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## INSTITUTE FOR THE HISTORY OF MATERIAL CULTURE

## SERGIEV POSAD STATE HISTORY AND ART MUSEUM-PRESERVE

## SITE ZAMOSTJE 2

## AND LANDSCAPE EVOLUTION IN THE VOLGA-OKA REGION DURING THE HOLOCENE

## РОССИЙСКАЯ АКАДЕМИЯ НАУК

## ИНСТИТУТ ИСТОРИИ МАТЕРИАЛЬНОЙ КУЛЬТУРЫ

СЕРГИЕВО-ПОСАДСКИЙ ГОСУДАРСТВЕННЫЙ ИСТОРИКО-ХУДОЖЕСТВЕННЫЙ МУЗЕЙ-ЗАПОВЕДНИК

## СТОЯНКА ЗАМОСТЬЕ 2

И РАЗВИТИЕ ПРИРОДНОЙ СРЕДЫ ВОЛГО-ОКСКОГО МЕЖДУРЕЧЬЯ В ГОЛОЦЕНЕ

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## ANIMAL EXPLOITATION DURING MESOLITHIC AND NEOLITHIC OCCUPATIONS AT ZAMOSTJE 2 (RUSSIA): PRELIMINARY RESULTS AND PERSPECTIVES OF RESEARCH

Charlotte LEDUC Louis CHAIX

# ЭКСПЛУАТАЦИЯ ЖИВОТНЫХ НА МЕЗОЛИТИЧЕСКИХ И НЕОЛИТИЧЕСКИХ ПОСЕЛЕНИЯХ В ЗАМОСТЬЕ 2: ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ И ПЕРСПЕКТИВЫ ИССЛЕДОВАНИЯ

Ш. Ледюк, Л. Ше

## INTRODUCTION

Since the beginning of excavations at Zamostje 2, in 1989, a very high quantity of faunal material has been collected from this multilayer (Mesolithic and Neolithic levels) peat-bog site. This concerns ten thousands of mammal remains, bird bones and hundred thousands of fish bones. Faunal remains, extremely well preserved, are present in all archaeological levels, from Late Mesolithic (lower level) to Middle Neolithic. A small part of this material has been analyzed, at present time. Initial work has been undertaken by L. Chaix, regarding part of the material from 1995–2000 excavation. This work, mostly concerning mammals from main Mesolithic and Neolithic levels, led to deciphering main trends in animal exploitation at Zamostje 2, specifically about the first hunted species, i. e. elk (Alces alces) and beaver (Castor fiber) and specific species such as dog (Chaix, 1996; 2003; 2004; 2009; 2013). A sample from recent excavation (2011) has recently been analyzed, specifically mammal remains (Leduc, unpublished), confirming previous trends observed by L. Chaix (Table 1). Both authors' main results are summarized in this paper, leading to arise some new problematic and specific topics.

In addition to these works, the discussion will take into account the results from other archaeozoological studies, focusing on specific animal groups at Zamostje 2, such as fish remains (Radu, Desse-Berset, 2012; 2013) and avifauna (Mannermaa, 2013). Combining these archaeozoological

data, even if mostly in preliminary state, gives us the opportunity to discuss some specific questions dealing with animal acquisition and exploitation modalities, focusing on environmental and cultural constraints, during Mesolithic and Neolithic occupations. The main purpose, in a long term perspective, is to decipher characteristics and evolution in such strategies between Mesolithic and Neolithic populations, in the specific context of Neolithization, i. e. with the maintenance of the subsistence based on hunting and fishing, in the Russian plain, particularly in the Upper Volga region.

### TAPHONOMY: GENERAL ASPECTS

The preservation of the faunal remains is exceptional, with the presence of very fragile bones (from birds and fishes) and also of fish scales. The bones are dark brown and the surface glossy, allowing an examination of the smallest and discreet features, and of all anthropic marks (fig. 1). Sometimes, blue deposits of vivianite (iron phosphate) are noticed, typical of a long stay in the peat.

The rate of fragmentation is low, particularly for the bones of small mammals and birds and a lot of long bones are complete. For the big mammals (e. g. elk) the breakage of skulls and postcranial bones are essentially of anthropic origin, i. e. for brain, grease or marrow extraction. In addition to such exceptional preservation conditions, it has to be mentioned that

**Table 1.** Faunal spectrum at Zamostje 2. Detailed list of species for upper Late Mesolithic layer, data from excavation area 2011, layers 5a and 6 (Leduc) and excavation area 1995–2000, layer 8 (Chaix, 2004).

**Таблица 1.** Фаунистический спектр в Замостье 2. Детальный список видов, для верхнего позднемезолитического слоя. Данные для раскопа 2011 г., слои 5а и 6 (Ледюк) и раскопа 1995–2000 гг., слой 8 (Chaix, 2004).

Таха	NISP (Leduc, 2011)	% NISP (Leduc, 2011)	NI SP (Chaix, 2003)	% NISP (Chaix, 2003)
Elk — Alces alces	839	60,2	548	34,3
Beaver — Castor fiber	416	29,8	825	51,7
Pine Marten — Martes martes	53	3,8	96	6
Badger — Meles meles	25	1,8	23	1,4
Canis sp. — (cf. familiaris — dog)	22	1,6	29	1,8
Brown bear — Ursus arctos	12	0,9	36	2,3
Wild boar — Sus scrofa	10	0,7	7	0,4
Reindeer — Rangifer tarandus	7	0,5	14	0,9
Otter — Lutra lutra	6	0,4	9	0,6
Fox — Vulpes vulpes	2	0,1	8	0,5
Wild cat — Felis sylvestris	2	0,1	0	0
Hedgehog — Erinaceus europaeus	0	0	1	0,1
Total Mammals	1394	100	1596	100

the whole sediment excavated in 1995–2000 and 2010–2013 has been sieved, leading to the acquisition of most of the smallest elements such as fishbones and giving the opportunity to work on a very representative sample of the faunal remains discarded into the site.

## **MAMMAL REMAINS**

Regarding mammal remains, first analysis show that elk (Alces alces) and beaver (Castor fiber) are largely predominant, reaching together from 70 to 90% of the NISP. The contribution of these two main hunted species is different from area 1995-2000 and area 2011 (table 1; fig. 2). This is mainly due to different methodology used in both studies. Actually, in the assemblage from excavation 2011, all faunal material has been taken into account, i. e. including remains relative to bone tool industry (bone tools and waste of debitage). This means that every single mammal bone fragment, converted or not in tool or object, wearing or not marks from debitage, manufacture (etc.), is part of the total detailed account and considered in faunal spectrum reconstruction. As the faunal assemblage from 2011 correspond to the faunal remains excavated during one unique excavation campaign (in opposition to the 1995-2000), it yielded a smaller sample of mammal bones (2011 = 1394 NSP; 1995–2000 = 1596 NSP). The difference does not appear very important here, but it has to be kept in mind, as mentioned above, that the bone tool industry is excluded from the sample analyzed by L. Chaix, thus leading to a very large underrepresentation of the total bone assemblage from this excavation.

Bone tool industry is a very important, quantitative, part of the animal bone material. Bone tool industry account for at least 25% of the whole 2011 assemblage, mostly realized from elk and beaver remains (86%). Such methodology, i. e. quantifying such material together with other faunal remains, allow to consider a more reliable and accurate faunal spectrum, and lead to much faithful interpretations

regarding animal exploitation modalities, for dietary products but also for technological purposes (regarding typological and technological aspects, see: Lozovski, 1996; David, 1998; Lozovski, 1999; Clemente et al., 2002; Clemente, Lozovskaya, 2011; Лозовский, 2003; 2008; Лозовский, Лозовская, 2010; Lozovskaya, Lozovski, 2013; Maigrot, 2013; Treuillot, 2013; etc.). Previous work relative to other Mesolithic groups, characterized by abundant bone tool industry, i. e. Maglemose culture in Denmark (9600-6650 cal BC), underlined the importance of using such methodology (Leduc, 2010; 2013) for global understanding of animal exploitation. This can lead to interesting results relative to the role of the different species in the whole economic system of the societies involved. In the Zamostje 2 context, involving hunter-gatherers occupations in diachrony, and in a context of environmental and cultural modifications (e.g. use of pottery), reconstructing in details the position and economic role of each species, in this perspective, appears essential to us.

Taking into account all bone remains, manufactured or not (e. g. 2011) thus led to a better representation of elk remains among mammals. Considering these methodological aspects, and the predominance of elk in bone tool industry at the whole site scale, elk must be considered as the first hunted species at Zamostje 2 in every chronological levels.

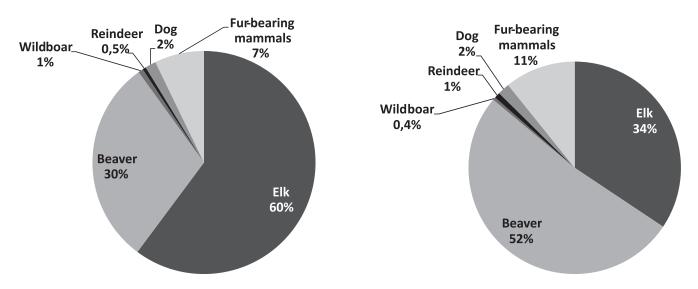
## ELK (ALCES ALCES)

During Mesolithic period, first analysis show a large number of hunted individuals: 20 elks in lower Late Mesolithic level and 15 elks identified in the upper Late Mesolithic level (Chaix, 2009); 8 individuals identified in the 2011 assemblage (upper Late Mesolithic level) adding further to these individuals. Previous work suggests that adults and males were preferential target for Mesolithic people, even if young individuals are present (lower Late Mesolithic level in 2011 assemblage). Two possible different hunting strategies have been proposed for



Fig. 1. Beaver mandible showing dark and very well preserved bone surfaces with very visible cutmarks.

Рис. 1. Челюсть бобра с темной костяной поверхностью очень хорошей сохранности, с отчетливыми следами.



**Fig. 2.** Faunal spectrum at Zamostje 2, for upper Late Mesolithic layer. Left: excavation area 2011, layers 5a and 6 (Leduc) — NISP = 1394; Right: excavation area 1995–2000, layer 8 (Chaix, 2004) — NISP = 1567.

**Рис. 2.** Фаунистический спектр в Замостье 2, для верхнего позднемезолитического слоя. Слева: раскоп 2011 г., слои 5а и 6 (Ледюк): общее число определимых остатков = 1394. Справа: раскоп 1995–2000 гг., слой 8 (Chaix, 2004) (= 1567).

different Mesolithic level. Two different slaughtering peaks have been evidenced in lower level: juvenile less than one year's old and adults from 3 to 4 years old, while one slaughtering age peak concerns adult from 2 to 3 years old in upper level, showing an increasing selective strategy. Morphologic and osteometric data, registered on pelvis bone (area 1995–2000), indicate the predominance of males (lower Late Mesolithic level: 11 males/4 females; upper Late Mesolithic level: 10 males/3 females), differing from natural sex-ratio of the species and suggesting selective hunting strategies. Search for raw material, as male adult antlers, much used in bone tool manufacture, could be one explanation to such specific and selective hunts. Regarding

seasonality evidences at Zamostje 2, elks seem to have been slaughtered mainly during summer, autumn and winter, more scarcely during spring.

Elk skeletal parts distribution shows different patterns relatively to the different studies. The material from excavation 2011 show a better representation of limb bones, specifically of foreleg bones, and of head elements (skull and teeth remains). While elements from axial skeleton and lower extremities (phalanges) appear to be less represented (fig. 3). Data from other analysis (Chaix, 2009; Moubarak et al., 2014) suggest more homogeneous distribution of anatomical elements, but still with under-representation of axial skeleton. Such discrepancies

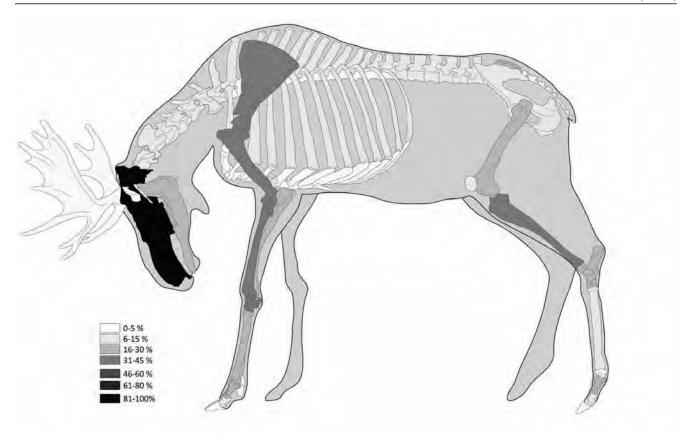


Fig. 3. Elk skeleton part distribution from Zamostje 2 excavation 2011. (NISP = 839; MNE = 211).

**Рис. 3.** Распределение костей скелета лося, представленных в Замостье 2, раскоп 2011 г. (=839; минимальное число элементов = 211).

can be explained by the use of diverse methodologies in quantification of bone elements, and the nature of studied samples (size of sample, with or without bone industry elements etc.). An exhaustive study of elk remains is thus recommended, with the use of detailed quantification criteria (Number of Identified Specimen; Minimum Number of Element; Minimal Number of Individual; Frequency of bone tool industry pieces etc.). This should lead to more reliable interpretations relatively to elk carcass exploitation. For instance, it might be possible to identify some spatial disparities in discarding processes, or specific carcass treatment such as primary butchering off-site and/or selective transport of some skeleton portions etc.

Detailed analysis of anthropic marks (cut marks, breakage marks, "technical" marks such as debitage and manufacture marks) suggest that elks have been exploited for a large panel of products, for diet purposes (meat, grease, fat, marrow) and technical purposes (hides, teeth, bones, antlers). Exploitation of elk for bone tool industry was particularly important at Zamostje 2 (Lozovski, 1996; 1999; Лозовская, 1997; David, 1998; Clemente et al., 2002; Лозовский, 2003, 2008; Лозовский, Лозовская, 2010; Lozovskaya, Lozovski, 2013; Maigrot, 2013; Treuillot, 2013 etc.). Regarding material from excavation 2011, 30% of the elk bones were involved in bone tool manufacture. A large part of skeletal elements was used as raw material: long bones (tibia, metapodial, radius, ulna and more occasionally humerus and femur), flat bones (scapula, ribs and some vertebras), some skull elements (pre-maxillar bones), teeth and antlers.

Cutmarks from butchering activities are also very numerous (Chaix, 2009; Moubarak et al., 2014). In 2011 material, 19,5%

of elk anatomical elements wear cutmarks. Distribution of cutmarks show that elks were intensively disarticulated, reducing carcasses in smaller anatomical segments, allowing the removal of meat and the selection of raw material. Removal of meat is clearly visible from long and longitudinal cutmarks on fleshy bones (scapula, humerus, pelvis, femur). At the very first step of the butchering *chaîne opératoire*, hide should have been removed, as suggested by long transversal cutmarks on lower extremities (metapodials and phalanges) and skulls. At last, long bones, but also mandibles and phalanges where broken for marrow extraction. Marrow should also have been extracted from bones used as raw material, during debitage process.

In the early Holocene, elk (Alces alces) was widely distributed in Western, Central and Eastern Europe. In the Preboreal, it slowly vanished from the southwestern parts of Europe, leading to its extinction in France and, later, in England, and during the Atlantic period, in Denmark (Aaris-Sørensen, 1980; Schmölcke, Zachos, 2005). This is mostly due to environmental changes, leading to the reduction of suitable habitat for elk population i. e. boreal and mixed deciduous forests, bog areas, in temperate and subarctic climates — as well as hunting pressure, during Boreal and Atlantic period. At that time, population densities apparently decreased in the rest of Central Europe (Schmölcke, Zachos, 2005) but the species was and still is present in North-Eastern Europe, specifically in Russia. Elk is thus scarcely represented in Mesolithic assemblage from France, specifically from southern parts of the country (Bridault, 1992), while the species is often well represented, specifically during Preboreal and Boreal chronozone, in Mesolithic Scandinavian sites

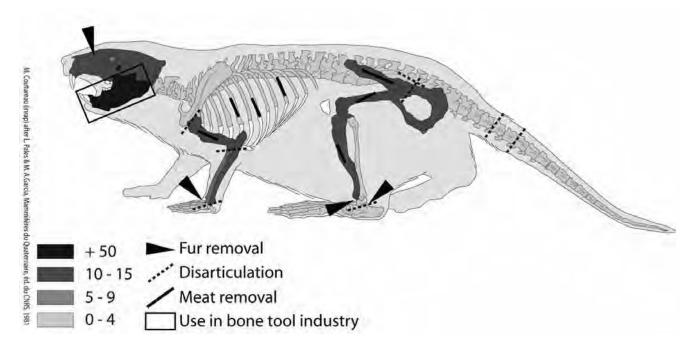


Fig. 4. Beaver skeleton part and cutmarks distribution (Zamostje 2, excavation 2011; Chaix, 2004).

Рис. 4. Распределение представленных частей скелета бобра и порезов (Замостье 2, раскоп 2011 г.; Chaix, 2004).

(Møhl, 1978; Aaris-Sørensen, 1980; Møller-Hansen, 2003; Møller Hansen et al., 2004; Leduc, 2014) and is predominant in archaeological faunal spectrum from Mesolithic and Neolithic sites in Russia (Жилин, 1995; Zhilin, 2002; Kirillova, 2002; Sablin, Syromyatnikova, 2009; Chaix 2009).

At Zamostje 2, during Mesolithic and Neolithic period, the environment of the site was particularly suitable for elk. During Mesolithic occupations, the site was located at the edge of a large lake, with shallow water, reed and grassy marshes, progressively becoming overgrown with alder forests in Early Neolithic (Ershova, 2013; см. также главу 2). Elk populations should have been quite important in the region, spending a lot of time feeding with aquatic plants from the near shallow water. The predominance of such species in faunal spectrum from Zamostje 2 thus shows a very good adaptability of Mesolithic and Neolithic societies to local and very abundant resource. Elk is the first hunted species, exploited for a large quantity of products, with very standardized modalities and for these reasons, is indisputably a key-species in the techno-economic system at Zamostje 2, for Mesolithic and Neolithic people. Its symbolic role is also evident, as suggested by diverse production bearing the effigy of elk head such as bone or antler objects and sculpture (Lozovski, 1996; 1999, etc.).

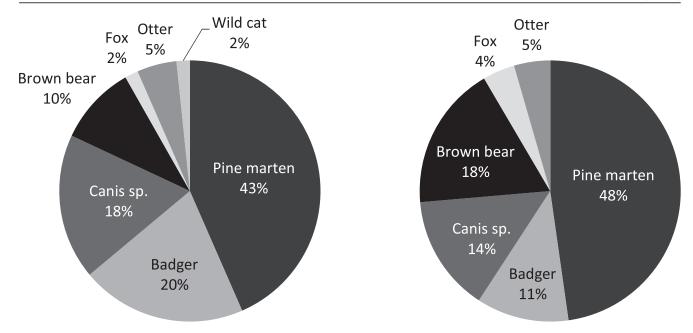
These first results have to be confirmed at the scale of the whole site. A detailed examination of all elk remains, respectively to all different chronological levels, should allow to get more accurate vision of acquisition and exploitation strategies of such very important resource. The exact position of elk in subsistence economy has to be reconstruct with accuracy, in order to emphasize (or not) variations in hunting strategies, exploitation modalities from Late Mesolithic to Neolithic level, maybe relative to environment or cultural changes.

## BEAVER (CASTOR FIBER)

Beaver is in second position in the Zamostje 2 general faunal spectrum. As mentioned for elk, the beaver should have been very abundant in the area of the site, at the edge of the lake. The species hunted at Zamostje 2 show relatively small size,

according to osteometric data (Chaix, 2004) and in comparison to European populations (Freye, 1978) and could be attributed to the sub-species *C.f. vistulanus*, nowadays living in the Vistula basin and Poland. First analysis of hunting strategies show two main slaughtering ages, just as well in Mesolithic as in Neolithic levels, with animals hunted from 6 months to 2 years old, and animals hunted from 7 to 15 years old. Such distribution is also known from other Mesolithic sites in Russia (Djoshkin, Safonow, 1972). It has to be noted that such distribution is close to the natural distribution observed for recent Russian beaver population during summer (Freye 1978). This could thus suggest that beavers were not selectively hunted, and maybe hunted during summer, as it has been proposed in Neolithic sites from Northwestern Russia (Sablin & Syromyatnikova, 2009).

Regarding beaver exploitation, at Zamostje 2, beaver mandibles are all manufactured, transformed in tools interpreted as burins (Clemente Conte et al., 2002; Clemente Conte, Lozovskaya, 2011; Лозовская, Лозовский, 2015). These tools are very abundant (more than 2000 specimens). According to recent work on faunal remains from excavation 2011, mandible appears to be the main represented anatomical part in the beaver assemblage, by far. These elements are clearly over-represented (fig. 4): 51 individuals identified from mandibles (51 left and 24 right complete mandibles) to only 12 individuals represented by post-cranial elements (MNI). The study of all beaver remains, collected at Zamostje 2, in different excavations area and stratigraphic levels has to be completed, in order to confirm this phenomenon, excluding biases due to studied samples. Such gap between mandibles and other skeletal part distribution arise questions relative to the acquisition of such specific elements, for making tools, and the acquisition of beaver themselves. Hypothesis of circulation of such tools, from and toward off-site (other connected sites or contemporaneous settlements sites?) might be discussed. Such use of beaver mandibles is known from other contemporaneous sites from Volga-Oka area, where beaver is sometimes the first species in the faunal spectrum (e. g. Minino 2, Сорокин, 2013). Reconstruction



**Fig. 5.** Carnivores spectrum at Zamostje 2 for Upper Late Mesolithic layer. Left: excavation area 2011, layers 5a and 6 (Leduc) — NISP = 122; Right: excavation area 1995–2000, layer 8 (Chaix, 2004) — NISP = 201.

**Рис. 5.** Спектр хищников в Замостье 2 для верхнего слоя позднего мезолита. Слева: раскоп 2011 г., слои 5а и 6 (Ледюк) (= 122). Справа: раскоп 1995–2000 гг., слой 8 (Chaix, 2004) (= 201).

of slaughtering ages and sex-ratio, from mandibles (teeth eruption and wear patterns) but also from other anatomical part (epiphysis fusion stages; osteometry) has to be performed in order to evidence some possible specific behavior regarding selection of beaver, for dietary products exploitation and/or removal of mandibles for tools. Examination of complete series of beaver remains would also allow to document other purposes in exploitation, such as fur removal, meat consumption etc. Previous work (Chaix, 2004) evidenced a lot of cutmarks on beaver anatomical parts, referring to skinning, disarticulation and meat removal (fig. 4).

## **CARNIVORES**

Carnivores, and particularly fur-bearing mammals are numerous at Zamostje 2, reaching from 9 to 11% of the faunal remains identified to species in both assemblages from excavation 2011 and 1995-2000 (fig. 2). At that time, and specifically regarding Upper Late Mesolithic layer, 9 species have been identified: brown bear (Ursus arctos), badger (Meles meles), wolf (Canis lupus), dog (Canis familiaris), fox (Vulpes vulpes), polecat (Mustela putorius), otter (Lutra lutra), pine marten (Martes martes). Wild cat (Felis sylvestris), has been identified from two teeth remains from excavation 2011. In both Mesolithic assemblages, i. e. 1995–2000 and 2011, pine marten is the first carnivore represented, dominating the furbearing species (fig. 5). Brown bear, badger and dog remains are then represented in similar proportions, from 10 to 20% of the carnivore remains. Mustelids bones are often complete (fig. 6) and wearing a lot of cutmarks referring to fur removal: on ventral side of mandibles and distal extremities of long bones. Cutmarks from defleshing also exist, evidencing the consumption of meat from carnivores. Some canines also have been transformed into pendants.

The exploitation of fur-bearing mammals appears quite important at Zamostje 2 and may have increase from Mesolithic to Neolithic period. At this step of the research,

such data is not available, i. e. complete carnivore assemblages chronologically distinct. But this is one question to decipher in the future research. Indeed, the relationship between carnivore rates in faunal spectrum and environment (in terms of exploited biotopes) could be significant. For instance, later Early Neolithic sites from Northwestern Russia always give a high representation of fur-bearing carnivores (marten, polecat, otter, wolf and brown bear) reaching from 12% to 31% of the mammal remains (Sablin, Syromyatnikova, 2009). Among these species, the pine marten is often very well represented (around 20% of the mammals). It is also the case in contemporaneous Mesolithic peat-bog sites from Volga-Oka area (Zhilin, 2002). In Middle Neolithic sites, the proportion of carnivores is still very important, sometimes reaching very high value such at Naumovo layer B (39,1%) and Usvyaty B (41%). In these sites, established in very different environment than Zamostje 2, with higher forest ressources, the proportion of brown bear is getting very important (respectively 10,4 and 14,1% of the mammal remains), while the pine marten is still the main hunted carnivore, with respectively in both sites 28,7% and 17,8% of the mammal bones. The exploitation of these two species, pine marten and brown bear, of course does not imply same hunting and exploitation strategies as we are dealing with the smallest (50 cm long and 1,5 kg) and the biggest (250 kg) furbearing carnivores.

Carnivore contribution and the way they were exploited at Zamostje 2 might have change from first Mesolithic occupations to those attributed to different Neolithic period and is consequently a topic for future research.

Dog is the only domesticated species identified at Zamostje 2, in Mesolithic or Neolithic layers. A recent publication concerning dog remains from excavation 1995–2000 underlined interesting aspects (Chaix, 2013). During Mesolithic, several individuals are present (3 in the lower level and 7 in the upper level). Two individuals only have been identified in Neolithic level. Mesolithic dogs



Fig. 6. Complete long bones from mustelidae at Zamostje 2 (picture L. Chaix).

Рис. 6. Целые трубчатые кости куньих в Замостье 2 (фото Л. Ше).

seems to be strong animals, probably males, with marked muscular prints and a clear frontal stop, as observed from Palaeolithic dogs from various European areas (Benecke, 1987; Sablin, Khlopachev, 2002; Germonpré et al., 2009). These dogs show large size, near the zone of variation of the wolf females. On the contrary, Neolithic dogs seem to be more slender, as other contemporaneous Neolithic dogs. Most of the Zamostje 2 dogs are adults and some of their bones wear cutmarks. These marks are found on skulls, mandibles, phalanges, mostly referring to fur removal but also to meat removal.

## OTHER UNGULATES

In addition to elk, other ungulates are present at Zamostje 2, but in very small proportions. This concerns two species: wild boar (Sus scrofa) and reindeer (Rangifer tarandus). Regarding other European Mesolithic and Neolithic contexts, the absence of some taxa, at Zamostje 2, can be noted, such as aurochs (Bos primigenius), red deer (Cervus elaphus) or roe deer (Capreolus capreolus). Such absences can be due to specific environmental parameters, or specific biotopes exploitation by Zamostje 2 people,

preferring lacustrine biotopes to forest biotopes and can be a characteristic of peat-bog sites from Volga-Oka area, as other contemporaneous sites also show very low rates or absence of these taxa (Zhilin, 2002).

## **BIRDS AND FISHES**

In this section, we just address main results from previous and on-going colleague's research, as these results arise some interesting topics regarding animal and environment exploitation at Zamostje 2. In the actual state of research, birds are not very numerous in the faunal spectrum, regarding other taxa. Preliminary research (Mannermaa, 2013) shows a change in fowling strategies from Mesolithic to Neolithic period. Mesolithic people exploited preferentially aquatic environment, hunting mostly Anatidae. On the contrary, Neolithic people went fowling in forests, as shown by the increase of capercaillie (Tetrao urogallus), in the birds spectrum (Mannermaa, 2013). At present, a sample of bird assemblage have been analyzed but bird bones are very abundant in various layers. On-going research on bird exploitation is thus very promising and should give some very interesting data regarding environment exploitation and modification from Mesolithic to Neolithic.

Bird bones are often numerous in early Mesolithic contexts from the area. Many sites dated to this period, in the upper Volga area yielded bird bones, attributed to a very high number of species. More than thirty species were identified at Ivanovskoye 7 (layer IV), a peat-bog site located 150 km

to the North-east of Moscow, with a predominance of waterfowl species (67,3% of the NISP; NISP = 921), mostly ducks (Karhu, 2002; Zhilin, Kahru, 2002). Such a predominance of aquatic birds is also very clear from Stanovoye 4 (layer III), in the Podozerskoye peat bog complex, 50 km South-East of Ivanovskoye 7, where 24 identified species (NISP ca. 500) have been identified (Zhilin, Kahru, 2002). Such assemblages, as the one from Zamostje 2 Mesolithic and Neolithic layers, reflect fowling in the immediate surroundings of occupation areas, i. e. in the lake side or on water. As highlighted at Zamostje 2, such Mesolithic layers yielded a very few bones from capercaillie (*Tetrao urogallus*), suggesting that fowling in forest was not very common during (Early?) Mesolithic times.

Finally, fish bones are extremely abundant at Zamostje 2. Considering the number of specimen (NSP), they are largely predominant in the faunal assemblage. The proportion of fish remains (bones, scales) have been estimated for the upper Late Mesolithic level (excavation 1995–2000), reaching 62% of the total faunal remains (Chaix, 2004) and possibly more according to sieved samples (fig. 7). Diverse systematic sampling, using stratigraphic profiles (25 cm x 25 cm columns) led to the identification of 14361 fish bones, distributed in at least 11 species (Radu, Desse-Berset, 2012; 2013). Pike (Esox lucius), perch (Perca fluviatilis) and cyprinids are predominant, as observed in other Mesolithic peat-bog sites from the area (Zhilin, 2002). Fish bones analysis suggest different fishing methods at Zamostje 2, during the Mesolithic period (from boat, using nets, fish traps, fish hooks... Lozovski et al., 2013a,

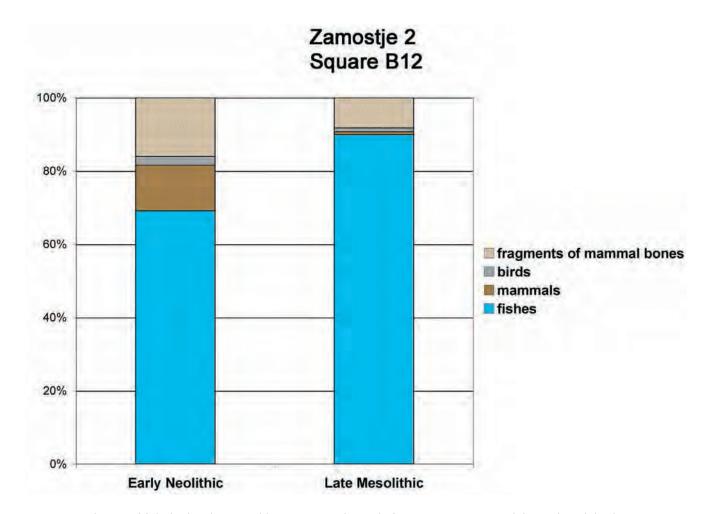


Fig. 7. Distribution of fish, bird and mammal bones in sieved sample from square B12, Mesolithic and Neolithic layers.

**Рис. 7.** Распределение костей рыб, птиц и млекопитающих в промывке квадрата Б12 (раскоп 1995–2000 гг.), мезолитические и неолитические слои.

b; Gyria et al., 2013), occurring in springtime, while harpooning pike seems to predominate in Neolithic period, also during springtime. It is thus very important to keep in mind that people living at Zamostje 2, and other contemporaneous peat-bog sites (Sychevskaya, 2002) are above all fishers, and not only huntergatherers. Considering the fish remains, and all the associated material culture (fishnets, fishing weapons, fishtraps...), fishing must have been a very important activity at Zamostje 2, during Mesolithic and Neolithic period.

## CONCLUSIONS: PERSPECTIVES OF RESEARCH

First results exposed here regarding this exceptional material offers various research problematic to explore. First, one main topic is to evidence (or not?) possible variations in animal resource exploitation, according to stratigraphic level, i. e. to chronological occupations layers, from Mesolithic different levels to those attributed to Neolithic period. At Zamostje 2, both Mesolithic and Neolithic subsistence economy rely on hunting, fishing and gathering, as no domestic animals (except dog) have been identified. It is also the case in other Early Neolithic sites from other regions in Russia (Sablin, Syromyatnikova, 2009) and margins, such in Eastern Baltic region, where the earliest (ca 5900 cal BC) domestic bone finds are bovine tooth pendants found in graves as part of funerary goods and then not clearly evidencing cattlebreeding (Kriiska, 2009). The detailed reconstruction of faunal spectrum has thus to be performed as differences can exist in acquisition strategies involved, maybe marking differences in environment exploitation modalities due to cultural change (e. g. introduction of pottery).

In this perspective, the characterization of the exploited biotopes, for each period, is a key aspect. Since Mesolithic, exploitation of aquatic biotopes is predominant, as suggested by faunal spectrum: elk (a large ungulate deeply depending on aquatic environment), beaver and fish. This could refer to on-site exploitation, on the lakeside. However, the trend observed in bird exploitation (Mannermaa, 2013), suggesting a change in the exploited biotope, from Mesolithic to Neolithic, increasing fowling in forests, has to be confirmed and maybe confronted with other data. For instance, it could be interesting to examine all the pine marten (*Martes martes*) remains, as this taxon is strongly connected to forest environment, in order to precise its position in the different faunal spectrum.

Finally, detailed examination of elk and beaver remains, the two mammals largely predominant at Zamostje 2, has to be achieved. These two species are also the significantly main species hunted from other Mesolithic and Neolithic peatbog sites from Central Russia (Жилин, 1995; Zhilin, 2002; Kirillova, 2002; Sablin, Syromyatnikova, 2009), as from Early Mesolithic sites in the Eastern Baltic area (Kriiska, 2009). For instance, in Neolithic sites from Northwestern Russia (Serteya VIII, Serteya X, Rudnya Serteya), i. e. from later period than Zamostje 2 occupations, elk is still the first hunted species, from 41 to 64% of the mammal remains. Hunting strategies in such context also show selective hunts towards adults (78,5% of the individuals from Early Neolithic sites, cf. Sablin, Syromyatnikova, 2009).

This highlights the importance of these species in the techno-economic system in Early Holocene societies from this area. The complete analysis of elk and beaver bones has to be focused on the reconstruction of hunting strategies (age and sex attribution) and exploitation strategies (body part representation, distribution of cutmarks, contribution in bone

tool industry etc.). Such analyses would undoubtedly led to get important information regarding occupation modalities at Zamostje 2, giving results in terms of function of the site, nature of occupations, seasonality etc. The restitution of carcass integrity, concerning elk, would allow to discuss about hunting episodes, close or far from the site, through selective transport. Regarding beaver, if the species was abundant in the site environment, close to occupations, the over-representation of tools made from mandibles, arise some questions related to cycle occupations and circulation of artefacts between sites.

To conclude, these preliminary scattered works and results, lead to highlight the huge potential of the Zamostje 2 site, considering the exploitation of animal resources at the crucial transition between Mesolithic and Neolithic periods in Russia. Further archaeozoological analysis, relying on exhaustive assemblage, detailed quantification of remains and focusing on specific aspects, such as hunting strategies, exploitation modalities, seasonality etc. should allow the reconstruction of key aspects of socio/techno-economic systems of these hunters-fishers-gatherers societies.

## **BIBLIOGRAPHY**

Aaris-Sørensen K. 1980 Depauperation of the mammalian fauna of the island of Zealand during the Atlantik period, Vidensk // Meddr dansk naturh. Foren, 142. P. 131–138.

Benecke N. 1987 Studies on early dog remains from Northern Europe // Journal of Archaeological Science 14. P. 31–34.

Bridault A. 1992 The status of Elk during the Mesolithic // Anthropozoologica, 19.

Chaix L. 1996 Appendice: la faune de Zamostje // V.M. Lozovski. Zamostje 2. Les derniers chasseurs-pêcheurs préhistoriques de la plaine russe. Guide archéologiques du «Malgré-Tout». Treignes: CEDARC, 1996. P. 85–95.

Chaix L. 2003. A short note on the Mesolithic fauna from Zamostje 2 (Russia) // L. Larsson, H. Lindgren, K. Knutsson, D. Loeffler, A. Akerlund (éds.), Mesolithic on the move. Oxford: Oxbow Books, 2003. Papers presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm, 2000. P. 645–648.

Chaix L. 2004 Le castor, un animal providentiel pour les Mésolithiques et les Néolithiques de Zamostje (Russie) // J.P. Brugal, J. Desse (eds.) Petits animaux et sociétés humaines. Du complément alimentaire aux ressources utilitaires. Actes des XXIV Rencontres Internationales d'Archéologie et d'Histoire d'Antibes, 23–25 octobre 2003, APDCA, Antibes. P. 325–336.

Chaix L. 2009. Mesolithic elk (*Alces alces L.*) from Zamostje 2 (Russia) // M. Cartan, S.R. Schulting, G. Warren, P. Woodman (eds.). Mesolithic Horizons. Seventh International Conference on the Mesolithic in Europe, Belfast 2005. Vol. I. Oxbow Books, Oxford and Oakville, 2009. P. 190–197.

Chaix L. 2013 Cynophagy at Zamostje 2 (Russia) (Mesolithic and Neolithic) // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 231–236.

Clemente Conte I., Lozovskaya O. 2011 Los incisivos de castor utilizados como instrumentos de trabajo. Rastros de uso experimentales para una aplicación arqueológica: el caso de Zamostje 2 (Rusia) // A. Morgado Rodríguez, J. Baena Preysler, D. García González (eds.). La investigación experimental aplicada en la arqueología. Universidad de Granada, Universidad Autónoma de Madrid, Asociación Experimenta. Málaga. P. 231–238.

Clemente Conte I., Gyria E.Y., Lozovzska O.V., Lozovski V.M. 2002 Análisis de instrumentos en costilla de alce,

mandíbulas de castor y en caparazón de tortuga de Zamostje 2 (Rusia) // I. Clemente-Conte, R. Risch, J.F. Gibaja (eds.) Análisis Funcional: su aplicación al estudio de sociedades prehistóricas. Oxford: Archaeopress, 2002. P. 187–196.

David E. 1998 Etude technologique de l'industrie en matières dures animales du site mésolithique de Zamostje 2 — fouille 1991 (Russie) // Archéo-Situla, 1996: 26. P. 5–62.

Djoshkin W.W., Safonow W.G. 1972 Die Biber der Alten und Neuen Welt. Die Neue Brehm Bücherei. Ziemsen Verlag. Wittenberg, Lutherstadt, 1972.

Ershova E. 2013 Zamostje 2, 2013. Results of the botanical and pollen analysis // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 183–194.

Freye H.A. 1978 *Castor fiber* Linnaeus 1758 — Europäisches Biber // J. Niethammer, F. Krapp (eds.) Handbuch der Säugetiere Europas. Wiesbaden: Akademische Verlagsgesellschaft, 1978. P. 184–200.

Germonpré M., Sablin M.V., Stevens R.E., Hedges R.E.M., Hofreiter M., Stiller M., Després V.R. 2009 Fossil dogs and wolves from Palaeolithic sites in Belgium, the Ukraine and Russia: osteometry, ancient DNA and stable isotopes // Journal of Archaeological Science, 36. P. 473–490.

Gyria E., Maigrot Y., Clemente Conte I., Lozovski V., Lozovskaya O. 2013. From bone fishhooks to fishing techniques: the example of Zamostje 2 (Mesolithic and Neolithic of the central Russian plain) // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 111–120.

Карху А.А. 2002 Орнитокомплекс поселения Ивановское VII // М.Г. Жилин, Е.Л. Костылева, А.В. Уткин, А.В. Энговатова (ред.) Мезолитические и неолитические культуры Верхнего Поволжья. По материалам стоянки Ивановское VII. М.: Наука, 2002. С. 102–105. (In Russian with English summary).

Кириллова И.В. 2002 Фауна млекопитающих поселения Ивановское VII // М.Г. Жилин, Е.Л. Костылева, А.В. Уткин, А.В. Энговатова (ред.) Мезолитические и неолитические культуры Верхнего Поволжья. По материалам стоянки Ивановское VII. М.: Наука, 2002. С. 92–102. (In Russian with English summary).

Kriiska A. 2009 The beginning of farming in the Eastern Baltic // P.M. Dolukhanov, A.M. Shukurov, G.R. Sarson (eds.) The East European Plain on the Eve of Agriculture. BAR, International Series 1964. Oxford, 2009. P. 159.

Leduc C. 2010 Acquisition et exploitation des ressources animales au Maglemosien: essai de reconstitution des chaînes opératoires globales d'exploitation d'après l'analyse des vestiges osseux des sites de Mullerup et Lundby Mose (Sjælland — Danemark) // Archéologie, Ethnologie, Anthropologie. Université Paris 1 Panthéon-Sorbonne, Paris, 2010. P. 670.

Leduc C. 2013 Ungulates exploitation for subsistence and raw material, during the Maglemose culture in Denmark: the example of Mullerup site (Sarauw's Island) in Sjælland // Danish Journal of Archaeology, 2012, 1(1). P. 62–81.

Leduc C. 2014 An Early Maglemose specialized site at Lundby Mose (Sjælland, Denmark): Contribution to the understanding of animal resource exploitation patterns during Maglemose culture // Journal of Archaeological Science, 41. P. 199–213.

Лозовская О.В. 1997 О функциональном назначении орудий 45° из мезолитических слоев стоянки Замостье 2 // Древности Залесского края. Материалы к международной конференции Каменный век европейских равнин: объекты из органических материалов и структура поселений

как отражение человеческой культуры, 1–5 июля 1997, Сергиев Посад. С. 74–85.

Lozovskaya O., Lozovski V.M. 2013 Barbed points from the site of Zamostje 2 // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 77–110.

Лозовская О.В., Лозовский В.М. 2015 Универсальные орудия из челюстей бобра на поселении Замостье 2: технология изготовления и использование // Следы в истории. К 75-летию Вячеслава Евгеньевича Щелинского. О.В. Лозовская, В.М. Лозовский, Е.Ю. Гиря (ред.) СПб: ИИМК РАН, 2015. С. 163–180.

Lozovski V.M. 1996 Zamostje 2. The Last Prehistoric Hunter-Fishers of the Russian Plain. Guides archéologiques du «Malgré-Tout». Treignes: CEDARC, 1996.

Lozovski V.M. 1999 The Late Mesolithic bone industry in Central Russia // P. Bintz, A. Thévenin (eds.) L'Europe des derniers chasseurs. Epipaléolithique et Mésolithique. Actes du 5e Colloque international UISPP, Commission XII. Grenoble, 18–23 septembre 1995, Paris, 1999. P. 417–424.

Лозовский В.М. 2003 Переход от мезолита к неолиту в Волго-Окском междуречье по материалам стоянки Замостье 2: дис. ... канд. ист. наук. СПб, ИИМК РАН: 2003.

Лозовский В.М. 2008 Изделия из кости и рога мезолитических слоев стоянки Замостье 2 // А.Н. Сорокин (ред.) Человек, адаптация, культура. М.: ИА РАН, 2008. С. 200–222.

Лозовский В.М., Лозовская О.В. 2010 Изделия из кости и рога ранненеолитических слоев стоянки Замостье 2 // И.С. Каменецкий, А.Н. Сорокин (ред.) Человек и древности. Памяти Александра Александровича Формозова. М.: Гриф и К, 2010. С. 237–252.

Lozovski V., Lozovskaya O., Clemente Conte I., Maigrot Y., Gyria E., Radu V., Desse-Berset N., Gassiot Ballbè E. 2013a Fishing in the Late Mesolithic and Early Neolithic of the Russian Plain: the case of site Zamostje 2 // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 19–46.

Lozovski V., Lozovskaya O., Clemente Conte I., Mazurkevich A., Gassiot Ballbè E. 2013b Wooden fishing structures on the Stone age site Zamostje 2 // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 47–76.

Maigrot Y., Clemente Conte I., Gyria E., Lozovskaya O., Lozovski V. 2013 Analyse fonctionnelle des outils biseautés à 45° de Zamostje 2 // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 121–142.

Mannermaa K. 2013 Fowling in lakes and wetlands at Zamostje 2, Russia c. 7900–6500 uncal // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 215–230.

Moubarak-Nahra R., Castel J.C., Besse M. 2014 Reconstructing carcass processing related to elk (*Alces alces*) exploitation during the Late Mesolithic: The case of Zamostje 2 (Central Russia) // Quaternary International, 337. P. 170–188.

Møhl U. 1978 Elsdyrskeletterne fra Skottemarke og Favrbo; Skik og brug ved borealtidens jagter // Aarbøger For Nordisk Oldkyndighed og Historie, Det Kongelige Nordiske Oldskriftselskab. København, 1978. P. 5–32.

Møller Hansen K. 2003 Pre-Boreal elk bones from Lundby Mose // L. Larsson (ed.) Mesolithic on the Move, papers presented at the Sixth International Conference on the Mesolithic in Europe. Stockolm: Oxbow books, 2000. P. 521–526.

Møller Hansen K., Brinch Petersen E., Aaris-Sørensen K. 2004 Filling the gap: Early Preboreal Maglemose elk deposits at Lundby, Sjælland, Denmark // T. Terberger, B.V. Eriksen (eds.) Hunters in a changing world. Jäger in einer sich wandelnden Welt., Verlag Marie Leidorf, Rahden/Westfalen. P. 75–84.

Radu V., Desse-Berset N. 2012 The fish from Zamostje and its importance for the last hunter-gatherers of the Russian Plain (Mesolithic-Neolithic) // C. Lefèvre (ed.) Proceedings of the General Session of the 11th International Council for Archaeozoology Conference (Paris, 23–28 August 2010). BAR S2354. Oxford: Achaeopress, 2012. P. 147–161.

Radu V., Desse-Berset N. 2013 Fish and fishing at the site of Zamostje 2 // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 195–214.

Sablin M.V., Khlopachev G.A. 2002 The earliest Ice Age dogs: evidence from Eliseevichi I // Current Anthropology, 43. P. 795–799.

Sablin M.V., Syromyatnikova E.V. 2009 Animal Remains from Neolithic Sites in Northwestern Russia P.M. Dolukhanov, A.M. Shukurov, G.R. Sarson (eds.) The East European Plain on the Eve of Agriculture. BAR, International Series 1964. Oxford, 2009. P. 153–158.

Schmölcke U., Zachos F.E. 2005 Holocene distribution and extinction of the moose (*Alces alces*, Cervidae) in Central Europe // Journal of Mammalian Biology, 70. P. 329–344.

Сорокин А.Н. 2013 Стоянка и могильник Минино 2 в Подмосковье: костяной и роговой инвентарь. М.: ИА РАН, 2013.

Сычевская Е.К. 2002 Состав промысловых уловов и характер рыбного промысла у жителей почеления Ивановское VII // М.Г. Жилин, Е.Л. Костылева, А.В. Уткин, А.В. Энговатова (ред.) Мезолитические и неолитические культуры Верхнего Поволжья. По материалам стоянки Ивановское VII. М.: Наука, 2002. Р. 105–108. (In Russian with English summary).

Treuillot J. 2013 From the Late Mesolithic to the Early Neolithic: continuity and changes in bones productions from Zamostje 2 (excavations 1995–2000), Russia // V. Lozovski, O. Lozovskaya, I. Clemente Conte (eds.) Zamostje 2. Lake settlement of the Mesolithic and Neolithic fisherman in Upper Volga region. Saint-Petersbourg: IHMC RAS, 2013. P. 143–158.

Жилин М.Г. 1995 Стоянка Окаемово 4 на Средней Дубне // Проблемы изучения эпохи первобытности и раннего средневековья лесной зоны Восточной Европы. Вып. 2. Иваново, 1995. С. 23–32.

Zhilin M.G. 2002 Mesolithic hunting and fishing in the interfluve area of Volga and Oka rivers (on the materials of the peat bog settlements) // A.V. Golovnev (ed.) Northern Archaeological Congress. Khanty-Mansiisk, Ekaterinburg. P 113–123

Zhilin M.G., Karhu A.A. 2002 Exploitation of birds in the Early Mesolithic of Central Russia // Proceedings of the 4th Meeting of the ICAZ Bird Working Group, Kraków, Poland, 11–15 September, 2001. Acta zoologica cracoviensia. P. 109–116.