INSTITUTUL DE ARHEOLOGIE „VASILE PÂRVAN”

MATERIALE ŞI CERCETĂRI ARHEOLOGICE
SERIE NOUĂ, SUPPLEMENTUM I

SCRIPTA PRAEHISTORICA. MISCELLANEA IN HONOREM MARIAE BITIRI DICATA

EDITED BY
ROXANA DOBRESCU, ADINA BORONEANȚ, ADRIAN DOBOȘ

EDITURA CETATEA DE SCAUN

2021

COVER: Dan Iulian Mărgărit

MCA SERIE NOUA
SUPPLEMENTUM I

www.mcajournal.ro

Descrierea CIP a Bibliotecii Naţionale a României
Scripta praehistorica : miscellanea in honorem Mariae Bitiri dicata /
ed. by Roxana Dobrescu, Adina Boroneanţ, Adrian Doboş. - Târgovişte :
Cetatea de scaun, 2021
Conţine bibliografie
ISBN 978-606-537-545-1

I. Dobrescu, Roxana (ed.)
II. Boroneanţ, Adina (ed.)
III. Doboş, Adrian (ed.)

902

All papers published in *Materiale şi Cercetări Arheologice* are peer-reviewed.
***Materiale şi Cercetări Arheologice* is indexed in the following data-bases:**
Persée, Copernicus, ERIH PLUS, Scopus, CEEOL, EBSCO and DOAJ.

This volume was edited with the financial support of the "Vasile Pârvan" Institute of Archaeology in Bucharest.

© 2021, EDITURA CETATEA DE SCAUN

MARIA BITIRI

CONTENTS/SOMMAIRE

Tabula gratulatoria 5

List of contributors/Liste des contributeurs 9

Maria Bitiri – La Dame du Paléolithique de la Roumanie 13

Maria Bitiri – Photographic retrospective/Retrospective photographique 17

Maria Bitiri – Selected bibliography/Bibliographie séléctive 21

Editorial 27

* * *

Alain TUFFREAU, Les premiers peuplements humains de l'Est des Carpates et de leurs abords dans le contexte européen 29

Vadim STEPANCHUK, Sergii RYZHOV, Yurii VEKLYCH, Oleksandr NAUMENKO, Zhanna MATVIISHYNA, Sergii KARMAZYNENKO, The Lower Palaeolithic assemblage of Medzhibozh 1 layer III (Ukraine) and its palaeoenvironmental context 37

Andrea PICIN, At the onset of the Micoquian in Central Europe: raw material constraints and technological versatility at Neumark-Nord 2/0 (Germany) 71

Maria GUROVA, Stefanka IVANOVA, Mishin Kamik Cave: an unusual Pleistocene site in Northwestern Bulgaria 85

Leonid VISHNYATSKY, Vitalie BURLACU, New research on the Middle Paleolithic of the Middle Prut Basin, Moldova 105

Stanimira TANEVA, On the Middle Paleolithic leaf points from Bulgaria (Southeast Europe) 125

Yuri E. DEMIDENKO, Petr ŠKRDLA, Béla RÁCZ, Adrián NEMERGUT, Sándor BÉRES, The Aurignacian in the Carpathian Basin of Eastern Central Europe and its Proto-Aurignacian industry type 141

Jacopo GENNAI, Set in Stone? Discussing the early Upper Palaeolithic taxonomy using European and Levantine assemblages 183

Paolo BIAGI, Elisabetta STARNINI, The Palaeolithic sequence of the Arma dell'Aquila (Finale Ligure, Savona, North-western Italy) 217

†Vasile CHIRICA, Pierre NOIRET, Philip R. NIGST, Valentin-Codrin CHIRICA, Marjolein D. BOSCH, Timothée LIBOIS, Les stations paléolithiques de Mitoc, sur le Prut (Roumanie) 229

Roxana DOBRESCU, Adrian DOBOȘ, Constantin HAITĂ, Ancuța BOBÎNĂ, Bogdan BOBÎNĂ – L'Atelier aurignacien découvert à Bușag (Nord-Ouest de la Roumanie). Données préliminaires 259

Marin CÂRCIUMARU, Elena-Cristina NIȚU, Ovidiu CÎRSTINA, Theodor OBADĂ, Florin-Ionuț LUPU, Marian LEU, Gravettian and Epigravettian personal ornaments in Eastern Carpathians 275

Loredana NIȚĂ, Mircea ANGHELINU, Cristina CORDOȘ, The shouldered points and the Gravettian of the Eastern Carpathian area: insights from Bistricioara-Lutărie III (Ceahlău Basin, Northeastern Romania) 291

Natalya B. AKHMETGALEEVA, Aleksandr E. DUDIN, New art works made of ivory and bone animals from the Upper Palaeolithic site of Kostenki 11 (Russian Plain) 313

Marian COSAC, George MURĂTOREANU, Daniel VERES, Loredana NIȚĂ, Cristoph SCHMIDT, Ulrich HAMBACH, Alexandru RADU, Roxana CUCULICI, Dan Lucian BUZEA, Dan ȘTEFAN, Monica MĂRGĂRIT, Ștefan VASILE, Valentin DUMITRAȘCU, Marius ROBU, Alexandru PETCULESCU, Tiberiu SAVA, Valentin GEORGESCU, Gabriel ȘERBĂNESCU, Ionel GEAMBAȘU, Recent archaeological researches in the Vârghiș Gorges karst area (Eastern Carpathians, Romania). A synthesis of the 2014–2020 campaigns 325

Serghei COVALENCO, Roman CROITOR, Palaeolithic reindeer hunting camps from Cosăuți (Middle Dniester, Moldova) 351

Ștefan VASILE, Valentin DUMITRAȘCU, Zooarchaeological analysis of the faunal remains from the Palaeolithic site of La Adam Cave (Dobrogea, SE Romania) – new data from recent excavations 361

Adrian Balășescu, Valentin Radu, Adina Boroneanț, Clive Bonsall, Mesolithic Icoana revisited (II) – a reappraisal of the faunal remains 373

Dragana ANTONOVIĆ, Vidan DIMIĆ, Ground and abrasive stone tools from the Early Neolithic site of Bataševo (Serbia) 413

Costel ILIE, Florian MIHAIL, The lithic material discovered in the Starčevo-Criș cultural layer from the archaeological site of Negrilești-*Curtea Școlii*, Galați County 429

Tanya DZHANFENOVA – Exploring the beginnings: a multianalytical archaeometric study of the Early Neolithic pottery production at Koprivets, Northern Bulgaria 445

Erika GÁL, Anna Zsófia BILLER, Éva Ágnes NYERGES, Anett OSZTÁS, Bird remains from the Starčevo and Lengyel culture settlements of the site Alsónyék-Bátaszék (South-western Hungary) 467

Selena VITEZOVIĆ, The Neolithic bone industry from the site of Slatina–Paraćin (excavations of 1962–1985) 487

Cristian Eduard ȘTEFAN, Human bones from Șoimuș-*La Avicola (Ferma 2)*, Romania, in context 499

Katalin T. BIRÓ, György SZAKMÁNY, Veronika SZILÁGYI, Zoltán KOVÁCS, Zsolt KASZTOVSZKY, Ildikó HARSÁNYI, The first greenstone axe in Hungary 517

Andreea ȚERNA, Elena-Lăcrămioara ISTINA, A first insight into the production of bone, antler and tooth objects at the Copper and Bronze Age site of Fulgeriș – *La trei cireși* 529

Radu BĂJENARU, The Glina-type flanged axes revisited 553

Vasile DIACONU, Adela KOVACS, Deer antler mace-heads from the Late Bronze Age in Northeastern Romania 569

Monica MĂRGĂRIT, Adrian BĂLĂȘESCU, Adina BORONEANȚ, Reinterpreting an intriguing osseous assamblage from Chitila-Fermă (Bucharest, Romania) 581

Abréviations/ Abbreviations 591

MESOLITHIC ICOANA REVISITED (II) – A REAPPRAISAL OF THE FAUNAL REMAINS

Adrian BĂLĂȘESCU[a], Valentin RADU[b], Adina BORONEANȚ[a], Clive BONSALL[c]

[a] *'Vasile Pârvan' Institute of Archaeology, Bucharest, Romania, e-mail: a.balasescu@gmail.com, boro30@gmail.com*

[b] *National History Museum of Romania, Bucharest, Romania, Research Institute of the University of Bucharest, Division of ArchaeoSciences, University of Bucharest, e-mail: valentin.radu@icub.unibuc.ro*

[c] *University of Edinburgh, UK, e-mail: c.bonsall@ed.ac.uk*

Keywords: *Iron Gates, Mesolithic, zooarchaeology, cynophagy, faunal remains*

Abstract: *Located in southwestern Romania in the Iron Gates Gorges, Icoana was among the sites submerged following the building of the Iron Gates I dam and hydro-power station. Eight trenches were excavated with a total area of 91m² and a maximum depth of ca. 3 m between 1967 and 1969. According to the AMS ^{14}C dates, Icoana saw two occupations, one between ca. 8500–7600 cal BC during the Middle Mesolithic and the second during the Final Mesolithic ('Mesolithic-Neolithic Transformation Phase' of some authors, ca. 6200–5900 cal BC). In this paper, we present a revision of the Middle Mesolithic faunal remains from Icoana based on the existing collection curated at the 'Vasile Pârvan' Institute of Archaeology in Bucharest.*

Cuvinte cheie: *Porțile de Fier, mezolitic, arheozoologie, cynofagie, resturi faunistice.*

Rezumat: *Localizat în zona Porților de Fier în sud-vestul României, Icoana era unul dintre siturile preistorice inundate ca urmare a construcției barajului hidrocentralei Porțile de Fier I. În perioada 1967-1969 au fost cercetate 91m² până la o adâncime de maxim 3m. Datele radiocarbon AMS indică pentru Icoana două perioade de locuire de scurtă durată, prima pe durata mezoliticului mijlociu (cca. 8500–7600 cal BC și a două pe durata celui final (tranziția de la mezolitic/neolitic timpuriu cca. 6200–5900 cal BC). Articolul de față prezintă o re-evaluare a resturilor faunistice provenite din locuirea datată în mezoliticul mijlociu aflată în colecțiile Institutului de Arheologie 'Vasile Pârvan'.*

INTRODUCTION

Most early prehistoric sites in the Iron Gates region were identified in the 1960s and 1970s during field surveys and salvage excavations in areas along both banks of the Danube that would eventually be flooded due to dam construction, although more recent excavations have been possible at Schela Cladovei (Romania) and Vlasac (Serbia). The earlier excavations produced substantial amounts of archaeological material and their study has been the focus of numerous research papers. Here, we consider the Mesolithic faunal remains from Icoana. The chronological subdivision of the Iron Gates Mesolithic used in this paper follows Bonsall, Boroneanț 2018, fig. 3.

Located in southwestern Romania in the Iron Gates Gorges, Icoana was among the sites submerged due to the construction of the Iron Gates I dam and hydro-power station. Situated in the canyon of Cazanele Mici ('the Little Cauldrons') within the Iron Gates gorge, the site occupied a narrow strip of land along the bank of the Danube, at the foot of the eastern escarpment of the Ciucaru Mic plateau (Fig. 1). One and a half kilometres upriver at the confluence of the Mraconia River and the Danube was the site of Răzvrata, while on the opposite bank of the Danube in Serbia was the site of Hajdučka Vodenica (Fig. 1). Vasile Boroneanț conducted limited excavations at Icoana from 1967 until it was completely flooded in 1969. Information was published on various aspects of the site, mainly on the artefacts (Boroneanț 1970; 1973; 2000; Păunescu 2000) and faunal remains (Bolomey 1973a; 1973b; 1983; Kessler 1985; Nalbant 1970, cited in Păunescu 2000, p. 407). More recent studies have reinterpreted various aspects of the site: the excavation (Boroneanț 2011; 2012), faunal remains (Dinu 2006; Dinu *et alii* 2007), osseous artefacts (Mărgărit *et alii* 2018), human remains (Boroneanț *et alii* 2008; Boroneanț, Bonsall 2016), and chronology (Dinu *et alii* 2007; Boroneanț, Bonsall 2016).

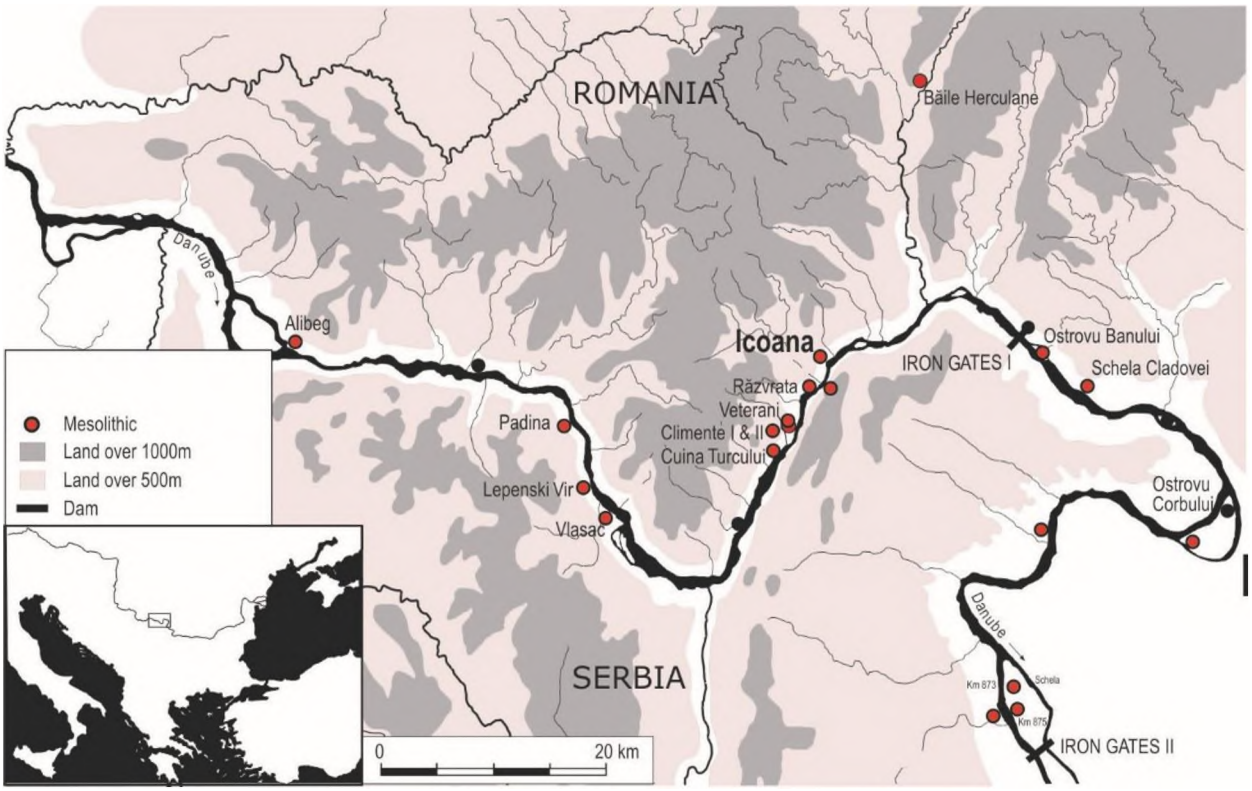

Figure 1. Map of the Mesolithic sites in the Iron Gates region mentioned in the text.

THE EXCAVATION

Eight trenches were excavated with a total area of 91m^2 and a maximum depth of c. 3 m (Boroneanț, Bonsall 2016). The site had previously been affected by river erosion and by road construction in the late 18th century. The excavation was based on an approximate 2-metre grid, and dry sieving using a c. 5 mm mesh was employed resulting in the recovery of very large numbers of faunal remains and artefacts (Fig. 2). Depths/levels were measured from the base of the revetment wall of the road, which was more or less horizontal across the excavated area (Boroneanț, Bonsall 2016). In the excavator's interpretation, a succession of three Mesolithic "layers" (Ia, Ib and II) was overlain by an Early Neolithic (Starčevo culture) 'layer', and then a surface 'layer' containing early Iron Age and Medieval artefacts. Păunescu (2000, p. 171) presented an alternative interpretation of the sequence in which V. Boroneanț's Mesolithic Ia was reinterpreted as 'Tardigravettian of Mediterranean type' (Epipalaeolithic) – and by implication Late Glacial in age – although this appears to have resulted from a misunderstanding of V. Boroneanț's account of the site.

According to AMS ^{14}C dating of mammalian and human bone (Dinu *et alii* 2007; Boroneanț, Bonsall 2016), Icoana saw two periods of Mesolithic occupation, one during the Middle Mesolithic (ca. 8500–7600 cal BC) and the second during the Final Mesolithic (*ca.* 6200–5900 cal BC).

In this paper, we present a revision of the Middle Mesolithic faunal remains from Icoana based on the existing collection curated at the 'Vasile Pârvan' Institute of Archaeology in Bucharest.

THE FAUNAL COLLECTION AND STUDY METHODOLOGY

A large part of the Mesolithic faunal assemblage from Icoana was studied and the results were subsequently published (Bolomey 1973b, 1973a, 1983). With new methodological developments in archaeozoological studies, we decided to re-examine the old collection, including the finds from the 1968 season of excavation which were not included in Bolomey's publications.

Overall, the archaeozoological material is in a good state of preservation but extremely fragmented, thus taxonomic identification in many cases was impossible. Both identification and measurements were hindered by the presence of a thin calcareous crust covering parts of the bones.

Figure 2. Excavating trench II (photo: archive V. Boroneant).

The identified species fall within several classes: Mollusca, Pisces, Reptilia, Aves and Mammalia. Mammals rank first with 94.06% of the remains, followed by fish (5.3%), reptilians and molluscs (Table1 and 9). Despite the small size of the excavation, this assemblage is among the largest from a Mesolithic site on the left bank of the Danube in the Iron Gates region.

Anatomic and taxonomic identifications were made with reference to the collections of the Archaeozoology Laboratory of the Bioarchaeology Department in the 'Vasile Pârvan' Institute of Archaeology in Bucharest. For the osseous mammal remains working methodologies were carried out according to Barone (1986) and Schmid (1972). The dental ages of the various wild species were estimated based on Brown (1991) and Knight (2001) for *Cervus elaphus*, while for *Capreolus* we referred to Tomé, Vigne (2003). Where no specific references were available for the wild species, those for domestic species were used (Horard-Herbin 1997 for suids, Payne 1973 for *Rupicapra rupicapra*).

Faunal estimations were based on NISP (number of identified specimens) and MNI (minimum number of individuals), while weight (in grams) was used as a third parameter to obtain average weight values to compensate for the substantial fragmentation of the assemblage.

Despite the allometry of the specimens, withers height was estimated based on Udrescu *et alii* (1999) and measurements were taken according to international methodology (Driesch 1976).

The terminology employed for fish skeletal elements was taken from Lepiksaar (1994). Fish remains previously attributed to the roach genus *Rutilus* (Cristiani *et alii* 2014) were attributed here to *Rutilus frisii*, according

to genetic identifications based on archaeological material from elsewhere in the Iron Gates region (Živaljević *et alii* 2017).

Measurements of sturgeon bones were carried out as follows: for *Huso* after Bartosiewicz, Takacs (1997) and age and weight after Pirogovskii *et alii* (1989); for *Acipenser gueldenstaedtii* (the parasphenoid bone) we used size M6 of *Huso* as indicated in Bartosiewicz, Takacs (1997). Total length was calculated by combining the data from the various fragmented archaeological remains, the reference collection (for both *Acipenser gueldenstaedtii* and *Acipenser stellatus*, as the two have similar morphologies), the data for the size of M1 in Živaljević 2017, and present-day records of the size by age for *Acipenser gueldenstaedtii* (Vlasenko *et alii* 1989, Table 40, 41, p. 314-317).

For *Cyprinus carpio* and *Silurus glanis* we used Radu (2011). For *Rutilus frisii,* we measured depth and breadth as indicated in Mărgărit *et alii* (2017a) at the third and fifth teeth of the pharyngeal bone (5th ceratobrachial). These were plotted together with the equivalent tooth measurements for a modern specimen of *Rutilus frisii kutum* of known size and two archaeological specimens from non-funerary contexts at Schela Cladovei (Late Mesolithic) where fish size has been estimated (Mărgărit *et alii* 2017a).

The *Testudo graeca* shell fragments were identified using the terminology proposed by Amiranashvili (2000) and measurements were taken only for the maximum dorsal-ventral length and plotted on a graph versus straight carapace lengths (SCL – straight carapace length). Data were compared with those of two modern adult individuals of *Testudo graeca* of known size in the reference collection of the National History Museum of Romania.

Taxon	NISP	%	W	%
Unio sp.	23		91.76	
Unio crassus	2		5.51	
Total Mollusca	**25**		**97.27**	
Sturgeon	535	56.91	550.37	29.60
Hucho hucho	8	0.85	7.75	0.42
Cyprinus carpio	111	11.81	83.65	4.50
Rutilus frisii	42	4.47	19.11	1.03
Cyprinidae	17	1.81	8.16	0.44
Silurus glanis	15	1.60	1061	57.07
Sander lucioperca	5	0.53	5.86	0.32
Pisces IND	207	22.02	123.26	6.63
Total Pisces	**940**	**100.00**	**1859.1**	**100.00**
Emys orbicularis	4		3.15	
Testudo graeca	68		169.77	
Chelonia	2		2.4	
Total Chelonia	**74**		**175.32**	
Aves	**14**		**19.42**	
Mammalia	**16690**		**123823**	
Total fauna	**17743**		**125974**	

Table 1. NISP and weights (in grams) for the species identified in the Icoana Mesolithic assemblage.

THE FAUNA

Molluscs. Few remains of *Unio* bivalves were identified (Table 1), among which were two of *Unio crassus* (Pl. 1/1). Given the heavy fragmentation, the 23 fragmented remains were attributed to only 12 individuals (the *Unio crassus* ones included). The average size based on height was 23–25 mm, which falls within the size ranges of *Unio* populations living in the Danube today (Radu 2011, Table 23, p. 89)

Fish are represented by 940 remains (Table 1) of which 733 are identifiable (78%). Taxa present include sturgeon, salmonids, cyprinids, *Siluridae* and *Percidae*. Sturgeons are best represented (56.9%) followed by common

carp (11.8%) and Black Sea roach (4.5%). Other species identified (less than 3%) are catfish (15 remains), Danube salmon (8) and pikeperch (5).

Sturgeon. Given the poor preservation and heavy fragmentation, very few (7.91%) of the 543 remains (Table 2) could be determined to species level. The most secure elements of identification in this sample were the bones of the cranium: the parasphenoid, the dentale and the maxilla (Table 2). For 53% of the remains, all that can be said is that they originate in the external cranial scutes or internal skeletal bones. Ten bones (1.84%) could not be assigned to any anatomical part. The dermal scutes and the bony elements of the viscero- and neuro-cranium represent 83% of the identified sturgeon bones. Scutes are few, representing only 6.81%.

Skeleton elements			Sturgeon	*Huso huso*	*Acipenser gueldenstaedti*	*Acipenser stellatus*	*Acipenser ruthenus*	Total		%
cranium	neurocranium	posttemporale	2					2		
		postorbitale	11					11		
		supratemporale	4					4		
		jugal			1			1	116	
		clavicula	18			1		19		
		cleithrum	17					17		
		parasfenoideum	42		17	2	1	62		83.43
	viscerocranium	suboperculare	11					11		
		dentale		11	5			16		
		maxillare	2	4				6	49	
		hyale/hyomandibulare	12					12		
		palatopterygoideum	3		1			4		
		plates ind	288					288		
pinnae		spina pinnae pectoralis	42					42	43	7.92
		fin rays	1					1		
scutae			37					37		6.81
		ind	10					10		1.84
Total			500	15	24	3	1	543		

Table 2. Distribution of sturgeon remains by body part.

Beluga (*Huso huso*) is represented by nine individuals (MNI) (Plate 1/3 and 1/4). Size was calculated for six individuals (Table 3) which correspond to specimens of reproductive age. Sizes range from 1.5 to 2.3 m (20 to 80 kg) and ages between 9 and 16 years. But it is possible that given the presence of certain fragmented remains (fragments of the dental bone, 1st pectoral fin and large cranial plates) identified as sturgeon, some individuals may have been much larger. Although the large size fragments of these remains are not more numerous than those of the small ones, they are difficult to identify with precision.

Element	M2	M4	Tl (mm)	Age (years)	Weight (kg)
dental		8.3	1660	9–10	25–30
dental		10.3	2060	13–14	60
dental		10.6	2120	14–15	70
dental		11.5	2300	15–16	80
maxilla	7.7		1480	8–9	20
maxilla	10.5		2019	13–14	60

Table 3. Calculated sizes for beluga (*Huso huso*). Measurements of skeletal elements and total length (Tl) were taken from Bartosiewicz, Takacs (1997) and estimated ages and weights from Pirogovskii *et alii* (1989).

Of the 42 sturgeon fragments of the parasphenoid bone, 14 indicate the Danube sturgeon (*Acipenser gueldenstaedti)*. Given their fragmentation, but only 12 yielded useful measurements (Pl. 1/5). They indicate an age range from 9–10 years to 25 years. Again, we observed the presence of reproductive specimens measuring between 1 m and 1.4 m (10–50 kg and 10–25 years). Two individuals were very large (Table 4).

Element	M6	M1	Tl (mm)	Age (years)	Weight (kg)
parasfenoideum	20.4		100*	9–10	10
	22				
	22.8				
	23.2				
	24				
	24				
	26.4	25	120	15–16	13–20
	26.4				
	26.6		132	21	20–23
	29	28.7	140	20–25	26
	32.8				
	40		>140	>25	40–50

Table 4. *Acipenser gueldenstaedti* ages, lengths and weights. Measurement M6 and total length (Tl) after Bartosiewicz, Takacs 1997, M1 after Živaljevic (2017); ages and weights estimated after Vlasenko *et alii* (1989, Table 40, 41, p. 314–317). *Approximate values based on the size of *Acipenser stellatus.*

The presence of the sterlet (*Acipenser ruthenus*) is indicated by a single parasphenoid bone (Pl. 1/6) with dimensions similar to those of the reference specimen. This was a specimen of ca 70 cm, 5–6 kg and over 15 years of age (cf. Sokolov, Vasil'ev 1989, Table 26, 27, p. 245–246).

The three starry sturgeon (*Acipenser stellatus)* remains were represented by a clavicle and two parasphenoid fragments (Pl. 1/7). From their measurements, these were adult individuals, large and very large (1.1 m and 5–6 kg), of over 11 years of age, and perhaps even older, 15–20 years (Shubina *et alii* 1989).

Skeleton elements			*Hucho hucho*	*Cyprinus carpio*	*Rutilus frisii*	Cyprinidae	*Silurus glanis*	*Sander lucioperca*	Total		%
cranium	neurocranium	parasfenoideum		4			1	1	6		
		basioccipitale		1			1		2	25	
		ind	1	16					17		
	viscerocranium	orbitala		7	1	1			9		
		maxillare		1				1	2		
		dentale		5			2	1	8		
		epihyale		2					2		
		hyomandibulare		2					2		
		aquadratum		6					6	97	61.62
		os pharyngicum inf.		2	21				23		
		dentes		1	16				17		
		hyomandibulare		1					1		
		articulare				1	2	1	4		
		operculare		3					3		
		interoperculare		6	1				7		
		praeoperculare		12	1				13		
pinnae		posttemporale		1					1		
		supracleithrale		7					7		
		cleithrum		3				1	4	44	22.22
		postcleithrum		7					7		
		spina pinnae pectoralis		20		1	2		23		
		axonost				2			2		
rachis	columna vertebralis	coastae		2		6			8	32	16.16
		vertebrae	7	2	2	6	7		24		
Total			8	111	42	17	15	5	198		

Table 5. Frequency of remains by body part for the identified taxa (other than sturgeons).

Common carp (*Cyprinus carpio*) ranks second in the assemblage by number of remains (Pl. 2/4). Over 96% originate from the anterior part of the skull, the neuro- or viscerocranium, or the pectoral fin (Table 5). From the rachis area, two vertebrae were securely assigned to carp, of the total of 10 for all cyprinids. Size was calculated for 8 specimens (MNI, Table 6) which range between 0.58–1.01 m (2.8–14.7 kg). All are reproductive specimens.

Element	M1	M4	Tl (mm)	Weight (kg)
quadratum	5.6		672	4352
quadratum	6.8		832	8167
dentale		5.4	673	4368
dentale		6.1	770	6481
dentale		6.2	783	6829
dentale		6.9	880	9615
dentale		7.9	1017	14763
hyomandibulare	19		584	2872

Table 6. Calculated carp sizes (*Cyprinus carpio*) – M1 and M4 measurements after Radu (2011).

Black Sea roach (*Rutilus frisii*) remains consist of 42 bones, 88% of which are fragments of pharyngeal bones (ossa pharyngea inferiora/5th ceratobrachial). Based on this bone, an MNI of 15 was calculated. The rest of the remains consist of cranial (3) and vertebral (2) fragments. The 5th ceratobrachial is highly fragmented, probably resulting from the extraction of the teeth and their use as adornments, as seen in Mesolithic burials from Icoana, Schela Cladovei, Ostrovul Corbului, Vlasac, and Lepenski Vir (Cristiani, Borić 2012; Cristiani *et alii* 2014; Mărgărit *et alii* 2017a; Živaljević *et alii* 2017). Mărgărit *et alii* (2017a) described the stages in extracting the teeth, and the remains of the 5th ceratobrachial bone identified at Icoana seem to have been subjected to the same treatment.

The assemblage comprised fragments of the 5th ceratobrachial without teeth (Pl. 2/6) and with 1–2 teeth (Pl. 2/7) and even isolated teeth, some in their final stage of processing (Pl. 3/1). These teeth were the only elements that yielded the necessary biometric data for calculating fish size. Following the methodology described in Mărgărit *et alii* (2017a), the measurements obtained for the depth and breadth of the teeth in positions 3 (4 teeth) and 5 (7 teeth) of the 5th ceratobrachial bone were plotted together with tooth measurements for specimens of known size (Fig. 3). The values obtained are similar to or higher than those yielded by the teeth of individuals longer than 64 cm. This confirms that the pharyngeal bones originated from reproductive individuals of large size.

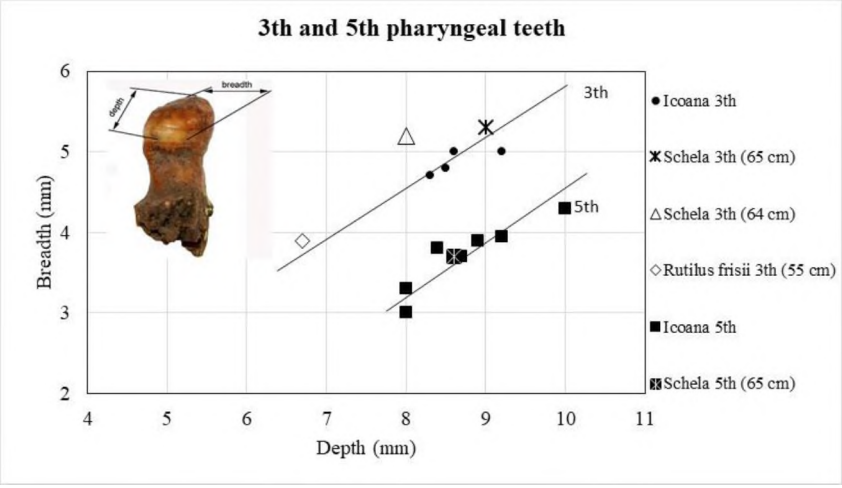

Figure 3. 3rd and 5th pharyngeal teeth of *Rutilus frisii* from Icoana, compared to measurements obtained from a modern *Rutilus frisii kutum* specimen of known size, and two archaeological specimens of estimated sizes from Mesolithic contexts at Schela Cladovei.

Of the 15 catfish (*Silurus glanis*) remains (Pl. 2/1–3), seven fragments were part of the spine (articulated vertebrae 1–18) of a single individual of very large size: *ca.* 2.6 m and 153.5 kg (Pl. 1/3). The other 8 were part of the skull from individuals of large size (Table 7) ranging from 1.4 to 1.7 kg and from 25 to 40 kg, while the fourth specimen was longer than 2 m and weighed over 67 kg.

Element	M1	M2	Tl (mm)	Weight (kg)
basioccipitale		37.2	2054	67080
articulare	19		1499	25343
articulare	23.1		1736	39872
spina pinnae pectoralis	21.9	17.1	1646	33869
vertebrae	49.1	50.3	2687	153515

Table 7. Calculated values for *Silurus glanis* length and weight. M1 and M2 measurements after Radu (2011).

Pikeperch (*Sander lucioperca*) is represented by a few cranial bones (Pl. 2/5) from three individuals (Table 5). Calculated lengths and weights for two of the specimens indicate large sizes (0.6 m and 2 kg) and very large (1 m and 9.1 kg) for the third.

Danube salmon (*Hucho hucho*) is one of the salmonid species. We identified seven vertebral fragments (Pl. 1/2) and a fragment probably from the cranium. The size of the vertebrae varies between 12 and 17 mm indicating reproductive individuals longer than 0.8 m.

Chelonians

The identified fragments were mostly from the carapace and the plastron of *Emys orbicularis* (4 remains) and *Testudo graeca* (68 remains).

Sixty of the *Testudo graeca* fragments come from the carapace and seven from the plastron. A single fragment originates from a limb (Table 8).

Most of the bones are disarticulated and only three fragments come from two articulated bones. Peripheral (28) and nuchal (8) are the most numerous (53%), being the most robust probably. Given the state of preservation, species determination was possible only for the 12 fragments with notable discriminating characteristics: the nuchal and neural bones (Amiranashvili 2000). All these bones display the specific characteristics of *Testudo graeca*.

Segment	Skeletal element	No.	Total no.	%
carapace	nuchal	8		
	neural	1		
	pleural	11		
	peripheral	28	60	88.24
	suprapygal	1		
	carapace ind	11		
plastron			7	10.29
skeletal bones	coracoid		1	1.47
Total			**68**	

Table 8. Skeletal elements of *Testudo graeca.*

Measurements of the nuchal and peripheral bones of the *Testudo graeca* carapace were compared to those of two modern individuals (marked in red in Figure 4). The results indicate that the majority of the bones came from mature individuals of sizes similar to those in the reference collection (19 cm and 22 cm respectively, straight carapace length=SCL). These comprise fragments from juvenile individuals (Figure 4, nuchal and peripheral bones 9 and 10) and mature individuals, larger than the specimens in the reference collection. The calculated MNI is 12 (9 nuchal and neural bones and three large fragments of the 10th peripheral bone). Two fragments showed traces of use wear on the inner face and different colouration. The study of the use-wear traces and residues indicates that these plates were in contact with a substance containing inorganic pigment (ochre) probably while the carapace was used as a container (Radu *et alii* forthcoming). Six fragments are burnt but it was impossible to determine whether this was intentional or accidental.

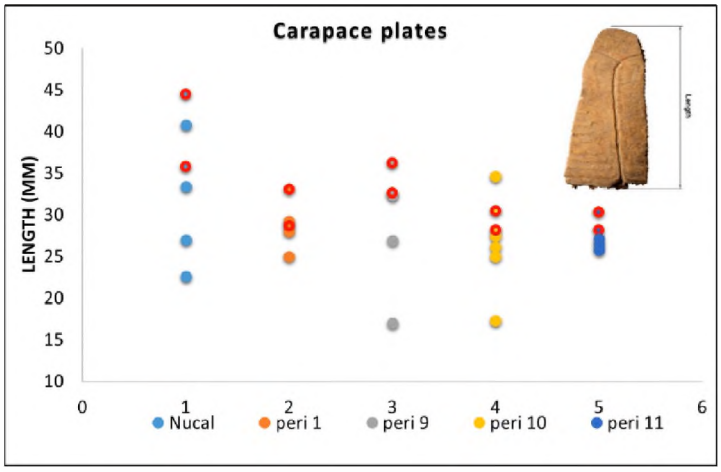

Figure 4. Maximum dorso-ventral length of the nuchal and peripheral bones 1, 9, 10 and 11 of *Testudo graeca* individuals from Icoana, compared to those of two modern individuals of 19 cm and 22 cm straight carapace length (SCL), respectively.

Bird remains are very fragmented, in a poor state of preservation and thus difficult to identify to species. Three long bone diaphyses (Pl. 3/3) and fragmented phalanges from the anterior limbs (Pl. 3/4) came from large birds. Other remains are fragments of the rachis (Pl. 3/5) or diaphysis of long bones from medium or small birds.

Mammals are represented by 16,960 remains weighing 123.82 kg making 94.06% (NISP) or 98.29% (W). 841 are antler fragments (835 NISP or 34.937 kg red deer and 6 NISP/28 g roe deer) of uncertain provenance, shed or unshed antler. Of the 16,119 mammal remains, 5005 were identified, representing 56.95 kg (64.08%). This shows once again the high degree of fragmentation of the assemblage (Table 9).

The list comprises 16 wild and one domestic species (Table 9 and Pl. 3/6–7 through Pl. 6).

Mammals	NISP	%	G	%	MNI	%
Canis familiaris	339	6.77	2547	4.47	13	8.97
Rupicapra rupicapra	22	0.44	507	0.89	4	2.76
Cervus elaphus	1814	36.24	27876	48.95	28	19.31
Capreolus capreolus	457	9.13	2189	3.84	19	13.10
Sus scrofa	2164	43.24	22331	39.22	42	28.97
Bos /Bison	23	0.46	495	0.87	2	1.38
Equus sp.	2	0.04	25	0.04	1	0.69
Felis silvestris	18	0.36	46	0.08	3	2.07
Lynx lynx	9	0.18	46	0.08	2	1.38
Meles meles	17	0.34	90	0.16	4	2.76
Ursus arctos	16	0.32	185	0.32	2	1.38
Canis lupus	9	0.18	18	0.03	2	1.38
Vulpes vulpes	15	0.30	33	0.06	2	1.38
Lutra lutra	2	0.04	5	0.01	1	0.69
Martes sp.	44	0.88	86	0.15	8	5.52
Castor fiber	43	0.86	445	0.78	10	6.90
Lepus europaeus	11	0.22	19	0.03	2	1.38
Total mammals determined	**5005**	100.00	**56943**	100.00	**145**	100.00
undetermined mammals large size	1654		13703			
undetermined mammals medium size	9453		18210			
undetermined micromammals	7		2			
antlers *Cervus elaphus*	835		34937			
antlers *Capreolus capreolus*	6		28			
Total mammals	**16960**		**123823**			

Table 9. Frequencies for the number of remains (NISP), weight (W) and minimum number of individuals (NMI) for the Icoana mammals.

In terms of NISP and MNI, wild boar ranks first (43.2% and 29%, respectively), followed by red deer (36.2% and 19.3%, respectively), roe deer (9.1% and 13.1%, respectively), and dog (6.8% and 9%, respectively) (Fig. 5). Weight-wise, red deer ranks first (48.9%) followed by wild boar (39.2%), dog (4.5%) and roe deer (3.8%) (Fig. 5). The other wild taxa show values below 1% both as NISP and W, but higher values as MNI; this is the case for carnivores reaching 16.5% and beaver with 6.9% (Fig. 5).

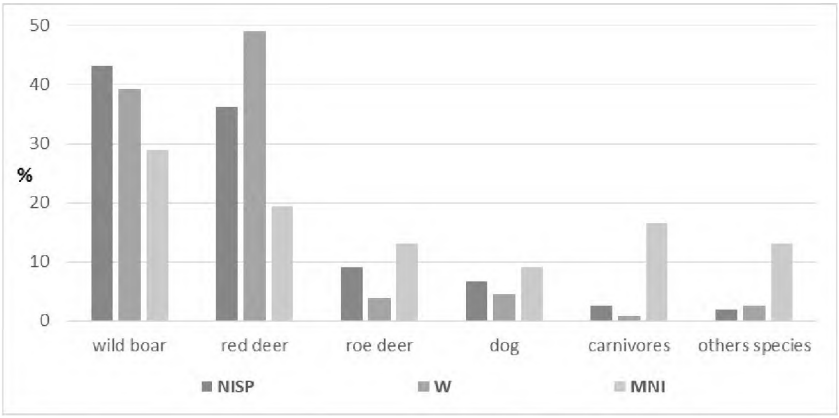

Figure 5. Frequencies of mammal remains by NISP, W and MNI. Legend: carnivores – *Canis lupus, Vulpes vulpes, Ursus arctos, Meles meles, Martes* sp., *Lutra lutra, Lynx lynx, Felis silvestris*; Other species – *Bos/Bison, Rupicapra rupicapra, Castor fiber, Lepus europaeus*.

The dog is the only domestic animal from Icoana (Pl. 3/6–7, Pl. 7/1–2). We identified 13 individuals based on the 13 left ulnae present in the assemblage. Two individuals were less than 16 months of age (ulna proximal epiphyses unfused), one 16 months (ulna proximal epiphyses in process of fusion) and ten older than 18 months (humerus proximal epiphyses fused). Skeletal ages match the dental ages in 10 individuals. In one case, the identification of an individual under 16 months was narrowed to 4–6 months based on the erupting P_2–P_4. Numerous bones display heavy and fine cut marks and traces of burning (ca. 5%), suggesting dogs were part of the human diet (see Fig. 6). Cynophagy (eating dog flesh) was not uncommon during the Mesolithic in the Iron Gates, being noted both at Padina (Clason 1980) and Lepenski Vir (Dimitrijević 2008, p. 11; Jovanović *et alii* 2019, p. 3281).

The average length of the lower molars (M_1) of 23 mm (N=12, range between 21 and 24.4 mm) is close to the values obtained for Mesolithic sites on the Serbian bank of the Danube (Vlasac, Padina, Lepenski Vir and Hajdučka Vodenica, see Dimitrijević, Vuković, 2015, Table 8) but greater than at Early Neolithic sites in the area (Bolomey, 1973a, p. 50, Table 5).

The size of these animals is not very large based on the measurements obtained from a few long bones. A complete humerus indicates a withers height of 52.2 cm (Koudelka index) and 50.5 cm (Harcourt index); two radii indicate 54.7 cm and 52.5 cm (Kouldeka index) and 56.0 cm and 53.8 cm (Harcourt index), respectively. The gracility indices are 8.97 and 9.66. A tibia indicates a size of 57.8 cm (Kouldeka) and 68.7 (Harcourt) with a gracility index of 6.8. The height of the Mesolithic dog from Icoana is 54.3 cm (Koudelka index N=4, within the range of 52.2 and 57.8 cm) and 54.7 cm (Harcourt index, ranges between 50.5 and 58.7cm) with a gracility index of 8.5 cm (N=3, range between 6.8 and 9.66 cm). These measurements indicate a dog larger than average (between 50 and 60 cm) with robusticity medium to large (Udrescu *et alii* 1999, p. 108).

Palaeogenetic results on a few mandibles from Icoana suggest those individuals were part of the C-mitochondrial haplogroup, present everywhere in Europe before the first Neolithic communities (Frantz *et alii* 2016; Ollivier *et alii* 2018).

Wild boar is the best represented wild mammal at Icoana (Pl. 4/3–4). The ages of the identified individuals were established based on dentition (the degree of eruption of the deciduous and permanent teeth and their use wear). Thus, we identified 42 individuals: one of 0–2 months, one of 4–6 months, four of 6–8 months, 10 of 8–10 months, five of 10–12 months, two of 16–22 months, one of 16–22 months, four of 22–24 months, two of 24–36 months, two of 30–36 months, six of 36–60 months and four of 60–84 months. However, many of the wild boar teeth (from males mainly) were probably transformed into tools and adornments.

Based on the number and morphology of the canines present we identified 17 females and 4 males. Taking also into consideration the empty canine sockets in the existing mandibles, there should be 21 females and 11 males. Most adults (over 36 months) are males.

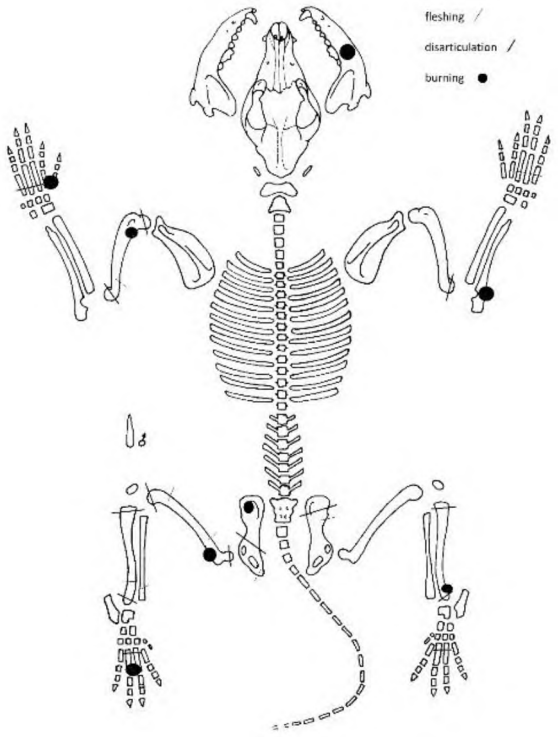

Figure 6. Cutting and defleshing marks on the bones of *Canis familiaris* (drawing after Helmer 1987) indicative of cynophagy at Icoana.

However, it is difficult to assess seasonality given that wild boar breed twice a year (in spring and autumn), a function of food availability in the surrounding environment (Șelaru 1995). Nevertheless, previous publications on the Iron Gates Mesolithic have suggested March/April for the birth of piglets (Dimitrijević *et alii* 2016). This would imply that very young specimens (younger than 12 months) were hunted during the warm season (March-April for the 0–2 months individual; July-August for the 4–6 months individual; September/October for the four individuals of 6-8 months), but most were killed during the cold season (November/December – 10 individuals between 8-10 months, and January/February for the 5 individuals between 10–12 months) (see also Fig. 9 on seasonality). Overall, this suggests young animals were hunted all year round (a ratio of 6:15 for the warm April-October seasons versus the cold season, November/February), with a preference for the cold season.

The high fragmentation of the material allowed for few measurements of the long bones, but we were able to approximate withers height (the Teichert indexes in Udrescu *et alii* 1999, p. 86, Table 12) based on the substantial number of astragali and calcanei (we excluded the porous bones that might have originated from juvenile individuals). Thus, based on the astragali the height at the neck was estimated at 89.5 cm (N=30, range 84.9–99.1 cm), the calcanei indicated 93.2 cm (N=10, range 88.7–98.4 cm) while one 3rd metacarpal yielded a value of 92.2 cm. The average value for the size of the Icoana wild boar is 90.5 cm (N=41, ranges between 84.9 and 99.1 cm).

Palaeogenetic analyses of various wild boar teeth from Icoana indicated the presence of the European mitochondrial haplotype Y2 (ANC-Y2-5A) (Frantz *et alii* 2019).

Red deer was represented by 28 individuals (Pl. 4/5–6). Their age at death frequency (based on dentition) indicates one individual of 1–5 months, two of ca. 5 months, three of 5–10 months, three of *ca.* 10 months, one of 10–18 months, one of *ca.* 18 months, one between 18–27 months, three of *ca.* 27 months, three between 3.5 and 4.5 years, two between 4 and 5.5 years, three between 5.5 and 7.5 years and five over 7.5 years of age. Adult individuals (over 27 months) are predominant, indicating an interest in individuals that had reached their maximum weight.

Given that fawns are born in May-June (Dimitrijević *et alii* 2016), we have at least one individual hunted in June-September (1–5 months of age), two in September (*ca.* 5 months of age), three in September-February (5–10 months of age), three in February (*ca.* 10 months of age), and one between February and October (aged 10–18

months). This suggests young animals were hunted throughout the year, pointing again toward year-round occupation of the site.

Although the quantity of red deer antler remains is impressive (835 pieces), only two preserve fragments of the neurocranium, indicating that those animals were hunted between August and February (Schmid 1972, p. 90). The high fragmentation of the antlers should be noted.

Based on the maximum length of calcanei, the average withers height of red deer was 119.2 cm (N=9, within a range between 114 and 128.4 cm, after Wilkens index (Wilkens 2002).

Roe deer is represented by 19 individuals (Pl. 4/7–8). Their age at death was estimated based on the lower dentition: one individual of *ca.* 4 months, two of 5–19 months, three of 8–29 months, seven of 31–72 months and six over 5 years of age. Given that female roe deer give birth at the end of May (Dimitrijević *et alii* 2016), this suggests one individual was hunted in August (ca. 4 months of age) and two between September and April (ca. 5–12 months of age, see also Fig. 9 on seasonality).

Adult animals are the most numerous (13 of 19, or 68.4%). Five individuals were males; in three cases antlers were still attached to the neurocranium (thus hunted between April and October/November) while the others had shed their antlers (thus hunted in October/November, see also Fig. 9 on seasonality).

Chamois (*Rupicapra rupicapra*, Pl. 5/1) is represented by four individuals with ages (estimated from lower dentition and the attrition of M_3) indicating three individuals of 3–4 years and one of 4–6 years. Thus, only adult individuals were recorded.

The remains of wild bovines (*Bos/Bison*, Pl. 5/2) consist of fragments from at least two subadult/adult individuals (identified based on two fused right scapulae). One was at least 2.5–3 years of age based on the presence of a P_4 with no traces of attrition.

Wild horse (*Equus* sp., Pl. 5/3) is represented by one individual, identified from a single lower tooth.

The list of carnivores comprises 8 taxa. Bear (*Ursus arctos*) is represented by two subadult/adult individuals identified by two left ulnas (Pl. 5/4–5). Wolf (*Canis lupus*), despite the small number of remains, comprises two individuals over 16 months (based on two fused left tibias). The two fox (*Vulpes vulpes*) individuals were identified from two fused left calcanei. Attrition of the mandibular dentition and the biometry allowed for the identification of four adults of *Meles meles* (Pl. 5/6–7). Otter (*Lutra lutra*) is represented by one adult individual. Marten (*Martes* sp.) is among the best-represented carnivore species at Icoana with at least 8 adult individuals identified based on mandibular dentition (Pl. 5/8). Two feline species were noted: *Lynx lynx* with two subadult/adult individuals (Pl. 6/2–3) and the wild cat – represented by three adult individuals, also determined from mandibular remains (Pl. 6/4). According to palaeogenetic (mtDNA) studies, two of the wild cat remains were attributed to clade I (*Felis s. silvestris*) and clade IV-A1 (*Felis s. lybica*) (Ottoni *et alii* 2017).

Beaver (*Castor fiber*) is represented by at least 10 individuals, nine adults and one juvenile, all identified based on mandibular dentition (Pl.6/5).

Hare (*Lepus europaeus*, Pl. 6/6) is represented by two adult individuals based on two fused left calcanei.

DISCUSSION

The first studies of Mesolithic faunal assemblages from the Iron Gates region were published several decades ago (Bökönyi 1970, 1978; Bolomey 1973a, 1973b; Clason 1980). Some collections were revisited recently (Dimitrijević 2008; Bălășescu, Radu 2012; Bălășescu *et alii* 2017; Jovanović *et alii* 2019; Zivalijević *et alii* 2017). New excavations have been undertaken at only two sites, Vlasac in Serbia (Borić *et alii* 2014) and Schela Cladovei in Romania (Boroneanț *et alii* 1999; Bonsall 2008; Bonsall, Boroneanț 2018). In these recent excavations, faunal remains were collected carefully and fine sieving/flotation was employed.

AMS ^{14}C dates obtained for animal and human remains since the 1990s indicate that Middle Mesolithic occupations occurred at Ostrovul Corbului (Bonsall, Boroneanț 2018), Ostrovul Banului and Răzvrata in Romania (unpublished data, forthcoming) and Padina, Lepenski Vir and Vlasac in Serbia (Borić 2011; Borić *et alii* 2014). But the main problem when studying the older faunal collections from these sites and comparing the results to the more recent excavations is the apparent mismatch between the old relative (stratigraphy-based) chronologies and the more recent absolute chronologies. Păunescu recognised a 'Late' Mesolithic generically at Ostrovul Corbului (Păunescu 1996, 2001), while the existing radiocarbon data point to the presence of both Late and Middle Mesolithic occupations (Bonsall, Boroneanț 2018, fig 3.). At Icoana, although the faunal assemblages from the two horizons postulated by V. Boroneanț, Icoana I & II, were studied separately, it is not possible to determine what was considered

by Bolomey as Icoana I or Icoana II, as there are no markings on the pieces. At Vlasac also, the faunal remains were treated in bulk (Bökönyi 1978; Borić *et alii* 2014; Table 2).

Another problem is represented by the long periods during which these sites appear to have been occupied, thus complicating comparisons between the faunal collections.

Fish, molluscs and chelonians

Like the molluscs recovered from other Mesolithic sites on the left bank of the Danube (Cuina Turcului, Veterani Terasă, Ostrovul Corbului, Schela Cladovei (Pickard *et alii* 2017) and Răzvrata (Bălășescu *et alii* 2017), the size of the sample is small. The species identified at Icoana, like neighbouring Răzvrata, is the freshwater bivalve, *Unio crassus*. This species is characteristic of rivers with well-oxygenated waters and strong currents. The fragmentation and (generally) poor state of preservation of the *Unio* shells, as well as the taphonomic conditions, do not allow for detailed comments on their size or their use as food or as raw material for manufacturing various items. The data lead to similar conclusions, that their presence could be the result of both natural depositional processes (floods) and deliberate human actions (cf. Bălășescu *et alii* 2017; Pickard *et alii* 2017).

In terms of the fish species represented, the Icoana assemblage comprises sturgeon, carp, Black Sea roach, Danube salmon, catfish and pikeperch. Sturgeons rank first, followed by carp and Black Sea roach, Danube salmon and catfish. This situation appears similar to that of other sites in the Iron Gates (Borić 2001; Bartosiewicz *et alii* 2008; Dinu 2010; Borić *et alii* 2014; Dimitrijević *et alii* 2016; Bălășescu *et alii* 2017; Živaljević 2017), where these species account for over two-thirds of the fish remains identified. Their capture reflects the distinctive character of the Iron Gates region for anadromous species (Bartosiewicz *et alii* 2008) and for those taxa that undertake annual migrations for reproduction upstream along tributary rivers (the Danube salmon). The low frequency of other species suggests their presence in the faunal spectra was incidental.

Body part distribution is indicative of the taphonomic processes that occur after the death of the individuals (Lyman 1994). The dermal scutes of sturgeon from the cranial area and the pectoral fin rays are the most frequent (Table 2) while abdominal scutes appear in small numbers (6.8%). There are only two carp vertebrae, while the number of vertebrae from all cyprinids is 10 (the total number of fish vertebrae is 170). The frequency data are particularly interesting for the Black Sea roach since 88% of their remains are bone fragments or teeth of the 5th ceratobrachial (the pharyngeal bone). For pikeperch, all bones present are cranial bones. Catfish and Danube salmon, on the other hand, show a different pattern. Table 5 indicates that seven catfish remains come from the vertebral column and eight from the head, giving a balanced distribution. On the other hand, all the vertebrae come from a single individual measuring 2.6 m. The remaining bones originate from the cranial area of at least four individuals. Danube salmon is represented mostly by vertebrae and one fragment from the cranial area, which is difficult to identify more precisely.

Regarding the bones that are present and their anatomical positioning, most originate from the head area. Sturgeons show a deficit of scutes coming from the five rows they possess (one dorsal, two lateral and two abdominal). This deficit (*ca.* 11%) was also observed at Schela Cladovei, where wet sieving was employed (Bartosiewicz *et alii* 2008). It appears that employing wet or dry sieving does not have an impact on the result.

Differential preservation of the various skeletal elements may play a part in bone representativity within the assemblage, but not in a categorical manner (e.g. vertebrae are among the more robust bones, so this argument does not stand for carp and catfish). In the case of catfish, at Icoana we noted only the presence of the rachis and isolated vertebrae (Bălășescu *et alii* 2017). Leaving aside the bias introduced by excavation methods and the area excavated, this may indicate differential treatment of the body of the animal during both the primary preparation of the fish in situ, as already postulated for the Iron Gates (Bartosiewicz *et alii* 2008, p. 44; Dimitrijević *et alii* 2016, p. 114) or their storage (Desse, Desse-Berset 2000).

We observed that sturgeon and carp (and sometimes catfish) were chopped and the head was present among the waste, while in Danube salmon and catfish the spine was discarded. Such processing methods seem to have nothing to do with the size of the fish or the quality of the flesh since sturgeon, catfish and Danube salmon are fish with high fat and energy content (Steffens 2006). The primary butchering of fish immediately after its capture to eliminate those parts that would rot first would have similar results to those observed at Icoana. Beheading as a means of reducing the weight of the carcass is an *in situ* method for storage and transportation. Since sturgeon does not have an ossified spine (or only partly, in old individuals) it is difficult to say if, following evisceration and beheading, the same treatment was applied as for catfish and Danube salmon. The removal of the rachis takes place when drying and smoking are in view for future preservation and storage (Desse, Desse-Berset 2000).

Carp vertebrae are rare and at Icoana (as for certain catfish individuals) the head was probably discarded while the rest of the body (rachis included) was transported elsewhere and perhaps exchanged for other goods.

A substantial part of the indeterminate remains is represented by ribs and elements of the fins (axonosts and radials). This suggests that fins (both dorsal and anal) and the abdominal part of cyprinids and catfish especially were discarded.

The *in situ* preparation of sturgeon and large and very large catfish made evisceration mandatory. Some of the remains of the smaller species (various cyprinids, percids and clupeids) identified at Mesolithic sites in the Iron Gates (Dimitrijević *et alii* 2016, p. 121, Table 4), although not at Icoana, may derive from the stomach contents of sturgeons and large catfish, which have a varied diet (Bănărescu 1964, p. 519; Pirogovskii *et alii* 1989, Table 8, p. 171).

The Black Sea roach at Icoana was treated differently than other species, reflected in the preponderance of complete and fragmented pharyngeal teeth (88%) compared to the other skeletal elements. This may be linked to their use as adornments but hitherto such items have only been reported from sites dated to the Late Mesolithic (Mărgărit *et alii* 2017a). Remains from the rest of the skeleton are very few (N=5). For a calculated MNI of 15, other skeletal elements should have numbered hundreds. This is more of a collection of pharyngeal teeth than the remains of food consumption of this species. Both the data from Răzvrata (Bălășescu *et alii* 2017) and those from Icoana seem to point toward the existence of raw material storage and waste resulting from the processing of pharyngeal teeth, with many of them showing the marks of the technical phases of obtaining the tooth, which was the desired end-product. The distribution of the skeletal elements in the case of the Black Sea roach raises questions regarding its presence in the Iron Gates area. Was it really captured locally? There are arguments for and against.

The species that could provide such teeth are *Rutilus meidingeri* and *Rutilus frisii* but neither is present today in the Iron Gates region. *R. meidingeri* survived in the upper reaches of the Danube (Lelek 1987, p. 233; Zauner, Ratschan 2005), while *R. frisii* has not been observed in the Danube but is present in rivers in the North Pontic region (Bănărescu 1964, p. 312). DNA analyses of archaeological *Rutilus* bones from Iron Gates archaeological contexts (Živaljević *et alii* 2017) failed to attribute the samples to one or other of the two species. Moreover, genetic studies of present-day individuals of *Rutilus meidingeri* and *Rutilus frisii* have not provided conclusive results (Ketmaier *et alii* 2008).

Adornments made from *Rutilus* pharyngeal teeth occur in Late Mesolithic sites in the Upper Danube catchment in Germany (Rigaud 2011; Rigaud *et alii* 2014, Table 3; Cristiani *et alii* 2014). Nevertheless, similar finds from Vlasac (also dating to the 7th millennium BC) prompted the suggestion that *"The use of carp teeth as ornaments might have been a local innovation of the Danube Gorges fisher-forager communities"* (Cristiani, Borić 2012, p. 3463). The finds from Icoana and, possibly, Cuina Turcului (see below) in the Romanian part of the Iron Gates provide evidence for the presence of such teeth before the 7th millennium BC when perhaps their importance in funerary customs increased.

The Icoana assemblage comprises sturgeons of sizes indicating reproductive individuals, regardless of the species. Beluga (*Huso huso*) individuals fall within the range of the early years of sexual maturity (9-16 years) and lengths between 1.5 and 2.3m. *Acipenser gueldenstaedtii* covers the entire range of size and length of reproductive individuals. *Acipenser ruthenus* and *Acipenser stellatus* comprise only individuals older than 15 years, this being the upper age limit for these species. Migration along the Danube is variable in these species: two times for the anadromous species (*Huso huso, Acipenser ruthenus and Acipenser stellatus*) in spring and autumn (Bănărescu 1964). During the spring migration beluga laid their eggs when the Danube waters were highest, which coincided with flood season (Pirogovskii *et alii* 1989, p. 185). Then the other sturgeon species follow. Their presence was noted in the Iron Gates between February and June, with higher frequency in April and May. According to Bartosiewicz *et alii* (2008, p. 48), in 19th-century Hungary upriver of the Iron Gates most sturgeon captures were reported between September and November, though they found no close connection between the migrations and the large number of captures. The Icoana assemblage also comprises other anadromous species such as the Black Sea roach (*Rutilus frisii*). All these species migrate in groups aiming to reach the upstream reaches of rivers with fast, oxygenated waters. On the other hand, carp and catfish have reproductive periods coinciding with the end of these migrations and prefer areas with still, warm waters. Analysis of the fish remains from Icoana recovered from the same depth in trench II (1.90 m) indicated the presence of all these important species, as well as two chelonian species. Based on these data and assuming no stratigraphic mixing, at Icoana we suggest that fishing started at the beginning of the summer season when all these species were present, vulnerable, and easy to capture by simple methods (Živaljević 2012). *Rutilus frisii* and *Hucho hucho* could have been captured easily at the confluence of the Mraconia River with the Danube when schools of fish were trying to reach the upstream areas. In addition to line fishing with hooks or bipoints (cf. Beldiman 2007), harpoons can be used in shallow waters or those with abrupt depth changes when the sturgeons had to pass

over rocky thresholds (Srejović 1972, p. 130). Clubbing (using stone clubs in prehistory) is another method suggested for their capture (Živaljević 2012). River areas are difficult to observe nowadays but in the past, such micro-zones occurred where the Mraconia flows into the Danube (Boroneanț 2017).

Mammals

Mammal remains tend to dominate the faunal assemblages from Mesolithic sites in the Iron Gates, apart from the recent excavations at Vlasac where sieving was employed (Borić *et alii* 2014, Table 2). Except for Vlasac, Icoana and Ostrovul Corbului, assemblage sizes are very small – less than 200 remains identified by species (Fig. 7).

At all Mesolithic sites in the Iron Gates region referred to in this study, the only domesticated animal is the dog, ranging from 1.2% at Răzvrata to 46% at Vlasac (Borić *et alii* 2014). At Icoana dog accounts for 6.8% (Fig. 7). All other mammals were hunted wild animals. The list of species is long and for each site is again influenced by the recovery techniques employed and the size of the faunal assemblage. The recent excavations at Vlasac yielded 11,384 mammal remains but taxa could only be determined for 709 (6.2%) of them (Borić *et alii* 2014). Nevertheless, the species list is rich, comprising 17 taxa. In comparison, Icoana yielded 15 taxa, Ostrovul Corbului 12, Ostrovul Banului 11, while only 6 were identified at Răzvrata (Fig. 7).

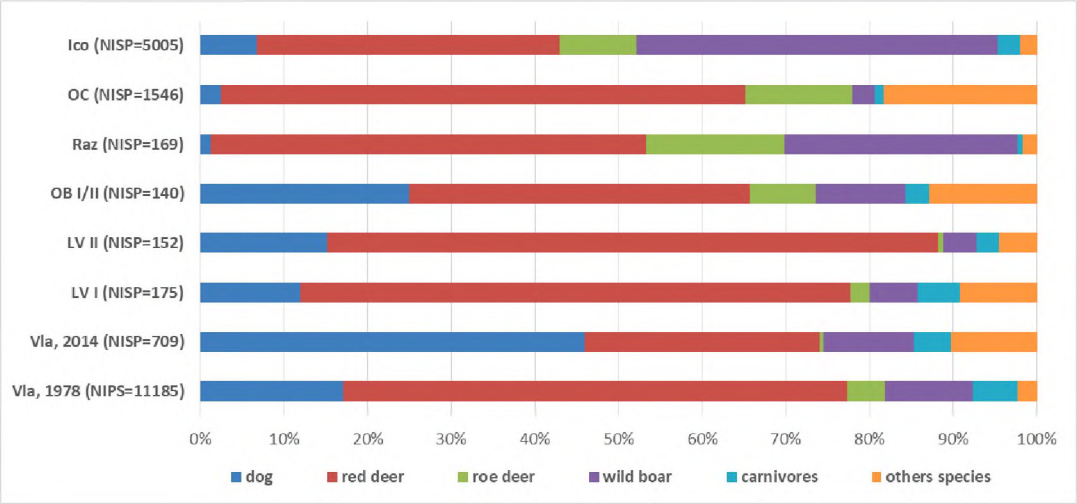

Figure 7. NISP frequencies at various Mesolithic sites in the Iron Gates Legend: Vla, 1978 - Vlasac in Bökönyi 1978); Vla, 2014 – Vlasac in Borić *et alii*, 2014); LV I and LV II – Lepenski Vir I and II (Bökönyi 1970); OB I/II – Ostrovul Banului levels I/II (Bălășescu, Radu 2012); Răzvrata (Bălășescu *et alii* 2017); Ostrovul Corbului (Haimovici 1987); Ico – Icoana; carnivores – bear, wolf, fox, lynx, wild cat, badger, marten, and otter; others species – aurochs, wild bovids (*Bos/Bison*), chamois, fallow deer wild horse, hydruntine, beaver, hare, squirrel and mole.

At most sites other than Icoana red deer is predominant (Fig. 7). Frequencies range from 28.1% at Vlasac (Borić *et alii* 2014) to 73% at Lepenski Vir. At Icoana red deer reaches 36.2%. The distinctiveness of Icoana is that wild boar remains are predominant (43.2%). At most other sites (Vlasac, Lepenski Vir I and II, Ostrovul Banului and Răzvrata) wild boar ranks second, with roe deer second at Ostrovul Corbului.

The carnivore group is extremely varied, with both large- (bear) and medium-size (wolf, fox, lynx, wild cat, badger, marten and otter) species. Their overall frequencies are low, ranging between 0.6% at Răzvrata (Bălășescu *et alii* 2017) and 5.3% at Vlasac (Bökönyi 1978) – see Fig. 7. These species were probably hunted both for furs and as food.

'*Other species*' exhibit very low frequencies (Fig. 7) suggesting little impact on subsistence, and probably many of these animals were hunted accidentally or occasionally. However, their contribution in terms of meat, as well as hides, bones, etc., should not be overlooked. They include the various species of equids (Ostrovul Corbului, Icoana, and Ostrovul Banului) and wild bovids (aurochs or *Bos/Bison* at Lepenski Vir, Icoana, Ostrovul Banului, Ostrovul Corbului, and Răzvrata). Interestingly, equid bones have been identified only at sites on the left bank of the Danube.

At Icoana the frequencies of skeletal elements of the mammals (mainly wild boar, red and roe deer) indicate they were brought to the site complete. They may have been hunted in the vicinity of the site (Annex 1). This is suggested by the substantial number of cranial and extremity bones recovered (Annex 1 and Fig. 8). Cranial remains (neurocranium, viscerocranium, mandible and teeth) account for 20% of NISP in all three taxa (22.2% in wild boar, 20.3% in red deer and 20.6% in roe deer) while the bones from extremities (metapodials, carpals, tarsals and

phalanges) reach over 42% in the case of wild boar, 47% for roe deer and 54.2% for red deer. Limb bones (scapula, humerus, radius, ulna, coxal, femur, tibia and fibula) account for 21.1% in red deer, 25.2% in roe deer and 26.7% in wild boar (Fig. 8). Vertebrae and ribs occur in low frequencies (wild boar – 8.9%; roe deer – 7.2%; red deer – 4.4%) and their greater fragmentation suggests human interventions linked to butchering and eating of the animals, although some of the fragmentation may be the result of taphonomic processes. Those bone areas rich in meat are likely to have been more affected by human actions for obtaining the meat/marrow, such as breakage with hard objects, firing, boiling, etc. Such fragmentation was not observed in the bones from the extremities, such as carpals, tarsals and phalanges, although there are some exceptions: 1st and 2nd red deer phalanges are invariably broken transversely to extract the marrow, while those of wild boar are always complete (see Pl. 1/6).

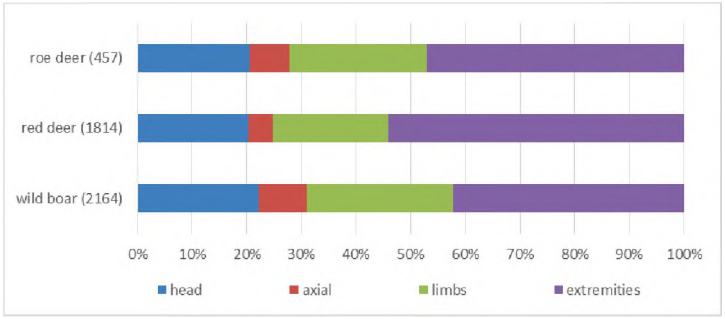

Figure 8. Frequencies of anatomical regions of the body for the main hunted species at Icoana.

We have attempted to reconstruct seasonal activities based on the present-day behaviour and ecology of the various species of fish and mammals. This rests largely on the remains of migratory fish (*Acipenseridae*, *Hucho hucho* and *Rutilus frisii*) with relatively precise migration periods (see above) indicating that their fishing took place mainly at the end of winter and beginning of summer (between February and June) (Fig. 9). Other species of fish (e.g., carp and catfish) were also considered. All these taxa indicate mainly the warmer season for capturing, with two periods of more intense fishing in March-June and September–October.

For mammals, our interpretations are based on the eruption of deciduous and permanent dentition and its degree of attrition in wild boar, red and roe deer. We also took into consideration the season for antler growth in red and roe deer (Fig. 9).

The data suggest year-round occupation of the site, with some activities such as fishing likely to have been more productive during the warm season while hunting would have been more successful during the cold season (Fig. 9). But it is more difficult to assess whether communities spent several years at the same site or moved between different locations.

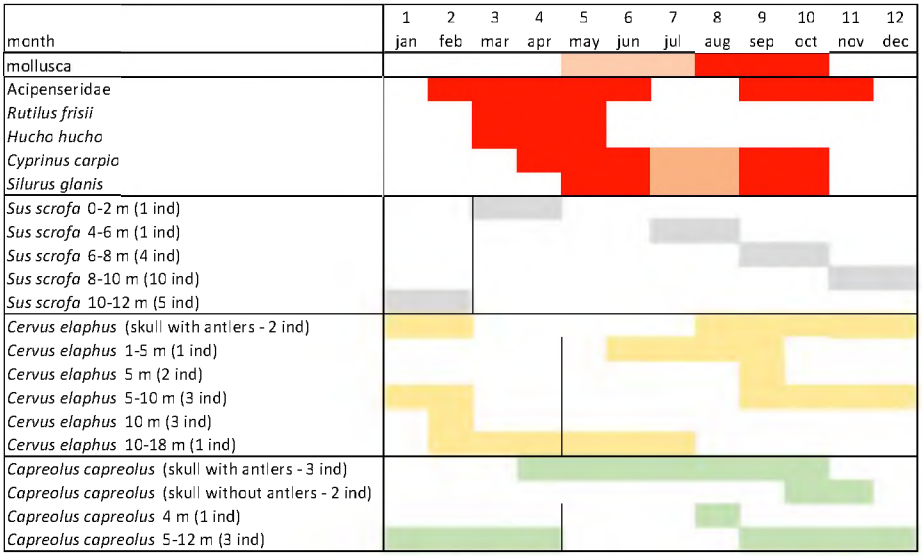

Figure 9. Fish taxa identified and their seasonal availability based on migration/ spawning seasons, feeding seasons and optimal water temperature, and tentative kill season of mammals at Icoana.

CONCLUSIONS

Compared to the previous studies of A. Bolomey, the number of mammal remains (NR) has increased to 16690, compared to 4056, through the identification of the entire Icoana assemblage.

The fish collection (940 remains) is second size-wise on the Romanian bank of the Danube (Table 9), after Schela Cladovei (1191 – from the 1992-1996 excavation seasons: Bartosiewicz *et alii*. 2001, Table 1). Moreover, while the Icoana assemblage dates to the Middle Mesolithic (ca. 8500-7600 cal BC), Schela Cladovei is Late Mesolithic (ca. 7200-6300 cal BC).

Nalbant's (1970) study of the Cuina Turcului assemblage (which is mainly Lateglacial [Early Mesolithic] in date, but possibly includes some Early Holocene [Middle Mesolithic] material) shows several differences compared to the data from other Iron Gates sites – and even to a previously unpublished smaller assemblage from Cuina Turcului (Table 10). Although the initial assemblage is lost, the published description permits some observations. Nalbant noted the presence of numerous pharyngeal teeth and brachial bones still preserving teeth (5th ceratobrachial), identified by him as originating from *Abramis brama* or *Leuciscus cephalus.* Since the former species only has one row of teeth, we believe Nalbant may have misidentified the species and that it was *Rutilus frisii.* According to Nalbant, their sizes ranged from 75-85 cm and their weight from 10-12 kg. These were calculated based on vertebrae with a diameter of 14-18 mm, which were probably also misidentified since we consider them to be carp vertebrae. In Table 11 (marked in grey) we have suggested a different identification, where the remains of the branchial arches and the teeth are seen as originating from *Rutilus frisii* and the vertebrae from other cyprinids. Most are carp vertebrae but since two species of cyprinid were identified at the site (carp and Black Sea roach) it was more prudent to assign them to cyprinids. Pikeperch vertebrae of 10-12 mm (but not the other bones) present a similar situation and have been reassigned to *Hucho hucho*.

Taxon	Cuina Turcului	Ostrovul Banului		Icoana	Răzvrata	Ostrovul Corbului
	Radu *unpublished*	Radu *unpublished*	Mărgărit *et alii* 2017b		Bălășescu *et alii* 2017	Haimovici 1987
Sturgeon	13	35		535		
Hucho hucho	40	7		8		
Esox lucius	3					
Cyprinus carpio	13	14		111		x
Rutilus frisii	64	41	18	42	9	
Ciprinidae	125	17		17		x
Silurus glanis	16	17		15	3	x
Sander lucioperca	2	4		5		
Pisces ind	22	20		207	2	x
Total	**298**	**155**	**18**	**940**	**14**	**84**

Table 10. Fish remains identified at Mesolithic sites on the left bank of the Danube (at Cuina Turcului the data have been compiled using Table 10 and previously unpublished data).

Each of the sites included in Table 10 has at least some evidence of Middle Mesolithic (Early Holocene) occupation, although the assemblages from these sites were not necessarily contemporaneous and may also include material from earlier or later Mesolithic phases. The assemblages include remains of *Hucho hucho*, sturgeon, roach, carp and catfish, except for Răzvrata and Ostrovul Corbului which are very small (14 and 74, respectively). Given the environmental conditions of the Iron Gates, these were perhaps the only species that could have been captured in large numbers by simple means. The best time of year for their capture was spring (March to June) during their spawning season. Autumn is another potential capture period for sturgeon, carp and catfish when it would have coincided with hunting activities. Fishing was likely linked to *in situ* processing of the fish immediately after capture

and perhaps basic preservation (as suggested by some previous authors – Borić 2007; Bonsall 2008; Dimitrijević *et alii* 2016) although this was never supported by archaeozoological observations.

Taxon	No. Nalbant 1970	Taxon	No. Our suggestion	No. Radu unpublished
Cuina Turcului I				
Esox lucius	1	*Esox lucius*	1	
Abramis brama (teeth+5th ceratobr.)	56	*Rutilus frisii*	56	3
Cyprinus carpio	2	*Cyprinus carpio*	2	11
Abramis brama (vertebrae)	77	Ciprinidae	77	
Sander lucioperca (vertebrae)	10	*Hucho hucho*	10	26
Pisces ind.	8	Pisces ind.	8	5
Total	**154**		**154**	
Cuina Turcului II				
Sturgeon	10	Sturgeon	10	3
Esox lucius	2	*Esox lucius*	2	
Abramis brama (teeth)	1	*Rutilus frisii*	1	
Leuciscus cephalus (5th ceratobr.+vert.)	4	*Rutilus frisii*	4	
Abramis brama (vertebrae)	42	Ciprinidae	42	
Sander lucioperca (vertebrae)	4	*Hucho hucho*	4	
Ciprinidae	6	Ciprinidae	6	
Silurus glanis	3	*Silurus glanis*	3	13
Sander lucioperca	2	*Sander lucioperca*	2	
Pisces ind.	9	Pisces ind.	9	
Total	**83**		**83**	**61**

Table 11. Fish remains identified at Cuina Turcului after Nalbant (1970) and our proposal for their re-identification (in grey) based on Radu's analysis of previously unpublished material.

As for the mammals, at Icoana the most hunted species was wild boar, followed by red and roe deer. The presence of a large quantity of wild boar remains sets Icoana apart from other Mesolithic sites in the Iron Gates region and suggests that during this period the area was a favourable environment for this species attracted by marshy and forested areas. The confluence of the Mraconia River and the Danube was probably such an area.

The list of hunted species at Icoana is extensive (16 species) reflecting skill and adaptability on the part of the inhabitants enabling them to hunt large size mammals such as wild bovids and horses, as well as other animals ranging in size from bear to hare.

Dogs were the only domestic animals at Icoana (and in the Iron Gates) during the Mesolithic, used probably for hunting and guarding the houses. Occasionally, dogs were eaten, which again, is not a singular occurrence in the Iron Gates.

The large range of species hunted in proximity to the Iron Gates sites suggests a wide variety of biotopes, from forested areas suitable for wild boar, red deer, bear, lynx, wild cat and marten, to more open areas suited to horse and hare.

Further work on the faunal remains from the Romanian sites in the Iron Gates is a research priority. In combination with the hands-on study of the earlier assemblages, direct AMS ^{14}C dating combined with stable isotope analysis is the only way of placing them in a secure chronological context.

ACKNOWLEDGEMENTS

We would like to thank our former colleague Mariana Prociuc for the database and biometry.

Radu Valentin's work was supported by a grant from the Ministry of Research, Innovation and Digitization, CNCS/CCCDI – UEFISCDI, project number PN-III-P4-ID- PCE-2020-2369, within PNCDI III". Adrian Bălășescu's and Adina Boroneanț's work were supported through a research grant developed with the financial support of the Recurring Donors Fund at the disposal of the Romanian Academy and managed by the "PATRIMONIU" Foundation GAR-UM-2019-II-2.1-1 (project no. GAR-UM-2019-II-2.1-1/15.10.2019).

REFERENCES

Amiranashvili 2000 – N. G. Amiranashvili, *Differences in shell morphology of* Testudo graeca *and* Testudo hermanni*, based on material from Bulgaria*, Amphibia-Reptilia 21, 2000, p. 67–81.

Barone 1986 – R. Barone, *Anatomie comparée des mammifères domestiques. Tome 1: ostéologie*, Paris, 1986.

Bartosiewicz,Takacs 1997 – L. Bartosiewicz, I. Takacs, *Osteomorphological studies on the great sturgeon (*Huso huso *Brandt), Archeofauna* 6, 1997, p. 9–16.

Bartosiewicz, Bonsall 2004 – L. Bartosiewicz, C. Bonsall, *Prehistoric fishing along the Danube,* Antaeus 27, 2004, p. 253–272.

Bartosiewicz *et alii* 2001 – L. Bartosiewicz, V. Boroneanţ, C. Bonsall, S. Stallibrass, *New data on the Prehistoric fauna of the Iron Gates: A case study from Schela Cladovei, Romania*, in: R. Kertesz, J. Makkay (eds.), *From Mesolithic to Neolithic*, Akaprint, Budapest, 2001, p. 15–22.

Bartosiewicz *et alii* 2006 – L. Bartosiewicz, V. Boroneanţ, C. Bonsall, *Size ranges of prehistoric cattle and pig at Schela Cladovei (Iron Gates region, Romania)*, Analele Banatului 14(1), 2006, p. 23–42.

Bartosiewicz *et alii* 2008 – L. Bartosiewicz, C. Bonsall, V. Sisu, Sturgeon fishing along the Middle and Lower Danube, in C. Bonsall, V. Boroneant and I. Radovanović (eds.), *The Iron Gates in Prehistory. New perspectives*, BAR IS 1893, Archaeopress, Oxford, 2008, p. 39–54.

Bălășescu, Radu 2012 – A. Bălășescu, V. Radu, *Fauna de la Ostrovul Banului, sector D*, in: A. Boroneanţ (ed.), *Aspects of the Mesolithic-Early Neolithic transition in the Iron Gates region*, Cluj-Napoca, p. 164–168.

Bălășescu *et alii* 2017 – A. Bălășescu, A. Boroneanț, V. Radu, *Animal exploitation at the Mesolithic site of Răzvrata, Romania*, in: M. Mărgărit, A. Boroneanț (eds.), *From hunter-gatherers to farmers. Human adaptations at the end of the Pleistocene and the first part of the Holocene*, *Papers in Honour of Clive Bonsall*, Târgoviște, 2017, p. 65–80.

Bănărescu 1964 – P. Bănărescu, *Fauna Republicii Populare Romîne, Pisces - Osteichthyes (peşti ganoizi şi osoşi)*, vol. XIII, Bucureşti, 1964.

Beldiman 2007 – C. Beldiman, *Industria materiilor dure animale în preistoria României. Resurse naturale, comunităţi umane şi tehnologie din paleoliticul superior până în neoliticul timpuriu*, SP, Supplementum 2, Bucureşti, 2007.

Bolomey, 1973a – A. Bolomey, *The present state of knowledge of mammal exploitation during the Epipaleolithic and the earliest Neolithic on the territory of Romania*, in: J. Matolcsi (ed.), *Domestikationforschung und Geschichte der Haustiere*, Akademiai Kiado, Budapest, 1973, p. 197–203.

Bolomey, 1973b – A. Bolomey, *An outline of the Late Epipalaeolithic economy at the "Iron Gates": the evidence on bones*, Dacia NS 17, 1973, p. 41–52.

Bolomey 1983 – *Les populations néo- et énéolithiques et de la période de transition. Leurs relations avec le milieu biotique*, in: V. Dumitrescu, A. Bolomey, F. Mogoşanu, *Esquisse d'une préhistoire de la Roumanie jusqu' à la fin de l'âge du bronze*, Bucarest, 1983, p. 12–28

Bökönyi 1970 – S. Bökönyi, Animal Remains from Lepenski Vir, Science, New Series 167 (3926), 1970, p. 1702–1704.

Bökönyi 1978 – S. Bökönyi, The Vertebrate Fauna of Vlasac, in: M.Garasanin (ed.), *Vlasac–mezolitsko naselje u Đerdapu (Vlasac. A Mesolithic Settlement in the Iron Gates) II*, Srpska akademija nauka i umetnosti, Beograd, 1978, p. 35–65.

Bonsall 2008 – C. Bonsall, *The Mesolithic of the Iron Gates*, in: G.N. Bailey, P. Spikins (eds.), *Mesolithic Europe*, Cambridge, 2008, p. 238–279.

Bonsall, Boroneanț 2018 – C. Bonsall, A. Boroneanț, *The Iron Gates Mesolithic – a brief review of recent developments,* L'Anthropologie (Paris), 122 (2), 2018, p. 264–280.

Bonsall *et alii* – C. Bonsall, M. Macklin, A. Boroneanţ, C. Pickard, L. Bartosiewicz, G. Cook, T. Higham 2015, *Holocene climate change and prehistoric settlement in the lower Danube valley*, Quaternary International 378, 2015, p. 14–21.

Borić 2001 – D. Borić, *Mesolithic and early Neolithic hunters and fishers in the Danube Gorges: an analysis of archaeozoological data*, in: R. Kertesz, J. Makkay (eds.), *From the Mesolithic to the Neolithic, Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22–27, 1996*, Archaeolingua, Budapest, 2001, p. 101–124.

Borić 2007 – D. Borić, *Mesolithic-Neolithic Interactions in the Danube Gorges*, in: J. K. Kozłowski, M. Nowak (eds.), *Mesolithic/Neolithic Interactions in the Balkans and in the Middle Danube Basin*, Archaeopress, Oxford, 2007, p. 31–45.

Borić 2011 – D. Borić, *Adaptations and transformations of the Danube Gorges foragers (c. 13,000–5500 BC): an overview*, in: R. Krauß (ed.), *Beginnings – New Research in the Appearance of the Neolithic between Northwest Anatolia and the Carpathian Basin*, 2011, p. 157–203.

Borić *et alii* 2014 – D. Borić, C. A. I. French, S. Stefanović, V. Dimitrijević, E. Cristiani, M. Gurova, D. Antonović, E. Allué, D. Filipović, *Late Mesolithic lifeways and deathways at Vlasac (Serbia)*, JFA 39 (1), 2014, p. 4–31.

Boroneant 2011 – A. Boroneanţ, *The Mesolithic of Banat*, in: F. Drașovean, N. Tasić (eds.), *The Prehistory of Banat. I: The Palaeolithic and the Mesolithic*, Bucharest, 2011, p. 103–141

Boroneant 2012 – A. Boroneanţ, *Aspecte ale tranziţiei de la mezolitic la neoliticul timpuriu în zona Porţile de Fier*, Cluj-Napoca, 2012.

Boroneanţ 2017 – A. Boroneanţ, *Răzvrata revisited. A supplementary account of the excavation*, in: M. Mărgărit, A. Boroneanţ (eds.), *From hunter-gatherers to farmers. Human adaptations at the end of the Pleistocene and the first part of the Holocene*, *Papers in Honour of Clive Bonsall*, Târgoviște, 2017, p. 45–63.

Boroneant, Bonsall 2016 – A. Boroneant, C. Bonsall, *The Icoana burials in contex*t, in: J. M. Grünberg, B. Gramsch, L. Larsson, J. Orschiedt,

H. Meller (eds.), *MesolithicBurials – Rites, Symbols and Social Organisation of Early Postglacial Communities*, vol.II, Landesmuseum für Vorgeschichte Halle (Saale), Halle, 2016, p. 757–780.

Boroneanț A. *et alii* 2008 – A. Boroneanț, V. Boroneanț, N. Mirițoiu, A. D. Soficaru, *The Icoana burials revisited*, SP 5, p. 51–60.

Boroneanț 1970 – V. Boroneanț, *La période épipaléolithique sur la rive roumaine des Portes de Fer du Danube*, PZ 45, p. 1–24.

Boroneanț 1973 – V. Boroneanț, *Recherches archéologiques sur la culture Schela Cladovei de la zone des « Portes de Fer »*, Dacia NS 17, p. 5–39.

Boroneanț 2000 – V. Boroneanț, *Paléolithique Supérieur et Épipaléolithique dans la Zone des Portes de Fer,* Bucureşti, 2000.

Boroneanț *et alii* 1999 – V. Boroneanț, C. Bonsall, K. McSweeney, R. Payton, M. Macklin, *A Mesolithic burial area at Schela Cladovei, Romania*, in: A. Thévenin (ed.), *L'Europe des derniers chasseurs: Épipaléolithique et Mésolithique*, *Actes du 5e colloque international UISPP, commission XII, Grenoble, 18–23 septembre 1995,* Paris, 1999, p. 385–390.

Brown 1991 – W. A. B. Brown, *The dentition of red deer (*Cervus elaphus*): a scoring scheme to assess age from wear of the permanent molariform teeth*, Journal of Zoology 224, 4, 1991, p. 519–536.

Clason 1980 – A. T. Clason, *Padina and Starčevo: game, fish and cattle*, Palaeohistoria 22, 1980, p. 141–173.

Cristiani, Borić 2012 – E. Cristiani, D. Borić, *8500-year-old Late Mesolithic garment embroidery from Vlasac (Serbia): technological, use-wear and residue analyses*, JAS 39, 2012, p. 3450–3469

Cristiani *et alii* 2014 – E. Cristiani, I. Živaljević, D. Borić, *Residue analysis and ornament suspension techniques in prehistory cyprinid pharyngeal teeth beads from Late Mesolithic burials at Vlasac (Serbia)*, JAS 46, 2014, p. 292–310.

Desse, Desse-Berset 2000 – J. Desse, N. Desse-Berset, *Salaisons de poissons marins aux marges orientales du monde gréco-romain. Contributions de l'archéozoologie*, MEFRA 112(1), 2000, p. 119–134.

Dimitrijević 2008 – V. Dimitrijević, *Lepenski Vir animal bones: what was left in the houses?*, in: C. Bonsall, V. Boroneanț, I. Radovanović (eds), *The Iron Gates in Prehistory: New perspectives*, Archaeopress, Oxford, 2008, p.117–130.

Dimitrijević, Vuković 2015 – V. Dimitrijević, S. Vuković, *Was the dog locally domesticated in the Danube Gorges? Morphometric study of dog cranial remains from four Mesolithic–Early Neolithic archaeological sites by comparison with contemporary wolves*, International Journal of Osteoarchaeology, 25, 1, 2015, p.1-30

Dimitrijević *et alii* 2016 – V. Dimitrijević, I. Živaljević, S. Stefanović, *Becoming sedentary? The seasonality of food resource exploitation in the Mesolithic-Neolithic Danube Gorges*, Documenta Praehistorica 43, 2016, p. 103–122.

Dinu 2006 – A. Dinu, *The question of Pig Domestication at Mesolithic Iron Gates* (unpublished PhD dissertation, University of Wisconsin), Madison, 2006.

Dinu 2010 – A. Dinu, *Mesolithic fish and fishermen of the Lower Danube (Iron Gates)*, Documenta Praehistorica 37, 2010, p. 299–310.

Dinu *et alii* 2007 – A. Dinu, D. Soficaru, N. Mirițoiu, *The Mesolithic at the Danube's Iron Gates: new radiocarbon dates and old stratigraphies*, Documenta Praehistorica 34, 2007, p. 31–52

Driesch 1976 – A. von den Driesch, *A guide to the Measurement of Animal Bone from Archaeological Sites*, Peabody Museum of Archaeology and Ethnology, Harvard, 1976.

Frantz *et alii* 2016 – L. A. F. Frantz, J. Haile, A. T. Lin, A. Scheu, C. Geörg, N. Benecke, M. Alexander, A. Linderholm, V. E. Mullin, K. G. Daly, V. M. Battista, M. Price, K. J. Gron, P. Alexandri, R.-M. Arbogast, B. Arbuckle, A. Bălăşescu, R. Barnett, L. Bartosiewicz, G. Baryshnikov, C. Bonsall, D. Borić, A. Boroneanț, J. Bulatović, C. Çakirlar, J.-M. Carretero, J. Chapman, M. Church, R. Crooijmans, B. De Cupere, C. Detry, V. Dimitrijevic, V. Dumitraşcu, L. du Plessis, C. J. Edwards, C. Merih Erek, A. Erim-Özdoğan, A. Ervynck, D. Fulgione, M. Gligor, A. Götherström, L. Gourichon, M. A. M. Groenen, D. Helmer, H. Hongo, L. K. Horwitz, E. K. Irving-Pease, O. Lebrasseur, J. Lesur, C. Malone, N. Manaseryan, A. Marciniak, H. Martlew, M. Mashkour, R. Matthews, G. Motuzaite Matuzeviciute, S. Maziar, E. Meijaard, T. McGovern, H.-J. Megens, R. Miller, A. Fatemeh Mohaseb, J. Orschiedt, D. Orton, A. Papathanasiou, M. P. Pearson, R. Pinhasi, D. Radmanović, F.-X. Ricaut, M. Richards, R. Sabin, L. Sarti, W. Schier, S. Sheikhi, E. Stephan, J. R. Stewart, S. Stoddart, A. Tagliacozzo, N. Tasić, K. Trantalidou, A. Tresset, C. Valdiosera, Y. van den Hurk, S. Van Poucke, J.-D. Vigne, A. Yanevich, A. Zeeb-Lanz, A. Triantafyllidis, M. T. P. Gilbert, J. Schibler, P. Rowley-Conwy, M. Zeder, J. Peters, T. Cucchi, D. G. Bradley, K. Dobney, J. Burger, A. Evin, L. Girdland-Flink, and G. Larson, *Ancient pigs reveal a near-complete genomic turnover following their introduction to Europe,* PNAS 116 (35), 2016, p. 17231–17238

Frantz *et alii* 2019 – L. A. F. Frantz, V. E. Mullin, M. Pionnier-Capitan, O. Lebrasseur, M. Ollivier, A. Perri, A. Linderholm, V. Mattiangeli, M. D. Teasdale, E. A. Dimopoulos, A. Tresset, M. Duffraisse, F. McCormick, L. Bartosiewicz, E. Gál, É. A. Nyerges, M. V. Sablin, S. Bréhard, M. Mashkour, A. Bălăşescu, B. Gillet, S. Hughes, O. Chassaing, C. Hitte, J.-D. Vigne, K. Dobney, C. Hänni, D. G. Bradley, G. Larson, *Genomic and archaeological evidence suggest a dual origin of domestic dogs,* Science 352, 6290, 2019, p. 1228-1231.

Haimovici 1987 – S. Haimovici, *L'Étude de la faune découverte dans l'établissement mésolithique de Ostrovul Corbului (culture Schéla Cladovei),* in: V. Chirica (ed.), *La genèse et l'évolution des cultures paléolithiques sur le territoire de la Roumanie*, BAI 2, Iași, 1987, p. 123–138.

Helmer 1987 – D. Helmer, *Fiches descriptives pour les relevés d'ensembles osseux animaux,* Fiches d'ostéologie animale pour l'archéologie, Serie B - mammifères, CNRS, Sophia-Antipolis, 1987.

Horard-Herbin 1997 – M.-P. Horard-Herbin, *Le village celtique des Arènes à Levroux. L'élevage et les productions animales dans l'économie de la fin du second Age du Fer*, 12ème supplément à la Revue archéologique du centre de la France, Levroux 4, Tours, 1997.

Jovanović *et alii* 2019 – J. Jovanović, C. de Becdelièvre, S. Stefanović, I. Živaljević, V. Dimitrijević, G. Goude, *Last hunters–first farmers: new insight into subsistence strategies in the Central Balkans through multi-isotopic analysis*, AAS 11, 2019, p. 3279–3298.

Kessler 1985 – E. Kessler, *Contribuții noi la studiul avifaunelor cuaternare din România*, Crisia 15, 1985, p. 485.

Ketmaier *et alii* 2008 – V. Ketmaier, P. G. Bianco, J.-D. Durand, *Molecular systematics, phylogeny and biogeography of roaches (*Rutilus*, Teleostei, Cyprinidae)*, Molecular Phylogenetics and Evolution 49, 2008, p. 362–367.

Knight 2001 – J. E. Knight, *Determining the Age of a Deer*. Montana State University Extension Service Guide 200107AG, Bozeman, MT, 2001.

Lelek 1987 – A. Lelek (ed.), *Threatened fishes of Europe,* The Freshwater Fishes of Europe 9, Wiesbaden, 1987.

Lepiksaar 1994 – J. Lepiksaar, *Introduction to Osteology of Fishes for Paleozoologists*, Göteborg, 1994.

Lyman 1994 – R.L. Lyman, *Vertebrate Taphonomy,* Cambridge, 1994.

Mărgărit *et alii* 2017a – M. Mărgărit, V. Radu, A. Boroneanț, C. Bonsall 2017a, *Experimental studies of personal ornaments from the Iron Gates Mesolithic*, AAS 10(8), 2017, p. 2095–2122.

Mărgărit *et alii* 2017b – M. Mărgărit, A. Boroneanț, C. Bonsall, *Analiza morfologică și funcțională a pieselor din materii dure animale din situl mezolitic de la Ostrovul Banului (jud.Mehedinți)*, Banatica 27, 2017, p. 39–72.

Mărgărit *et alii* 2018 – M. Mărgărit, A. Boroneant, M. Balint, A. Bălăşescu, C. Bonsall, *Human-environment interactions at Mesolithic Icoana (The Iron Gates Gorges)*, SP 14, p. 37–77.

Nalbant 1970 – T. Nalbant, *Câteva observaţii asupra resturilor de peşti descoperite în locuirile romanello-aziliene (I-II) de la Cuina Turcului-Dubova*, SCIV 21, 1970, 1, p. 41–43.

Nicolăescu Plopșor 1965 – C. S. Nicolăescu Plopșor, *Epipaleolitic sau mezolitic. O problemă de terminologie?*, SCIVA 16, 1965, 4, p. 765–773.

Ollivier *et alii* 2018 – M. Ollivier, A. Tresset, L. Frantz, S. Bréhard, A. Bălăşescu, M. Mashkour, A. Boroneanț, M. Pionnier-Capitan, O. Lebrasseur, R-M. Arbogast, L. Bartosiewicz, K. Debue, R. Rabinovich, M. V. Sablin, G. Larson, C. Hänni, C. Hitte, J.-D. Vigne, 2018, *Dogs accompanied humans during the Neolithic expansion into Europe,* Biology Letters 14 (10), 20180286. http://dx.doi.org/10.1098/rsbl.2018.0286.

Ottoni *et alii* 2017 – C. Ottoni, W. van Neer, B. De Cupere, J. Daligault, S. Guimaraes, J. Peters, N. Spassov, M. Prendergast, N. Boivin, A. Morales-Muñiz, A. Balasescu, C. Becker, N. Benecke, A. Boroneant, H. Buitenhuis, J. Chahoud, A. Crowther, L. Llorente N. Manaseryan, H. Monchot, V. Onar , M. Osypińska, O. Putelat, E.M. Quintana Morales, J. Studer, U. Wierer, R. Decorte, T. Grange, E.-M. Geigl, *The palaeogenetics of cat dispersal in the ancient world*, Nature Ecology & Evolution 1, 0139, 2017, p. 1–7.

Payne 1973 – S. Payne, *Kill-off patterns in sheep and goat: the mandibles from Asvan Kale*, Anatolian Studies 23, 1973, p. 281–303.

Păunescu 1996 – A. Păunescu, *Ostrovul Corbului. Die mesolithische Siedlung der Schela Cladovei-Kultur 1.b*, in: H. Hauptmann, P. Roman (eds.), Ostrovul Corbului, Bucureşti, p. 155–214.

Păunescu 2000 – A. Păunescu, *Paleoliticul şi mezoliticul din spaţiul cuprins între Carpaţi şi Dunăre*, Bucureşti, 2000.

Păunescu 2001 – A. Păunescu, *Paleoliticul şi mezoliticul din spaţiul transilvan*, Bucureşti, 2001.

Pickard *et alii* 2017 – C. Pickard, A. Boroneanț, C. Bonsall, *Molluscan remains from early to middle Holocene sites in the Iron Gates reach of the Danube, Southeast Europe*, in: M.J. Allen (ed.), *Molluscs in Archaeology: Methods, Approaches and Applications*, Oxbow Books, Oxford, 2017, p. 179–194.

Pirogovskii *et alii* 1989 – M. Pirogovskii, L. Sokolov, V. Vasil'ev, *Acipenseriformes.* Huso huso, in: J. Holcik (ed.), *The Freshwater Fishes of Europe,* vol. 1, part. 2, Wiesbaden, 1989, p. 154–200.

Radu 2011 – V. Radu, *Le Néolithique de la Roumanie Méridionale : Exploitation des ressources aquatiques dans les cultures Boian et Gumelnița*, Saarbrucken, 2011.

Radu *et alii* forthcoming – V. Radu, M. Mărgărit, V. Voinea, A. Boroneanț, I. D. Dulama, *Processing the Testudo carapace in Prehistoric Romania (8th and 5th millennia BC)*, AAS, submitted.

Rigaud 2011 – S. Rigaud, *La parure : traceur de la géographie culturelle et des dynamiques de peuplement au passage Mésolithique-Néolithique en Europe,* Ph.D. thesis, University of Bordeaux, https://tel.archives-ouvertes.fr/tel-00668694.

Rigaud *et alii* 2014 – S. Rigaud, M. Vanhaeren, A. Queffelec, G. le Bourdon, F. d'Errico, *The way we wear makes the difference: residue analysis applied to Mesolithic personal ornaments from Hohlenstein-Stadel (Germany)*; AAS 6 (2), 2014, p. 133–144.

Schmid 1972 – E. Schmid, *Atlas of Animal Bones: For Prehistorians, Archaeologists and Quaternary Geologists*, Elsevier, Amsterdam, 1972.

Shubina *et alii* 1989 – T. Shubina, A. Popova, V. Vasil'ev, *Acipenseriformes.* Acipenser stellatus, in: J. Holcik (ed.), *The Freshwater Fishes of Europe,* vol. 1, part. 2, Wiesbaden, 1989, p. 395–441.

Sokolov, Vasil'ev 1989 – L. Sokolov, V. Vasil'ev, *Acipenseriformes*. Acipenser ruthenus, in: J. Holcik (ed.), *The Freshwater Fishes of Europe,* vol. 1, part. 2, Wiesbaden, 1989, p. 227–262.

Srejović 1972 – D. Srejović, *Europe's First Monumental Sculpture: New Discoveries at Lepenski Vir*, London, 1972.

Steffens 2006 – W. Steffens, *Freshwater fish – wholesome foodstuffs*, Bulgarian Journal of Agricultural Science 12, 2006, p. 320–328.

Şelaru 1995 – N. Şelaru, *Monografia mistreţului*, Ploieşti, 1995.

Tomé, Vigne 2003 – C. Tome, J.D. Vigne, *Roe deer (*Capreolus capreolus*) age at death estimates: New methods and modern reference data for tooth eruption and wear, and for epiphyseal fusion*, Archaeofauna 12, p. 157–173

Udrescu et alii 1999 – M. Udrescu, L. Bejenaru, C. Hriscu, Introducere în arheozoologie, Iaşi, 1999.

Vlasenko *et alii* 1989 – A. Vlasenko, A. Pavlov, L. Sokolov, V. Vasil'ev, *Acipenseriformes. Acipenser gueldenstaedti*, in: J. Holcik (ed.), *The Freshwater Fishes of Europe,* vol. 1, part. 2, Wiesbaden, 1989, p. 294–344.

Wilkens, 2002 – B.Wilkens, *Archeozoologia*, Universita degli Studi di Sassari, CD-rom

Zauner, Ratschan 2005 – G. Zauner, C. Ratschan, E*rstnachweis von Perlfischen (*Rutilus meidingeri*) in der oberösterreichischen Donau - Bestätigung einer selbst erhaltenden Donaupopulation!,* Österreichs Fischerei Jahrgang 58, 2005, p. 126–129.

Živaljević 2012 – I. Živaljević, *Big Fish Hunting: Interpretation of stone clubs from Lepenski Vir*, in: N. Vasić (ed.), *Harmony of Nature and Spirituality in Stone, Proceedings of the 2nd International Conference, in: Kragujevac, Serbia, March 15–16, 2012*, Stone Studio Association, Belgrade, 2012, p. 195–206.

Živaljević 2017 – I. Živaljević, *Ribolov na Đerdapu u ranom holocenu (10. – 6. milenijum pre n. e.)*. Unpublished PhD thesis, Faculty of Philosophy, University of Belgrade, 2017.

Živaljević *et alii* 2017 – I. Živaljević, D. Popović, A. Snoj, S. Marić, *Ancient DNA analysis of cyprinid remains from the Mesolithic-Neolithic Danube Gorges reveals an extirpated fish species* Rutilus frisii *(Nordmann 1840*), JAS 79, 2017, p. 1–9.

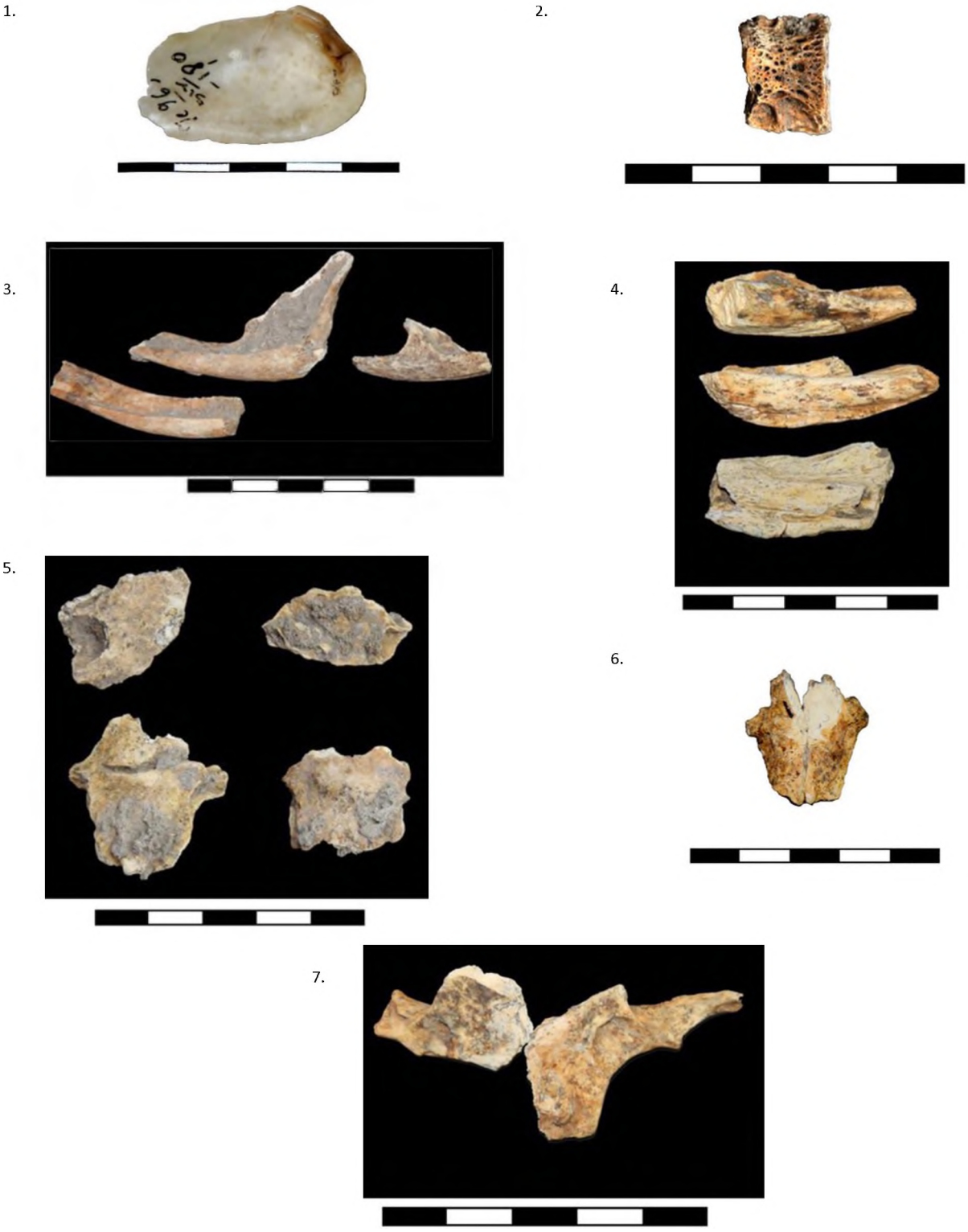

Plate 1. 1: *Unio crassus* left valve; 2: *Hucho hucho* vertebra; 3: *Huso huso* maxillary fragments; 4: *Huso huso* dentaries fragments; 5: *Acipenser gueldenstaedti* parasphenoid bones; 6: *Acipenser ruthenus* parasphenoid; 7: *Acipenser stellatus* parasphenoid bone.

Plate 2. 1: *Silurus glanis* basioccipital; 2: *Silurus glanis* parasphenoid; 3: *Silurus glanis* vertebral column (precaudal vertebrae); 4: *Cyprinus carpio* dentales; 5: *Sander lucioperca* cleithrum and articulare; 6: *Rutilus frisii* pharyngeal bones without teeth; 7: *Rutilus frisii* pharyngeal bones with teeth.

Plate 3. 1: *Rutilus frisii* isolated teeth; 2: *Testudo graeca* (left) and *Emys orbicularis* (right) nuchal bones; 3: Aves, bone diaphysis; 4: Aves, phalanges from anterior limbs; 5: Aves, rachis fragment; 6: Dog mandible (*Canis familiaris*); 7: Dog ulnas (*Canis familiaris*).

Plate 4. 1: Dog humerus (*Canis familiaris*); 2: Dog radius (*Canis familiaris*); 3: Wild boar mandible (*Sus scrofa*); 4: Wild boar astragalus (*Sus scrofa*); 5: Red deer mandibles (*Cervus elaphus*); 6: Red deer phalanx 1 (*Cervus elaphus*); 7: Roe deer mandibles (*Capreolus capreolus*); 8: Roe deer tibias (*Capreolus capreolus*).

Plate 5. 1: Chamois phalanx 2 (up) and phalanx 2 (down) (*Rupicapra rupicapra*): 2: Bovid phalanx 2 (*Bos/Bison*); 3: Wild horse lower tooth (*Equus* sp.); 4: 2nd bear phalanx (*Ursus arctos*), the one to the right with pathology; 5: Bear ulna (*Ursus arctos*): 6: Badger mandibles (*Meles meles*); 7: Badger humerus (*Meles meles*); 8: Marten mandibles (*Martes* sp.).

Plate 6. 1: Marten femurs (*Martes* sp.); 2: Lynx mandible (*Lynx lynx)*; 3: Lynx humerus (*Lynx lynx*); 4: Wild cat mandible (*Felis silvestris*); 5: Beaver mandibles (*Castor fiber*); 6: Hare femur (on left) and tibia (on right) (*Lepus europaeus*).

Annexe 1. Numerical distribution of anatomical elements by species.

Element anatomic	*Canis familiaris*	*Rupicapra rupicapra*	*Cervus elaphus*	*Capreolus capreolus*	*Sus scrofa*	*Bos/Bison*	*Equus ferus*	*Felis silvestris*	*Lynx lynx*	*Meles meles*	*Ursus arctos*	*Canis lupus*	*Vulpes vulpes*	*Lutra lutra*	*Martes sp*	*Castor fiber*	*Lepus europaeus*
Neurocranium	3	1	20	10	83	1											
Viscerocranium	11		37	6	43										1		
Dentes sup.	4		105	3	99												
Mandible	29		78	62	116	1		3	2	4				1	16	30	
Dentes inf.		11	64	10	42		1					2	4		1		
Dentes	25		65	3	97		1	1			3					1	
Atlas	4		1		19								1				
Epistropheus	2		1		12												
et Vert. cv.	9		5	2													
Vert. thor.	2		18	13	45												
Vert. lumb.	3		28	3	52												
Sacrum	1				2												
Vert. caud.					27												
Costae	16		27	15	35	1											
Scapula	6	1	37	9	81	7						1	1				
Humerus	26	1	47	19	95			1	3	3			1	1	10		
Radius	17	1	64	22	64			2	1	2					1	1	
Ulna	24		45	20	88			5		5	2	1				1	
Carpalia			128	110	1						1						
Metacarpus	29		111	6	67	2		2								2	
Pelvis	24	2	47	9	61	1		2			1				3	3	
Femur	16		43	16	86	2							2		8	1	3
Patella			17		20												
Tibia	17		82	20	76	1		2	1	1		2	2		4	2	2
Fibula	3				7												
Talus	7	3	56	16	63												3
Calcaneus	8		57	16	99								2				2
et Tarsalia			82	3	66												
Metatarsus	21		120	16	27				2		1		2			1	
Metapodalia	17		119	27	221					1	2					1	1
Phalanx 1	1	1	116	8	129	1				1	2	3					
Phalanx 2	14	1	102	10	96	5					3						
Phalanx 3			88	2	85	1					1						
Phalanx lat					60												
Sesamoidus			4	1													
Total	**339**	**22**	**1814**	**457**	**2164**	**23**	**2**	**18**	**9**	**17**	**16**	**9**	**15**	**2**	**44**	**43**	**11**
Cornua			835	6													

Annexe 2. Biometrics – all measurements were taken according to von den Driesch 1976 and are expressed in millimetres.

Canis familiaris

Humerus

GL	155												
Bp	30.97	30.89											
Dp	41.55	37.24											
Bd	30.95		26.3	33.92	20.07	31.68	28.83	31.95	28.04	27.8	31.12	28.4	
Bt	22.6		20.01	24.08	20.85	24.24	21.71	23.03	21.36	20.75	22.69	19.63	
Dd	24.89		22.24	27.43	23.2	27.05	24.35	26.12	23.78	22.01	25.88	24.28	27.87

Radius

GL	170	163											
Bp	21.38	18.81	17.36	19.5	16.56	21.79	15.66	20.06	16.28	17.43	18.04		
Dp	13.34	12.57	10.6	13.01	11.86	14.44	15.65	12.48	11.08	12.18	11.81		
SD	15.25	15.75											
Bd	26.55	24.5										22.37	
Dd	16.02											13.8	14.38

Ulna

LO	19.31	23.42				
DPA	23.51	27.23	21.24	22.35	27.45	23.37
SDO	21.31	24.2	21.65	19.89		

Metacarpus III

GL	68.91	68.72
Bd	10.39	9.63

Metacarpus IV

GL	70.16
Bd	9.73

Metacarpus V

GL	52.33	57.09	57.23
Bd	9.22	9.87	10.93

Pelvis

LA	24.82	22.62	23.63	23.01		
SC	20.04	17.79	23.68		18.67	22.86

Femur

Bp	39.16	37.35			
DC	18.99	17.8			
Bd			33.52	35.8	29.64
Dd			35.16	37.99	30.44

Tibia

GL	198									
Bp	36.43	42.45	36.04	33.1						
Dp	40.63	47.94	39.54	37.23						
SD	13.5				14.26					
Bd	23.06				23.81	24.28	20.19	22.97	21.01	23.51
Dd	18.03				18.63	18.45	15.47	16.77	16.57	16.97

Talus

GL	26.15	27.02	29.85	23

Calcaneus

GL	41.8	45.73	48.66	49.54	39.57	39.78
GB	1.24	18.98	18.94	19.29	16.59	

Metatarsus II

GL	59.71
Bd	8.01

Metatarsus IV

GL	69.45	63.56
Bd	8.14	

Metatarsus V

GL	62.62	57.04
Bd	8.87	7.43

Phalanx 1

GL	28.75	23.22	26.34	20.01		
Bp	11.72	10.22	9.54	10.71	8.26	
Sd	7.64	6.34	6.57	7.82	6.25	6.56
Bd	9.93	7.38	8.01	8.75	6.86	7.88

Canis lupus

Tibia

Bd	31.2
Dd	23.6

Rupicapra rupicapra

Mandible

LM3	21	21	19	20
IM3	8	7.6	8	8

Radius

Bp	34
BFp	32

Talus

GLl	34	34	34.5
GLm	33.5	33.5	34
Dl	20	20	19
Dm	19	19.8	18.9
Bd	22.52	23	23

Phalanx 1

GLpe	50.5
Bp	14.5
Sd	10.5
Bd	14

Cervus elaphus

Scapula

SLC	43.24	34.78	44.46	28.45	27.88							
GLP	64.04	56.72				59.63	57.76	57.45	52.82	64.42	56.29	
LG	50.45	43.12	50.26			47.08	43.9	42.27		46.88	42.5	44.25
BG	49.41	39.6	44.8	34.17		40.35	41.2	40.4	38.8			42.39

Humerus

Bd	63.81	57.45	67.91	62.16	53.76									
BT	56.8	50.79	62.21	58.66	50.34	59.02	51.34	47.56	52.32	49.31	55.21	54.24	49.19	49.89
Dd	61.69	53.88	64.69	59.1	52.54	59.64								

Radius

Bp	63.03	55.1	53.3	63.85	54.89	55.57							
BFp	59.18	51.87	50.55	58.48	52.04	51.71	48.94	50.19	51.46				
Dp	33.19	29.7	27.76	33.38	30.13	28.25	28.09	32.14	29.5	31.7	30.82	30.86	33.11

Radius

Bd	53.25	56.78	58.62	52.28	49.98	50.66	46.49	51.81	46.32	
BFd	50.57	51.96	56.4	50.96	48.61	48.59	44.76	48.98		48.2
Dd	37.9	41.01	42.77	38.2	36.75	35.35	34.17	37.5	36.71	

Ulna

LO	73.24	82.51	74.55
DPA	51.78		
SDO	50.61	56.58	

Metacarpus

Bd	44.51	39.61	42.56	45.25	42.34	44.77	43.86	42.11	48.96	42.65	46.79	44.51	49.49	41.67
Dd	30.46	27.18	28.21	29.9	27.35	30.79	29.23	28.86	31.96	28.81	31.45	28.98	33.03	27.53

Metacarpus

Bd	45.32	47.51	40.21	45.26	42.1	44.91	48.79
Dd	31.62	28.48	28.57	29.08	29.34	30.65	30.42

Femur

DC	37.48	38.68	39.2	35.74	36.4	33.54

Tibia

Bp	76.03	72.32										
Dp	63.34	74.22										
Bd			47.04	47.88	48.92	52.34	51.55	51.38	57.23	50.94	56.73	50.81
Dd			37.35	38.84	39.7	39.81	37.31	41.2	45.21	41.04	42.95	

Talus

GLl	60.97	56.61	54.71	55.33	60.71	57.01	57.49	55.04	57.65	57.46	57.19	57.34	54.4	56.4
GLm	54.93	52.52	51.64	52.8	56.92	53.49	53.86	52.63	56.76	53.56	51.67	53.44	50.31	51.78
Dl	34.94	31.42	30.68	29.98	33.56	30.27	30.31	28.83	31.66	30.99	31.25	30.17	29.04	29.58
Dm	34.74	29.42	29.02	30.11	30.73	30.04	21.99	28.84	33.64	30.5	31.08	29.45	29.56	30.32
Bd	37.31	34.02	33.05	34.89	39.13	36.48	35.11	33.69	38.85	34.48	33.83	36.22	24.13	43.04

Talus

GLl	57.41	58.28	56.07	58.03	62.9	56.99	54.03	60.44	58.21	59.97	56.06	61.18	55.72	59.13
GLm	52.84	54.82	52.07	54.44	58.93	53.03	50.96	56.36	54.69	55.66	52.4	56.18	52.69	54.1
Dl	31.2	32.89	29.66	31.78	33.51	29.51	27.74	33.55	30.17	33.02	31.14	33.71	29.65	31.14
Dm	30.01	33.06	30.12	30.59	30.34	29.72	30.92	33.68	31.55	32.71	30.72	36.23	30.35	31.18
Bd	36.47	35.81	34.47	37.15	39.05	36.06	32.63	38.81	36.17	38.21	34.54	39.78	34.71	36.3

Talus

GLl	57.94	56.6	54.47	60.93	56.38	53.25	56.7	55.77	56.16				
GLm	53.69	53.99	51.95	57.37	53.09	49.99	52.9	51.77		55.73	52.42	53.29	
Dl	31.84	30.2	29.29	32.44	30.3	28.82	30.22	29.87	30.65	31.9		27.85	
Dm	32.41	33.55	31	35.21	30.54					33.44	31.79		
Bd	36.35	37.45	35.68			33.7	30.73	33.33	36.41	40.2	36.22		37.94

Calcaneus

GL	115.8	118.6	114.4	115.3	128.3	115.8	128.8	118.3	120.6
BG	38.63	38.62	35.39	34.69	35.78	36.81	42.57	39.6	

Centrotarsus

GB	49.43	43.11	43.58	41.65	40.98	44.17	42.61	43.84	51	41.6	41.68	40.25	47.63	43.99
Dap	46.51	38.82	40.5	38.37	42.06	39.77	40.24	41.47	45.28	43.78	40.52	40.09	42.11	39.03

Centrotarsus

GB	43.67	48.34	45.28	45.56	47.19	39.1	41.57	50.55	40.32	43.66	42.73	45.32	43.73	42.78
Dap	39.02	41.12	40.6	43.39	42.8	36.79	40.12	46.04	38.8	39.61	38.26	42.23	38.74	38.64

Centrotarsus

GB	44.66	
Dap	39.08	40.51

Metatarsus

Bd	45.67	45.1	45.26	41.65	44.5
Dd	30.44	30.27	31.08	28.58	29.15

Phalanx 1

BP	24.33	20.88	20.91	20.85	22.11	26.05	21.53	21.77	22.13	23.08	22.26	22.6	21.09	20.89
SD	17.55													
Bd	22.54													

Phalanx 1

BP	21.73	23.52	22.49	24.84	24.71	23.6	23.91	22.85	21.91	21.28	20.95	23.53	
SD													
Bd													19.88

Phalanx 2

Bp	21.22	21.1	21.55	20.1	21.38	21.05	24.49	24.25	20.06	20.57	24.12	20.81	19.82	22.87
SD	16.71	15.47	16.38	15.11	16.44	16.13	17.86	18.14	15.37	15.03				
Bd	17.31	17.98	17.71	18.07	17.07	17.93	18.87	19.22	17.03					

Phalanx 2

Bp	19.76	20.97	21.47	21.7	22.3	20.81	20.11	21.35	24.5	25.05	22.24	24.17	21.25	21.76

Phalanx 3

DLS	49.95	47.87	42.05	50.08	52.04	50.03	44.75	56.53	55.07	46.68	50.98	47.42	46.91	48.23
Ld	44.08	46.6	38.76	47.24	46.08	45.66	39.38	49.04	48.88	41.81	47	41.03	42.02	41.66
MBS	14.83	14.49	13.06	14.2	14.81	14.48	12.38	15.65	14.8	12.71	17.07	13.84	14.95	13.62

Phalanx 3

DLS	46.62	47.42	49.58	48.95	53.26	51.87	59.02	54.59	49.17	54.76	57.71	51.66	47.88	46.13
Ld	43.21	43.58	44.88	46.17	48.32	44.95	53.2	47.11	46.17	50.19	52.06	46.54	41.89	43.09
MBS	13.3	14.06	16.37	14.28	15.74	13.83	17.2	14.49	13.7	15.4	13.2	14.99	13.81	13.43

Phalanx 3

DLS	54.32	48.07	46.82	46.47	54.48	50.08	51.57	53.32	51.7	42.87	38.73	41.36	41.89	46.4
Ld	47.41	43.05	44.77	45.27	51.08	41.33	43.85	46.85	44.59	36.03	32.38	38.35	37.87	44.23
MBS	14.81	13.03	16.47	15.51	16.26	13.81	14.47	15.43	16.27	11.86	10.93	12.53	10.13	15.05

Phalanx 3

DLS	42.57	48.8	49.18	43.01	44.45									
Ld	36.01	42.84	43.24	38.2	42.02	43.56	43.06							
MBS	11.53	12.88	15.15	12.74		14.4	15.72	16.46	13.15	15.85	16.64	13.76	15.41	14.2

Capreolus capreolus

Maxilar

L M1-M3	35.79

Mandibula

L P2-M3	65.27	69.6									
L M1-M3			41.08	37.59	41.29	40.78	36.9	41.04	40.86	40.76	39.63

Mandibula

L M3	15.99	16.07	16.26	14.12	16.04	16.4	16.45	17.01	16.06	18.03	16.48	16.73	16.78	
B M3	7.63	8.13	8.74	7.57	8.81	8.4	9.06	8.9	9.34	8.49	8.33	8.72	8.77	9.1

Scapula

SLC	19.44	17.64	19.93	
GLp	30.03	29.27	30.36	
LG	22.95	22.34	23.83	23.74
BG	22.93	21.18		

Humerus

Bd	31.3	30.68	28.91	31.86	32.27	30.19
Bt	25.68	25.36	23.84	24.43	28.04	26.33
Dd	28.15	27.41	26.58	27.26		

Radius

Bp	28.77	26.85	27.9	27.85	27.23	28.14	26.05		
Dp	16.52	15.91	15.88	16.93	16.44	15.97			
Bd								24.85	25.6
Dd								17.62	16.88

Ulna

LO	36.79	38.73	36.18	33.75	31.64	36.24
DPA	25.68	26.11	27.69	26.85	23.98	
SDO	22.96	22.52	23.91	24.37		22.25

Metacarpus

Bd	22.67
Dd	15.07

Femur

Bd	40.29
Dd	45.52

Tibia

Bd	29.52	31.44	27.84	29.78	27.07	26.61
Dd	21.67	24.42	21.73	22.81	21.01	21.15

Calcaneus

GL	64.68	67.06	68.75	66.58
GB	21.86	23.85		

Talus

GLl	30.93	31.42	31.07	30.9	29.51	31.7	31.28	31.58	33.53	31.87	32.2	31.02	31.97
GLm	29.88	29.69	29.64	27.78	28.64	30.33	30.37	30.13	32.41	30.25	30.12	30.1	30.66
DL	17.68	18.49	17.33	17.05	16.93	18.17	17.43	17.06	18.32	17.45	18.54	17.25	17.59
Dm	17.6	17.82	17.63	16.77	17.21	18.01	18.32	16.12	17.67	18.56	17.25	16.39	17.56
Bd	20.29	20.81	19.18	19.93	19.08	21.22	19.67	19.57	21.16	20.15	20.58	19.89	

Talus

GLl	30.41	28.97	30.1
GLm	28.43	29.2	29.51
DL	17.4	16.42	17.39
Dm	17.05	17.14	16.81
Bd	19.76	19.48	18.56

Centrotarsus

GB	24.97	27.22	25.81

Phalanx 1

GL	44.53	41.08	36.26	35.77		
Bp	14.36	12.72	12.42	11.04		
Sd	9.34	8.89	8.34	8.13		
Bd	12.03	11.4	9.67	8.78	11.5	11.05

Phalanx 2

GL	25.22	30.02	29.06	28.71	28.1	
Bp	10.25	11.9	11.89	11.89	11.35	10.74
Sd	7.7	8.63	8.39	8.51	7.27	7.79
Bd	7.66	9.09	8.64	8.02	8.05	

Sus scrofa

Scapula

SLC	32.16	33.07	35.59	33.11	25.96	30.33	27.84	29.51	29.28	28.41	28.1	24.42
GLP	46.84	45.56	46.37									
LG	39.34	37.89										
BG	32.27	30.56	33.3	31.8	26.94							

Scapula

GLP	43.35	37.91	36.17	39.41	37.08	45.18	45.95	44.01	43.68	43.16
LG	36.69	45.64	45.68	47.54	45.25	39.09	37.37	36.12		
BG	31.44	30.79	29.69	35.66	29.25	33.98	31.33	32.23	29.78	

Humerus

Bd	59.19	51.81	50.53	52.72	56.88	47.02	44.91	58.26	48.17	45.67	52.25		
Dd	51.02	50.42	49.3	50.93	53.66	47.77	44.78	51.04	47.77	44.73	50.07		
BT	40.37	37.34	39.97	37.92	41.94	36.75	34.74	41.08	38.37	34.64		38.11	43.7

Humerus

BT	40.34	35.65

Radius

Bp	30.9	35.7	34.1	35.9	36.8	37.1	34.9	33	37	36.1	35.7	40.9	
Dp	24.3	24.1	22.3	26.7	26.2	25.8	24.8	23	25.9	25.6	24.27		26.5	25

Radius

Dp	24.8	22.6	25.3						
Bd				48.3	41	42.2	44.1	43.3	40
BFd				42.2	36	36.4	38.5	37	34
Dd				33.7	27.5	31.6	31.8	31	28.6	30.2

Ulna

LO	77.91
DPA	47.27
SDO	39.41

Pelvis

LA	49.37	39.98	43.94	47.46	45.09

Femur

Bp	75.06								
DC	30.8	31.64	31.27						
Bd				55.52	54.44	56.95	59.68	61.04	60.17
Dd				67.5	70.27	74.32	75.3	78.24	74.35

Patella

GL	39.71	39.1	49.92	37.51	41.04	44.38	41.27	44.24	39.1	43.49	41.5	41.78	40.01
BG	25.49	26.07	24.99	24.98	30.04	29.08	28.55	28.5	27.62	27.77	27.14	24.67	25.19

Patella

GL	44.55	45.36			
BG			23.05	25.65	25.47

Tibia

Bp	57.62	57.96	56.1	55.52	64.74								
Dp	57.73	58.07	54.49	60.98	70.44								
Bd						37.47	32.9	34.28	34.24	37.6	34.67	32.35	34.28
Dd						31.81	28.15	29.98	29.6	31.71	29.43	28.37	30.28

Tibia

Bd	32.51	32.68	32.85	35.64	40.17	36.01	36.8	33.79	33.4	36.39	34.73
Dd	28.81	30.09	29.05	30.66	34.75	32.14	31.88	30.04	29.72	32.19	29.74

Talus

GLl	46.23	49.56	48.53	53.9	46.91	46.37	46.66	48.81	50.88	47.75	49.8	49.4	48.02	50.94
GLm	44.62	47.23	45.15	48.69	43.61	43.46	43.25	44.73	48.28	46.61	47.63	46.94	45.1	48.23
Dl	25.88	27.08	26.11	29.76	27.67	26.91	25.44	26.36	27.65	27.51	27.61	27.46	26.88	27.28
Dm	25.97	32.86	30.34	32.62	26.44	26.22	25.21	29.58	31.12	25.58	29.36	27.82	28.69	26.5
Bd	27.78	30.75	30.06	30.93	30.06	26.56	25.44	29.43	29.67	29.31	30.24	29.09	29.42	29.58

Talus

GLl	46.97	46.39	48.66	50.17	46.27	51.13	50.17	48.35	48.17	45.96	46.62	51.52	48.19	49.66
GLm	43.9	44.71	46.43	48.23	43.8	47.52	47.71	45.56	45.5	43.92	42.61	46.61	44.32	47.64
Dl	28.31	27.22	27.67	28.06	25.03	27.35	26.99	26.69	27.02	25.38	25.24	27.66	25.08	28.97
Dm	29.47	25.4	26.4	31.45	26.35	29.71	29.95	29.32	29.18	25.83	27.18	29.37		
Bd	29.58	27.62	30.61	31.71	27.41	31.27	29.9	27.36	28.7	28.71	27.35		27.79	29.39

Talus

GLl	47.58	47.5				
GLm	45.06	47.26	44.36	45.32	41.95	41.85
Dl						
Dm	27.58	24.73	24.97	28.24	24.43	24.15
Bd	27.72	28.96	28.35	29.04	25.87	
Talia Teichert	877.7	876.3				

Calcaneus

GL	93.24	92.41	92.2	101.3	102.5	94.94	95.01	100.6	102	95.94
BG	27.91	25.21	23.51	25.44	28.33	24.64	24.81	28.32	26.59	24.62

Metatarsus III

GL	98.16
Bp	19.87
Dp	23.3
SD	16.18
Bd	20.75

Phalanx 1

GLpe	43.68	44.2	42.93	43.77	39.53	38.33	43.52	45.28	51.61	48.15	48.83	45.66	46.05	47.28
Bp	21.69	19.9	17.84	21.05	20.66	18.99	22.84	19.73	23.61	21.57	21.1	19.78	20.26	21.48
Sd	16.93	16.34	14.56	19.56	14.99	13.66	18.15	16.27	16.95	16.99	18.18	15.39	15.41	16.72
Bd	19.08	17.91	16.96	44.41	18.54	16.31	20.05	18.11	20.23	19.12	21.43	17.45	17.96	18.58

Phalanx 1

GLpe	48.73	47.47												
Bp	23.57	21.99		18.77	19.1	18.53	22.25	20.78	20.05	21.29	23.1	20.53	21.05	22.19
Sd	17.43	16.9	14.78											
Bd	20.43	18.85	16.17											

Phalanx 1

Bp	18.4	20.42	20.44	20.92	22.18

Phalanx 2

GL	29.04	29.04	29.65	28.76	30.31	27.8	26.5	29.2	26.98	27.21	28.98	27.17	27.45	29.59
Bp	19.25	19.32	19.89	19.05	20.04	19.02	20.25	19.54	19.02	21.17	22.56	19.67	20.43	20.04
Sd	16.07	15.88	16.5	15.91	16.33	15.43	16.37	16.05	14.59	16.38	17.61	15.86	16.86	16.58
Bd	16.02	16.35	16.7	16.48	16.54	15.89	17.92	16.2	17.57	18.86	20.92	17.49	19.53	17.11

Phalanx 2

GL	31.97	27.76	25.28	30.03	28.12	24.31	28.81	28.2	31.76	26.38	32.18	25.75	28.25	27.85
Bp	22.05	21.65	18.34	21.52	20.84	18.62	18.82	19.66	21.15	19.69	22.82	18.03	22.07	19.9
Sd	18.02	18.08	13.88	17.98	17.27	15.52	14.81	15.76	17.09	16.8	19.99	15.44	16.4	15.57
Bd	17.74	19.74	14.62	19.33	19.22	16.59	14.84	15.92	17.84	18.02	19.66	16.21	18.87	16.09

Phalanx 2

GL	23.76	27.45	27.83	28.13	30.37	25.81	31.69	26.67	31.64	26.86	28.43	27.04	25.05	26.84
Bp	18.23	19.49	20.39	21.06	19.92	18.65	21.19	19.56	20.16	19.67	18.5	18.84	19.01	19.9
Sd	14.53	15.73	16.08	17.78	16.62	15.52	17.36	15.88	16.88	16.79	14.68	16.06	15.56	15.92
Bd	16.46	16.76	17.66	20.27	15.95	16.2	17.35	17.01	17.18	18.79	15.25	19.13	17.94	18.64

Phalanx 2

GL	28.33	26.83	29.8	27.17	24.8	29.01	27.78	25.17	24.78	30.75	30.89			
Bp	20.43	20.52	20.78	20.06	18.42	19.75	19.47	16.98	18.43	22.02		20.08	20.42	22.1
Sd	17.36	16.63	17.68	15.5	14.29	15.4	16.34	14.71			16.42	16.67	16.54	17.17
Bd	19.55	19.11	17.91						16.54	21.52	16.61	18.43	16.66	1.1

Phalanx 3

DLS	41.5	37.59	39.09	36.32	38.39	33.27	36.52	30.69	34.96	37.31	37.78	38.39	36.82	34.92
Ld	40.6	22.29	38.18	36.09	38.74	34.01	37.42	32.38	34.29	36.66	34.14	36.4	35.96	35.51
MBS	18.67	14.16	17.97	17.06	16.96	13.72	15.42	13.42	15.26	15.69	18.32	17.51	17.64	15.4

Phalanx 3

DLS	36.25	37.66	40.59	33.5	35.99	33.09	35.18	33.08	32.08	37.78	34.56	38.6	38.3	41.93
Ld	36.68	37.38	42.66	36.69	35.2	34.3	35.53	32.11	33.19	38.16	35.76	38.7	36.44	39.86
MBS	18.41	16.58	18.01	16.69	16.12	13.89	14.81	14.35	13.54	17.24	16.18			

Felis silvestris

Mandible

5	24.08	25.34	22.89
6 L	9.69	10.05	9.68
6B	4.17	4.37	
9	14.22	13.48	
10	13.05	14.25	

Meles meles

Mandible

L M1	15.34	14.12	16.78	15.14
l M1	7.14	6.86	7.79	7.01

***Martes* sp.**

Mandible

L M1	11.3	10.43	10.95	11.02	11.18	11.67	11.78	11.4	11.49
l M1	4.95	4.2	5.1	4.5	4.75	5.49	5.45	5.15	5.05

Femur

GL	85.5			
GLC	86.28	86.37		
BP	17.43			17.35
DC	8.19	8.3	7.35	
SD	6.44	6.18	5.48	5.57
Bd	15.61	16.47		
Dd	14.24	14.13		

Lutra lutra

Mandible

L M1	12.74
l M1	6.3

Ursus arctos

Phalanx 1

GL	42.7	35.2
Bp	20.3	18.9
Sd	12.9	11,4
Bd	14.8	12.3

Phalanx 2

GL	36.1	32.3	28.3
BP	22.1	17.3	16.2
SD	15.5		12
Bd	16.8	14.1	12.3

Castor fiber

Mandible

L P4-M3	35.13	36.46	36.37	35.3	31.33