 2005). Another study analyzing faunal materials from southern Romania is by Bălășescu, published in 2014, which examines the settlement at Măgura-Buduiasca and provides a comparative analysis of other Starčevo-Criș settlements in the country (Bălășescu, 2014).

CHAPTER 2. Material and methods of study

2.1. Material

The biological material under study consists of samples of animal skeletal remains discovered at archaeological sites on the Mureș Valley, dating from the Neolithic period and the Bronze Age.

In the proposed research were studied the multicultural sites from Șoimuș-*Teleghi*, investigated by archaeologists from the MCDR Deva, IAB, and MNIR Constanța; Șoimuș-*Lângă sat*; Vețel-*Luncă*; and Uroi-*Sigheti*, examined by archaeologists from MCDR Deva.

2.2. Methods

2.2.1. Determination of the archaeozoological material

The first stage of the archeozoological analysis involves sorting the bone remains into broad groups: invertebrates and vertebrates. The main vertebrate groups are identified based on the general characteristics of the skeletal remains. For mammals, the bone remains are further divided into large and medium-sized mammal subgroups. Subsequently, species identification is carried out using the reference collection of the Archeozoology Laboratory, as well as osteological atlases (Gheție and Paștea, 1954).

2.2.2. Quantification of the faunal remains

Calculation of the number of the identified specimens (NISP)

The number of identified specimens (NISP) is the simplest method available for measuring taxonomic abundance used by archeozoologists and is probably the most frequently employed (Cannon, 2012). This method involves counting the remains for each taxon after each skeletal fragment has been assigned to a species or a group of species. The results can also be expressed as percentages, allowing for various statistical analyses (Udrescu et al., 1999).

Calculation of the minimum number of individuals (MNI)

The calculation of MNI (Minimum Number of Individuals) is a widely used method that helps us estimate the relative importance of each species. MNI can be determined based on the most frequently occurring skeletal element, considering factors such as laterality (right/left), age, and sex (Reitz & Wing, 1999).

2.2.3. Estimating age at slaughter

The estimation of mammal ages is based on skeletal age, specifically the stage of development of various bones, and dental age — i.e., the replacement of temporary teeth with permanent ones (in diphyodont mammals, there are two types of dentition). This also involves observing the degree of wear on the permanent teeth to determine when the replacement of temporary teeth with permanent ones occurred (Chaix & Meniel, 2001).

2.2.4. Estimating sex

In animals with pronounced sexual dimorphism (e.g., cattle, deer), sex can be determined based on metric data collected. This task becomes more challenging when dealing with populations that include domestic, wild, castrated, and mixed individuals, such as in

Neolithic settlements with mixed populations of domestic cattle and aurochs. Generally, antlers are good indicators for determining sex and even species, provided they are numerous. For other species, the absence or presence of specific skeletal elements serves as a criterion for assessment; for example, antlers in cervids indicate males (except for reindeer); the presence of canines in equids is characteristic of males; and the spur on the tarsometatarsus is typical of males in the family Gallinaceae. Pelvic bones are another indicator for determining sex (El Susi, 1996).

2.2.5. Meat yield

Estimating proportions for different species, whether based on MNI or other quantification techniques, aims to assess the relative importance of meat from various taxa in the diet of a settlement. Estimating the quantity of meat can both overestimate and underestimate the actual amount of meat available in a given settlement (Udrescu *et al.,* 1999).

2.2.6. Osteometry and withers height estimation

Measurement of skeletal elements is a crucial part of archeozoological research and primarily involves determining the length of bones, the breadth of the proximal and distal ends of long bones, and the width and breadth of short bones. Measurements can be performed using the guide by Angela Von den Driesch (Von den Driesch, 1976).

Estimating the height at the withers is based on whole skeletal elements: long bones (humerus, tibia, metapodials) or short bones: astragali, calcanei (in the case of suids) (El Susi, 1996).

2.2.7. Taphonomical evaluation

Taphonomy is the science that studies the transition of organic matter from the biosphere to the lithosphere in all its details. This definition was given by the Russian paleontologist I. A. Efremov in 1940, who coined the term from the Greek words *taphos* (burial) and *nomos* (law). Taphonomy is important not only for paleontologists but also for paleoanthropologists, archeozoologists, and archaeobotanists—anyone studying organic remains found in archaeological contexts (Lyman, 1994).

2.2.8. Statistical analysis

One way to gain insights into an animal population from data obtained through the analysis of archeozoological samples is through descriptive statistical analysis. This involves

collecting data, presenting it in tables, creating graphical representations, and calculating statistical indicators. Creating tables and graphs helps in the easier interpretation of data (Boiculese *et al*., 2007).

Species Frequency. This refers to the relative abundance of identified taxa within a faunal assemblage and is based on the adopted quantification methods. It can be visualized in diagrams, graphs, or tables (Rizzetto & Albarella, 2017).

Correspondence Analysis (CA). This is a procedure for exploring the relationships between two or more sets of variables. A key feature of this analysis is the common scaling of row and column variables to provide information about the relationships between variables within a set and between row and column variables. Correspondence analysis can be used on both qualitative and quantitative data.

Shannon-Weaver Diversity Index. Species diversity can be best understood as consisting of two concepts—abundance and evenness (or equity). Abundance refers to the number of taxa within a given sample; the greater the number of taxa, the more abundant the sample (Reitz & Wing, 2008). Evenness or equity refers to the uniformity of the distribution of taxa within the sample. If each taxon is represented by the same number of individuals, then the sample is more evenly distributed compared to one dominated by a specific taxon (Reitz & Wing, 2008; VanDerwarker, 2010).

CHAPTER 3. Description of the studied archaeozoological samples

The Early Neolithic sample (Starčevo-Criș culture) from Șoimuș-*Teleghi* comprises 1,122 faunal remains, predominantly from mammals (99.29%) and mollusks (0.71%). The identification of river mussels (*Unio* sp.) in the sample indicates that the inhabitants of Șoimuș also exploited hydrographic resources. Among the mammalian skeletal remains, domestic animals predominate with a proportion of approximately 55%, followed by non-specifically identifiable mammals (41%), due to a high degree of fragmentation, and wild mammals, which make up the smallest proportion at approximately 4%.

The archaeozoological sample from the Late Neolithic (Vinča culture) at Șoimuș-*Teleghi* includes 1,523 faunal remains, with mammals predominating at 85.82%. Mollusks follow with 215 remains, representing approximately 14% of the sample. The mollusks identified belong to the genus Unio. Birds have the lowest proportion, with a single bone belonging to a large species accounting for 0.06%. The faunal remains belonging to mammals totals a number of 1,307 remains. Domestic mammals predominate with a proportion of

53.18%, while wild mammals represent only 8.72% of the total mammalian remains. Non-specifically identifiable mammalian remains account for approximately 38%, exhibiting a high degree of fragmentation, which prevents their identification to the species level.

The Chalcolithic sample (Tiszapolgár culture) from the Vețel-*Luncă* site (complex 391) comprises four isolated molars from the species *Bos taurus* (domestic cattle). The minimum number of individuals (MNI) was estimated for three individuals: one based on a slightly eroded M2 and two based on slightly eroded lower left M3 molars.

The archaeozoological sample from the Wietenberg culture Phase II (W II) at Șoimuș-*Teleghi* comprises approximately 5,092 faunal remains. These include mollusks, fish, amphibians, birds, and mammals. Mammals dominate the sample, constituting 54.85% of the identified faunal remains, followed by mollusks with 44.19%, birds with 0.71%, amphibians with 0.14%, and fish with 0.12%. Mollusks gathering represented an important food source for the community at Șoimuș. Among the mollusk remains, 14 are shells belonging to the genus Helix, while the remaining 2,236 are valve fragments from the genus *Unio*. The mammal group is represented by 2,793 bone remains, with the majority being non-specifically identified (44.15%) due to their high degree of fragmentation. The non-specifically identified remains were categorized into subgroups of large mammals and medium mammals. Domestic mammals follow with a percentage of 42.96%, while wild mammals occupy the last place with 12.89% of the total mammalian remains.

The assemblage from Șoimuș-*Lângă sat* (W II) includes 216 identified faunal remains, with the majority belonging to mammals at 91.20%, and the rest (8.80%) to mollusks. The identified mollusks belong to the genus *Unio*. Among the mammalian remains, non-specifically identified remains predominate due to high fragmentation, constituting 45.18%. They are followed by domestic mammals with 37.06% and wild mammals with 17.77%.

At Uroi-*Sigheti*, 103 faunal fragments were collected. Mammals account for 98% of the remains, with the remaining 2% attributed to mollusks. The identified mollusks at this site also belong to the genus *Unio*. Wild mammals account for 5%, non-specifically identified mammals approximately 30%, and domestic mammals 65% (Malaxa *et al.,* 2022).

The archaeozoological sample from the third phase (W III) of the Wietenberg culture at Șoimuș-*Teleghi* comprises 4,438 faunal remains. Mollusks dominate this sample at 54.82%, followed by mammals at 45.16%. Additionally, a bird femur was identified in this archaeozoological sample. The identified mollusks include shells attributed to the genus Helix (3 shells) and river mussels (*Unio* sp. - 2,430 valves). The mammal group consists of a total of 2,004 skeletal remains, with over half belonging to domestic mammals (56%). Wild mammals

account for 10.53%, while non-specifically identified mammal remains, due to high fragmentation, total 670 and represent 33.43% of the total identified mammal remains in the sample.

The Wietenberg III level from Șoimuș-*Lângă sat* includes 70 faunal remains, predominantly from mammals (approximately 86%) and mollusks (*Unio* sp.) at around 14%. The mammal group consists of 60 skeletal remains, of which approximately 47% belong to domestic mammals, about 28% to wild mammals, and 25% are skeletal fragments that could not be identified to the species level.

At Uroi-*Sigheti*, there are 647 faunal remains, with mammals accounting for 84%, mollusks for 15.77%, and fish for 0.15%. The mollusk remains were identified as belonging to the genus *Unio*. In the mammal group, domestic mammals prevail with approximately 51%, followed by non-specifically identifiable mammals with about 41%, and wild mammals with approximately 8% (Malaxa *et al.,* 2022).

The archaeozoological sample from the Late Bronze Age Phase I (LBA I) at Șoimuș-*Teleghi* originates from a community associated with "Bădeni III-Deva" type ceramics and comprises 6,669 faunal remains. The most significant faunal group is mammals, accounting for approximately 80% of the remains (NR). Mammals are followed by mollusks with 1,299 remains, representing 19.48% of the sample. Birds make up 0.13% with only 9 faunal remains, while fish contribute 0.06%, and reptiles are represented by a single bone, making up 0.01% of the total remains in the studied sample. The mollusks identified in the sample belong to the *Helix* (6 shells) and *Unio* (1,293 valves) genus. The large number of mollusks indicates that collecting them was a relatively important activity through which the inhabitants of the Șoimuș settlement obtained a surplus of animal protein.

The LBA I sample (Bădeni III-Deva cultural horizon) from Vețel-*Luncă* includes 1,671 faunal fragments. Most of these fragments are from mammals, comprising 53.68%, followed by mollusks at 45.9%. All identified mollusks in this sample were attributed to the genus *Unio*. Birds and fish each represent a proportion of less than 1% in the sample. Among the identified mammals in the sample, domesticated mammals are predominant, with 581 skeletal remains, representing 64.77%. A proportion of 25.42% consists of remains of mammals that could not be identified to the species level due to high fragmentation. Finally, the least represented mammals in the sample are the wild ones, making up 9.81% of the total identified mammal remains.

The archaeozoological sample from the Late Bronze Age Phase II (LBA II) at Șoimuș-*Teleghi* comes from a community using "Susani-Simeria" type ceramics and consists of only

174 faunal remains. Of these, mammals account for approximately 92%, with the remaining approximately 8% attributed to mollusks. Among the mammal category, domesticated mammals are predominant, accounting for 56.25%, followed by the group of mammals that could not be specifically identified, which consists of 57 bone fragments and represents 35.63%. The least represented are wild mammals, with only 8.13% of the total identified mammal remains.

The LBA II sample from Șoimuș-*Lângă sat*, belonging to the Susani-Simeria cultural horizon, comprises 42 faunal remains entirely attributed to mammals. Domestic mammals predominate at around 48%, followed by unidentified mammals at approximately 38%, and wild mammals at approximately 14%.

The LBA II sample (Susani-Simeria cultural horizon) from Vețel-*Luncă* consists of archaeological remains from five complexes and totals 143 faunal remains. These primarily derive from mammals, accounting for 96.5% of the sample. The remaining 3.5% comprises river mussel shells (*Unio* sp.). Domesticated mammals are the most frequent, accounting for approximately 62%. They are followed by unidentified specific mammals, which make up about 25%, and wild mammals, which constitute 13%.

CHAPTER 4. Anatomical-comparative study of the identified faunal remains

This chapter will address the animal species discovered in the studied prehistoric samples, ranging from the Neolithic to the Late Bronze Age. The identified archaeological material is diverse, including species from various animal groups (Gastropoda, Bivalvia, Pisces, Reptilia, Aves, and Mammalia).

4.1. Bos taurus (cattle)

Domestic cattle represent the domestic species with the highest frequency of skeletal remains in all settlements, except for the W II settlement at Uroi-Sigheti and the LBA II settlement at Șoimuș-Teleghi, where domestic pig and sheep/goat groups respectively exceed cattle. A total of 3,152 skeletal remains has been identified, originating from a minimum of 73 individuals. The osteological remains are fragmented with traces of butchery, disarticulation, or burning, representing household waste of prehistoric communities.

The frequency of domestic cattle remains in the samples varies between 24.27% NISP in LBA II and 53.98% in the Early Neolithic at the Șoimuș-Teleghi settlement. In the

Tiszapolgár culture settlement at Vețel-Luncă (Calcolithic), only domestic cattle remains were identified (4 fragments), thus this sample will be excluded from the following statistical analyses as it is not relevant compared to the other studied samples. High frequencies of NISP were also identified in the LBA I settlement at Vețel – approximately 45%, in the Vinča settlement at Șoimuș-Teleghi – approximately 40%, and in the W III level at Uroi-Sigheti with 37% identified cattle remains.

The situation changes, however, when considering the minimum number of individuals (MNI) estimated, where domestic cattle are most frequent only in the W II settlements at Uroi-Sigheti, the W III level at Șoimuș-Lângă sat, and the LBA II level at Vețel-Luncă. In Early and Developed Neolithic communities, domestic cattle hold the top position for MNI, but share this position with sheep/goat. The same situation is observed in W II and LBA II at Șoimuș-Lângă sat. In the W III level at Uroi-Sigheti and LBA II at Șoimuș-Lângă sat, cattle share the top spot with domestic pig, while in the W III settlement at Șoimuș-Lângă sat, all these taxa—cattle, sheep/goat, and pig—have the same estimated MNI of two each. In the Calcolithic settlement at Vețel-Luncă, three individuals were estimated. The estimated MNI percentages for domestic cattle range from 14.29% in the W II settlement at Șoimuș-Lângă sat to 27.8% in the Starčevo-Criș culture settlements at Șoimuș-Teleghi (Early Neolithic) and W II at Uroi-Sigheti. In the case of the Uroi settlement, the frequency of estimated individuals is higher than the number of fragments. High MNI frequencies were also recorded in the LBA II settlement at Vețel-Luncă—25% and the W III level at Uroi-Sigheti—approximately 24%.

The highest average withers height for cattle is recorded in the W II settlement at Șoimuș-Teleghi, while the maximum withers height is noted in the LBA I settlement at Vețel. This site also shows the greatest variation in withers height for cattle. The lowest withers height is observed at the LBA I site at Șoimuș-Teleghi, at 1048.6 mm (Table 4.1).

4.2. Ovis aries/Capra hircus (sheep/goat)

According to the number of identified specimens (NISP), the sheep/goat group ranks first in the LBA II settlement at Șoimuș-*Teleghi* and second in the Early and Developed Neolithic settlements at Șoimuș-*Teleghi*, as well as in LBA I at Vețel-*Luncă*. In the rest of the settlements, this group typically ranks third, following domestic cattle and domestic pigs. This group comprises two species, often challenging to differentiate due to their high degree of morphological similarity in skeletal remains, compounded by severe fragmentation of bone pieces. From sheep/goat, there are 1,900 osteological remains identified, estimated to originate

from a minimum of 70 individuals. Among these remains, at least 16 come from *Capra hircus* and at least 13 from *Ovis aries*.

The sheep/goat group shows the highest frequency, approximately 40%, at the LBA II site at Șoimuș-*Teleghi*, making it the most numerous in this settlement. A similar proportion of about 38% is observed at the Starčevo-Criș site at Șoimuș, but it ranks second after cattle. The lowest frequencies for the sheep/goat group were recorded at the Șoimuș-*Lângă sat* site, where it ranks third after cattle and pigs. Specifically, in the W II layer, the sheep/goat group constitutes about 13%, which then decreases to below 7% in the W III layer and increases again to 7.69% in the LBA II layer.

For the settlement at Șoimuș-*Teleghi*, there is a gradual decrease in the frequency of sheep/goat remains over time, from 37.77% in the Early Neolithic to 27.32% in the Late Neolithic, and down to 19.29% in LBA I. In LBA II, however, the frequency of sheep/goat remains increases to 39.81%, making it the most numerous group in the entire sample and even surpassing its frequency in the Early Neolithic. Similarly, in the W II and III layers at Șoimuș, *Teleghi*, and *Lângă sat,* the frequency of sheep/goat remains also decreases in the settlement at Uroi-*Sigheti*, from 22.54% in phase II to 18.81% in phase III of the Wietenberg culture. In the settlement at Vețel-*Luncă*, the sheep/goat group also experiences a decrease in frequency, from 21.82% in LBA I to 16.35% in LBA II.

As MNI, the sheep/goat group ranks first alongside cattle in the Starčevo-Criș (27.78%), Vinča (22.5%), and LBA II (21.43%) layers at Șoimuș-*Teleghi*. In the W III layer at Șoimuș-*Lângă sat*, the sheep/goat group holds the top position with approximately 18% MNI, together with both cattle and pigs. In the W II layer at Uroi-*Sigheti* and in LBA II at Vețel-*Luncă*, it shares the second place with domestic pigs. In the W II layer at Șoimuș-*Teleghi*, it holds the second position with an 18% share, surpassing cattle but not pigs, which rank first in estimated MNI. The lowest MNI frequencies (10%) are found in the W III layers at Uroi-*Sigheti* and LBA II at Șoimuș-*Lângă sat*. The next lowest MNI frequency (below 12%) is also found in the W III layer, but this time at the site of Șoimuș-*Teleghi*. The MNI frequency shows a pattern similar to that of NISP frequency, with a gradual decrease observed at Șoimuș-*Teleghi* from 27.78% in the Early Neolithic to 11.90% in W II, followed by an increase from 16.25% in LBA I to 21.43% in LBA II. A decrease from 18.18% in W II to 10.34% in W III is also recorded at the Uroi-*Sigheti* site. At the cultural layers of Vețel-*Luncă*, the MNI frequency for sheep and goats remains constant at approximately 17% in both LBA I and LBA II. An increase in MNI frequencies is recorded at Șoimuș-*Lângă sat*, where the MNI frequency rises from 14.29% in W II to 18.18% in W III, but then drops to 10% in LBA II.

Table 4.1. Withers height estimations for *Bos taurus* species.

Settlement	Culture/ Period	Anatomical element	GL (mm)	Bp (mm)	Proximal index	SD (mm)	Diaphyseal index	Bd (mm)	Distal index	Sex	Withers height (mm)	Mean (mm)
Șoimuș-*Teleghi*	Vinča	Metatarsus	223	45	20.18	25	11.21	52	23.32	F	1193.05	
Șoimuș-*Teleghi*	W II	Metacarpus	198	61	30.8	35	17.68	63	31.82	C	1211.76	1197.80
Șoimuș-*Teleghi*	W II	Metatarsus	218	46	21.1	24	11	50	22.94	F	1166.3	
Șoimuș-*Teleghi*	W II	Metatarsus	223	47	21.07	27	12.11	56.5	25.34	C	1215.35	
Șoimuș-*Teleghi*	Bădeni III-Deva	Metatarsus	196	42	21.43	23	11.73	45.5	23.21	F	1048.6	
Vețel-*Luncă*	LBA I	Metatarsus	265	41	15.47	22.5	8.49	46	17.36	F	1417.75	1175.85
Vețel-*Luncă*	LBA I	Metatarsus	212	48	22.64	29	13.68	57.5	27.12	M	1176.6	
Vețel-*Luncă*	LBA I	Metatarsus	204	41	20.1	23	11.27	45	22.06	F	1091.4	
Vețel-*Luncă*	LBA I	Metatarsus	205	41	20	23.5	11.46	49	23.9	F	1096.75	
Vețel-*Luncă*	LBA I	Metatarsus	205	42,5	20.73	22.5	10.98	46.5	22.68	F	1096.75	

The distinction between sheep and goat could be made at the level of the metapodia based on the diaphyseal index and the distal epiphyseal index, and subsequently, the withers height was calculated for each species. For *Capra hircus*, the withers height was estimated only at the LBA I site at Șoimuș-*Teleghi*. Based on 3 metatarsals with GL of 118 mm, 128 mm, and 141 mm, respectively, and a humerus with GL of 151 mm, the withers height was estimated to be 630.12 mm, 683.52 mm, 752.94 mm, and 582.86 mm, respectively. The average withers height for goats was calculated to be 662.36 mm (Table 4.2).

4.3. Sus domesticus (pig)

Domestic pigs account for 1,877 skeletal remains from a minimum of 79 estimated individuals. Within the W II culture at Uroi-*Sigheti*, domestic pigs represent the highest proportion at 33.80%, making them the most frequent taxon based on NISP in this settlement. High values of NISP are observed in the W III phase at Uroi-*Sigheti* and in the LBA II phase at Șoimuș-*Lângă sat*, with approximately 27%, with domestic pigs occupying the second place after cattle. Domestic pigs also rank second in the W II and W III phases at Șoimuș-*Teleghi* and Șoimuș-*Lângă sat*, as well as in the LBA I phase at Șoimuș-*Lângă sat* and the LBA II phase at Vețel-*Luncă*, where similar proportions of 21-26% are recorded. Pigs show similar frequencies of 15-16% in the Vinča cultural levels at Șoimuș-*Teleghi*, LBA I at Vețel-*Luncă*, and LBA II at Șoimuș-*Teleghi*.

The lowest frequency of pig fragments is observed in the Early Neolithic sample from Șoimuș-*Teleghi*, where only 5 pig remains are identified, representing 0.76% of the total mammal remains. The frequency of domestic pigs decreases in the Uroi-*Sigheti* site from 33.80% in W II to 27.27% in W III, while in other settlements, an increase in NISP can be seen over the studied historical periods. Specifically, at Vețel-*Luncă*, there is an increase of nearly 10 percentage points from LBA I to LBA II, at Șoimuș-*Lângă sat*, the frequency rises from approximately 21% in W II to about 27% in LBA I, and at Șoimuș-*Teleghi*, the frequency of pigs increases from 0.76% in the Early Neolithic to around 15% in the Late Neolithic and up to about 26% in LBA I, before decreasing by approximately 10 percentage points in LBA II.

Table 4.2. Withers height estimations for *Ovis aries/Capra hircus* species.

Settlement	Culture/Period	Species	Anatomical element	GL (mm)	Bp (mm)	Proximal index	SD (mm)	Diaphyseal index	Bd (mm)	Distal index	Withers height(mm)	Mean (mm)
Șoimuș-*Teleghi*	Vinča	*Ovis aries*	Metatarsus	134	20	14.92	11	8.21	24	17.91	608.36	
Șoimuș-*Teleghi*	LBA I	*Capra hircus*	Metatarsus	118	22	18.64	13	11.02	24	20.34	630.12	662.36
Șoimuș-*Teleghi*	LBA I	*Capra hircus*	Metatarsus	128	20.5	16.02	13.5	10.55	25	19.53	683.52	
Șoimuș-*Teleghi*	LBA I	*Capra hircus*	Humerus	151				32		17	582.86	
Șoimuș-*Teleghi*	LBA I	*Capra hircus*	Metatarsus	141	21	17.9			23	10.5	752.94	
Șoimuș-*Teleghi*	LBA I	*Ovis aries*	Metatarsus	143	20.5	14.33	11.5	8.04	25	17.48	649.22	642.46
Șoimuș-*Teleghi*	LBA I	*Ovis aries*	Metacarpus	130	23.5	18.08	12	9.23	25	19.23	635.7	
Uroi-*Sigheti*	W II	*Ovis aries*	Metatarsus	138.5	17	12.27	11	7.94	22	15.88	628.79	625
Uroi-*Sigheti*	W II	*Ovis aries*	Metatarsus	137.5	18	13.09	11	8	22	16	624.25	
Uroi-*Sigheti*	W II	*Ovis aries*	Metacarpus	128	19.5	15.23	13	10.17	23	17.97	625.92	
Uroi-*Sigheti*	W II	*Ovis aries*	Metacarpus	127	20	15.75	12.5	9.84	23	18.11	621.03	
Uroi-*Sigheti*	W III	*Ovis aries*	Metacarpus	120	21	17.5	13	10.83	24	20	586.8	

According to the MNI, *Sus domesticus* ranks first, showing the highest frequencies in the W II layers at Șoimuș-*Teleghi* (26.23%) and Șoimuș-*Lângă sat* (21.43%), and in the LBA I at Șoimuș-*Teleghi* (23.75%) and Vețel-*Luncă* (24.39%). In the W III layers at Uroi-*Sigheti* and the LBA II layers at Șoimuș-*Lângă sat*, pigs share the top position with domestic cattle, presenting proportions of 24.14% and 20%, respectively. For the W III level at Șoimuș-*Lângă sat,* pigs, cattle, and the sheep/goat group have two estimated individuals each, representing 18.18% of the NMI. With a minimum of 8 estimated individuals, domestic pigs rank second in the W III layer at Șoimuș-*Teleghi* with a proportion of 19% and share the second place with sheep/goats in the W II layer at Uroi-*Sigheti* with proportions of 18.18% and in the LBA II layer at Vețel-*Luncă* with proportions of 16.67%. In the remaining studied samples, domestic pigs follow cattle and sheep/goats, presenting frequencies between 5.56% in Starčevo-Criș and 14.29% in the LBA II layer at Șoimuș-*Teleghi*. The frequency of MNI does not seem to follow the same pattern as the frequency of NISP. At the Șoimuș-*Teleghi* site, the proportion of MNI increases from approximately 6% in the Neolithic to about 26% in W II, then decreases to 19% in the subsequent phase, followed by an increase to around 24% in LBA I, and then a further decrease of about 10 percentage in LBA II. A similar pattern is observed at the *Lângă sat* point: the frequency decreases from approximately 21% in W II to around 18% in W III and then increases to 20% in LBA II. For the Uroi-*Sigheti* site, MNI increases from W II to W III, while at Vețel-*Luncă*, it decreases from LBA I to LBA II. MNI shows higher proportions compared to NR in four settlements: Starčevo-Criș and W II at Șoimuș-*Teleghi*, W II at Șoimuș-*Lângă sat*, and LBA I at Vețel-*Luncă*.

Regarding the withers height of *Sus domesticus*, it was estimated to be 807.46 mm in the W III phase at Șoimuș-*Teleghi*, based on a metacarpal III. For the LBA I phase at the same site, the estimated withers heights were 807.46 mm, 813 mm, 770.88 mm, and 712.24 mm. The average withers height at this site is estimated to be 783.32 mm. In the LBA II phase at Vețel-*Luncă*, the average withers height was 775.09 mm (Table 4.3).

Table 4.3. Withers height estimations for *Sus domesticus* species.

Settlement	**Culture/Period**	**Anatomical element**	**GL (mm)**	**Withers height (mm)**	**Mean (mm)**
Șoimuș-*Teleghi*	W III	Metacarpus III	78	807.46	
Șoimuș-*Teleghi*	LBA I	Metacarpus III	78	807.46	783.32
Șoimuș-*Teleghi*	LBA I	Metatarsus IV	81	712.24	
Șoimuș-*Teleghi*	LBA I	Metacarpus IV	80	813	
Șoimuș-*Teleghi*	LBA I	Metacarpus IV	76	770.88	

Șoimuș-*Teleghi*	LBA I	Metacarpus IV	80	813	
Vețel-*Luncă*	LBA II	Calcaneus	85	819.9	775.09
Vețel-*Luncă*	LBA II	Calcaneus	87.5	843.25	
Vețel-*Luncă*	LBA II	Astragalus	38	703.2	
Vețel-*Luncă*	LBA II	Metacarpus IV	72.5	734.02	

4.4. Canis familiaris (dog)

Dogs rank as the fourth most frequent domestic species after cattle, sheep/goats, and pigs. There are 232 identified bone remains from a minimum of 25 estimated individuals.

The frequency of dogs in the studied settlements ranges from 0.15% in the Starčevo-Criș culture, 0.63% in W III at Uroi-*Sigheti*, and 0.96% in LBA II at Vețel-*Luncă*, to 3.11% in the LBA I phase at Șoimuș-*Teleghi*, and up to 5.83% in the LBA II phase of the same settlement.

In terms of MNI, dogs show the highest frequencies in the following settlements:W II phase at Șoimuș-*Lângă sat*, with a share of 14.29%, LBA I phase at Vețel-*Luncă*, with 9.76% and W III phase at Șoimuș-*Teleghi*, with a similar percentage of 9.52%. For the W II level at Uroi-*Sigheti* and the W III at Șoimuș-*Lângă sat*, a single individual was estimated, accounting for 9% in each case. The lowest percentages of estimated MNI are recorded in the Neolithic phases at Șoimuș-*Teleghi*, with 2.5% in the Late Neolithic and 2.78% in the Early Neolithic. No dog skeletal fragments were found in the LBA II phase at Șoimuș-*Lângă sat*.

The withers height for *Canis familiaris* was calculated for two individuals based on a tibia from the LBA I settlement at Șoimuș-*Teleghi* and a radius from the LBA I settlement at Vețel-*Luncă*. Based on a tibia, with a maximum length of 115.5 mm, the withers height was estimated at 332.47 mm, while based on a radius, with a length of 126 mm, the withers height was estimated at 381.17 mm. Both individuals were assessed as medium-sized dogs according to the scale proposed by Udrescu *et al*., 1999. By calculating the diaphyseal index for both individuals and using a metacarpal III, the robustness of the dogs was also evaluated (Udrescu *et al.,* 1999). Thus, with a diaphyseal index of 6.06 for the tibia, the individual was assessed as gracile. Based on the diaphyseal index of the radius (7.14), a dog of medium robustness was estimated, and based on the metacarpal III, with an index of 9.09, a robust dog is represented (Table 4.4).

Table 4.4. Withers height estimations for *Canis familiaris* species.

Settlement	Period	Anatomical element	GL (mm)	Withers height (mm)	Relative height	Diaphyseal index	Robustness
Șoimuș-*Teleghi*	LBA I	tibie	115.5	332.47	Medium-sized	6.06	gracile
Vețel-*Luncă*	LBA I	radius	126	381.17	Medium-sized	7.14	medium robustness
Vețel-*Luncă*	LBA I	metacarpian III	71.5	-	-	9.09	robust

4.5. Equus caballus (domestic horse)

Domestic horses have 147 skeletal fragments identified from a minimum of 15 estimated individuals. This species first appears in Middle Bronze Age samples, specifically in the Wietenberg II cultures at Șoimuș-*Teleghi*, Șoimuș-*Lângă sat*, and Uroi-*Sigheti.* In the studied settlements, horses exhibit low frequencies in terms of number identified specimens (NISP), ranging from 1.57% in the W III layer at Șoimuș-*Teleghi* to 7.69% in the LBA II layer at Șoimuș-*Lângă sat.* In the cultural levels at Șoimuș-*Teleghi*, the horse frequency is under 2% as NISP, with a slight increase in the Late Bronze Age: 1.60% in W II, 1.57% in W III, 1.87% in LBA I, and 1.94% in LBA II. An increase in the proportion of horses is also observed at the Vețel-*Luncă* site, rising from 2.69% in LBA I to 4.81% in LBA II.

Horses are better represented in terms of NMI, with higher frequencies compared to the NISP. The lowest recorded proportion for MNI is in the W III level at Șoimuș-*Teleghi* (2.38%) and in LBA I at Vețel-*Luncă* with a similar proportion of 2.44%. The highest proportion is recorded in the LBA II level at Șoimuș-*Lângă sat* with 10% MNI. Similar to NISP, there is a noticeable decrease in the frequency of MNI in the Șoimuș-*Teleghi* settlement from 3.28% in W II to 2.38% in W III, followed by an increase to 5% in LBA I and up to 7.14% in LBA II. Additionally, the proportion of MNI for horses increases from 2.44% in LBA I to 8.33% in LBA II for the Vețel-*Luncă* settlement. These increase in MNI frequency do not reflect an actual rise in the estimated MNI for horses but rather a decrease in the estimated MNI for other mammals.

Based on a metacarpal with a GL of 202.5 mm identified in the W III level at Șoimuș-*Teleghi*, the withers height was estimated to be 1298.02 mm for an individual of *Equus caballus*.

4.6. Equus asinus (domestic donkey)

Donkeys first appeared in the Middle Bronze Age, specifically in the Wietenberg III settlement at Șoimuș-*Teleghi*, accounting for 0.15% based on NISP and estimated at 2.38% by MNI. This species first appears in the Middle Bronze Age in the Wietenberg III settlement at

Șoimuș-*Teleghi*, with a proportion of 0.15% by NISP and 2.38% by estimated MNI. At the Vețel-*Luncă* settlement, the donkey is only present in the LBA I period, with a proportion of 0.15% by NISP and 2.44% by MNI. The donkey is represented by a fragment of radius and a scapula from the W III settlement at Șoimuș-*Teleghi*, each associated with a minimum of one estimated individual, and a radius fragment from the LBA I site at Vețel-*Luncă*, also associated with one individual.

4.7. Cervus elaphus (red deer)

The red deer is the most frequently occurring wild species in most of the studied sites, with 764 skeletal remains from a minimum of 46 estimated individuals. The percentages of deer remains vary, by NISP, between 5.44% in the Vinča culture settlement at Șoimuș-*Teleghi* and 19.44% in the W II culture settlement at Șoimuș-*Lângă sat*. Similar proportions to that in the Vinča settlement are also recorded in the Starčevo-Criș settlements – 5.5% and W II at Uroi-*Sigheti* – 5.63%. The frequency of red deer remains increases in the Șoimuș-*Teleghi* settlement from about 5.5% in the Neolithic levels to 10.58% in W II, then decreases to 7.72% in W III, followed by an increase in LBA I to 9.61%, and a decrease to 7.77% in LBA II.

In the Șoimuș-*Lângă sat* settlement, the frequency of red deer remains decreases from 19.44% in W II to 15.56% in W III and remains constant up to LBA I, where a proportion of 15.38% is recorded. For the layers at Uroi-*Sigheti*, there is an increase from 5.63% in W II to 8.15% in W III. In the LBA layers at Vețel-*Luncă*, the proportion of red deer decreases from 9.12% in the first phase to 6.73% in the subsequent phase.

Based on MNI, the red deer is most frequent in the LBA II settlement at Șoimuș-*Lângă sat* with a proportion of 20%. With an estimated minimum of 5 individuals in the W III settlement at Uroi-*Sigheti*, the red deer presents the second highest proportion of 17.24%. The lowest proportion of red deer by MNI is found in the W II settlements at Șoimuș-*Lângă sat* and LBA II at Șoimuș-*Teleghi* – both at 7.14%. The MNI frequency decreases in the sample from Șoimuș-*Teleghi* from 13.89% in the Starčevo-Criș level to 7.5% in Vinča, then increases from 8.20% in W II to 13.75% in LBA I. After this increase, there is a decrease in LBA II, with the frequency of red deer reaching 7.14%. In the Șoimuș-*Lângă sat* settlement, the red deer shows an increase from 7.14% in W II to 9% in W III and up to 20% in LBA II. An increase in MNI proportion is also recorded at the Uroi-*Sigheti* site: from 9% in W II to 17.24% in W III. For the Vețel-*Luncă* settlement, there is a decrease in MNI frequency from 14.63% in LBA I to 8.33% in LBA II.

4.8. Sus scrofa (wild boar)

The wild boar has 384 osteological remains from a minimum of 27 estimated individuals. The wild boar is the second most frequently hunted wild taxon in all settlements, except in the LBA II site at Vețel-*Luncă,* where wild boar fragments outnumber those of red deer. Thus, the highest frequency of wild boar is recorded in the LBA II settlement at Vețel with approximately 11%, while the lowest proportion is found in the Starčevo-Criș settlement at Șoimuș (0.76%). The LBA I and II settlements at Șoimuș-*Teleghi* and the LBA I settlement at Vețel-*Luncă* show similar proportions of wild boar, around 3-4%. The frequency of wild boar increases in the Șoimuș-*Teleghi* site from 0.76% in the Starčevo-Criș level to 7.50% in W II, followed by a gradual decrease to 5.25% in W II, reaching a minimum value of 2.91% in LBA II. In the Șoimuș-*Lângă sat* settlement, an increase from 11.11% to 13.33% is recorded in W II, followed by a decrease to 3.85% in LBA II. In the Uroi-*Sigheti* sample, the frequency of wild boar increases from one phase to the next from 1.41% to 3.76%, while at Vețel-*Luncă* it increases from 3.29% to 10.58%.

Based on MNI, the wild boar is most frequent (approximately 18%) in the W III settlement at Șoimuș-*Lângă sat*, where it surpasses the red deer in terms of MNI. In the LBA I sample from Șoimuș-*Teleghi*, the wild boar is the least frequent with a proportion of 3.75%. At Șoimuș-*Teleghi*, a gradual decrease in the estimated NMI proportion of wild boar is observed from 8.33% in the Starčevo-Criș level to the LBA I level, followed by an increase to 7.14% in LBA II. In W II at Șoimuș-*Lângă sat* and in LBA II at the Teleghi point, the proportion of wild boar as MNI is equal to that of red deer – 7.14%. The same occurs in the Vinča level at Șoimuș-*Teleghi* and W II at Uroi-*Sigheti*, but with higher proportions of 7.5% and 9%, respectively. For LBA at Vețel-*Luncă*, the MNI frequency increases from approximately 5% to about 17%.

The only wild species for which withers height has been estimated is *Sus scrofa*, within the W II, W III, and LBA I settlements at Șoimuș-*Teleghi* and the LBA I and LBA II settlements at Vețel-*Luncă*. The highest withers height is found in the W III site at Șoimuș-*Teleghi* – 1193.5 mm, estimated from a calcaneus with a GL of 125 mm. In the LBA I site, also at Șoimuș-*Teleghi*, a high withers height of 1032.58 mm is noted, calculated from a third metacarpal with a GL of 99 mm. In contrast, during the same period, the sample from Vețel-*Luncă* shows the lowest withers height value – 871.36 mm. In the LBA II settlement at Vețel-*Luncă*, the withers height could be calculated for three wild boar individuals, based on a fourth metatarsal, a third metatarsal, and an astragalus. Thus, the withers heights were estimated at 915.56 mm, 892.9 mm, and 900.1 mm, respectively, with an average height of 902.85 mm (Table 4.5).

Table 4.5. Withers height estimations for *Sus scrofa* species.

Settlement	Culture/Period	Anatomical element	GL (mm)	Withers height (mm)	Mean (mm)
Șoimuș-*Teleghi*	W II	Calcaneus	94	903.96	
Șoimuș-*Teleghi*	W III	Calcaneus	125	1193.5	
Șoimuș-*Teleghi*	Bădeni III-Deva	Metacarpus III	99	1032.58	
Vețel-*Luncă*	LBA I	Metatarsus IV	99	871.36	
Vețel-*Luncă*	LBA II	Metatarsus IV	104	915.56	902.85
Vețel-*Luncă*	LBA II	Metatarsus III	95	892.9	
Vețel-*Luncă*	LBA II	Astragalus	49	900.1	

4.9. Capreolus capreolus (roe deer)

The roe deer has 116 osteological fragments from a minimum of 21 estimated individuals. This taxon is absent from the W II levels at Uroi-*Sigheti*, the W III levels at Șoimuș-*Lângă sat*, and the LBA II levels at Șoimuș-*Lângă sat* and Vețel-*Luncă*. In the Vinča culture sample, the roe deer has the highest proportion, 2.6% by the NISP, while in the LBA I sites at Vețel-*Luncă*, Starčevo-Criș at Șoimuș-*Teleghi*, and W III at Uroi-*Sigheti*, the roe deer has the lowest frequency - 0.3%. The proportion of roe deer by MNI varies between 2.38% in the W III sample from Șoimuș-*Teleghi* and 14.29% in the W II sample from the same site.

4.10. Bos primigenius (aurochs)

The aurochs accounts for 30 skeletal remains from a minimum of 5 estimated individuals. The aurochs is present in the Starčevo-Criș culture settlements (0.61% NISP, 5.56% MNI), Vinča (0.25% NISP, 2.5% MNI), W II (1.15% NISP, 1.64% MNI), and LBA I (0.21% NISP, 1.25% MNI) at Șoimuș-*Teleghi*.

4.11. Lepus europaeus (hare)

For the hare, 34 bone fragments have been identified from a minimum of 7 estimated individuals. The hare has the highest percentage (1.15%) in the W II culture sample from Șoimuș-*Teleghi*, while in other sites where it was identified, it has frequencies below 1%. In terms of MNI, the hare is better represented, with the lowest percentage being 1.25% in the LBA I settlement at Șoimuș-*Teleghi*, and the highest in the W III settlement at Uroi-*Sigheti* with 3.28%.

4.12. Ursus arctos (bear)

The bear has 14 skeletal remains from a minimum of 5 estimated individuals. The highest proportion of the bear, both in terms of NISP and MNI, is in the W III settlement at Șoimuș-*Lângă sat*, where similar frequencies of approximately 9% are recorded. The lowest frequencies are in the LBA I period site, with values of 0.07% for both NISP and MNI.

4.13. Meles meles (badger)

The badger is represented by 18 bone remains from a minimum of 6 estimated individuals. The badger is present at the Șoimuș-*Teleghi* settlement from the Middle Bronze Age (W II) to the LBA II. Additionally, the badger has been identified in the LBA II settlement at Șoimuș-*Lângă sat*. The highest frequencies are observed in the LBA II site at Șoimuș-*Lângă sat*, with 3.85% for NISP and 10% for MNI. In the W II sample at Șoimuș-*Teleghi*, the badger has the lowest proportion for NISP at 0.06%, while the lowest percentage for MNI is recorded in the LBA I settlement at 1.25%.

4.14. Canis lupus (wolf)

The wolf has 8 skeletal remains from a minimum of 4 estimated individuals. In the Vinča-type settlement, the wolf has a frequency of 0.37% based on the NISP and 2.5% based on MNI. The lowest proportion is observed in the LBA I settlement, with 0.07% for NISP and 1.25% for MNI.

4.15. Castor fiber (beaver)

The beaver comprises 8 bone remains from a minimum of 3 estimated individuals. The beaver was identified only in the settlement from Șoimuș-*Teleghi* within the Vinča culture level – with one mandible (NISP – 0.12%; MNI – 2.5%), in W II – with one skull, one femur, and one mandible (NISP – 0.19%; MNI – 1.64%), and in LBA I – with one coxal bone, one femur, and two vertebrae (NISP – 0.14%; MNI – 1.25%).

4.16. Vulpes vulpes (fox)

For the fox, 4 skeletal fragments have been identified from a minimum of 2 estimated individuals. The fox is found only in the Middle Bronze Age, in the W II settlements (one humerus and two radii) with frequencies of 0.19% by NISP and 1.64% by MNI, and in W III (one mandible) with a proportion of 0.08% NISP and 2.38% MNI.

4.17. Equus ferus (wild horse)

The wild horse is present only in the Late Neolithic, in the Vinča culture settlement at Șoimuș-*Teleghi*, with its domestic form appearing from the Bronze Age onwards. Five bone remains have been identified, originating from a minimum of one individual.

4.18. Equus hydruntinus (european wild donkey)

For the european wild donkey, a species extinct since the Bronze Age, only a fragment of the radius was identified from the Vinča settlement at Șoimuș-*Teleghi.*

4.19. Lynx lynx (lynx)

The lynx is found only in the W III culture settlement at Șoimuș-*Teleghi*, where a skull fragment from one individual was identified.

4.20. Mustela putorius (polecat)

The polecat is present only in the Starčevo-Criș culture settlement at Șoimuș-*Teleghi*, represented by a mandible fragment.

4.21. Wild birds

Most fragments from wild birds have been identified in the W II settlement at Șoimuș-*Teleghi*, with a total of 36 remains. The studied fragments come from large and medium-sized species that are not specifically identifiable. Five fragments are from Anatidae and nine from Galliformes.

4.22. Mollusks

In the studied samples, two classes of mollusks were identified: Gastropoda and Bivalvia. The most frequent are bivalves, represented by the freshwater mussel (*Unio* sp.), totalling 7,101 fragments. Less frequent are gastropods, with only 23 shells of the escargot (*Helix* sp.) identified. Most freshwater mussel valves were found in the Middle Bronze Age and LBA I contexts.

4.23. Fish

From fish, there are 13 remains from 4 settlements, with the only species identified to a specific level being carp and catfish.

4.24. Amphibians

Amphibians are represented by 7 remains that are not identifiable to the species level, originating from the Wietenberg II culture at Șoimuș-*Teleghi*.

4.25. Reptiles

Reptiles are represented in the LBA I settlement at Șoimuș-*Teleghi* by a dermal plate from *Testudo* sp.

CHAPTER 5. Evolution of animal palaeoeconomy and palaeoenvironment of prehistoric communities in the Mureș Valley

5.1. Importance of the domestic animals

Animal husbandry represented the main source of animal protein for all the studied settlements in the Mureș Valley, with remains of domestic mammals predominating in all the studied sites.

Among the prehistoric communities at Șoimuș-*Teleghi*, a shift in dietary preferences over time can be observed based on archaeozoological results. Domestic cattle played a central role in the population's diet, but the inhabitants' preferences gradually shifted from an almost exclusive raising of large and small cattle in the Early Neolithic to an increasing reliance on pork at the expense of sheep/goat meat. This increase in the frequency of pig remains and decrease in sheep/goat remains is observed starting from the Late Neolithic and continuing until the first phase of the Late Bronze Age. In LBA II, the situation changes, with the sheep/goat group experiencing a rise in frequency by approximately 20%, at the expense of both pigs and domestic cattle. This inverse correlation between the proportions of pigs and those of sheep and goats could be attributed to cultural factors, dietary preferences, or a change in the surrounding environment.

5.1.1. Exploitation strategies of domestic species

The age distribution for cattle indicates an exploitation focused more on primary products, with individuals in most settlements being slaughtered as soon as they became adults (at ages between 2-3 years). Only in the W II communities at Șoimuș-*Teleghi*, W III at Uroi-*Sigheti*, LBA I at Vețel-*Luncă*, and LBA II at Șoimuș-*Lângă sat* were most cattle slaughtered over the age of 4 years, these being adult specimens used for milk production and/or draft power. In LBA I at Șoimuș-*Teleghi*, mixed exploitation of cattle was practiced, with most being

slaughtered as juveniles (under one year) and immediately as they became adults, at ages of 2-3 years (slaughtered after the first possible reproduction) or 3-4 years. Only about one-third were allowed to survive beyond 4 years, for the exploitation of secondary products and to ensure herd reproduction (Figure 5.1).

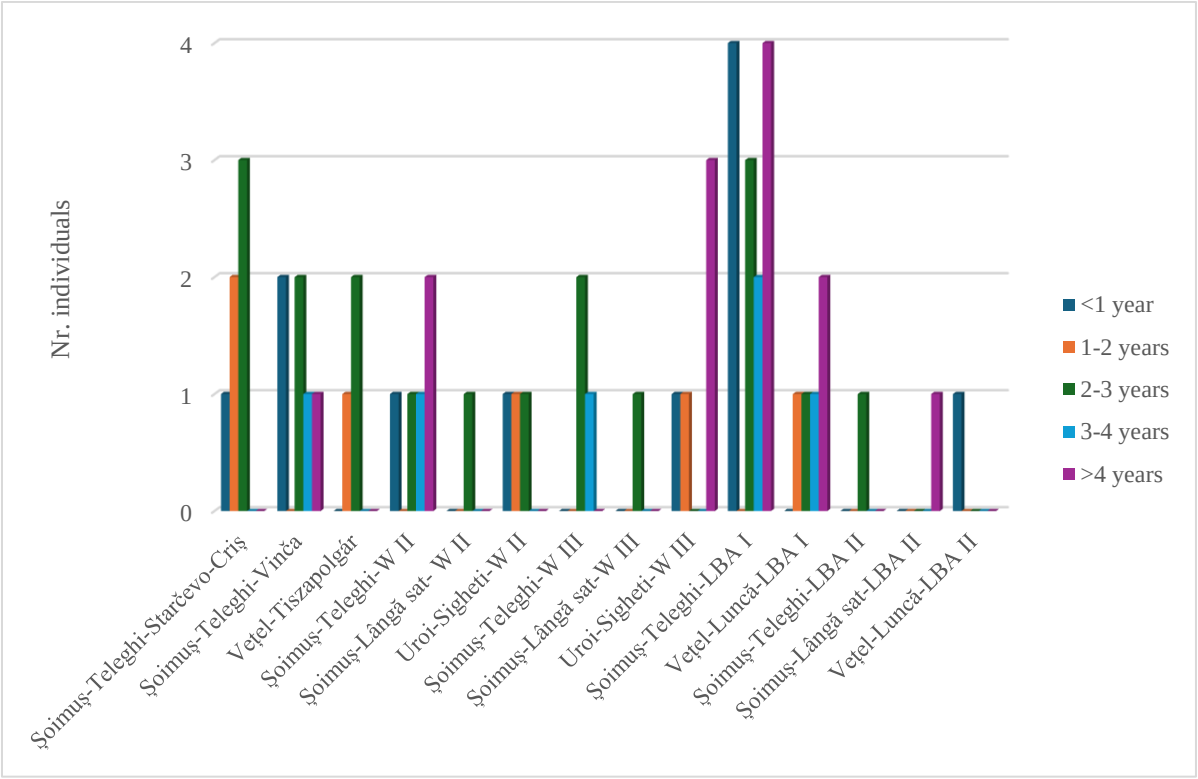

Figure 5.1. Age distribution for *Bos taurus* species.

Using age classes, we can observe an exploitation of the sheep/goat group aimed at obtaining secondary products (milk, wool), with the majority of individuals being slaughtered between 2-3 years and over 3 years old. There are exceptions to this type of exploitation; for example, in the Starčevo-Criș culture at Șoimuș, sheep/goats were slaughtered at ages under two years. In the Vinča culture, the number of specimens exploited for secondary products increases, but a high proportion of sheep and goats were still sacrificed for meat at ages under two years. In LBA II, a more intensive exploitation of these species can be observed, with most specimens being slaughtered under two years of age and only about one-third surviving to three years (probably to ensure the flocks), after which they were killed to obtain primary products (Figure 5.2).

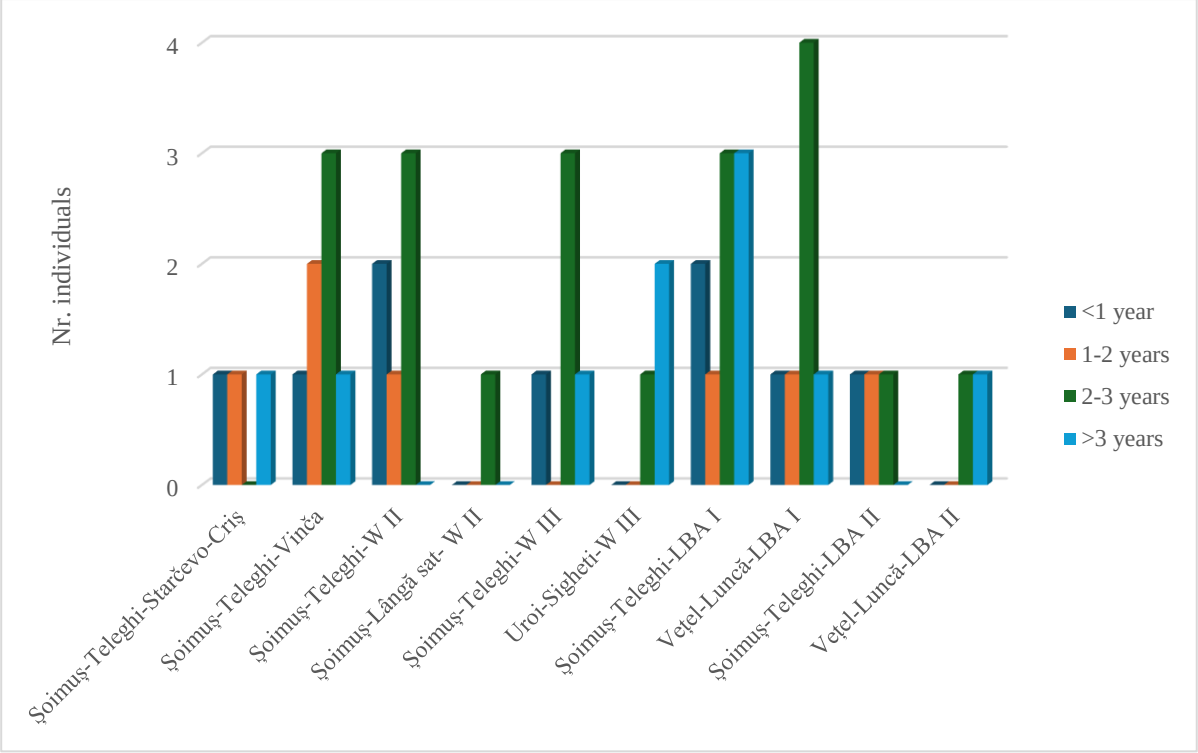

Figure 5.2. Age distribution for *Ovis aries/Capra hircus* species.

The slaughter season of sheep/goats was estimated based on individuals sacrificed under the age of two years, as their ages at slaughter are expressed in months. In the first year of life, sheep/goats were slaughtered in all settlements during the warm season, from April to August. Starting from the second year of life, they were slaughtered 69% of the time during the warm season, from March to August, and the remaining 31% of individuals were slaughtered during the cold season, from August to February (Table 5.1).

Table 5.1. Representation of the months in which sheep/goats were slaughtered in the studied settlements along the Mureș Valley.

	First year											
	mar	**apr**	**mai**	**iun**	**iul**	**aug**	**sept**	**oct**	**nov**	**dec**	**ian**	**febr**
Settlement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Șoimuș-*Teleghi*-Starčevo-Criș			1									
Șoimuș-*Teleghi*-Vinča				1								
Șoimuș-*Teleghi*-W II			2									
Șoimuș-*Lângă sat*- W II												
Șoimuș-*Teleghi*-W III			1									

Uroi-*Sigheti*-W III												
Șoimuș-*Teleghi*-LBA I		1	1									
Vețel-*Luncă*-LBA I			1									
Șoimuș-*Teleghi*-LBA II			1									
Vețel-*Luncă*-LBA II												

	Second year											
	mar	**apr**	**mai**	**iun**	**iul**	**aug**	**sept**	**oct**	**nov**	**dec**	**ian**	**febr**
Settlement	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Șoimuș-*Teleghi*-Starčevo-Criș	1											
Șoimuș-*Teleghi*-Vinča	1					1						
Șoimuș-*Teleghi*-W II	1											
Șoimuș-*Lângă sat*- W II	1			1								
Șoimuș-*Teleghi*-W III	1											
Uroi-*Sigheti*-W III	1											
Șoimuș-*Teleghi*-LBA I						1						
Vețel-*Luncă*-LBA I						2						
Șoimuș-*Teleghi*-LBA II	1											
Vețel-*Luncă*-LBA II	1											

In the case of pig, the situation differs from that of cattle and the sheep/goat group. Pigs were primarily raised for primary products (meat, fat), and the prevalence of mature specimens in the samples can be explained by the existence of a primitive breed of pig, which required a longer period to reach an optimal amount of meat for consumption. In the Early Neolithic period, there is a preponderance of juvenile individuals slaughtered before the age of one year, but in the later phase, they are slaughtered in equal proportions to adults aged 2-3 years or over 3 years. Juvenile specimens remain predominant in W III at Șoimuș-*Teleghi*, with a quarter of them being slaughtered before reaching the age of one year. In the remaining settlements, pig was primarily slaughtered as adults (Figure 5.3).

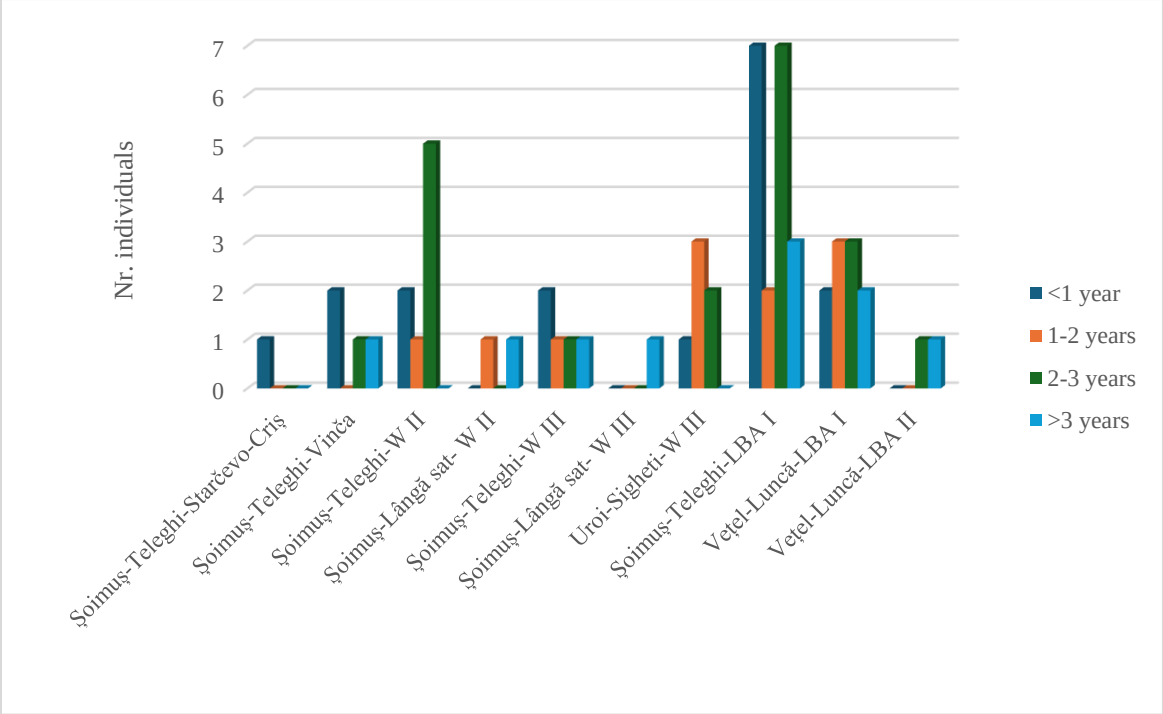

Figure 5.3. Age distribution for *Sus domesticus* species.

Dog was exploited for utilitarian purposes, mainly for protection or hunting, with most individuals being mature. Dog was not used in the food economy of the settlements, as no taphonomic evidence indicating the practice of cynophagy was found.

The prevalence of mature individuals in all the studied samples suggests that *Equus caballus* was used by the inhabitants of the settlements primarily for riding, hunting, or warfare. In some cases, it is possible that this species was also consumed.

The two estimated individuals of domestic donkey are mature, indicating that they were used for riding, carrying heavy loads, or traction.

5.2. Hunting

Hunting for food was a secondary activity in the economy of the studied settlements, but it could provide a significant amount of animal protein due to the focus on large and medium-sized mammals, such as aurochs, deer, wild boar, and roe deer. The most intensely hunted wild taxa were the red deer (*Cervus elaphus*), wild boar (*Sus scrofa*), roe deer (*Capreolus capreolus*), aurochs (*Bos primigenius*), as well as the wolf (*Canis lupus*), beaver (*Castor fiber*), hare (*Lepus europaeus*), lynx (*Lynx lynx*), badger (*Meles meles*), fox (*Vulpes vulpes),* polecat (*Mustela putorius*), brown bear (*Ursus arctos*), wild horse (*Equus ferus*), and european wild donkey (*Equus hydruntinus*). The latter two species were identified only in the Vinča settlement at Șoimuș-*Teleghi.*

Some of the analyzed communities also practiced wild bird hunting, such as the Vinča, W II, W III, and LBA I cultures at Șoimuș-*Teleghi* and LBA I at Vețel-*Luncă*.

5.3. Fishing

Fishing does not seem to have played a major role for any of the studied communities. The low number of fish remains may be a consequence of the fact that the sediments excavated during the archaeological digs were not sieved. Despite the very few fish remains, these communities could occasionally exploit the aquatic resources in the area and supplement their diet with carp and catfish (Figure 5.4).

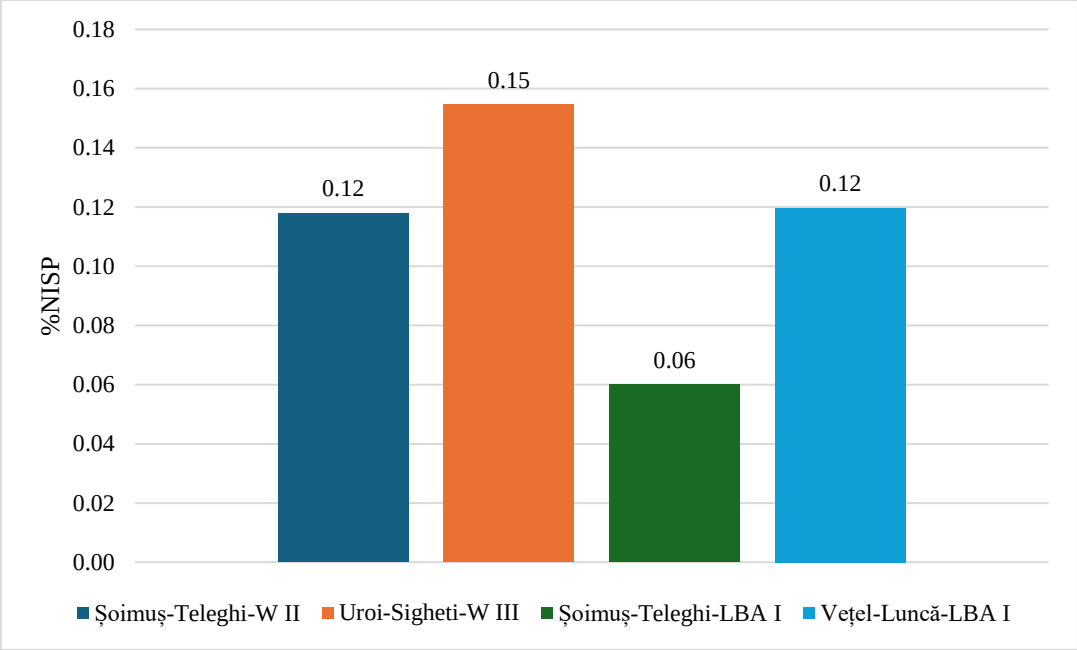

Figure 5.4. Frequency of skeletal remains from fish in the studied settlements along the Mureș Valley.

5.4. Mollusk gathering

Mollusk gathering was practiced by all the communities, except for the LBA II community at Șoimuș-*Lângă sat*, where no mollusk fragments were discovered. Compared to fishing, this activity was much more intensively practiced by the studied communities. Through this activity, the communities could additionally obtain the necessary amount of animal protein for subsistence without affecting their stocks of domestic animals, especially in settlements where mollusks represent 44-55% of the total faunal remains discovered (Figure 5.5).

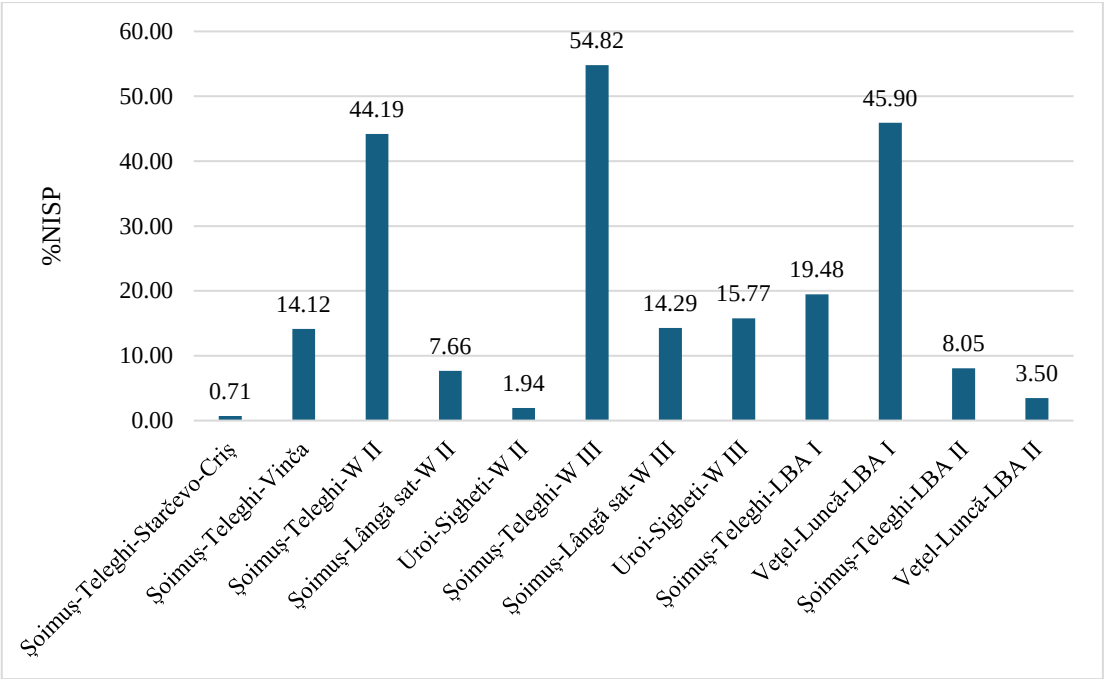

Figure 5.5. Frequency of mollusk remains from the studied settlements along the Mureș Valley.

5.5. Meat yield

Based on the minimum number of individuals and absolute weight, the quantity of meat for the species used in food could be calculated and expressed as a percentage. Thus, cattle is the main species providing meat in all the studied settlements. Besides domestic cattle, these communities also raised sheep, goat, and pig with the primary goal of consumption. However, these species, due to their relatively small size, provided reduced quantities of meat. In some communities, under certain conditions (famine, war, siege, etc.), it is possible that hippophagy was practiced. Due to its large specific size, the horse could provide a considerable amount of meat. Hunting played an important role in the diet of the populations of the studied settlements, with large-sized animals (aurochs, deer, bear, wild boar) as well as small-sized animals (hare, beaver, badger) being hunted. Hunting represented an additional activity for obtaining animal protein without reducing the stock of domestic animals, which could also be used for other utilitarian purposes.

5.6. Energy yield

The energy yield was estimated to advance the archaeozoological analysis and determine the relative importance of each species. The caloric contribution was calculated based on the quantity of meat estimated in the previous subsection. The energy yield shows

similar proportions to the estimated meat quantity. Cattle thus provide between 68% in LBA I at Șoimuș-*Teleghi* and 90% in W II at Uroi-*Sigheti* of the total estimated energy. With percentages exceeding half of the total kilocalories (kcal) estimated, cattle continue to play a central role in the diet of all studied communities. The sheep/goat group and pig, due to their relatively small size, do not contribute a very high caloric value. As seen in previous subsections, some of the studied communities also consumed horse meat in addition to beef, sheep, goat, or pork. In settlements where hypophagia was practiced, the horse provided the second highest amount of energy among domestic species, after domestic cattle. In terms of energy, hunting provided a much smaller number of kilocalories compared to animal husbandry. The wild species with the highest caloric contribution are the aurochs and the red deer.

5.7. Palaeoeconomy evolution

Based on the taxon frequencies, correspondence analysis (CA) was performed using RStudio Version 2023.03.0+386. This statistical analysis method was used to determine taxon associations during the studied periods and to identify a possible synchronous and diachronic evolution of the animal palaeoeconomy of the studied settlements on the Mureș Valley. Thus, the Early and Developed Neolithic communities primarily focused on raising large and small horned species, indicating that these two communities were mainly herders of cattle and sheep/goat. In the Middle Bronze Age, there is evidence of a sedentary lifestyle among the studied populations, with the importance of pig increasing significantly and playing a central role in their economy. Among all the studied communities, the Middle Bronze Age community at Șoimuș-*Teleghi* practiced mollusk gathering most intensively (especially freshwater species, with the river mussel being the most numerous), although the primary source of meat was still cattle. Hunting was an important activity, particularly for the Middle and Late Bronze Age communities, while for the Neolithic communities, hunting was not a primary occupation. Instead, it served as a secondary means to supplement their necessary intake of animal protein.

To observe potential dietary changes in the studied communities, the Shannon-Weaver diversity index was calculated. Low evenness values in the settlements of Starčevo-Criș, W II, W III at Șoimuș-*Teleghi*, and LBA I at Vețel-*Luncă* indicate a less uniform species distribution. These communities had a palaeoeconomy based on the intensive exploitation of certain taxa, such as domestic mammals in Starčevo-Criș and mollusks in W II and W III at Șoimuș-*Teleghi* and in LBA I at Vețel-*Luncă*. The samples from Șoimuș-*Lângă sat*, W II at Uroi-*Sigheti*, and

LBA II at Vețel-*Luncă* show the most uniform distribution of taxa; thus, these communities exploited each identified species in a relatively equal manner (Figure 5.6).

5.8. Palaeoenvironment evolution

The palaeoenvironment of the studied settlements was predominantly of a dense and extensive forest, with representative species identified such as *Cervus elaphus* (red deer), *Sus scrofa* (wild boar), *Ursus arctos* (brown bear), and *Lynx lynx* (lynx). This forested environment also included skirts and open field areas, where species like roe deer, along with aurochs, hare, wild horse, and wild donkey were identified. Both cattle and sheep/goat group grazed in the open fields; thus, one should imagine that settlements were situated in open fields, with skirt and forest relatively nearby but not necessarily adjacent to the settlements. Steppe zones appear to have been more prevalent during the Neolithic period, with species typical of steppe environments becoming rarer starting from the Bronze Age. The presence of fish and especially freshwater mollusks identified in significant proportions in most samples indicates a rich hydrographic network near these studied settlements. Another indicator of a rich hydrographic network and forest is the beaver (Figure 5.7).

Considering the type of diet, the identified wild species were categorized as follows: browsers, herbivores that feed on leaves, fruits, or shoots (e.g., red deer, and roe deer), grazers, herbivores adapted for grazing, feeding on low vegetation, primarily grass (e.g., aurochs, wild horse, European wild ass), omnivores, species that eat both plant and animal matter (e.g., wild boar, weasel, badger, and bear) and carnivores, species that primarily consume other animals (e.g., wolf, lynx, and fox).

The classification of species by diet type confirms the predominant forest environment, as well as the presence of open areas around most settlements, especially during the Neolithic and the W II culture periods. During these times, steppe-specific taxa are more numerous compared to other settlements (Figure 5.8). The prevalence of open areas in the Early Neolithic (Starčevo-Criș culture) is also supported by archaeobotanical studies (Malaxa *et al*., 2022), with a strong dominance of grasses confirmed by the analyzed phytoliths. While woody species were part of the landscape, the proportion of phytoliths indicating a forest habitat is modest.

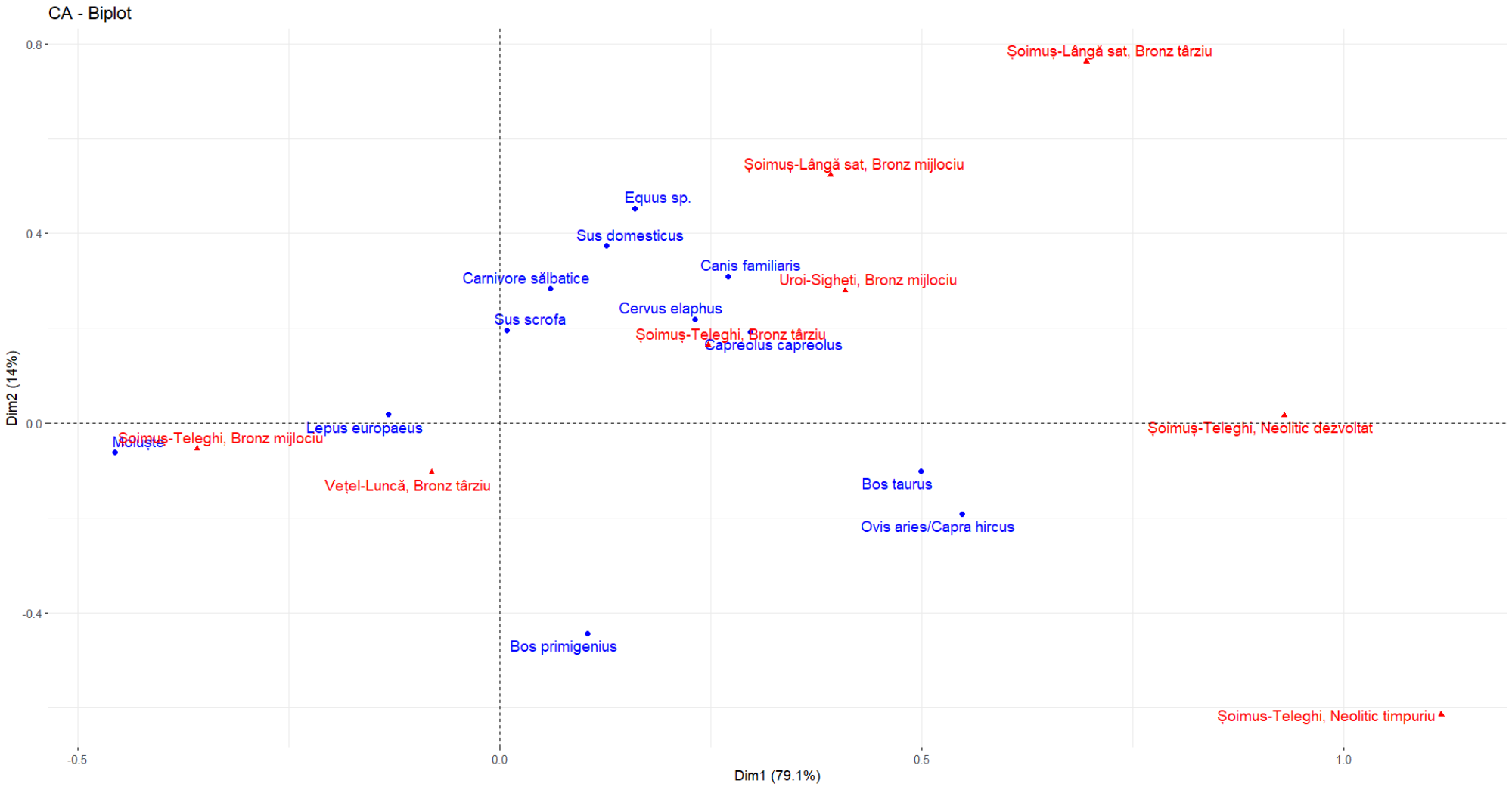

Figure 5.6. CA diagram (bidimensional representation).

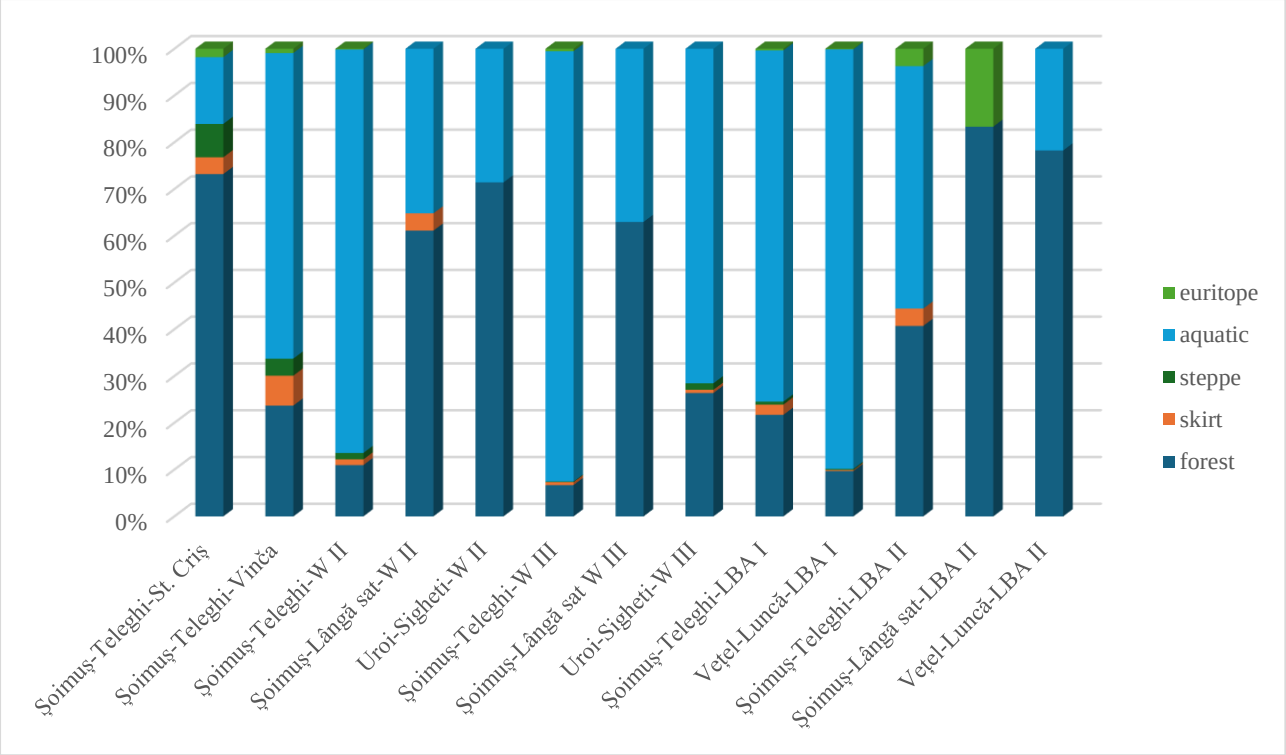

Figure 5.7. Relative frequency (%NISP) of ecological groups in the studied sites on the Mureș Valley.

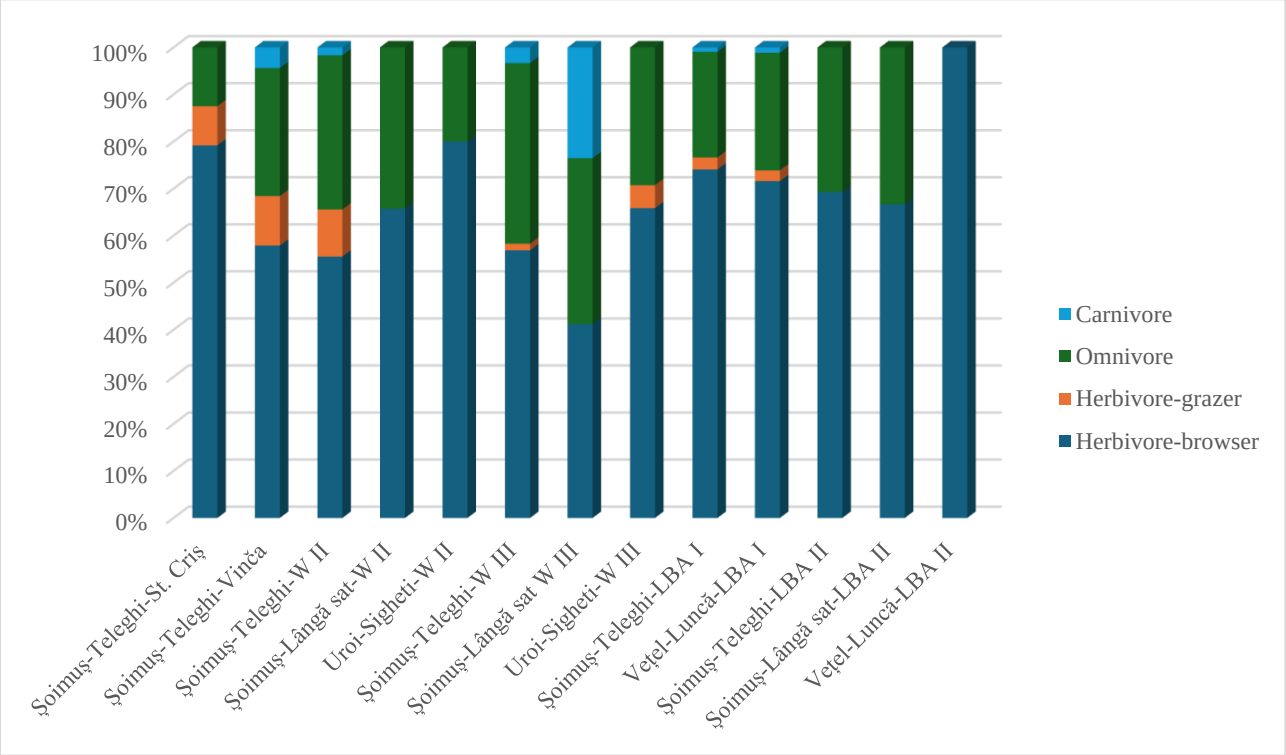

Figure 5.8. Relative frequency (%NISP) of feeding types in the studied sites on the Mureș Valley.

Conclusions

The biological material studied in this work consists of samples of faunal remains discovered in archaeological sites from western Romania, on the Mureș Valley. These sites date from the Early Neolithic (Starčevo-Criș culture), Late Neolithic (Vinča culture), Eneolithic (Tiszapolgár culture), Middle Bronze Age (Wietenberg culture), Late Bronze Age I (Bădeni III-Deva cultural horizon), and Late Bronze Age II (Susani-Simeria cultural horizon).

The zooarchaeological samples studied total 21,946 faunal remains and come from the multicultural sites of Șoimuș-*Teleghi*, Șoimuș-*Lângă sat*, Uroi-*Sigheti*, and Vețel-*Luncă*.

Samples with a small number of remains, such as W III and LBA II from Șoimuș-*Lângă sat*, W II from Uroi-*Sigheti*, and LBA II from Vețel-*Luncă*, should be treated with a certain degree of caution, as these small samples may not fully reflect the reality.

This study aims to assess the animal resources utilized by prehistoric communities on the Mureș Valley and, based on these indicators, to describe the natural landscape of the area. The objectives of this research include evaluating the strategies for exploiting animal resources (age and sex selections, skeletal frequencies, butchery techniques, etc.), describing the morphometric characteristics of the animal species used by these communities, and assessing the regional (Mureș Valley) palaeoeconomic and palaeoecological dynamics both synchronically and diachronically.

The methods applied in this study aim to identify the zooarchaeological material, quantify faunal remains, evaluate taphonomy, estimate sex and age at slaughter, perform osteometry and estimate withers height, calculate meat quantity, reconstruct the paleoenvironment, and conduct statistical analysis.

The identified faunal material is diverse and includes species from various faunal groups: Gastropoda, Bivalvia, Pisces, Reptilia, Aves, and Mammalia.

Cattle (*Bos taurus*) account for 3,152 skeletal remains from a minimum of 73 individuals and represent the domestic species with the highest frequency in terms of the number of remains across most of the studied sites.

The sheep/goat group (*Ovis aries/Capra hircus*) consists of 1,900 osteological remains from a minimum of 70 estimated individuals. Among these remains, at least 16 are attributed to *Capra hircus* (goat) and at least 13 to *Ovis aries* (sheep).

Pig (*Sus domesticus*) comprises 1,877 osteological remains from a minimum of 79 estimated individuals.

Dog (*Canis familiaris*) is represented by 232 identified bone remains, originating from a minimum of 25 estimated individuals.

Domestic horse (*Equus caballus*) is represented by 147 skeletal fragments from a minimum of 15 estimated individuals. It first appears in the Middle Bronze Age samples from the Wietenberg II culture at Șoimuș-*Teleghi*, Șoimuș-*Lângă sat*, and Uroi-*Sigheti.*

Domestic donkey (*Equus asinus*) first appears in the Middle Bronze Age and is represented by three fragments from a minimum of two estimated individuals.

Red deer (*Cervus elaphus*) is the most frequently encountered wild species in the majority of the studied sites, with 764 skeletal fragments from a minimum of 46 estimated individuals.

Wild boar (*Sus scrofa*) includes 384 osteological fragments from at least 27 estimated individuals and is the second most intensively hunted wild taxon in most settlements.

Roe deer (*Capreolus capreolus*) includes 116 osteological fragments from a minimum of 21 estimated individuals.

Aurochs (*Bos primigenius*), an extinct species, is represented by 30 skeletal fragments from a minimum of 5 estimated individuals. The aurochs is present in the Starčevo-Criș, Vinča, W II, and BT I phases at Șoimuș-*Teleghi*.

Other mammals identified in the analyzed assemblages, which have much lower frequencies, include: the hare (*Lepus europaeus*), bear (*Ursus arctos*), badger (*Meles meles*), wolf (*Canis lupus*), beaver (*Castor fiber*), fox (*Vulpes vulpes*), wild horse (*Equus caballus*), European wild donkey (*Equus hydruntinus*), lynx (*Lynx lynx*), and polecat (*Mustela putorius*). These species collectively amount to 94 faunal fragments from a minimum of 31 estimated individuals.

Wild birds are represented in the studied samples by 52 osteological remains, of which at least 14 fragments come from gallinaceous birds and at least 5 remains are from Anatidae.

Mollusks in the studied samples are represented by two classes: Gastropoda and Bivalvia. Bivalves are the most frequent, with freshwater mussels (*Unio* sp.) accounting for 7101 fragments. Less common are gastropods, with only 23 remains identified as land snail shells (*Helix* sp.).

Fish remains amount to 13 fragments from 4 settlements. The only fragments that could be identified to the species level belong to carp (*Cyprinus carpio*) and catfish (*Silurus glanis*).

Amphibians are represented by 7 nonidentifiable remains from the site of Șoimuș-*Teleghi*, W II culture.

Reptiles are present in the BT I period settlement of Șoimuș-*Teleghi* with a dermal plate from *Testudo* sp..

Animal husbandry was the primary source of animal protein for the studied sites on the Mureș Valley, with domestic mammals predominating in all settlements. It can be asserted with certainty that cattle, sheep, goats, and domestic pigs played significant roles in the animal economy of the studied communities from Mureș Valley, providing both primary products (meat, bones, hides, blood, etc.) and secondary products (draft power, milk, wool, etc.). Domestic cattle played a central role in the economy of all analyzed prehistoric communities. The Neolithic and LBA II communities of Șoimuș-*Teleghi* and LBA I of Vețel-*Luncă* were predominantly herders. In other settlements, sheep and goats are surpassed by domestic pigs, indicating these communities had lower mobility.

Among the prehistoric communities at Șoimuș-*Teleghi,* a change in dietary preferences over time can be observed based on the number of identified specimens. The inhabitants' preferences gradually shift from an almost exclusive reliance on large and small ruminants during the Early Neolithic to a diet increasingly based on pork, to the detriment of sheep/goat meat, during the Middle Bronze Age and the early phase of the Late Bronze Age, followed by a return to a diet with sheep/goat meat in LBA II.

The age distribution of cattle indicates an exploitation focused on obtaining primary products, with individuals in most settlements being slaughtered as soon as they reached adulthood, at ages between 2-3 years.

Slaughter profiles for sheep and goat indicate an exploitation aimed at obtaining secondary products (milk, wool), with the majority of individuals being slaughtered between the ages of 2-3 years and over 3 years. There are exceptions, especially in the pastoral communities (Neolithic and LBA II) at Șoimuș-*Teleghi*, where there was a focus on meat production from these species. The slaughter of sheep and goat predominantly occurred during the warm season, and only in some settlements was their slaughter practiced during the cold season.

In the case of pig, the situation differs from that of cattle and the sheep/goat group, as pig were primarily raised for primary products (meat, fat).

The dog was utilized for utilitary purposes, primarily for protection or hunting, with most individuals being mature in the majority of settlements. The dog was not used in the food economy of the settlements, as no taphonomic evidence was found to attest to the practice of cynophagy.

The prevalence of mature individuals in all studied samples suggests that the species *Equus caballus* was primarily used by the inhabitants of the settlements for riding, hunting, or warfare. In some cases (such as during famine, siege, etc.), it is possible that this species was consumed.

Hunting for food was a secondary activity in the economy of the studied settlements, but it could provide a significant amount of animal protein due to the hunting of large and medium-sized mammals. Hunting became more widespread and diversified starting with the Late Neolithic period, Vinča culture. According to the study of slaughter ages based on MNI, inhabitants of all settlements preferred to hunt primarily mature individuals, thus obtaining as much meat as possible. Hare, bear, badger, and beaver could be hunted for both their meat and their fur. Wolf, fox, and polecat were also hunted for their fur, but it is possible that they were also hunted to eliminate their predatory impact.

Some of the analyzed communities also hunted wild Anatidae and gallinaceous birds, as well as other large and medium-sized species.

Fishing does not seem to have been of major importance to any of the studied communities. The small number of fish remains may be a consequence of the sediment excavated during archaeological excavations not being sieved. Although fish remains are very limited, these communities could have exploited, at least occasionally, the aquatic resources in the area and supplemented their diet with carp and catfish. These fish could have been caught primarily from the Mureș River, but also from other tributaries of this river.

Gathering mollusks was practiced by all communities, except for the BT II settlement at Șoimuș-*Lângă sat*, where no mollusk fragments were found. Compared to fishing, this activity was practiced much more intensively by the studied communities. Through this activity, these communities could additionally procure the necessary animal protein for subsistence without affecting the stock of domestic animals, especially in settlements where mollusks represent 44-55% of the total faunal remains discovered.

Based on the MNI and the absolute weight, the amount of meat for the species used in the diet was calculated and expressed as percentages. Cattle played a crucial role in the subsistence of all the archaeozoologically analyzed communities, providing over half of the estimated meat quantity in all settlements. In addition to cattle, these communities also raised sheep, goat, and pig with the ultimate goal of consuming them. However, due to their relatively small size, these species provided smaller quantities of meat.

The caloric yield was estimated to advance the archaeozoological analysis and to determine the relative importance of each species. With percentages exceeding half of the total

estimated kilocalories, cattle continue to play a central role in the diet of all the studied communities. In terms of energy, hunting provided a much smaller number of kilocalories compared to animal husbandry.

According to CA, Early and Late Neolithic communities focused primarily on the breeding of cattle and sheep/goat group, in the Middle Bronze Age being seen a trend towards the sedentarization of the studied populations. Consequently, the importance of pig increased and played a central role, particularly within the communities of Uroi-*Sigheti* and Șoimuș-*Lângă sat*. The Late Bronze Age communities at Șoimuș-*Teleghi* and *Lângă sat* had economies based on the raising of cattle and pig. The inhabitants of the settlement at Vețel-*Luncă* had an animal husbandry economy similar to that of the Middle Bronze Age community at Șoimuș-*Teleghi*, where mollusk gathering was a relatively important activity. Hunting was a significant occupation, especially for the Middle and Late Bronze Age communities.

The studied settlements were surrounded, during their period of occupation, by open fields, suggested by the predominance of cattle, sheep/goat that required open areas for grazing, as well as by the representative species of the steppe biotope. Forest and skirts were relatively close to the settlements. Steppe areas seem to have been more extensive during the Neolithic, while from the Bronze Age onwards, steppe wild species have become rarer. This may also be due to a change in the local landscape, with forest areas possibly expanding, at least during the Middle Bronze Age, where remains of pig become more prominent at the expense of sheep and goat. The predominance of open fields in the Early Neolithic (Starčevo-Criș culture) is also confirmed by the archaeobotanical study, with a strong dominance of grasses evidenced by the studied phytoliths. The presence of fish and especially freshwater mollusks indicates a rich hydrographic network near these studied settlements.

List of published papers related to the doctoral thesis

ISI papers

Malaxa, D.I., Stanc, M.S., Bărbat, I.A., Gâza, O., Păceșilă, D., Bejenaru, L., Danu, M. (2022). Farming Beginning in Southwestern Transylvania (Romania). Subsistence Strategies in Mureș Valley during the Early Neolithic. *Diversity*, 14, 894. https://doi.org/10.3390/d14100894. IF=2,4.

Malaxa, D., Stanc, S., Bejenaru, L. Reconstructing ancient human diet by valuing animal remains: archaeozoological data concerning the multicultural site of Vețel-*Luncă* (Hunedoara County, Romania). *Journal of Ancient History and Archaeology*, în evaluare.

BDI papers

Malaxa, D., Bejenaru, L., Stanc, S. (2020). Evaluation of animal resources used in Neolithic settlements of Vinča culture: archaeozoological review. *Analele Științifice ale Universității „Alexandru Ioan Cuza" din Iași, s. Biologie animală*, 64, p. 47-62.

Malaxa, D.I., Stanc, M.S., Bejenaru, L. (2022). Analiza arheozoologică a materialului descoperit în situl de cultură Wietenberg (1900-1450/1400 a.CHR.) de la Uroi-Sigheti (Județul Hunedoara, România). *Arheologia Moldovei*, XLV, p. 205-218.

Malaxa, D.I., Stanc, M.S., Bejenaru, L. Animal resources used in Bronze Age communities: archaeozoological data from the Șoimuș-*Lângă sat* site (Hunedoara county, Romania). *Arheologia Moldovei,* acceptat sub tipar.

List of papers presented at international and national conferences

International conferences

- *26th EAA Virtual Annual Meeting, 24-30 august 2020:*

Malaxa, D., Danu, M., Cabat, A., Bărbat, A., Stanc, S., Bejenaru, L., Farming beginning in southwestern Transylvania (Romania): animals remains and phytoliths from the early Neolithic site of Șoimuș – Teleghi.

- *26th EAA Virtual Annual Meeting, 24-30 august 2020:*

Malaxa, D., Marc, A. T., Stanc, S., Bejenaru, L., Valuing animal remains for reconstruction of human diet in the Bronze Age community of Șoimuș-Teleghi (Romania).

- 9th PZAF: Postgraduate Zooarchaeology Forum 25-27th June 2021:

Malaxa, **D.,** Marc, A. T., Stanc, S., Bejenaru, L., Valuing animal remains discovered in the archaeological site of Vețel-Luncă (Hunedoara County, Romania)

- *EAA Kiel Widening Horizons Virtual Meeting, 6-11 september 2021:*

Malaxa, D., Stanc, S., Danu, M., Marc, A. T., Bejenaru, L., Bioarchaeological approaches to farming practices and palaeoenvironment in the late Neolithic settlement of Vinča culture from Șoimuș-Teleghi (Hunedoara County, Romania)

- *Sesiunea Ştiinţifică a Facultăţii de Biologie, New trends in Biology: from molecules to complex systems, October 28-29, 2021 Iaşi:*

Malaxa, D., Marc, A. T., Stanc S., Bejenaru, L., Archaeozoological data on the Bronze Age community of Wietenberg Culture from Uroi-Sigheti (Hunedoara County, Romania)

- *Int. Conference "Animal Life Histories" 17-19 March 2022, Basel, Switzerland:*

Malaxa, D., Bărbat, A., Marc, A. T., Stanc, S., Bejenaru, L., Exploiting strategies of the animal resources used in some prehistoric communities from the Mureș Valley (Romania).

- *28th EAA Annual Meeting Budapest, Hungary, 31 august-3 september 2022:*

Malaxa, D., Marc, A., Stanc, S., Bejenaru, L., Evaluating animal remains for reconstructions of palaeoeconomy and palaeoenvironment in Bronze Age settlements (Wietenberg Culture) in the Mureș Valley (Romania)

- *World Archaeological Congress-9 2022, Prague, Czech Republic july 03-08, 2022:*

Stanc, S., **Malaxa**, D., Danu, M., Bărbat, A., Bejenaru, L., Farming beginning in southwestern Transylvania (Romania): animals remains and phytoliths from early Neolithic sites in Mureș Valley (ID 1027)

- *Conference "Animal Life Histories" 17-19 March 2022, Basel, Switzerland:*

Malaxa D., Bărbat, A., Marc, A. T., Stanc, S., Bejenaru, L., Exploiting strategies of the animal resources used in some prehistoric communities from the Mureș Valley (Romania)

- *Sesiunea Ştiinţifică Internaţională Pontica, Ediţia 55: Istorie şi arheologie în spaţiul vest-pontic, noiembrie 2022:*

Malaxa, D., Bărbat A., Marc, A., Stanc, S., Bejenaru, L. Palaeoenvironment reconstruction of Neolithic and Bronze Age settlements in Mureș Valley (Romania), from archaeozoological remains

- *Sesiunea Științifică a Facultății de Biologie, Tendințe în Biologie: De la molecule la sisteme complexe, 27-28 octombrie 2022:*

Malaxa, D., Bărbat A., Marc, A., Stanc, S., Bejenaru, L. Analiza paleomediului pe baza resturilor faunistice pentru unele așezări preistorice de pe Valea Mureșului (Jud. Hunedoara)

National conferences

- *Simpozion "ArheoVest": Interdisciplinaritate în Arheologie ediția a VII-a: In Honorem Prof. Univ. Dr. Sabin Adrian LUCA, Timişoara, 23 noiembrie 2019:*

Stanc, S., **Malaxa, D.,** Marc, A. T., Mototolea A., Culturi preistorice pe malul Mureșului - Situl de la Șoimuș-Teleghi (județul Hunedoara).

- *Zilele Academice Ieșene, ediția a XXXV-a, Antropologia o abordare interdisciplinară, 16 octombrie 2020:*

Malaxa, D., Stanc, S., Bejenaru, L., Date arheozoologice privind comunitatea neolitică de cultură Vinča de la Șoimuș (Județul Hunedoara)

- *Zilele Academice Ieșene, ediția a XXXVI-a, Antropologie interdisciplinară, 21*

octombrie 2021:

Malaxa D., Marc A. T., Stanc S., Bejenaru L., Evaluarea resturilor faunistice pentru reconstituirea dietei comunităților de Epoca Bronzului din așezarea de la Șoimuș, punctul Lângă sat (Județul Hunedoara)

- *Arheologie în pandemie. Rezultate ale cercetărilor arheologice recente din România (organizat în cadrul „Zilelor Academice Ieşene", ediția a XXXVI-a), 21-23 octombrie 2021:*

Malaxa D.,, Bărbat, A., Marc, A. T., Stanc, S., Bejenaru, L., Identificarea arheozoologică a resurselor animale utilizate de unele comunități preistorice de pe Valea Mureșului

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