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Animal exploitation over two millennia at Aukuras hill hillfort at the Kernavė archaeological complex, Lithuania: zooarchaeological evidence from birds, fish, and mammals (c. 800 cal BC–1400 cal AD)

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ABSTRACT

The Kernavė archaeological complex in eastern Lithuania provides a rare opportunity to investigate long-term changes in human–animal relationships within a single site landscape. This paper presents the results of zooarchaeological analyses of 15 339 animal remains recovered from Aukuras hill hillfort in Kernavė, of which 4207 were identified to various taxonomic levels, from order and family to species. The assemblage spans four occupation phases between c. 800 cal BC and 1400 cal AD and includes mammals, birds, and fish, allowing the reconstruction of animal husbandry, hunting, and fishing practices over nearly two millennia. The results demonstrate that farming was already fully established during the Late Bronze Age, with pigs and sheep/goats forming the basis of animal husbandry. During the late Pre-Roman and Roman periods, cattle became increasingly important, likely reflecting the intensification of crop cultivation. The same period yielded the earliest known chicken remains in Lithuania, indicating the introduction of the domestic chicken by c. 200 cal BC–200 cal AD. The medieval assemblage reveals a distinct pattern of elite consumption and hunting. Compared with the inhabitants of Kernavė's medieval Upper and Lower Towns, pork, birds, fish, and wild game appear to have played a more important role in the diet of the residents of Aukuras hill hillfort. The abundance of northern goshawk remains and hare bones points to the importance of falconry and specialised hunting focused on small game. The assemblage provides new insights into the interaction between farming, social status, and animal exploitation in the eastern Baltic from prehistory to the medieval period.

KEYWORDS

animal husbandry, falconry, fishing, chickens, eastern Baltic.

Introduction

Animal and plant remains recovered during archaeological excavations are among the most important sources for reconstructing past subsistence strategies, dietary practices, environmental conditions, and economic activities. In recent decades, increasing opportunities offered by scientific methods, including stable isotope and ancient DNA analyses, have substantially increased scholarly interest in archaeological faunal remains. At the same time, traditional zooarchaeological studies have often remained overshadowed by laboratory-based approaches. In Lithuania, detailed zooarchaeological research has focused primarily on major medieval centres, including the Vilnius Lower Castle (Piličiauskienė & Blaževičius 2018; 2019; Rumbutis et al. 2018; Ehrlich et al. 2023), Klaipėda Castle (Ehrlich et al. 2020), Kernavė (Baublienė et al. 2004; Vėlius et al. 2025), and Trakai Peninsula Castle (Piličiauskienė et al. 2024). Consequently, the zooarchaeology of medieval Lithuania is comparatively well understood.

A different situation exists for earlier periods. Although Late Bronze Age[1] subsistence in Lithuania and the wider Baltic region has received increasing attention (Luik et al. 2022; Micelicaitė et al. 2023; Minkevičius et al. 2023; 2026), studies addressing long-term economic developments between the establishment of farming and the medieval period remain scarce. This is largely due to the limited availability of bioarchaeological material and the rarity of well-preserved, continuously occupied settlement sites (Minkevičius 2020; Minkevičius et al. 2025).

The Kernavė archaeological complex in east-central Lithuania provides a rare opportunity to investigate such long-term developments. Human activity is documented there from the Upper Palaeolithic until the end of the 14th century AD, while abundant bioarchaeological remains dating from the late 1st millennium BC onwards enable the reconstruction of long-term changes in subsistence practices, environmental conditions, and human–animal relationships. Particularly important in this respect are the excavations conducted at Aukuras hill hillfort in 2021–2022, which yielded a large and well-dated assemblage of mammal, bird, and fish remains. Owing to the exceptional preservation of archaeological deposits and the presence of stratigraphically distinct occupation horizons spanning from the Late Bronze Age to the 13th–14th centuries AD, the site offers a rare opportunity to examine long-term changes in animal exploitation within a single settlement location (Minkevičius et al. 2025; Vėlius et al. 2025).

In this paper, we analyse long-term changes in animal exploitation at Aukuras hill hillfort in Kernavė between c. 800 cal BC and 1400 cal AD, based on the faunal material from the site and using standard zooarchaeological methods. The results are discussed in relation to subsistence practices and, where relevant, compared with data from other sites in the Kernavė archaeological complex.

Site description

Kernavė, located approximately 35 km northwest of Vilnius on the eastern bank of the River Neris, is one of the most significant archaeological sites in the southeastern Baltic and is widely recognised as the first historical capital of the Grand Duchy of Lithuania. The archaeological complex occupies

1 In this paper, we use the following chronological periods for Lithuanian prehistory and history: Subneolithic (5000–2900 cal BC), Neolithic (2900–1800 cal BC), Early Bronze Age (1800–1100 cal BC), Late Bronze Age (1100 cal BC–500 cal AD), Pre-Roman Iron Age (500–1 cal BC), Roman Period (1–400 cal AD), Migration and Post-Migration periods (400–800 cal AD), Viking Period (800–1100 cal AD), and Medieval Period (1100–1400 cal AD).

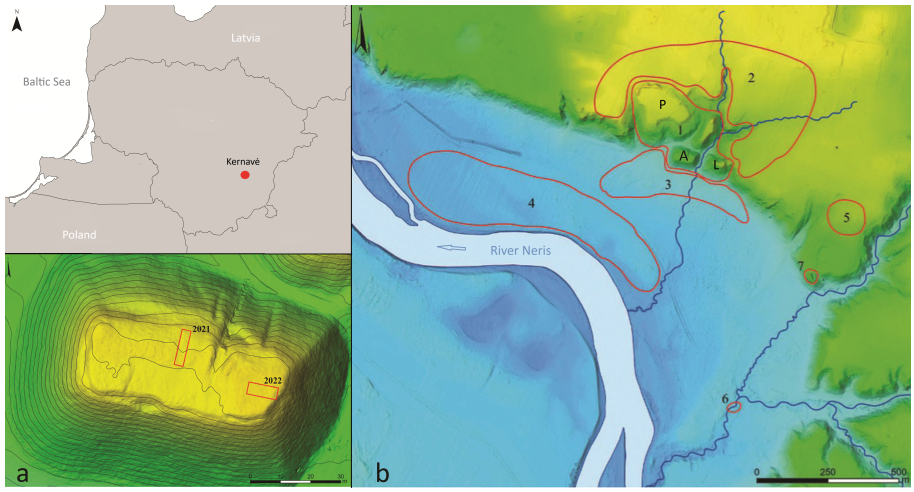

FIG. 1. Location map of the Kernavė archaeological complex and Aukuras hill hillfort: (a) Aukuras hill hillfort, with the areas excavated in 2021–2022; (b) medieval Kernavė in the late 12th–early 13th centuries: 1 – castle and fortified part of the town: A – Aukuras hill hillfort, P – Pilies hill hillfort, L – Lizdeika hillfort; 2 – Upper Town; 3 – Lower Town in a wet peaty area; 4 – Lower Town near the River Neris; 5, 6 – cemeteries; 7 – Kriveikiškis hillfort.

around 200 ha and includes a diverse cultural landscape consisting of hillforts, settlements, and burial sites spanning from prehistory to the medieval period (Fig. 1). Owing to its exceptional preservation and long-term cultural continuity, Kernavė was inscribed on the UNESCO World Heritage List.

Archaeological evidence indicates repeated human occupation from the Upper Palaeolithic (c. 10 000 cal BC) until the decline of the medieval centre following the Baltic crusades and the abandonment of much of the settlement at the end of the 14th century AD. Since systematic excavations began in 1979, Kernavė has produced one of the richest archaeological datasets in Lithuania, including material from five hillforts, eight burial grounds, and several chronologically distinct settlement areas (Vengalis 2016; Minkevičius et al. 2025; Vėlius et al. 2025).

Settlement activity in Kernavė became more prominent from the Late Bronze Age and reached its greatest extent in the medieval period (1200–1400 cal AD). The chronology of Kernavė broadly follows established phases of Lithuanian prehistory, including the Pre-Roman and Roman Iron Ages, the Migration and Post-Migration periods, and the Viking Age (Vengalis 2012; Podėnas et al. 2016; Baltramiejūnaitė et al. 2019; Minkevičius et al. 2025). Most archaeological sites at Kernavė are concentrated in the River Neris valley, where prehistoric and medieval settlement areas, including the Lower Town, have been identified (Vengalis

2012). The most distinctive features of the Kernavė archaeological complex, however, are the hillforts and associated medieval town on the upper terrace (Fig. 1b). Excavations indicate occupation beginning around 1000 cal BC, with gradual development into a major medieval centre. The largest hillfort, Pilies (Castle) hill hillfort, functioned as a fortified market area from the medieval period onward (Luchtanas 1986), while Lizdeika hillfort formed part of the 13th–14th-century defensive system (Vengalis & Vėlius 2019). North of the hillforts, the area called the Upper Town emerged during the 13th century as medieval Kernavė expanded onto the upper terrace of the River Neris (Vaičiūnienė 2000; Vengalis et al. 2020).

Aukuras (Altar) hill hillfort is one of the principal hillforts of the Kernavė archaeological complex (Fig. 1a). Archaeological investigations began there in 1992 and have continued intermittently since, revealing evidence of occupation from approximately 1000 cal BC onward. The site developed from a Late Bronze Age and Iron Age settlement into part of medieval Kernavė, and by the 13th–14th centuries AD, it likely functioned as the residence of the Grand Duke of Lithuania and the elite, as indicated by changes in material culture and reduced evidence of everyday household activities. The hillfort is therefore important for studying both long-term settlement continuity and social differentiation. Excavations conducted in 2021–2022 yielded one of the richest bioarchaeological assemblages in Kernavė, including extensive archaeobotanical and zooarchaeological material, making it one of the most intensively investigated areas within the Kernavė complex (Minkevičius et al. 2025; Vėlius et al. 2025).

Historical and archaeological evidence suggests that repeated attacks by the Teutonic Order in 1365 and 1390 led to the relocation of political and economic power away from Kernavė (Vitkūnas 2005). The subsequent abandonment of large parts of the settlement halted further urban development and contributed to the exceptional preservation of the archaeological layers visible today.

Zooarchaeological research at Kernavė began alongside the first archaeological excavations, when large quantities of animal remains were recovered and recognised as an important source of information about past subsistence practices (Kulikauskas & Luchtanas 1979; Volkaitė-Kulikauskienė 1984; Luchtanas 1990). Over several decades of fieldwork, one of the largest zooarchaeological collections in Lithuania was assembled from various locations within the Kernavė archaeological complex, including the Upper and Lower Towns, Aukuras hill hillfort, and other excavated areas, making Kernavė an important site for the study of animal husbandry, hunting, and diet in the past (Bilskienė & Daugnora 2001; Baublienė et al. 2004; Vengalis 2010; 2014; 2020; Vėlius et al. 2025).

Today, the Kernavė zooarchaeological collection comprises approximately 35 000 animal skeletal specimens recovered during more than four decades of archaeological investigations and is stored at the Zooarchaeological Repository of Vilnius University. As one of the largest faunal collections in Lithuania, it represents an important resource for investigating long-term changes in subsistence practices, animal exploitation, and human–animal relationships.

Material and methods

During the archaeological excavations in 2021–2022, a total of 234 m² was investigated in two areas of Aukuras hill hillfort, yielding 15 339 animal remains (Table 1). During the 2021–2022 excavations at Aukuras hill hillfort dry sieving with a 4-mm mesh size was used. This allowed the recovery of very small bone fragments, including small fish bones and remains of small mammals, which might otherwise have been missed. The use of sieving also resulted in the recovery of a substantial amount of highly fragmented material, of which only 4207 specimens (27.4%) were identified to various taxonomic levels, from order and family to species. The methods used to collect faunal remains during the excavations may therefore have influenced the composition of the zooarchaeological assemblage. Based on archaeological evidence and primarily on radiocarbon dates obtained from charred cultivated plant remains, five occupation phases from 800 cal BC to 1400 cal AD were identified at the site:

1. c. 800–200 cal BC (Late Bronze Age–early Pre-Roman Iron Age);
2. c. 200 cal BC–200 cal AD (late Pre-Roman–early Roman Iron Age);
3. c. 200–700 cal AD (late Roman Iron Age–Post-Migration Period);
4. c. 700–1200 cal AD (Late Iron Age);
5. c. 1200–1400 cal AD (medieval period).

The earliest analysed samples were dated to 2508 ± 26 BP (777–544 cal BC), while the latest yielded dates of 665 ± 30 BP (1278–1393 cal AD), approximately corresponding to the second 14th-century fire event in Kernavė (Minkevičius et al. 2025; Vėlius et al. 2025). Zooarchaeological material was recovered from cultural layers representing four of the five occupation phases; no animal remains were found from the Late Iron Age.

TABLE 1. Chronological distribution of analysed faunal remains from Aukuras hill hillfort

Chronology	Identified mammals		Undetermined mammals		Birds		Fish		Total	
	n	%	n	%	n	%	n	%	n	%
c. 800–200 cal BC	31	15.3	171	84.7	–	–	–	–	202	1.3
c. 200 cal BC–200 cal AD	246	16.7	1138	77.4	49	3.3	38	2.6	1471	9.6
c. 200–700 cal AD	76	15.5	405	82.5	9	1.8	1	0.2	491	3.2
c. 1200–1400 cal AD	3087	23.5	8920	68.0	671	5.1	438	3.3	13116	85.5
Undetermined, c. 200 cal BC–1400 cal AD	13	22.0	43	72.9	2	3.4	1	1.7	59	0.4
Total	**3453**	**22.5**	**10677**	**69.6**	**731**	**4.8**	**478**	**3.1**	**15339**	**100.0**

Sheep (*Ovis aries*) and goat (*Capra hircus*) remains were identified following the criteria proposed by Boessneck et al. (1964), Payne (1985), and Prummel and Frisch (1986). Specimens that could not be attributed to either taxon were classified as *Ovis/Capra* (sheep/goat). Similarly, specimens that could not be distinguished between auroch and European bison were classified as *Bos primigenius / Bison bonasus* (auroch/bison). Remains of the mountain hare (*Lepus timidus*) and European hare (*Lepus europaeus*) were not reliably distinguished at the species level and were therefore grouped and recorded as *Lepus timidus / L. europaeus*.

Osteometric measurements were taken according to von den Driesch (1976). Age-at-death estimations were based on epiphyseal fusion and tooth eruption patterns following Silver (1969). The minimum number of individuals (MNI) was calculated following White (1953), taking into account animal age and body size. Age profiles for sheep/goats were assessed using tooth wear stages following Payne (1973), while those for pigs (*Sus scrofa domesticus*) and cattle (*Bos taurus*) were evaluated according to Grant (1982).

Sex determination in cattle was based on metacarpal and metatarsal measurements using the discriminant function developed by Kobryńczuk and Kobryń (1993). Withers height in cattle was reconstructed from the greatest lengths (GL) of metacarpal and metatarsal bones using Tsalkin's (1960) coefficients. The withers height of sheep was estimated from radial bone length (GL), applying the coefficients of Teichert (1975). The withers height of pigs was calculated using the coefficients proposed by Teichert (1969).

Fish size was estimated by comparing archaeological specimens with modern fish of known size from the reference collection.

Mammal and fish remains were analysed at the Zooarchaeology Laboratory, Faculty of History, Vilnius University, using a comparative collection of modern animal skeletons. Bird bones were identified at the Kaunas Tadas Ivanauskas Museum of Zoology using a reference collection of modern bird skeletons.

Results

A total of 15 339 zooarchaeological specimens were analysed. The 2021 excavations yielded faunal remains (n = 7269) from four chronological periods, spanning from the Late Bronze Age to the 13th–14th centuries AD, whereas the 2022 investigations produced exclusively medieval animal remains (n = 7794). The quantitative analyses presented below are based only on specimens identified to the species, family, or order level. Unidentified faunal remains, as well as a few small rodent bones (n = 26; 0.2%), were excluded from further analyses.

The earliest cultural layers (c. 800–200 cal BC) yielded the fewest animal remains (n = 202). Of these, 31 identified bone and tooth fragments belonged to at least six wild and domestic animal taxa (Tables 1 and 2). Domestic animals accounted for 90.3% of identified remains, with pigs being the most frequent taxon (35.5%), followed by sheep/goats (25.8%) and cattle (19.4%). Pig remains included a newborn animal and at least two individuals older than one year. Sheep/goat remains comprised a newborn animal and at least one individual older than 1.5 years. All identified cattle remains belonged to mature animals (older than 3–4 years). Horse (*Equus ferus caballus*) remains represented at least two individuals, including one yearling animal and one adult horse with cut marks on the first phalanx. Wild fauna was represented only by hare and red deer remains.

Faunal remains were considerably more abundant (n = 1471) in the cultural layer dated to c. 200 cal BC–200 cal AD (Table 1). In addition to the dominant mammal remains, bird and fish bones accounted for 3.3% and 2.6% of the assemblage, respectively. Among identified mammals (Table 2), cattle predominated (42.3%), representing at least six individuals of different ages. At least three cattle were adults, while the remains of one newborn calf and one approximately 1.5-year-old individual were identified; at least one more animal was younger than 3–4 years. Pig (26.8%) and sheep/goat (17.9%) remains were less abundant. Pig remains (n = 66) represented at least five individuals of various ages, ranging from newborn piglets to animals older than 2–3 years. Sheep/goat remains also belonged to at least five individuals, including one newborn and at least three animals older than 1.5–2 years.

TABLE 2. Species distribution of mammal bones during the different occupation phases of Aukuras hill hillfort. MNI – minimum number of individuals, NISP – number of identified specimens

Species	800–200 cal BC		200 cal BC–200 cal AD		200–700 cal AD		1200–1400 cal AD	
	NISP/ MNI	%NISP/ %MNI	NISP/ MNI	%NISP/ %MNI	NISP/ MNI	%NISP/ %MNI	NISP/ MNI	%NISP/ %MNI
Cattle (*Bos taurus*)	6/2	19.4/ 18.2	104/6	42.3/25.0	36/3	47.4/25.0	1128/32	36.5/23.5
Sheep (*Ovis aries*)							21/6	0.7/4.4
Goat (*Capra hircus*)							3/2	0.1/1.5
Sheep/goat (*Ovis/Capra*)	8/2	25.8/18.2	44/5	17.9/20.8	11/2	14.7/16.7	455/10	14.7/7.4
Pig (*Sus scrofa domesticus*)	11/3	35.5/27.3	66/5	26.8/20.8	19/3	25.0/25.0	1043/33	33.8/24.3
Horse (*Equus ferus caballus*)	3/2	9.4/18.2	2/1	0.8/4.0	2/1	2.6/8.3	13/2	0.4/1.5
Dog *(Canis familiaris*)							17/3	0.6/2.2
Bison/auroch (*Bison bonasus / Bos primigenius*)							14/3	0.5/2.2
Elk (*Alces alces*)			1/1	0.4/4.0			7/2	0.2/1.5
Red deer (*Cervus elaphus*)	2/1	6.5/9.1	14/2	5.7/8.3	2/1	2.6/8.3	80/5	2.6/3.7
Roe deer (*Capreolus capreolus*)			1/1	0.4/4.0			9/3	0.3/2.2
Boar (*Sus scrofa*)			8/2	3.3/8.3			21/3	0.7/2.2
Mountain/European hare *(Lepus timidus / L. europaeus*)	1/1	3.2/9.1	6/1	2.4/4.0	5/1	6.6/8.3	242/20	7.8/14.7
Beaver (*Castor fiber*)					1/1	1.3/8.3	4/1	0.1/0.7
Fox (*Vulpes vulpes*)							3/2	0.1/1.5
Pine marten (*Martes martes*)							1/1	0.0/0.7
Red squirrel (*Sciurus vulgaris*)							25/7	0.8/5.1
Northern white-breasted hedgehog *(Erinaceus roumanicus*)							1/1	0.0/0.7
Total	31/11	100.0/100.0	246/24	100.0/100.0	76/12	100.0/100.0	3087/136	100.0/100.0

A horse tibia fragment had cut marks. Wild animals accounted for 12.2% of identified mammalian remains and were dominated by red deer (*Cervus elaphus*) (n = 14) and wild boar (*Sus scrofa*) (n = 8).

Bird remains from this period included 49 specimens, of which 32 (65.3%) were identified to species, family or order level (Table 3). The assemblage represented at least seven bird species and was dominated by wild and domestic Galliformes (n = 24). Domestic chicken (*Gallus gallus domesticus*) was particularly well represented with at least seven identified bones, while two additional specimens could not be distinguished from willow grouse or black grouse. Other taxa included mallard (*Anas platyrhynchos*), western capercaillie (*Tetrao urogallus*), common raven (*Corvus corax*), western jackdaw (*Corvus monedula*) and a few others.

Among the 26 identified fish remains, freshwater species predominated (Table 4). Pike (*Esox lucius*) was the most frequently recorded species. Estimated pike sizes ranged from 40 to 110 cm, with most individuals measuring 60–70 cm. Among cyprinid remains (n = 12), only bream could be identified. At least six bream (*Abramis brama*) individuals represented fish measuring approximately 40–45 cm in length. In addition, a palatine bone fragment of a large catfish (*Silurus glanis*), over 2.0–2.5 m long, was

TABLE 3. Anatomical and species distribution of bird bones, 200 cal BC–200 cal AD. NISP – number of identified specimens

Species/element	Tibiotarsus	Humerus	Ulna	Radius	Carpometacarpus	*Ossa digitorum manus*	Sternum	*Coracoideum*	Scapula	*Pelvis et synsacrum*	*Vertebrae cervicales speciales*	Undetermined	**Total**	**%NISP**
Mallard (*Anas platyrhynchos*)								1	1				**2**	**6.3**
Western capercaillie (*Tetrao urogallus*)					1						6		**7**	**21.9**
Grey partridge / hazel grouse (*Perdix perdix / Bonasa bonasia*)			2				1	3					**6**	**18.8**
Willow grouse / domestic chicken (*Lagopus lagopus / Gallus gallus domesticus*)			1		2								**3**	**9.4**
Domestic chicken / black grouse (*Gallus gallus domesticus / Tetrao tetrix*)	1												**1**	**3.1**
Domestic chicken (*Gallus gallus domesticus*)	1		1		1			2		2			**7**	**21.9**
Common raven (*Corvus corax*)					1	1							**2**	**6.3**
Western jackdaw (*Corvus monedula*)		1											**1**	**3.1**
Galliformes sp.		1											**1**	**3.1**
Columba sp.				1									**1**	**3.1**
Passeriformes sp.		1											**1**	**3.1**
Aves, undetermined	1									2		14	**17**	**–**
Total	**3**	**3**	**4**	**1**	**5**	**1**	**1**	**6**	**1**	**4**	**6**	**14**	**49**	**100.0**

recovered. Dentaries of three eels (*Anguilla anguilla*) indicated individuals measuring approximately 80–90 cm in length.

Faunal remains recovered from deposits dated to 200–700 cal AD were sparse, comprising only 491 animal bone fragments, the vast majority of which were mammalian remains (98.0%) (Table 1). Among the 76 identified specimens, domestic animals predominated (89.5%). Cattle were the most common species (47.4%), although no remains of juvenile or newborn individuals were recorded; identified specimens included one animal younger than 3.5–4 years and at least one older than 8–9 years. Pig remains ranked second (25.0%), while sheep/goat remains (14.7%) were nearly half as abundant. No juvenile pigs or sheep/goats were identified. Horse remains, as in other periods, were scarce (2.6%). Among wild animals, hare remains were the most frequent (Table 2).

Most of the nine bird bone fragments were highly fragmented and very small. It can only be stated that at least four likely belonged to Galliformes. The single identified fish remain belonged to a 30–35-cm-long perch (*Perca fluviatilis*) (Table 4).

TABLE 4. Species composition of fish remains during the different occupation phases of Aukuras hill hillfort. NISP – number of identified specimens

Species/dating	200 cal BC–200 cal AD		200–700 cal AD		1200–1400 cal AD	
	NISP	%NISP	NISP	%NISP	NISP	%NISP
Pike (*Esox lucius*)	10	38.5			99	29.8
Zander (*Sander lucioperca*)					8	2.4
Perch (*Perca fluviatilis*)			1	100.0	12	3.6
Wels catfish (*Silurus glanis*)	1	3.8			10	3.0
Salmon (*Salmo salar*)					27	8.1
Sturgeon (*Acipenser* sp.)					15	4.5
Eel (*Anguilla anguilla*)	3	11.5			4	1.2
Cyprinids (Cyprinidae)	6	23.1			55	16.6
Bream (*Abramis brama*)	6	23.1			67	20.0
Tench (*Tinca tinca*)					9	2.7
Crucian carp (*Carassius carassius*)					1	0.3
Common rudd (*Scardinius erythrophthalmus*)					7	2.1
Roach (*Rutilus rutilus*)					6	1.8
Common chub (*Squalius cephalus*)					3	0.9
Ide (*Leuciscus idus*)					1	0.3
Asp (*Leuciscus aspius*)					2	0.6
Vimba bream (*Vimba vimba*)					6	1.8
Identified, total	26		1		332	
Undetermined	12				106	
Total	38	100.0	1	100.0	438	100.0

The medieval period, representing the latest chronological phase, yielded by far the largest zooarchaeological assemblage, comprising 13 116 animal bone fragments (Table 1). In addition to the dominant mammalian remains (91.5%), bird (5.1%) and fish (3.3%) remains were also quite abundant. Among the 3087 identified specimens, domestic animals accounted for 86.8%, with cattle (36.5%) and pigs (33.8%) being the most frequent taxa (Table 2).

Due to their high fragmentation, age could be estimated for only eight cattle individuals and ranged from newborns to animals aged 8–9 years, with no clear predominance of any age group. The sex and withers height of three individuals were determined: two bulls measured 106 cm and 108 cm, while one cow measured 105 cm in height. Pig remains represented individuals of various ages, from newborn piglets to animals aged 5–6 years, although one- and two-year-old pigs predominated, as is commonly observed (Piličiauskienė & Blaževičius 2018). Estimated withers heights of three pigs were 63 cm, 66 cm, and 47 cm.

Sheep and goat remains comprised 479 fragments, representing at least six sheep, two goats, and eight additional undetermined sheep/goat individuals (Table 2). The age range of sheep and goats varied from newborns to animals aged 4–6 years. At least five sheep had been slaughtered at approximately 9 months of age, while one individual survived to around 3 years. One goat was younger than 2–3 years, whereas another was older. In the sheep/goat group, remains of animals aged 1.5–2 years predominated. Based on radius length, the estimated withers height of sheep was approximately 66 cm.

Horse remains were extremely scarce in the medieval assemblage (0.4%). The 13 horse bone and tooth fragments represented at least two adult individuals. Only a single horse bone, a pelvic fragment, had cut marks. A total of 17 highly fragmented dog bones belonged to at least three adult individuals.

Wild mammals accounted for 13.2% of identified mammalian remains during the medieval period. Hare bones were the most abundant (7.8%), while considerably fewer remains of red deer (2.6%) and other large ungulates, including bison/auroch and elk (*Alces alces*), were identified. Unusually high numbers of small mammals not previously recorded at Kernavė were also recovered: 25 red squirrel (*Sciurus vulgaris*) bones, representing at least seven individuals. In addition, a hedgehog mandible (*Erinaceus roumanicus*) was found (Table 2).

Of the 671 bird bones recovered, 372 were identified, representing at least 23 bird species (Table 5). Domestic chicken was the most frequent taxon, accounting for 34.4% of identified remains. Most chicken bones belonged to adult birds. Additional chicken remains were likely included within the broader category of unidentified Galliformes, as birds of domestic chicken size comprised approximately half of the unidentified galliform fragments. Remains of birds comparable in size to black grouse (*Tetrao tetrix*) and capercaillie were also relatively common. Among wild Galliformes, black grouse predominated (n = 11), followed by western capercaillie (n = 6) and hazel grouse (*Bonasa bonasia*) (n = 5); three grey partridge (*Perdix perdix*) bones were also recorded (Table 5).

TABLE 5. Species composition of bird remains from medieval Aukuras hill hillfort, 1200–1400 AD. NISP – number of identified specimens

Bird species	♀	♂	Undetermined	NISP	%NISP
	n	n	n		
White stork / black stork (*Ciconia ciconia / C. nigra*)			1	1	0.3
Mute swan / whooper swan (*Cygnus olor / C. cygnus)*			1	1	0.3
Greylag goose *(Anser anser*)			3	3	0.8
Goose (*Anser* sp.)			9	9	2.4
Anseriformes			2	2	0.5
Anas (*Anas* sp.)			2	2	0.5
Diving ducks (*Aythia* sp.)			1	1	0.3
Northern goshawk (*Accipiter gentilis*)	7	4	3	14	3.8
Eurasian sparrowhawk (*Accipiter nisus*)	2			2	0.5
Golden eagle (*Aquila chrysaetos*)		1		1	0.3
Falconiformes			1	1	0.3
Common buzzard (*Buteo buteo*)	3			3	0.8
Hazel grouse (*Bonasa bonasia*)			5	5	1.3
Black grouse (*Tetrao tetrix*)	3	6	2	11	3.0
Western capercaillie (*Tetrao urogallus*)		3	3	6	1.6
Black grouse / western capercaillie (*Tetrao tetrix / T. urogallus*)			3	3	0.8
Grey partridge (*Perdix perdix*)			3	3	0.8
Domestic chicken (*Gallus gallus domesticus*)		4	124	128	34.4
Galliformes			137	137	36.8
Stock dove (*Columba oenas*)			2	2	0.5
Common wood pigeon (*Columba palumbus*)	1	1		2	0.5
Eurasian magpie (*Pica pica*)			1	1	0.3
Rook (*Corvus frugilegus*)			1	1	0.3
Hooded crow (*Corvus cornix*)			2	2	0.5
Common raven (*Corvus corax*)	2		25	27	7.3
Western jackdaw (*Coloeus monedula*)			2	2	0.5
Eurasian jay (*Garrulus glandarius*)			2	2	0.5
Total	18	19	335	372	100.0

Domestic chicken was the only undoubtedly domestic bird species identified in medieval Kernavė. Although remains of greylag goose (*Anser anser*) (n = 3) were recovered, it was not possible to determine whether they belonged to wild or domestic individuals. A relatively high proportion (5.6%) of bird remains belonged to birds of prey, most commonly the northern goshawk (*Accipiter gentilis*) (n = 14). Additional remains included the golden eagle (*Aquila chrysaetos*), Eurasian sparrowhawk (*Accipiter nisus*), common

buzzard (*Buteo buteo*), and an unidentified falcon (Table 5). Unexpectedly large numbers of common raven bones were identified (n = 27), including at least two female individuals. Other corvids, such as the hooded crow (*Corvus cornix*), Eurasian magpie (*Pica pica*), rook (*Corvus frugilegus*), western jackdaw, and Eurasian jay (*Garrulus glandarius*), were also present. Less frequent finds included remains of stock dove (*Columba oenas*) and common wood pigeon (*Columba palumbus*). In addition, remains of a white or black stork (*Ciconia ciconia / C. nigra*) and either a mute swan or whooper (*Cygnus olor / C. cygnus*) were recovered (Table 5).

Of the 438 fish bones and bone fragments recovered from the medieval cultural layer, 332 were identified, representing at least 16 freshwater and migratory fish species (Table 4). Remains of three migratory fish taxa accounted for 13.9% (n = 46) of identified fish remains. Among these, salmon (*Salmo salar*) bones were the most frequent (n = 27), followed by sturgeon (*Acipenser* sp.) scutes (n = 15) and eels, represented by four dentaries. Salmon were large in size; no individuals smaller than 90–100 cm were identified, while most specimens derived from fish measuring 100–110 cm or slightly more. Vertebrae and dentaries predominated among salmon remains. Based on the size of the recovered dentaries, the eels were approximately 80–100 cm long.

Cyprinids were the most abundant fish, comprising 47.3% (n = 157) of identified remains. A total of nine cyprinid species were identified. Bream was the most common species (n = 67), whereas common rudd (*Scardinius erythrophthalmus*), roach (*Rutilus rutilus*), tench (*Tinca tinca*), and vimba bream (*Vimba vimba*) were represented by 6–9 fragments each (Table 4). Less frequent taxa included asp (*Leuciscus aspius*), ide (*Leuciscus idus*), common chub (*Squalius cephalus*), and crucian carp (*Carassius carassius*). Most bream measured 40–45 cm, with another common size group ranging from 30 to 35 cm. Rudd were typically 25–30 cm long. Tench and asp tended to be relatively large, with estimated lengths of 40–45 cm and 60–70 cm, respectively. Crucian carp measured approximately 20–25 cm, whereas chub reached 50–60 cm.

Pike accounted for 29.8% of all identified fish remains. Estimated body lengths ranged from 30–40 cm to 110–120 cm or more. Small pikes (30–40 cm) were very scarce (4.4%), while individuals measuring 60–80 cm predominated (50.7%). More than one-fifth (21.7%) of the pike were exceptionally large, reaching 90–120 cm in length.

Other predatory fish were generally large in size. Perch ranged from 25 to 45 cm, while zander (*Sander lucioperca*) were most commonly 40–60 cm long. Most catfish were large individuals; although some measured 50–60 cm, specimens representing fish 100–150 cm in length predominated. Various skeletal elements were recovered, although cranial bones were considerably

more frequent than vertebrae. Approximately 80 fish scales were also found, most of which belonged to cyprinids and percids.

Discussion

Long-term changes in farming and subsistence practices at Kernavė are assessed through the analysis of faunal remains from Aukuras hill hillfort. Particular attention is paid to temporal variation in taxonomic representation, the relative abundance of domestic and wild taxa, and changes in faunal diversity and exploitation patterns over time.

FROM THE NEOLITHIC TO THE LATE BRONZE AGE: REGIONAL DEVELOPMENTS IN FARMING AND SUBSISTENCE

The earliest zooarchaeological material recovered from Aukuras hill hillfort reflects the subsistence economy of local communities during the Late Bronze Age. By the end of the 2nd millennium BC, agriculture had already become fully established in Lithuania, although the precise timing and regional variability of this process remain unclear. Domestic animals first appeared in present-day Lithuania at the beginning of the 3rd millennium BC (Piličiauskas et al. 2017a; 2017b; Piličiauskas 2018). However, knowledge concerning the nature and economic significance of animal husbandry during the 3rd–2nd millennia BC remains extremely limited. This is largely due to the near absence of zooarchaeological material dating from the Neolithic to the Late Bronze Age. With the exception of the Alksnynė 3 site, faunal evidence is limited to a small number of directly dated domestic animal bones recovered from multi-period settlements where material from different periods is mixed (Piličiauskas et al. 2017b; Piličiauskas 2018). Therefore, while Neolithic economies can still be reconstructed from limited faunal remains and human skeletal material, the Early Bronze Age record relies almost exclusively on organic residue analyses, as human remains from this period are absent and animal bones are exceedingly rare. Evidence derived from analyses of Early Bronze Age pottery suggests that during this period, fish remained an important component of the diet despite the introduction of domestic animals (Piličiauskas 2018; Piličiauskas et al. 2018; Podėnas et al. 2023).

The situation changes considerably during the Late Bronze Age, when fortified settlements first appear in the archaeological record. Excavations at these sites, as well as at open sites, have recovered abundant and well-preserved faunal and plant remains, making this period considerably better documented than the preceding Neolithic and Early Bronze Age (Luik et al. 2022; Minkevičius et al. 2023; 2026). The earliest cultivated crops in the region, primarily barley and millet, appeared around 1300 cal BC

(Piličiauskas et al. 2021; 2022). By around 1000 cal BC, crop cultivation had intensified significantly, as reflected in the increasing diversity of cultivated plant taxa (Minkevičius et al. 2020; 2023). Faunal analyses from northeastern Lithuanian hillforts indicate that between 900 and 600 cal BC, small domestic ungulates, particularly pigs and, to a lesser extent, sheep, predominated in animal husbandry and consumption practices. In contrast, cattle and horses occur only in small numbers, accounting for up to 10% and 5% of identified faunal remains, respectively. The relatively low representation of cattle, which likely served primarily as draught animals, may reflect the still limited scale of crop cultivation in eastern Lithuania during this period. Consequently, Late Bronze Age communities in the region appear to have relied more heavily on animal husbandry than on arable farming (Bliujienė et al. 2020; Minkevičius et al. 2023).

The representation of wild animals at fortified Late Bronze Age sites across both eastern and western Lithuania was consistently low, generally accounting for only 7–10% of identified faunal remains (Luik et al. 2022; Micelicaitė et al. 2023; Minkevičius et al. 2026). This pattern appears to have been characteristic of the entire territory of present-day Lithuania and suggests that wild fauna no longer played a significant role in subsistence during this period. According to zooarchaeological evidence, stable isotope analyses of pottery food crusts, and human remains, fish were likewise of relatively minor importance during the Late Bronze Age (Piličiauskas et al. 2017a; Simčenka et al. 2022; Podėnas et al. 2023). In eastern Lithuania, fish remains generally comprise up to 3.6% of faunal assemblages (Luik et al. 2022; Micelicaitė et al. 2023), whereas a somewhat higher proportion (10%) was recorded at the Kukuliškiai fortified site in coastal Lithuania (Minkevičius et al. 2026).

Bird remains are almost entirely absent from Late Bronze Age fortified site assemblages throughout Lithuania, although birds are known from Stone Age settlements (Stančikaitė et al. 2009). This likely indicates that the hunting of wild birds had greatly declined by this period, while the earliest domestic birds, specifically chickens, had not yet reached the territory of present-day Lithuania.

The representation of horses at Late Bronze Age settlement sites in western Lithuania and Latvia increased at least ten- to twentyfold compared with Stone Age sites, reaching 10–40% of identified faunal remains (Bliujienė et al. 2020; Minkevičius et al. 2026). Furthermore, around 1000 cal BC in western Latvia (Vasks et al. 2019; 2021) and later, during the late Pre-Roman period in western Lithuania (Bliujienė et al. 2020; Piličiauskienė et al. 2022; Budvydas & Juškaitis 2024), horse burial and sacrifice practices emerged. The notable increase in horse remains, together with the appearance of horse-related ritual practices, was most likely related to the spread of

modern DOM2-type horses (Niskanen 2023; Anthony et al. 2026), which may also have contributed to the emergence of a horse cult in the eastern Baltic region.

ANIMAL EXPLOITATION AT AUKURAS HILL HILLFORT, LATE BRONZE AGE–EARLY ROMAN PERIOD

Although the number of identified specimens is relatively small, the faunal assemblage from Aukuras hill hillfort appears relatively typical compared with those from other 1st-millennium BC sites in Lithuania, suggesting that the main pattern observed is unlikely to be substantially biased by the limited sample size. Wild mammals accounted for approximately 10% of identified mammal remains during the Late Bronze Age, and their representation remained largely unchanged until the medieval period, varying between 10% and 13%. From the Late Bronze Age onward, the inhabitants of Kernavė kept all major domestic animal species, although their representation changed over time. During the Late Bronze Age, animal husbandry was dominated by small domestic ungulates – sheep/goats and especially pigs – which together accounted for 61.3% of identified domestic animal remains. This proportion is somewhat higher than at Kukuliškiai fortified site in coastal Lithuania (Minkevičius et al. 2026), but lower than at hillforts in northeastern Lithuania, where pig remains alone comprised 45–58% of faunal assemblages (Fig. 2).

Changes in animal husbandry practices at Kernavė became apparent during the late Pre-Roman–early Roman period. At this time, the proportion of cattle more than doubled, reaching 42.3%, while the proportion of pigs and sheep/goats decreased by approximately one-third (Fig. 2). No major subsequent changes are evident, and a similar taxonomic composition of domestic animals persisted until the medieval period.

The increase in cattle during the late Pre-Roman–early Roman period may be associated with the intensification of arable farming. Expanding cultivated areas would have required larger numbers of draught animals, as well as greater quantities of manure, both of which were primarily provided by cattle. These changes and the possible intensification of crop cultivation broadly coincide with the climatic optimum associated with the Roman Warm Period (Campbell et al. 1998). Archaeobotanical analyses from Aukuras hill hillfort indicate substantial agricultural changes, particularly the introduction of rye cultivation, which gradually replaced the previously dominant millet. However, these developments likely began somewhat later, around the 5th century AD (Minkevičius et al. 2025).

One of the most significant discoveries among the Aukuras hill hillfort faunal remains is related to the appearance of another domesticated animal species in Lithuania and the eastern Baltic region. Bones (Fig. 3) of at least

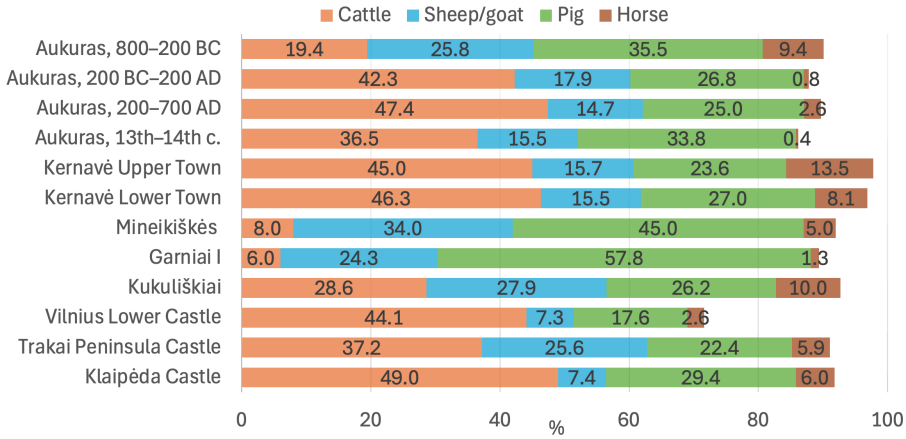

FIG. 2. Taxonomic composition of domestic animals at Aukuras hill hillfort during different occupation periods and at other archaeological sites in Lithuania. Chronologies of the sites and references for the data: Garniai I and Mineikiškės fortified sites, 900–500 cal BC (Micelicaitė et al. 2023); Kukuliškiai fortified site, 900–500 cal BC (Minkevičius et al. 2026); Kernavė Lower Town, 13th–14th centuries (Luchtanas 1990); Kernavė Upper Town, 13th–14th centuries (Baublienė et al. 2004); Vilnius Lower Castle, 13th–mid-14th centuries (Piličiauskienė & Blaževičius 2018); Klaipėda Castle, 13th–14th centuries (Ehrlich et al. 2020); Trakai Peninsula Castle, late 14th–15th centuries (Piličiauskienė et al. 2024). For more details, see Table 2.

three chickens (MNI = 3) were recovered from a cultural layer dated to 200 cal BC–200 cal AD, representing the earliest evidence of domestic chicken currently known in Lithuania. Chickens appeared in Scandinavia and Estonia during approximately the same period (Lepiksaar 1977; Ehrlich et al. 2021; Olli et al. 2026), and their discovery in Lithuania was therefore not entirely unexpected. Nevertheless, prior to this study, confirmed chicken remains in Lithuania had only been known from medieval contexts (Rumbutis et al. 2018).

ANIMAL EXPLOITATION AND ELITE PRACTICES AT MEDIEVAL AUKURAS HILL HILLFORT

The relatively small faunal assemblage dated to 200–700 cal AD from Aukuras hill hillfort does not indicate major changes in farming practices. In contrast, the 13th–14th-century zooarchaeological material is considerably more informative. During the medieval period, wild animals accounted for 13.2% of identified mammal remains at the site, which can be considered a relatively high proportion. In medieval contexts, wild fauna is generally more abundant at sites associated with elites, particularly castles and hillforts. For example, wild animals constituted 28% of identified mammal remains at the Vilnius Lower Castle during the 13th–14th centuries (Piličiauskienė & Blaževičius 2018), 9% at Trakai Peninsula Castle (Piličiauskienė et al. 2024),



FIG. 3. The earliest remains of domestic chicken from Aukuras hill hillfort, 200 cal BC–200 cal AD.

and 7% at Klaipėda Castle (Ehrlich et al. 2020). In contrast, wild animal remains in medieval towns usually comprise less than 1% of assemblages (Piličiauskienė, unpublished data; Piličiauskienė & Blaževičius 2018).

Differences are also evident between contemporaneous but socially distinct areas of medieval Kernavė, including Aukuras hill hillfort, the Upper Town, and the Lower Town. The latter two were inhabited by ordinary townspeople, and wild animal remains there account for only around 1% of identified fauna – approximately ten times less than at the hillfort (Luchtanas 1990; Baublienė et al. 2004; Vėlius et al. 2025). In contrast, Aukuras hill hillfort served as the residence of the ruling elite, and hunting during the medieval period was closely associated with aristocratic privilege and lifestyle. It functioned not only as a form of leisure but also as an important means of political interaction and a practice connected with economic prestige and benefit (Jaworski 2001; Petrauskas 2003).

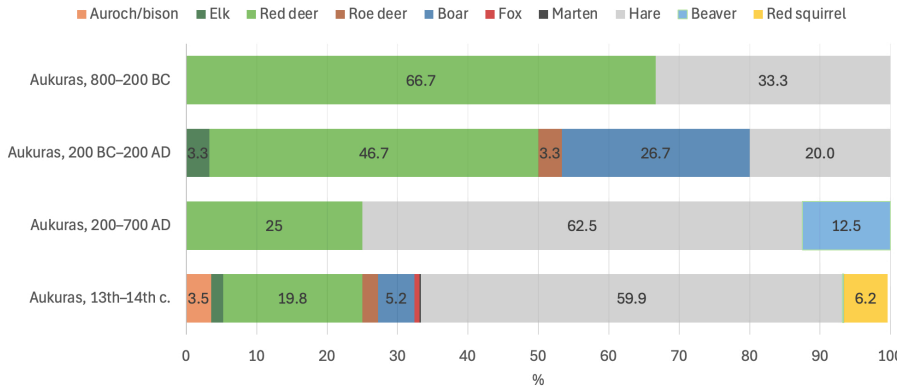

FIG. 4. Taxonomic composition of the main wild game species at Aukuras hill hillfort during different occupation periods. For more details, see Table 2.

Although wild animal remains are relatively well represented at Aukuras hill hillfort, as is typical of high-status sites, the taxonomic composition of the hunted fauna is unusual and differs significantly from that observed at other medieval castles and hillforts. Rather than being dominated by large ungulates – the typical prey associated with aristocratic hunting – the assemblage at Aukuras hill hillfort is characterised primarily by small game, especially hares. Hare remains account for as much as 59.9% of identified wild mammals, while red squirrels comprise an additional 6.2% (Fig. 4). In contrast, remains of bison/auroch and elk are scarce, representing only a few per cent of the assemblage. Conversely, hare and red squirrel remains are generally rare in medieval castles, even when faunal remains are collected by sieving (Ehrlich et al. 2020; Vengalis 2020; Piličiauskienė et al. 2024; Piličiauskienė & Micelicaitė 2026).

The unusually high abundance of hares and red squirrels at medieval Kernavė may reflect the character of local hunting practices, particularly hunting with birds of prey. Notably, remains of the northern goshawk, the most popular hunting bird in medieval Lithuania, were also exceptionally abundant at Aukuras hill hillfort, accounting for 3.8% of identified bird remains (Fig. 4). Goshawks may have been used to hunt small mammals, including red squirrels and hares, especially juveniles, as well as wild Galliformes, waterfowl, and pigeons (Tornberg 1997). Approximately 30% of hare remains from the site belonged to young individuals, some of them very young animals. Moreover, most of the hare bones at the site likely belonged to the mountain hare, which is smaller than the European hare, as the mountain hare was more widespread in Lithuania until the 17th–18th centuries (Isokas 2006). Large numbers of squirrel and hare remains have also been recorded in medieval Novgorod, where these animals were extensively hunted for their

fur (Maltby et al. 2020). Similarly, it cannot be ruled out that hares and red squirrels at Kernavė were hunted primarily for their fur.

Compared with other medieval castles and hillforts, cattle remains are less abundant at Aukuras hill hillfort. In the 13th–14th-century assemblage, the proportion of cattle unexpectedly declines to 36.5%, while pig remains increase correspondingly. This shift may reflect the dietary preferences of the higher-status residents at the hillfort. Pork, especially preserved products such as slabs of smoked bacon and ham, was highly valued and more widely consumed among medieval and early modern-period elites (Dambrauskaitė 2018; 2019; Piličiauskienė & Blaževičius 2018). This interpretation might be supported by the fact that pig remains were about 10% less common in the Upper and Lower Towns of Kernavė, where they account for only 23–27% of identified fauna (Fig. 2).

Cattle dominate Lithuanian urban faunal assemblages of the 15th–16th centuries, where they comprise 40–70% or more of identified mammal remains. The long-term increase in the importance of cattle began already during the Late Bronze Age, but intensified considerably from the second half of the 16th century onward, following the land reform, when expanding cultivated land increased the demand for draught animals and manure, resulting in more intensive cattle breeding and greater beef consumption in urban areas (Piličiauskienė & Blaževičius 2018).

Differences in the faunal assemblages between the distinct medieval zones of Kernavė are also particularly evident in relation to horses (Fig. 2). In contrast to Aukuras hill hillfort – the presumed ducal residence area – horse remains were exceptionally abundant in the contemporaneous urban contexts of the Upper and Lower Towns, where they accounted for 8–13% of identified mammal remains (Luchtanas 1990; Baublienė et al. 2004). By comparison, horse remains are considerably less common (2.6–6.0%) at other high-status medieval sites in Lithuania, including Klaipėda Castle, Vilnius Lower Castle, and Trakai Peninsula Castle. In most other 15th–16th-century urban assemblages, horses generally comprise no more than 2–3% of identified mammals (Piličiauskienė & Blaževičius 2018; Ehrlich et al. 2020; Piličiauskienė et al. 2024).

The unusually numerous horse remains in the Kernavė Upper and Lower Towns may indicate specialised activities, possibly including the slaughter and processing of horses no longer suitable for work. However, horse bones bearing butchery marks are rare in all medieval contexts at Kernavė, generally accounting for only 5–10% of horse remains (Piličiauskienė, unpublished data; Vengalis 2020). Valentina Danilčenko, who analysed the faunal assemblage from the Lower Town, likewise stated that horse meat consumption was uncommon there (Luchtanas 1990). In contrast, horse bones with butchery marks comprise up to 30% or even 40% of horse remains

at the Vilnius Lower Castle and Trakai Peninsula Castle (Piličiauskienė & Blaževičius 2018; Piličiauskienė et al. 2024).

The inhabitants of Aukuras hill hillfort appear to have kept predominantly sheep rather than goats. This interpretation is supported by both the identified specimens and the wider zooarchaeological record from Lithuania. From the Late Bronze Age onward, sheep remains consistently outnumbered goat remains in settlement assemblages (Micelicaitė et al. 2023). This pattern persisted throughout the medieval and post-medieval periods. Estate inventories from the post-medieval period similarly indicate that goats, unlike sheep, were usually kept only in very small numbers. Zooarchaeological evidence confirms the same tendency. For example, at the Vilnius Lower Castle, sheep-to-goat ratios vary between 7:3 and 8:2, depending on the chronological period (Piličiauskienė & Blaževičius 2018).

FISH, BIRDS, AND FALCONRY AT MEDIEVAL AUKURAS HILL HILLFORT

The diversity of fish remains recovered from Aukuras hill hillfort is exceptionally high, comprising at least 16 species. By comparison, 12 fish species have been identified at the Vilnius Lower Castle, ten at Trakai Peninsula Castle, and nine at Klaipėda Castle (Piličiauskienė & Blaževičius 2018; Ehrlich et al. 2020; Piličiauskienė et al. 2024). The higher diversity at Aukuras hill hillfort may partly be related to excavation methods, as the material from the other sites was not systematically sieved, potentially resulting in the underrepresentation of small fish remains. Most fish species identified at Aukuras hill hillfort were likely caught in the nearby River Neris. In general, fish, particularly sturgeon, salmon, and large pike, were expensive and highly valued food in the medieval period, commonly associated with elite diets. Remains of such fish are usually encountered only in high-status contexts. Pike, in particular, appears to have been the most popular fish among the Lithuanian nobility during the medieval and post-medieval periods (Piličiauskienė & Blaževičius 2019). The abundance of large and valuable fish species, including salmon, sturgeon, and pike, at Aukuras hill hillfort further supports the interpretation of the high social status of the inhabitants of this area.

Nevertheless, despite the presence of several prestigious fish species, fish do not appear to have played an important role in the diet of either commoners or elites. The final decline in fish consumption that began during the Late Bronze Age remained evident throughout the Migration and Viking periods. The importance of fish increased somewhat after the Christianisation of Lithuania in 1387, although primarily among elite social groups. Even during the late medieval and post-medieval periods, however, fish consumption in Lithuania remained lower than in neighbouring Poland and

in northern and western Europe, while peasants consumed fish only rarely (Whitmore 2014; Piličiauskienė & Blaževičius 2019; Whitmore et al. 2019; Skipitytė et al. 2020; Skipitytė 2022).

Bird remains account for 3.1% of the assemblage dated to 200 cal BC–200 cal AD and 5.1% of the medieval assemblage. The latter value is relatively high and is typical of elite medieval sites. The high proportion of bird remains at Aukuras hill hillfort may also partly reflect the use of sieving during excavation, which likely increased the recovery of small bird bones. Birds were consumed more frequently by higher social strata, and their remains therefore occur in greater numbers at castles and manor sites. At the Vilnius Lower Castle, bird remains comprised 3.1% of the assemblage during the 13th–mid-14th centuries and increased to 8.1% during the 16th–mid-17th centuries. In contrast, bird remains in Lithuanian urban contexts of the 15th–16th centuries generally account for only 1–2% of identified fauna. Domestic chicken bones constitute approximately 60–70% of bird remains in Lithuanian assemblages dated to the 13th–16th centuries (Rumbutis et al. 2018; Ehrlich et al. 2020; 2023; Piličiauskienė & Micelicaitė 2026).

In the 200 cal BC–200 cal AD assemblage, domestic chickens accounted for at least 21.9% of identified bird remains. In the 13th–14th-century bird assemblage, chickens comprise at least 34.4%, while a further 36.8% of remains were identified only generally as Galliformes (Fig. 5). Considering that chickens account for the majority of identified galliform remains, it is likely that many of the unidentified galliform specimens also represent chickens. Greylag goose and other *Anser* remains are relatively rare at Aukuras hill hillfort, making up only 3.2% of the medieval bird assemblage, despite being common in medieval faunal collections. For example, geese comprised approximately 25% of bird remains at the Vilnius Lower Castle (Rumbutis et al. 2018). However, hand-collecting at the Vilnius Castle likely contributed to the more efficient recovery of goose bones. Morphological analysis did not allow determination of whether the greylag geese recovered at Aukuras hill hillfort were wild or domestic individuals.

Among wild birds from the 13th–14th centuries, Galliformes formed the largest group, particularly black grouse, with smaller numbers of capercaillie, hazel grouse, and partridge. During the medieval period, these birds were among the most frequently hunted and consumed game birds of the elite. Similar taxa have been recorded at the Vilnius Lower Castle (Rumbutis et al. 2018; Ehrlich et al. 2023). Western capercaillie and black grouse are widely regarded as indicators of elite environments (Makowiecki et al. 2013).

Northern goshawk remains at Aukuras hill hillfort are almost three times more abundant than at the Vilnius Lower Castle, accounting for 3.8% and 1.3% of identified bird remains, respectively (Rumbutis et al. 2018). As is typical in falconry assemblages, females outnumber males. Female goshawks

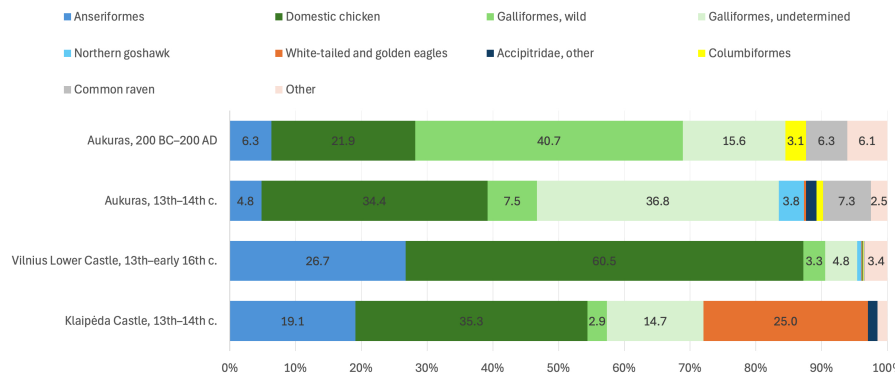

FIG. 5. Bird taxa identified at Aukuras hill hillfort, Vilnius Lower Castle (Rumbutis et al. 2018; Ehrlich et al. 2023), and Klaipėda Castle (Ehrlich et al. 2020).

are larger and capable of hunting larger prey, making them more desirable for hunting purposes. According to historical and zooarchaeological data (Rumbutis et al. 2018; Zarankaitė-Margienė 2018; Ehrlich et al. 2023), goshawks were the most popular birds used in medieval falconry in the region, owing to their local availability, suitability for hunting in the regional environment, and relatively low cost compared with other birds of prey (Dynak 1993; Makowiecki 2009). Other raptors identified at the site include the sparrowhawk, golden eagle, and falcon. Under Lithuanian environmental conditions, hunting with golden eagles would likely have been difficult, whereas sparrowhawks were commonly used to hunt small galliform, columbiform, and passerine birds (Prummel 1997). Although birds of prey are exceptionally abundant at Aukuras hill hillfort, no remains of other expensive birds commonly associated with elite medieval contexts – such as the common pheasant (*Phasianus colchicus*) and peafowl (*Pavo cristatus*), which became relatively frequent in the Vilnius Lower Castle assemblages during the late 14th–early 16th centuries – have yet been identified at Kernavė (Rumbutis et al. 2018; Ehrlich et al. 2023).

Exceptionally large numbers of common raven bones (n = 27; 7.3%) were recovered from the 13th–14th-century layers at Aukuras hill hillfort, together with remains of other corvids. These birds may have been used in the training of hunting raptors and may also have served as food for birds of prey (Hamilton-Dyer et al. 2016). On the other hand, owing to their intelligence and social behaviour, corvids were also frequently kept as pets (Tyrberg 2002), and this possibility cannot be excluded in the case of Kernavė. Ravens and crows also occupied a prominent place in Lithuanian and broader European mythology, often being associated with the afterlife (Racėnaitė 2005; Plachovičiūtė 2023). Various skeletal elements of corvids were recovered, particularly humeri and tarsometatarsi, although it remains

difficult to determine the precise reasons for the unusually high frequency of common raven remains at the site.

Taken together, in the context of Kernavė and Lithuania, the faunal assemblage from Aukuras hill hillfort broadly follows regional patterns during the Late Bronze Age and Iron Age, while the medieval assemblage reveals greater differences between sites. The medieval fauna shares features with other high-status sites but also differs from that of the contemporaneous Upper and Lower Towns of Kernavė. These comparisons demonstrate that animal exploitation varied not only through time but also between different social and functional contexts within the same archaeological complex.

Conclusions

The faunal assemblage from Aukuras hill hillfort provides valuable evidence for understanding long-term developments in animal exploitation and subsistence practices from the Late Bronze Age through the Iron Age and medieval period in the eastern Baltic. Although the number of identified specimens varies between periods, the overall patterns are broadly consistent with those observed at other sites in Lithuania. The study indicates that farming was already fully established during the Late Bronze Age and followed the general pattern observed in northeastern Lithuania. During the late Pre-Roman and early Roman periods, the increasing importance of cattle may indicate changes in farming strategies, likely associated with the intensification of crop cultivation and the expansion of arable farming. The appearance of domestic chickens during this period provides some of the earliest evidence of chicken husbandry in Lithuania.

The medieval assemblage from Aukuras hill hillfort reveals a distinct pattern of elite consumption that differed from that of the contemporaneous urban population of Kernavė and, in some respects, from those of other elite centres in the region. Pork, birds, fish, and wild game appear to have played a more important role in the diet of the hillfort inhabitants.

Unlike many contemporary elite centres, where hunting was primarily oriented towards large ungulates, the medieval faunal remains from Aukuras hill hillfort point to the greater importance of falconry. The abundance of northern goshawk remains and small game animals, particularly hares, suggests that elite hunting in Kernavė was characterised by specialised hunting practices focused on smaller prey. This pattern may suggest that hunting at Kernavė was oriented towards falconry and small game rather than the prestigious large-ungulate hunts characteristic of many contemporary elite centres. The scarcity of large game may indicate that the inhabitants of Aukuras hill hillfort occupied a somewhat different social and political position from the elites of major political centres, where large-game hunting

played a more prominent role in social status, political culture, and elite interaction.

DATA AVAILABILITY STATEMENT

All data supporting the results of this study are included within the article.

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Loomakasvatus ja jaht kahe aastatuhande jooksul Aukurase mäe linnamäel Kernavė arheoloogilisel alal Leedus: lindude, kalade ja imetajate zooarheoloogiline andmestik (u 800 kal eKr–1400 kal pKr)

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RESÜMEE

Kernavė arheoloogiline ala Leedu idaosas on haruldane paik, kus saab uurida inimeste ja loomade suhteid pika perioodi jooksul. Käesolevas uurimuses analüüsiti Aukurase mäe linnamäelt leitud 15 339 loomaluud ja -hammast. Nendest õnnestus täpsemalt määrata 4207 luuleidu, mis pärinevad kahe aastatuhande pikkusest perioodist hilispronksiajast (u 800 eKr) hiliskeskajani (1400 pKr). Luukogum sisaldab imetajate, lindude ja kalade jäänuseid ja on üks paremini kirjeldatud zooarheoloogilisi andmestikke idapoolses Baltikumis. Kuigi eri perioodide andmestiku maht on erinev, annab luumaterjal loomakasvatuse ja jahi kohta siiski tervikliku pildi ning on võrreldav teiste Leedu arheoloogiliste muististega.

Uurimistulemuste põhjal oli loomakasvatus hilispronksiajaks välja kujunenud. Määratud luumaterjalist moodustavad koduloomad ligikaudu 90%, kusjuures karjakasvatuse põhilise osa moodustasid sead ja lambad/kitsed. Metsloomade osakaal imetajaluude hulgas on vaid 10%, mis viitab jahiloomade vähesele majanduslikule olulisusele. Kalu ja linde on materjalis samuti vähe, seega ei olnud ka need inimeste toidulaual olulised.

Hilisel eelrooma rauaajal ja varasel rooma rauaajal (u 200 eKr–200 pKr) toimus suur muutus: veiste olulisus kasvas, nende luuleiud moodustavad koduloomadest ligikaudu 42%. See viitab tõenäoliselt põllumajanduse intensiivistumisele ja suurenenud vajadusele veojõu ja sõnniku järele. Samast

perioodist on teada varaseimad Leedust leitud kodukanade jäänused, mis täiendavad seniseid tõendeid kodukana saabumise kohta Baltikumi kaguossa.

Keskaja luumaterjalis on näha kõrgemale sotsiaalsele klassile omaseid tarbimismustreid. Võrreldes Kernavė üla- ja all-linnaga, kus elasid tavalised linnaelanikud, tarvitati Aukurase mäel suuremas koguses sea- ja linnuliha, kala ning ulukiliha.

Keskaegses luukogumis on tähelepanuväärsed tõendid spetsialiseerunud jahipidamise kohta. Kui paljudes teistes Leedu paikades jahtis eliit suurulukeid, nagu põtra ja punahirve, siis Aukurase mäe elanikud keskendusid peamiselt väikeimetajate jahile, eriti jänestele ja oravatele. Kuna materjalis on ka palju kanakulli luid, viitab see jahikullide kasutamisele. Arvukad rongaluud võivad samuti olla selle tegevusega seotud.

Ka kalaluud võivad viidata kõrgema sotsiaalse klassi tarbimisharjumustele. Kokku määrati kuusteist kalaliiki, sh lõhe, tuur ja angerjas. Suurt kasvu lõhed, haugid, sägad ja karplased on materjalis tavalised. Kalaliikide mitmekesisus on suurem kui paljudes teistes Leedu suuremates keskaegsetes paikades.

Linnuluudki näitavad eliidile omaseid toitumisharjumusi. Enamasti söödi kana, aga ka jahilinde, nagu tetre, metsist ja laanepüüd. Viimatinimetatute suhteliselt suur osakaal on kooskõlas linnamäe muude eliidile viitavate leidudega.

Kokkuvõttes näitab Aukurase mäe zooarheoloogiline materjal, et loomade kasvatust ja kasutust Kernavės kujundasid nii loomakasvatuse kui ka sotsiaalse staatuse areng, kõrgema ühiskonnakihi tarbimisharjumused ja spetsialiseerunud jahitraditsioonid. Kuigi määratud luuleidude arv on perioditi erinev ja seetõttu tuleb mõnesse järeldusse suhtuda asjakohase ettevaatlikkusega, pakub uurimus siiski olulisi uusi teadmisi pikaaegsete majanduslike ja kultuuriliste arengusuundumuste kohta Baltikumi idaosas.