Research Article

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Wild Resources in the Economy of Bronze and Early Iron Ages Between Oder and Bug Rivers – Source Overview

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Abstract: The archaeological discussion still appears to largely disregard the role of natural resources in the early agricultural economy of Central Europe. Cereal cultivation and animal husbandry strategies remain a central area of studies. Wild resources are the only proxy data helping to reconstruct the strategies mentioned above. The data for the assessment of the wild resource role in consumption strategies are scarce. Plant and animal remains preserved within the archaeological sites represent one of the very few sources of information. The dominant funeral rite – cremation – leaves no opportunity for insight into the human bones' diet composition signatures. This study's primary goal is to gather in one place all information concerning wild resource food use based on archaeological data, which is scattered through various publications. The study's time scope corresponds to Lusatian, post-Lusatian (Pomeranian Face Urn Culture), and contemporary cultures (Western Baltic Kurgans Culture). It covers roughly the time span 1400–400 BC, which is the late Bronze and early Iron Ages. Only data from a homogenous settlement context was included within the presented review. Although the reviewed literature methodology does not always meet the modern standard, it still offers insight into broader plant and animal food use in the past. The animal bone analysis is usually based on hand-collected bone material or sifted soil samples. Malacological materials come from sampled features. Some clam mussels were also identified among the bone materials submitted for zooarchaeological analysis. All plant materials come from sampled features undergoing soil analysis.

Keywords: wild resources, Late Bronze Age and Early Iron Age, subsistence strategies, food sources

1 Introduction

The archaeological discussion still appears to largely disregard the role of natural resources in the early agricultural economy of Central Europe. A greater emphasis is usually paid to cereal cultivation and animal husbandry strategies. Admittedly, there are mentions of wild plants in the literature. They are still only proxy data in assessing different cultivation process elements (weediness, soil richness, time, and harvesting techniques). The presence of open habitat plant indicators in pollen profiles, mostly plants resistant to trampling, helps to assess the space suitable for grazing (Lityńska-Zajac, 2005, pp. 181–184). The environmental conditions of the European Lowlands and the role of “wild resources” in ethnographic data of relatively recent times suggest that such an “excluding” approach significantly reduces our understanding

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of the economy in past societies (Goldhahn, 2019, p. 142; Łuczaj, 2010, 2012; Łuczaj et al. 2013; Moszyński, 1929).

Nevertheless, the image of the past that archaeology tries to offer may appear naive, resembling an idyllic painting of a Bronze Age village by Rasmus Christiansen. Regardless of the exceptionally detailed presentation of the Nordic Bronze Age “material culture,” it left the viewer with many unanswered questions. What about the hut’s roof? Where did they get the raw material for its construction? What kind of fabric are the clothes made of? What if there were to be a bad harvest or an epidemic that would hit the livestock? If we admit that the basic metallurgic technique in the Bronze Age was lost-wax casting, then where did the people take the wax from?

Without human impact, the central European natural environment would consist of mixed forests that, combined with extensive wetlands, create an extraordinarily differentiated and abundant environment capable of providing all kinds of resources depending on the season and plant community (Bohn, et al. 2004; Matuszkiewicz, 2008). These resources, if used reasonably, are renewable without involving too much work investment. Therefore, the hamlet could indeed be surrounded by small fields and the graves of ancestors, as in Christiansen’s painting. The living space was surrounded by different environments, offering various goods (regular and seasonal sources of food, fuel, medications, toxins, and raw materials of all kinds). It is hard to believe that people would not use these goods in the past, primarily because they use many of them in the present time. The more time without them, the more people would be unable to satisfy the needs of relying solely on cultivated plants, bred animals, and then known technology.

However, it is not easy to evaluate the Late Bronze Age economy’s actual proportion of natural resources and that of the Early Iron Ages. It seems that acquiring basic food would not belong to the elements that people of these periods want to include in the sphere of visual communication (e.g. figurative art). For some reasons, this activity did not seem significant enough to be recorded. Only hunting, particularly for red deer, was favoured enough to be portrayed, as on the Pomeranian face urns. Labour ensuring everyday existence is not a common theme of symbolic representation, at least not in “prehistoric art.” People in the past would have used more communicative than aesthetic values (Gediga, Mierzwiński, & Piotrowski, 2001).

The difficulty in evaluating the share of “wild resources” in the prehistoric economy is not just a matter of imperfect research methods or the state of preservation of archaeological data. The factors that cause a reduction in the data available can or cannot be dependent on human activity (Figure 1). The loss of

Figure 1: Human and natural factors of information loss.

information and the factors that alter it may occur at every stage of transformation. It starts in a “living culture” context and continues through the “fossil record” formation to the “re/constructed past.” The fossil record does not directly or indirectly reflect past reality. Nonetheless, it is still a valuable source of information, enabling us to approximate living conditions at the end of the Bronze Age and in the Early Iron Age.

Taphonomy study remains transition “from the biosphere to the lithosphere” (Efremov, 1940, p. 85). Owing to the ongoing research in this field, we can better understand the mutual relations between the remains and the discovered context. Between the biocenosis and the remains uncovered on sites, many stages and altering processes are acting. Their knowledge helps distinguish organisms living together in one place and time (taphocenosis/palaeobiocenosis) from “tanathocenosis” (both organisms living together and brought to the place after their death). When studying animal remains, the first stage is always the biological death of the organism. A human-made alteration to bone materials regarding culinary practices (cutting, defleshing, chopping, boiling, roasting) affects the later stage of bone alterations in the soil layers.

The second stage of alteration is after the remains are discarded and then subjected to other altering processes: mechanical (e.g. trampling and animal gnawing), climatic (e.g. weathering), biological (e.g. microbial activity), and chemical. At the third stage, different diagenetic factors also alter the state of the bone. All three stages and activities affect information and bone material loss and leave traces that can be interpreted.

2 The Objective

The idea for this study came up while preparing a piece of study on the Late Bronze Age economy. The prevailing number of works pays attention primarily to agricultural activities. The share of wild resources is marginalised and reduced only to the statement about the low input of hunting, fishing, and gathering. Therefore, this study’s primary goal is to gather all information scattered over different partial publications about the Late Bronze and Early Iron Age sites in the present Poland. The body of evidence collected here is far from complete. It cannot be considered a full summary of the state of research on wild resources for the period and culture discussed. The study will not cover all stages of particular resource acquisition, from preparation tools to long-term storage.

This study provides an overview of published source data on the Bronze and Iron Ages. Those data are barely present in broader discussion due to the language barrier and limited literature. Although the possible use of wild resources can be much broader, only food comes into the scope of this study.

The publication review shows quite a problematic picture: the source data do not form any coherent knowledge block. Usually, they are dispersed within different kinds of publications: field reports, final excavation reports, site monographs, or problem studies on a particular issue. Moreover, the data come from different periods, from the first half of the twentieth century to recently. Hence, they represent inconsistent and hardly comparable methodologies. Nonetheless, such an extensive data review can be helpful for future, more detailed studies.

This study sums up only the archaeological data. The historical and ethnographic sources review should be presented as a series of studies. It provides such a broad range of themes even within food sources. Thus, ethnographic and historical sources will be included in the study’s discussion part, broadening the understanding of the particular issue.

3 Scope: Time and Space

The study’s time scope corresponds to Lusatian, post-Lusatian (Pomeranian Face Urn Culture), and contemporary cultures (Western Baltic Kurgans Culture). It roughly covers the time span 1400–400 BC, which is the Late Bronze and Early Iron Age. The geographical scope of the study does not form any coherent geographical unit. The applied range – between Oder and Bug rivers and Masurian Lakeland – corresponds

to Poland's current borders and thus covers different types of physiographic regions within the European Plain. The bulk of the collected data comes from the central part of the Polish Plain.

4 Method

The text corresponds to organisms' biological classification: Animalia (kingdom of animals) and Plantae (kingdom of plants). For complete consistency, the study should address Fungi separately. Indeed, some species of mushrooms were undoubtedly used in prehistoric times as food sources. However, in the absence of findings, we cannot assess their nutrition regime's role based solely on the archaeological record. These organisms do not have any durable tissue or other complex parts that could have been preserved within archaeological contexts.

Only data from a closed and homogenous context are included within the presented review. Most data come from the settlement context. However, each site's excavation scope differs (from large-scale rescue excavations that cut the site with narrow strips corresponding with the planned building intervention). Animal bones were analysed based on the hand-collected bone material or sifted soil samples. Malacological materials come from sampled features. Some mussels could be identified among bone materials submitted for zooarchaeological analysis. The plant material comes from sampled features, except for Polanowo site. This site provides a deposit of two pots buried underneath a house construction in Lusatian open village (Latałowa & Pińska, 2010), which is now submerged in Powidzkie Lake. The soil sample size varied over time. The reasons for sampling specific archaeological features on the site in most cases were arbitrary. Thus, the samples collected are not fully comparable. That is why the data collected were not subject to any statistical analysis.

The acquisition of natural resources involves several stages. During the preparation phase, people strive to localise the places where desirable resources occur and prepare all necessary items to obtain them. In the case of plants, people browse areas where particular species grows. To do so, they need to know how a particular plant changes seasonally. With animals, humans should have an acquaintance with the behaviour and occurrence of any given animal group. This stage also entails the preparation of hunting equipment and baits. The next step would be to properly acquire the resource, followed by its processing for consumption and storage (Figure 2) (van Amerongen, 2016). The investigation here does not cover all stages but instead focuses only on the acquisition, consumption, and deposition phases.

Figure 2: Activities related to natural resource exploitation (based on van Amerongen, 2016, p. 65 – with modifications by author).

5 Materials

5.1 Animalia (Kingdom of Animals)

Various multi-celled organisms – invertebrates and vertebrates – are the primary sources of animal-derived products for consumption. The exploitation of animal resources has been and still is one of the subsistence pattern pillars. However, mammals are only one of the groups that man could have utilised in prehistoric times. Other animals present in archaeological contexts are birds, fishes, reptiles, and amphibians.

Only little evidence is available on the usage of insects and insect-derived products, except for beeswax and its suggested role in metallurgy technology. The historical and ethnographic records confirm only the honey and beeswax use (Apidae subfamily products). Unfortunately, the insufficient amount of data prevents us from estimating the total proportion of bee products in the Bronze and Iron Age economy. It is not possible to assess whether there was a specialisation of maintenance of wild swarms and the acquisition of (wild) bee products (honey harvesting).

5.1.1 Mollusca (Figure 3)¹

All materials included in this study come from closed contexts: storage or trash pits or hearths. Sixteen sites are known for mollusc remains' finds (Table 1, Figure 3). Not all of these cases are equally useful for further investigation. There is no detailed information about the species or even number of mollusc shells found (six sites: Juszkowo, Grzybiany, Kamionka Nadbużna, Łagiewniki, Polanowo, and Wojkowice). Only four sites provide detailed malacological analysis of soil samples, namely, Lutol Mokry (Table 1, No. 3), Ruda (Table 1, No. 6), Komorowo site 1 (Table 1, No. 11), and Jankowo (Table 1, No. 13).

Only the sites at Nowy Łowicz and Juszkowo stand out regarding findings number and state of preservation. Discovered under the Roman Period barrows in Nowy Łowicz, three pits contained compact deposits of shells. The features are attributed to the Lusatian culture and have no association with the Roman Period cemetery itself. There are also other Lusatian culture features on the site, but only those three contained mollusc shells. One was filled with only sorted big specimens of mainly *Unio crassus*, and two others with unsorted (by size) material. According to malacological analysis by authors, the first pit contained deliberately chosen, sorted material for further processing. The other two were waste (Bogucki, Ożgo, & Kolmetz, 2007, pp. 96–96).

In Juszkowo (Będzieszyn in older literature), 15 pierced shells of a marine mollusc were found in one pit. Unfortunately, this finding did not undergo malacological analysis, but the findings show the similarity to *Cerastoderma* genus. All items were drilled and probably were a part of adornment rather than food waste or food source (Fudziński & Ślusarska, 2017, figure 39).

5.1.2 Fish (Figure 4)

The data consist of identified fish remains derived from 25 Late Bronze and Early Iron Age sites (Table 2, Figure 4). Six of them will be eliminated from further analysis because the species were unidentified.

Mostly anadromous and freshwater fish were identified. Sturgeon remains come solely from sites located near the Baltic Sea shore and Szczecin and Vistula Lagoons. Species of freshwater reservoirs, such as pike, bream, and perch, predominate on inland sites. The most diverse assemblage comes from coastal sites. They contain both freshwater and brackish water preferring species.

¹ The maps presented here play a purely illustrative role. They present the location of a particular site but cannot serve as a basis for any geographical analysis. What they show is the regional intensity of archaeological excavation and the methodology that involves non-archaeological analysis.

Figure 3: The mollusc shells at the Late Bronze and Early Iron Age sites with mollusc shells. (The sites numbering according to Table 1.)

5.1.3 Reptiles (Figure 5 – Indicated with White Markers)

Remains of reptiles are extremely rare discoveries at Late Bronze and Early Iron Age sites. The reports indicate the only animal remains related to the single specimen of this class: the tortoise. The remains of the European pond tortoise (*Emys orbicularis*), usually a small number of plastron and carapace scutes, have come from six settlements (Table 3). On Komorowo fortified settlement, cut marks were identified on a plastron piece (Makowiecki & Rybacki, 2001).

5.1.4 Amphibians (Figure 5 – Indicated with Black Markers)

The cases of amphibian bone findings are even rarer than all the organisms presented above. Only three sites from Poland have been published so far with the discovery of frog bones. Frog bones were identified within bone material from Chłapowo, Wojkowice, and Sobiejuchy (Table 3). Chłapowo and Wojkowice represent open villages, and Sobiejuchy was a fortified one.

Unfortunately, the publication does not provide any information about the part of the skeleton the bones come from, or how many individuals were identified within the bone materials submitted for zooarchaeological analysis. Hence, it is hard to establish any connection with the consumption of frogs.

5.1.5 Birds (Figure 6)

Bird remains have come from 13 sites (Table 4). Only five of them provide information about the species (Ruda, Wojkowice, Sobiejuchy, Komorowo, and Biskupin). The water birds are recurrent species in the bone assemblage (especially the subfamily Anatinae). Similarly, the representatives of the family of corvids (Corvidae) are common. Bones of diurnal (Accipitriformes) and nocturnal (Strigiformes) birds of prey are found much less often in bone collections. Their bones were identified among bone materials from three fortified sites, namely, Sobiejuchy (Harding et al., 2004), Komorowo (Godfredsen & Makowiecki, 2004), and Biskupin (Krysiak, 1950; Lubicz-Niezabitowski, 1936, 1938).

Table 1: Mollusc shell finds from Late Bronze and Early Iron Age sites in Poland

No	Site	Site type	Chronology	Context	NISP	Reference
1	Kamionka Nadbużna site 1	Settlement	Late Bronze Age	2 pits with traces of fire and destructs of pots	No data (unidentified freshwater clam)	(Zabilska, 2012, Table 1)
2	Nowy Łowicz	?	Late Bronze Age	3 pits earlier than cemetery	No data ^a (species identified in sample <i>Unio crassus</i> , <i>Unio tumidus</i> , and <i>Unio pictorum</i>)	(Bogucki et al., 2007)
3	Lutol Mokry	Settlement	Late Bronze Age	16 waste pits (30 soil samples)	Unionidae: 872 – 30 samples of different sizes	(Kurzawska, 2012, Tables 1 and 2)
4	Łagiewniki site 5/7	Settlement	Late Bronze Age/ Early Iron Age	No data	No data (unidentified freshwater clam)	(Zabilska, 2012, Table 1)
5	Kruszwica site 4/2	Settlement – pits, hearths	Late Bronze Age/ Early Iron Age	4 storage/waste pits 2 hearths 1 dugout	<i>Unio tumidus</i> – 1,175 <i>Unio</i> unidentified – 1,444 <i>Unio pictorum</i> – 208 <i>Unio crassus</i> – 23 Unionidae – 30 <i>Anodonta</i> – 234 <i>Planorbarius cornuus</i> – 12 <i>Viviparus</i> unidentified – 6 <i>Lymnaea stagnalis</i> – 4 <i>Planorbarius</i> – 2 Unidentified – 2	(Zabilska, 2012, Table 1)
6	Ruda site 3–6	Settlement	Late Bronze Age/ Early Iron Age		<i>Unio crassus</i> – 122, <i>Unio tumidus</i> – 107 <i>Unio pictorum</i> – 6 1,188 fragments of undetermined shells <i>Anodonta</i> – 3	(Rembisz, Gackowski, Makowiecki, Markiewicz, & Polcyn, 2009) (Zabilska, 2012, Table 1)
7	Będzin-Grodziec site 16	Fortified settlement	Late Bronze Age/ Early Iron Age	No data	No data (<i>Anodonta</i>)	(Zabilska, 2012, Table 1)
8	Sobiejuhy site 1	Fortified settlement	Late Bronze Age/ Early Iron Age	No data	No data	(Zabilska, 2012, Table 1)
9	Juszkowo site 3	Settlement – votive deposit?	Early Iron Age	1 storage pit	Brackish water clam – 15 pierced shells (probably <i>Cerastoderma</i>)	(Fudziński & Ślusarska, 2017, Figure 39)
10	Wrocław-Osobowce	Fortified settlement	Late Bronze Age/ Early Iron Age	No data	No data (<i>Unio</i>)	(Zabilska, 2012, Table 1)
11	Komorowo site 1	Fortified settlement	Early Iron Age	13 soil samples	<i>Unio crassus</i> – 3, <i>Unio tumidus</i> – 1	(Makowiecki & Makowiecka, 2004a, 2004b; Zabilska 2012, Table 1)
12	Gacanowo site 11	Settlement	Early Iron Age	No data	<i>Unio</i> – 52 <i>Unio pictorum</i> – 4 <i>Unio tumidus</i> – 1	(Zabilska, 2012, Table 1)

Table 1: Continued

No	Site	Site type	Chronology	Context	NISP	Reference
13	Jankowo	Fortified settlement	Early Iron Age	46 soil samples	Land snails – 434, (<i>Clausiliidae</i> gen. et sp. juv. – 3, <i>Clausilia bidentata</i> – 1, <i>Carychium tridentatum</i> – 11, <i>Acanthinula aculeata</i> 2, <i>Punctum pygmaeum</i> – 6, <i>Aegopinella nitidula</i> – 5, <i>Nesovitrea hammonis</i> – 12, <i>Zonitoides nitidus</i> – 10, <i>Carychium minimum</i> – 63 <i>Carychium</i> sp. – 60, <i>Vallonia pulchella</i> – 64, <i>Vallonia costata</i> – 35, – 47, <i>Vertigo antvertigo</i> – 32 <i>Vertigo angustior</i> – 17, <i>Vertigo pygmaea</i> – 2, <i>Vertigo</i> sp. – 9, <i>Cochlicopa</i> sp. – 7, <i>Succinea</i> sp. – 42 <i>Oxyloma elegans</i> 1, <i>Trichia hispida</i> – 2, <i>Helicidae</i> gen. et sp. juv. – 2 <i>Arianta abustorum</i> – 4, <i>Bradybaena fruticum</i> – 6, <i>Euconulus fulvus</i> – 1 Freshwater clams – 1,952 (<i>Valvata pulchella</i> – 3 <i>Lymnaea</i> (<i>Galba</i>) <i>truncatula</i> – 294, <i>Planorbis planorbis</i> – 166, <i>Anisus spirorbis</i> – 163, <i>Segmentina nitida</i> – 48, <i>Pisidium obtusale</i> – 7, <i>Pisidium casertanum</i> – 3, <i>Viviparus contectus</i> – 5, <i>Viparus</i> – 3, <i>Valvata piscinalis</i> – 19, <i>Valvata cristata</i> – 319, <i>Bithynia tentaculate</i> – 68, <i>Bithynia leachi</i> – 61, <i>Bithynia</i> – 22, <i>Lymnaea stagnalis</i> – 8, <i>Lymnaea</i> (<i>Radix</i>) <i>peregra</i> – 2, <i>Lymnaea</i> (<i>Radix</i>) – 6, <i>Lymnaea</i> (<i>Galba</i>) <i>corvus</i> – 100, <i>Lymnaea</i> (<i>Galba</i>) <i>turricula</i> – 33, <i>Lymnaea</i> (<i>Galba</i>) – 106, <i>Lymnaea</i> (<i>Myxas</i>) <i>glutinosa</i> – 1, <i>Lymnaeidae</i> gen. et sp. juv. – 2, <i>Acroloxus lacustris</i> – 3, <i>Planorbarius corneus</i> – 140, <i>Planorbis</i> – 36, <i>Anisus vortex</i> – 18, <i>Anisus</i> – 1, <i>Bathyomphalus contortus</i> – 72, <i>Gyraulus albus</i> – 12, <i>Gyraulus laevis</i> – 3, <i>Gyraulus rossmaessleri</i> – 2, <i>Gyraulus riparius</i> – 12, <i>Armiger crista f. nautilus</i> – 9, <i>Armiger crista f. cristatus</i> – 5, <i>Armiger crista</i> – 2, <i>Planorbidae</i> gen. et sp. juv. – 6, <i>Unio crassus</i> – 6	(Zabilska, 2012, Table 3)

Table 1: Continued

No	Site	Site type	Chronology	Context	NISP	Reference
14	Wojkowice	Settlement	Late Bronze Age/ Early Iron Age	29 features (pits, dugouts, housing structures)	<i>Unio tumidus</i> – 4, <i>Unio pictorum</i> – 4, <i>Unio</i> sp. – 49, <i>Anodonta</i> sp. – 23, <i>Unionidae</i> gen. et sp. juv. – 6 1, <i>Sphaerium corneum</i> – 32, <i>Pisidium henslowianum</i> – 14, <i>Pisidium milium</i> – 4 <i>Pisidium subtruncatum</i> 5, <i>Pisidium nitidum</i> – 12, <i>Pisidium</i> <i>molessierianum</i> – 3, <i>Pisidium</i> sp. – 20) No data	(Krupska & Chrószcz, 2010, Table)
15	Grzybiany	Settlement	Late Bronze Age/ Early Iron Age	No data	Mollusca – 8	(Diakowski & Zych, 2014, Table 1)
16	Polanowo site 12	Settlement – votive deposit?	Early Iron Age	Pot	Gastropoda – 1	(Gręzak, 2010)

^aThe shells were discovered in three compact clusters – (1) diameter 55 cm, depth 32 cm, (2) diameter 30 cm, depth 30 cm, and (3) an oval pit, diameter 85–100 cm, depth 75 cm. The clusters were sampled.

Figure 4: Fish remains on the late Bronze and Early Iron Age sites. (The sites numbering according to Table 2.)

5.1.6 Mammals (Figure 7)

Remains of wild mammals come from 52 settlements, including 11 defensive sites (Table 5). Data for wild mammal hunting were collected and published by Piątkowska-Małecka (2013). The pool of data collected for this study is based on this work, with several sites excavated and analysed after 2010.

Among big-game animals, red deer remains were present at most sites: 42 in 26 sites, with red deer bones exceeding 10. Roe deer bones were found in 28 sites, but collections more significant than 10 bones were only discovered at 12 sites. Additionally, wild boar remains were frequently found among bone materials. These animal bones appeared at 27 sites, including 13 with more than 10 wild boar bones (Table 5).

The group of small animals is quite diverse. The bones of particular species are usually small (except for the Grodziec-Dorotka site with 102 beaver bones). However, the composition of identified species differs from site to site and does not form any repeated pattern. However, one species is present at over half of the sites: a hare. Hare bones were identified among bone assemblages from 28 sites.

5.2 Plantae (Kingdom of Plants)

Two types of plant remains are pretty well represented in the archaeological record: plants with edible nuts and fruits (2.1) and grasses and perennials (2.2). Including a particular plant in the study involved two conditions: culinary purpose (I have omitted, for instance, plants used in the dyeing of textiles) and repeated presence at five sites. The presented list is incomplete since many research reports have not been published yet (Table 6).

5.2.1 Nuts and Fruits (Figure 8)

Reviewing the list of identified plant remains in soil samples brought a fairly long list of nuts, stones, and caryopses of different plant types. Some of them represent local vegetation and could get into the sample without deliberate human action. The presence of fleshy fruits can only be recognised by preserved stones, although these finds are rare. There is information scattered in the literature about the single finds of

Table 2: Fish remains from Late Bronze and Early Iron Age sites in Poland

No	Site	Site type	Chronology	NISP	References
1	Komorowo site 1	Fortified settlement	Early Iron Age	41 (identified: – pike: 6 vertebrae, 1 palatinum – catfish: 6 vertebrae, 1 cleithrum – perch: 1 vertebra – common bream: 1 vertebra – Cyprinidae: 2 vertebrae, 2 costae)	(Makowiecki & Makowiecka, 2004b)
2	Juszkowo site 3	Settlement	Early Iron Age	No data ^a (identified: – 3 sturgeon: scales and bones – 6 common bream – 1 common roach – 1 zander – vimba bream – asp)	(Fudziński & Ślusarska, 2017)
3	Ruda site 3–6	Settlement	Late Bronze Age/ Early Iron Age	2 (identified: – pike)	(Rembisz et al., 2009)
4	Tolknicko site 1	Fortified settlement	Early Iron Age	3,796 (identified: – pike: 45 – common roach: 415 – ide: 1 – asp: 11 – white bream: 92 – common bream: 2,757 – vimba bream: 1 – sichel: 112 – crucian carp: 1 – catfish: 5 – perch: 55 – zander: 393 – bubbot: 2 – salmon: 1 – sturgeon: 36)	(Makowiecki, 2003)
5	Łęcze 1	Fortified settlement	Early Iron Age	46 (identified: – common roach: 4 – white bream: 1 – common bream: 34 – perch: 2 – zander: 1 – sturgeon: 1 – salmon: 3)	(Makowiecki, 2003)
6	Szczecin-Wzgórze Zamkowe	Fortified settlement	Early Iron Age	16 (identified: – sturgeon: 1 – pike: 1 – catfish: 2 – common roach: 9 – common bream: 1 – zander: 1)	(Chetkowski, 1965)
7	Szczecin ul. Grodzka	Fortified settlement	Early Iron Age	10 (identified: – sturgeon: 3)	(Makowiecki, 2003)
8	Żegotki site 18	Settlement	Late Bronze Age/ Early Iron Age	1 (unidentified)	(Makowiecki & Makowiecka, 2004a)

Table 2: Continued

No	Site	Site type	Chronology	NISP	References
9	Bożejewice site 22/23	Settlement	Late Bronze Age/ Early Iron Age	1 (identified: crucian carp)	(Makowiecki, 2003)
10	Kruszwica site 2–4	Fortified settlement	Late Bronze Age/ Early Iron Age	No data	(Makowiecki, 2003)
11	Łagiewniki site 5/7	Settlement	Late Bronze Age/ Early Iron Age	No data	(Makowiecki, 2003)
12	Bnin site 2a	Fortified settlement	Late Bronze Age/ Early Iron Age	6 (identified: – pike: 1 – common roach: 1 – common bream: 1 – crucian carp: 1 – perch: 1 – zander: 1)	(Makowiecki, 2003)
13	Biskupin site 4	Fortified settlement	Early Iron Age	114 (identified: – pike: 5 – perch: 5 – common roach: scales – white bream: scales – common bream: 9 – catfish: c.95)	(Makowiecki, 2003)
14	Bnin site 2b	Fortified settlement	Early Iron Age	No data	(Makowiecki, 2003)
15	Objezierze site 1	Fortified settlement	Early Iron Age	2 (identified – pike: 1 – common bream: scales – tench: 1)	(Makowiecki, 2003)
16	Słupca	Fortified settlement	Early Iron Age	1 (identified: – perch: 1)	(Makowiecki, 2003)
17	Ustowo 1	Settlement	Early Iron Age	6 (identified: – common bream: 1 – zander: 4)	(Makowiecki, 2003)
18	Żubronajcie site 2	Settlement	Early Iron Age	1,256 (identified: – pike: 102 – Cyprinidae: 394 – common roach: 106 – common dace: 2 – <i>Squalius cephalus</i> : 3 – common rudd: 18 – common bream: 28 – tench: 16 – catfish: 1 – perch: 27)	(Makowiecki, 2003)
19	Żółwin site 29	Settlement	Early Iron Age	2 (identified: – pike: 1 – Cyprinidae: 1)	(Makowiecki, 1998)
20	Święty Wojciech site 10	Settlement	Early Iron Age	1 (identified: – Cyprinidae: 1)	(Makowiecki & Dzieduszycki, 1998)
21	Ołtarze – Gołacze site 1	Settlement	Late Bronze Age	No data	(Węgrzynowicz, 1972)
22	Janów Pomorski site 1	Settlement	Early Iron Age	176 (identified: – Cyprinidae: 136 including 37 scales – common roach: 4 – common rudd: 1 – Salmonidae: 2)	(Makowiecki & Makowiecka, 2012)

Table 2: Continued

No	Site	Site type	Chronology	NISP	References
				– Acipenseridae: 2 – Percidae: 4 – common bream: 5 – pike: 6 – zander: 14)	
23	Polanowo site 12	Settlement	Early Iron Age	Unidentified	(Gręzak, 2010)
24	Mierzyn site 38	Settlement	Late Bronze Age/ Early Iron Age	Unidentified	Author's archive – unpublished
25	Sobiejucho	Fortified settlement	Late Bronze Age/ Early Iron Age	1,036 (identified: – pike: 157 – Cyprinidae: 688 – perch: 32 – eel: 17 – white bream: 3 – bream: 18 – roach: 38 – Vendacae: 14 – Salmonid: 4 – tench: 11 – bleak: 2 – barbel: 1 – gudgeon: 5 – nase: 2 – dace: 12 – rudd: 9 – chub: 4 – burbot?: 7 – zander: 12)	(Locker, 2004)

^a The site was excavated in 1970, but not published until 2017. The full analysis of faunal remains is missing. The documentation in the Archaeological Museum in Gdańsk archives is incomplete and consists of several pieces of paper with a tabular summary.

Rubus sp., *Crataegus* sp., *Fragaria* sp., *Prunus* sp., and *Cerasus* sp. stones (Agdan, 2016). The only plant that repeats on the list is *Sambucus*. Although usually a single finding, quite numerous collections, were also found, e.g. in Biskupin (over 200 stones), Grzybiany (38) (Table 6).

Nuts and acorns were more frequently identified in soil samples. The remains of hazelnuts occurred at 8 sites and acorns at 11 sites. In addition to single finds, more numerous contexts are found: Biskupin, site 4 with over 100 or Grzybiany with over 38 *Corylus* nuts (Table 6).

5.2.2 Grass (Figure 8)

The seeds of wild grass, mostly *Bromus* and *Setaria*, were identified at 15 and 9 sites, respectively. They were usually an admixture among cultivated cereals. So it is hard to determine whether people would have collected them individually or as tolerated weeds together with cultivated species (Table 6).

Certain species of perennial plants, mainly of *Rumex* (12 sites) and *Chenopodium* (24 sites), have also been recorded based on preserved caryopses. It is worth noting that goosefoot seeds (*Chenopodium*) were in various states of preservation. While waterlogged seeds were randomly found in the settlement, charred seeds, notably in large numbers, would suggest deliberately collecting and processing these plants. It is still an open question whether such significant assemblages (e.g. over 3,000 seeds in Polanowo, site 12) evidence wild plant collecting or indicate storing kernels of the cultivar (Latałowa & Pińska, 2010).

Figure 5: Amphibian and reptile remains from the Late Bronze and Early Iron Age sites. (Legend: white dots – European pond turtle, black dots – frogs. Numbered according to Table 3.)

6 Results

6.1 Animalia (Kingdom of Animals)

It is worth mentioning that comparing such collections as done in this study is a highly complicated task. It contains data acquired according to different methodologies. However, the information also comes from different sites (open villages and fortified sites) of different ecological regions. Furthermore, the range of the excavated areas is incomparable. It is challenging to assess the data's representativeness in one group: records from small-scale rescue excavations such as Ruda or Parlówko site, multiple-season projects such as Sobiejuchy or Biskupin, which was excavated at a different time and by a different excavating group. Most of the data are sparse or limited, which does not make the task easier, nor do the diverse taphonomic ramifications of biological data.

6.1.1 Molluscs

Detailed malacological analyses are still rare for Bronze Age and Early Iron Age sites in the Polish territory. However, mollusc shells were present and identified in archaeological sites.

Several factors may obscure the evaluation of mollusc presence in the archaeological context. To name some of them:

- molluscs are rarely preserved intact
- the employed excavation method may not favour mollusc shell preservation
- mishandling of soil samples in the initial stage of analysis.

It is also worth mentioning that molluscs – mainly aquatic – have very narrow ecological requirements. Thus, these organisms can serve as a bioindicator for particular ecological conditions. However, this mollusc presence in the archaeological context is beyond the study's scope (Zabilska, 2012, pp. 255–62).

The outcome of the analysis of the 16 sites gathered for the study is hardly comparable due to the different mollusc shell acquiring methods. All sites provided material, either hand-picked or acquired by

Table 3: Amphibian and reptile remains from the Late Bronze and Early Iron Age sites

No	Site	Site type	Chronology	NISP	References
1	Brześć Kujawski site 13	Settlement	Late Bronze Age	Not specified (European pond turtle – <i>Emys obicularis</i>)	(Makowiecki & Rybacki, 2001)
2	Biskupin site 4	Fortified settlement	Early Iron Age	1 (European pond turtle <i>Emys obicularis</i> : fragment of plastron)	(Krysiak, 1950, p. 47)
3	Komorowo site 1	Fortified settlement	Early Iron Age	5 (European pond turtle <i>Emys obicularis</i> – 3 fragments of plastron, one with cutmarks, and 2 carapaces)	(Makowiecki & Rybacki, 2001)
4	Ruda site 3–6	Settlement	Late Bronze Age/Early Iron Age	1 (European pond turtle <i>Emys obicularis</i> : fragment of plastron)	(Rembisz et al., 2009)
5	Chłapowo site 3	Settlement	Late Bronze Age/Early Iron Age	3 (Ranidae)	(Wrzesiński, 1994)
6	Wojkowice site 15	Settlement	Late Bronze Age/Early Iron Age	3 (Ranidae)	(Krupska & Chrószcz, 2010)
7	Sobiejuchoy	Fortified settlement	Early Iron Age	11 (European pond turtle <i>Emys orbicularis</i>) 2 (Ranidae) 11 (European pond turtle <i>Emys orbicularis</i> – fragments of carapaces)	(Rackham, 2004)

Figure 6: Bird remains from the Late Bronze and Early Iron Age sites. (Legend: white dots – identified species, black dots – unidentified. Numbered according to Table 4.)

selective sampling only those features, where shells were noticed during the excavation process. Within the sites with the most numerous collections (Ruda, Kruszwica, Lutol Mokry, and Jankowo), the most frequent finds are freshwater molluscs: *Anodonta* and Unionidae. Two sites deserve special mention. In Lutol Mokry, molluscs were discovered in 16 features. Shells from four features have traces of burning. Additionally, those features were filled up with charcoal, which attests to the theory of heat treatment. Other features were interpreted as a waste pit containing heat-treated complete mussels which had not opened during heating. No signs of opening or processing (other than thermal alterations) were found on these shells. According to Kurzawska, who analysed those samples, molluscs were deliberately collected and brought to the site. They were heat treated, most probably for consumption (Kurzawska, 2012).

Nowy Łowicz mollusc shells tell another story. The shells were discovered in three compact clusters – one (diameter 55 cm, depth 32 cm), second (diameter 30 cm, depth 30 cm), and third, an oval pit (diameter 85–100 cm, depth 75 cm). All clusters were sampled. As already stated above, one feature contained selected big complete shells, the other two contained unsorted shells but also complete. The authors of this analysis ruled out consumption as a purpose of collecting those particular shells and leaned towards the interpretation of raw material sorted and stored “for later” (Bogucki et al., 2007).

The issue of the non-food use of mussels, however significant, is beyond the scope of this article. The best example of non-food use can be found in the investigation results of two sites, namely, Nowy Łowicz and Juskowo (Bogucki et al., 2007; Fudziński & Ślusarska, 2017).

6.1.2 Fish

Most assemblages of fish remains derive from fortified settlements, and those were analysed most thoroughly. Those sites during the Hallstatt period were located quite close to the water. Three sites included in the review need some comment: the fortified sites in Tolkmicko and Łęcze and the open settlement in Żubronajcie. According to the archaeological division, they represent Western Baltic Barrow Culture, not Lusatian. Regardless, those sites are dated to the Early Iron Age. The presence of a large number of fish species is not surprising taking into account their location.

The most diverse assemblages in terms of the number of represented species come from coastal sites. Fish favouring both freshwater and brackish water environments are present in the bone materials. This

Table 4: Birds remains from the Late Bronze and Early Iron Age sites

No	Site	Site type	Chronology	NISP	References
1	Ruda site 3–6	Settlement	Late Bronze Age/Early Iron Age	1 (Mallard duck)	(Rembisz et al., 2009)
2	Wojkowice site 15	Settlement	Late Bronze Age/Early Iron Age	20 (Hawk – 12, Crow – 4, Goose – 4)	(Krupska & Chrószcz, 2010)
3	Żegotki site 3	Settlement	Late Bronze Age/Early Iron Age	1 (Bird indeterminable)	(Makowiecki & Makowiecka, 2004a, 2004b)
4	Ślask Wielki (Ślasko Wielkie) site 12	Settlement	Late Bronze Age/Early Iron Age	2 (Bird indeterminable)	(Makowiecki & Makowiecka, 2004a, 2004b)
5	Witkowo site 42	Settlement	Early Iron Age	5 (Bird indeterminable)	(Ablamowicz, 2009)
6	Tworów site 9	Settlement	Late Bronze Age/Early Iron Age	1 (Bird indeterminable)	(Lisowski, 2014)
7	Zagórzycze site 1	Settlement	Late Bronze Age/Early Iron Age	2 (Bird indeterminable)	(Gocman & Pieńkos, 2012)
8	Sobiejuhy	Fortified settlement	Early Iron Age	153 (cf. Eagle – 1, cf. Goshawk – 1, Domestic Fowl – 1, Partridge – 7, Grouse – 1, Black grouse – 2, Capercaillie – 9, Galliform – 1, Goose – 1, Mallard – 2, cf. Mallard – 6, Wild Duck sp. – 8, cf. Wigeon – 4, Teal – 2, Raven – 1, Rook – 34, Crow – 5, Crow/ Rook – 22, Tawny owl – 2, Barn owl – 1, Stork – 1, Crane? – 9, Coot – 1, Dove sp. – 4, Wood pigeon? – 2, Large bird – 5, Bird indeterminable – 20) No data (Goose)	(Rackham, 2004)
9	Inowrocław site 11	Settlement	Early Iron Age		(Wiejačka & Makowiecki, 2018)
10	Komorowo	Fortified settlement	Early Iron Age	26 (Red-neck grebe/Great crested grebe – 1, Grey Heron – 1, Ducks – 4, Golden eagle – 1, Black grouse – 6, Domestic Fowl – 2, Carrion crow – 3, Carrion crow/ rook – 4, Bird indeterminable – 4)	(Godfredsen & Makowiecki, 2004)

Table 4: Continued

No	Site	Site type	Chronology	NISP	References
11	Biskupin site 4	Fortified settlement	Early Iron Age	86 (<i>Podiceps</i> sp. – 1, White-tailed eagle – 3, Crane – 1, 10 – Mallard duck, Ducks – 6, Grey goose – 3)	(Krysiak, 1950; Lubicz-Niezabitowski, 1936, 1938)
12	Bnin	Fortified settlement	Early Iron Age	No data (Goose)	(Wiejacka & Makowiecki, 2018)
13	Węgry	Settlement	Early Iron Age	No data (Goose)	(Wiejacka & Makowiecki, 2018)
14	Polanowo site 12	Settlement – votive deposit?	Early Iron Age	2 (Bird indeterminable)	(Gręzak, 2010)
15	Grodno	Fortified settlement	Early Iron Age	6 (Bird indeterminable)	(Piątkowska-Matecka, 1999)

Figure 7: Game animals found on the Late Bronze and Early Iron Age sites. (Numbered according to Table 5.)

suggests people sourced fish from both inland reservoirs and the Baltic Sea. Sturgeon, a migratory fish, has been recorded solely at the sites located on the Oder River (Szczecin, Wzgórze Zamkowe, and Szczecin Grodzka street) (Chelkowski, 1965; Makowiecki, 2003). Eilhard Lubinus mentioned the sturgeon's occurrence in the Szczecin Lagoon in the seventeenth-century Great Map of the Pomeranian Principality. European sea sturgeon could make its travel to spawn deep into the large rivers flowing into the Baltic Sea still in the early years of the twentieth century (Makowiecki, 2003, p. 49). A ganoid scale and bones of sturgeon were present in Juszkowo, in the region of the Radunia River, the tributary of lower Vistula (Fudziński & Ślusarska, 2017). Sturgeon remains have not been discovered so far on “interior” sites of the present Poland. The remains of Cyprinidae, perch, pike, and catfish are in the highest amount. The presence of this fish and the species composition can serve as an argument in favour of an opportunistic approach to this source – sourcing fish mostly from waters located near settlements (including lakes and small rivers).

6.1.3 Reptiles and Amphibians

The remains of both groups are very scarce and inconclusive in terms of their food use. The observations of small vertebrates (frogs) and reptiles (tortoises) can be straitened by how the sites are excavated and samples obtained. The remains of frogs and tortoises are known from the Late Bronze and Early Iron Age sites in Poland. However, the findings are sparse, and their representation is small within a single site. The occurrence of a single bone of those animals can hardly indicate that they were acquired purposefully for consumption. Only numerous collections of particular parts of the frog skeleton, such as bones of the pelvis and hind legs, would confirm eating frogs. These doubts could be dispelled by the analyses of soil sampling from archaeological features. However, this method is not yet widespread in archaeology. Thus, small vertebrate remains can be easily overlooked or deliberately rejected as contemporary remains. The written records offer some information supporting the thesis on the frogs as a food resource. A cookery book from 1901 reports that frogs are edible, but only the green ones and are the best for eating in May. The same book says that only hind limbs suit consumption (Niewiarowska & Malkowska, 1901, p. 222). Ochorowicz-Monatowa, in her “Universal cookery book”, reported that frog legs were sold at markets until the late summer (Ochorowicz-Monatowa, 1926, pp. 298–299).

There is little information concerning the potential eating of frogs in the literature regarding consumption resources and diet in prehistory. Only one report published provides information about over 180 adult

Table 5: Game animals from the Late Bronze and Early Iron Age sites

No	Site	Site type	Chronology	NISP					References
				Red deer	Roe deer	Wild boar	Other	Other small animals	
1	Grodziec-Dorotka site 1	Settlement	Late Bronze Age/ Early Iron Age	38	19		Elk – 16; auroch/ E.bison – 9, bear – 20		(Piątkowska-Matecka, 2013)
2	Łądów Górny site 2	Settlement	Late Bronze Age	61					(Piątkowska-Matecka, 2013)
3	Dębica	Settlement	Late Bronze Age/ Early Iron Age	20	6	1	Auroch/E.bison – 1, bear – 2		(Piątkowska-Matecka, 2013)
4	Dolki site 8	Settlement	Late Bronze Age	2	2				(Piątkowska-Matecka, 2013)
5	Gniechowice site 2	Settlement	Late Bronze Age	41	10		Auroch/E.bison – 31		(Piątkowska-Matecka, 2013)
6	Koszyce site 3	Settlement	Late Bronze Age	2	2				(Piątkowska-Matecka, 2013)
7	Kraków - Nowa Huta Mogiła site 62	Settlement	Late Bronze Age/ Early Iron Age	3	1				(Piątkowska-Matecka, 2013)
8	Łąglewniki site 5/7	Settlement	Late Bronze Age/ Early Iron Age	46	5	9	Auroch/E.bison – 1		(Piątkowska-Matecka, 2013)
9	Maciejowice site 2	Fortified settlement	Late Bronze Age	2		1			(Piątkowska-Matecka, 2013)
10	Witów site 1	Settlement	Late Bronze Age	10					(Zielińska (Gocman), 2009)
11	Nowa Wieś site 1,12	Settlement	Late Bronze Age/ Early Iron Age	2	2				(Piątkowska-Matecka, 2013)
12	Łądów Górny site 3	Settlement	Late Bronze Age	6	2	1		Beaver – 1	(Piątkowska-Matecka, 2013)
13	Wąsosz	Settlement	Late Bronze Age	1				Hare – 1	(Piątkowska-Matecka, 2013)
14	Woryty site 2	Fortified settlement	Early Iron Age	2	2				(Piątkowska-Matecka, 2013)
15	Biskupin site 4	Fortified settlement	Early Iron Age	710	391	121	Auroch/ E.bison – 10, bear – 24	Beaver – 12, hare – 21, marten – 1, fox – 1, hedgehog – 1	(Piątkowska-Matecka, 2013)
16	Grodno site 6	Settlement	Early Iron Age	76	48	3	Elk – 1, auroch/ E.bison – 1, bear – 1	Beaver – 6, hare – 6	(Piątkowska-Matecka, 2013)
17	Grzybiany site 1	Settlement	Early Iron Age	296	126	72	Elk – 18, auroch/ E.bison – 32, bear – 9	Beaver – 11, hare – 1, badger – 2	(Piątkowska-Matecka, 2013)
18	Izdebno site 5	Settlement	Early Iron Age	150	90	13		Hare – 2, fox – 1	(Piątkowska-Matecka, 2013)
19	Jankowo	Fortified settlement	Early Iron Age	888	550	51	Auroch/ E.bison – 42	Beaver – 4, hare – 17, badger – 4	(Piątkowska-Matecka, 2013)

Table 5: Continued

No	Site	Site type	Chronology	NISP					References
				Red deer	Roe deer	Wild boar	Other	Predators	
20	Komorowo site 1	Fortified settlement	Early Iron Age	396	216	41	95	Elk – 3, auroch/ E.bison – 35	Hare – 4 (Piątkowska-Matecka, 2013)
21	Koziegłowy site 1	Fortified settlement	Early Iron Age	168	79	54	24	Elk – 5	Beaver – 1, hare – 4, badger – 1 (Piątkowska-Matecka, 2013)
22	Słupca site 1	Settlement	Early Iron Age	125	54	36	27	Auroch/E.bison – 1	Beaver – 1, hare – 5-1, marten – 1 (Piątkowska-Matecka, 2013)
23	Smuszewo site 3	Settlement	Early Iron Age	482	269	106		Elk – 17, auroch/ E.bison – 4, bear – 12	Beaver – 15, hare – 26, marten – 3, fox – 22, badger – 1, otter – 1 (Piątkowska-Matecka, 2013)
24	Sobiejucho site 1	Settlement	Late Bronze Age	730	346	256	32	Elk – 1	Hare – 46, fox – 30, hedghog – 1, badger – 1, otter – 6 (Piątkowska-Matecka, 2013)
25	Górzycza	Settlement	Late Bronze Age	7	5				Beaver – 1, hare – 1 (Piątkowska-Matecka, 2013)
26	Kotlin site 1	Settlement	Early Iron Age	49	20	15	4	Auroch/E.bison – 3	Hare – 1, marten – 5 (Piątkowska-Matecka, 2013)
27	Kruszwica site 2/4	Fortified settlement	Early Iron Age	4			2		Hare – 2 (Piątkowska-Matecka, 2013)
28	Nowy Śleszów site 4	Fortified settlement	Early Iron Age	1					Hare – 1 (Piątkowska-Matecka, 2013)
29	Słupca site 3	Settlement	Early Iron Age	1					Beaver – 4, hare – 1 (Piątkowska-Matecka, 2013)
30	Szczecin Wzgórze	Settlement	Early Iron Age	7			1	Wildcat – 1	
31	Szczecin ul Grodzka	Settlement	Early Iron Age	3	3				Beaver – 1 (Piątkowska-Matecka, 2013)
32	Szczecin Ustowo site 1	Settlement	Early Iron Age	10	10	1		Auroch/E.bison – 2	Beaver – 1 (Piątkowska-Matecka, 2013)
33	Białbrzegi site 1A	Settlement	Early Iron Age	79	61	1	13	Elk – 1	Hare – 3 (Piątkowska-Matecka, 2013)
34	Gżin site 1	Settlement	Late Bronze Age/ Early Iron Age	1	1				
35	Kąldus site 3, 6	Settlement	Late Bronze Age/ Early Iron Age	34	23	4	4		Hare – 2 (Piątkowska-Matecka, 2013)
36	Kobylniki site 2	Settlement	Late Bronze Age/ Early Iron Age	19	11		1		Beaver – 2, hare – 1, squirrel – 4 (Piątkowska-Matecka, 2013)
37	Węgry	Settlement	Late Bronze Age/ Early Iron Age	6	4		1		Hare – 1 (Piątkowska-Matecka, 2013)

Table 5: Continued

No	Site	Site type	Chronology	NISP					References	
				Red deer	Roe deer	Wild boar	Other	Predators		
38	Żółwin site 29	Settlement	Late Bronze Age/ Early Iron Age	16	8	2	1	Elk – 5		(Piątkowska-Matecka, 2013)
39	Juszkowo site 3	Settlement	Late Bronze Age	42	15	2	18		Hare – 6, fox – 1	(Piątkowska-Matecka, 2013)
40	Brześć Kujawski	Settlement	Late Bronze Age/ Early Iron Age	8	2				Hare – 6	(Piątkowska-Matecka, 2013)
41	Ruda site 3–6	Settlement	Late Bronze Age/ Early Iron Age	6	1	2	1		Hare – 2	(Rembisz et al., 2009)
42	Chłapowo	Settlement	Late Bronze Age/ Early Iron Age	156	123	29	4		Hare – 2	(Wrzesiński, 1994)
43	Kozielice site 76	Settlement	Late Bronze Age/ Early Iron Age	21	9		10		Hare – 1	(Kozłowska-Skoczka, Kowalówka, Kowalski, Dziewanowski, & Rogalski, 2009)
44	Wilenko site 49	Settlement	Early Iron Age	4	2			Auroch/E.bison – 2		(Osypińska, 2014)
45	Wojkowice	Settlement	Early Iron Age	30	19	1			Hare – 1, squirrel – 8, unident. rodent – 1	(Krupska & Chrószcz, 2010)
46	Siniarzewo site 1	Settlement	Early Iron Age	16	3	4	3	Wolf – 1	Hare – 5	(Makowiecki & Makowiecka, 2004a, 2004b)
47	Ślawsk Wielki (Ślawsko Wielkie) site 12	Settlement	Early Iron Age	27	26		1			(Makowiecki & Makowiecka, 2004a, 2004b)
48	Żegotki site 18	Settlement	Late Bronze Age	2					Hare – 2	(Makowiecki & Makowiecka, 2004a, 2004b)
49	Tworów site 9	Settlement	Late Bronze Age	2		2				(Lisowski, 2014)
50	Zagórzycze site 1	Settlement	Early Iron Age	8	8					(Gocman & Pienkos, 2011)
51	Powidz site 16	Fortified settlement	Early Iron Age	31	28	2		Elk – 1		(Gręzak, 2010)
52	Polanowo site 12	Fortified settlement	Early Iron Age	13	9	1		Elk – 3		(Gręzak, 2010)

Table 6: Wild plant species identified from the Late Bronze and Early Iron Age sites

No	Site	<i>Sambucus</i>	<i>Quercus</i>	<i>Corylus</i>	<i>Chenopodium</i>	<i>Bromus</i>	<i>Rumex</i>	<i>Setaria</i>	References
1	Biskupin site 4	>220	11	>133	X	18	x	x	(Jaroń, 1938; Moldenhawer, 1950)
2	Bnin site 2		x			x			(Klichowska, 1984)
3	Grabowiec site 1			1	x	x			(Stachowicz-Rybka, Moskal-del Hoyo, Tomczyńska, & Lityńska-Zajac, 2014)
4	Grzybiany site 3	38	3	>38	923	x	x	x	(Klichowska, 1984)
5	Jankowo site 1	x	x		x		x		(Klichowska, 1984)
6	Juszkowo site 3		x			x	x		(Klichowska, 1979)
7	Kowalewice site 6–7				x	x	x	x	(Wasylikowa, Tomczyńska, Polcyn, & Bieniek, 2003)
8	Kruszwica site K2/4		x			x			(Klichowska, 1984)
9	Kruszwica site 20								(Sady, 2005)
10	Łagiewniki site 5				x				(Klichowska, 1984)
11	Mielnik n/Bugiem		x		x	x	X	X	(Klichowska, 1984)
12	Polanowo site 12	x			>3,000		X	x	(Latatowa & Pińska, 2010)
13	Rosiejów				x				(Klichowska, 1984)
14	Ruda site 3–6			16	31				(Rembisz et al., 2009)
15	Stupca	x	x		X				(Moldenhawer, 1958)
16	Smuszewo		x		x	X			(Klichowska, 1979)
17	Sobiejuhy				x				(Klichowska, 1971b)
18	Parłówko site 11		1		>300		5	2	(Abramów, 2010)
19	Wojnicz site 48			x	x	x			(Lityńska-Zajac, Tomczyńska, & Moskal-del-Hoyo, 2010)
20	Modlnica site 5				x				(Lityńska-Zajac et al., 2015)
21	Kraków-Bieżanów site 27			x	x	x	x	x	(Lityńska-Zajac & Tomczyńska, 2003)
22	Kraków-Rząka site 1			x	x	x	x	x	(Lityńska-Zajac & Tomczyńska, 2003)
23	Lutomiersk-Koziówki site 3a–c				X	x	x	x	(Aldona Mueller-Bieniek, Kittel, Muzolf, & Muzolf, 2015)
24	Grabek site 11		x		x	x			(Mueller-Bieniek, 2002)
25	Kozów site 2	188		9	x				(Kupryanowicz, 2014)
26	Bruszczewo site 5		1	1	x		x		(Klichowska, 1971a)
27	Jakuszowice site 2				x	x			(Lityńska-Zajac, 1999)

X: Over 100 pieces or sample size by volume, x: Present in small amount or no exact figures available.

Figure 8: Wild plant species from the Late Bronze and Early Iron Age sites. (Numbered according to Table 6.)

frogs bone discovery at an Eneolithic site in Bohemia (Kysely, 2008). The collection consisted almost entirely of hind leg bones, which for Kysely has been suggestive of deliberately collecting frogs for consumption.

The remains of tortoises represent just a tiny percentage of bones belonging to wild animals from the Late Bronze and Early Iron Age archaeological sites. Only in five known sites the remains of this animal have been found. The state of preservation of tortoise remains that consisted of typical remaining parts after consuming the meat. This fact can indicate that this animal served as a food resource as early as the beginning of the Holocene. Tortoise consumption continues to modern times (Makowiecki & Rybacki, 2001).

6.1.3.1 Big- and Small-Game Animals: Birds and Mammals

Relatively more data are available concerning wild animal hunting, especially mammals, compared to the species discussed above. Birds are an exception here since their remains often provide no grounds for species identification. Among the remains of birds, waterfowl, chiefly of the family Anatidae, dominate at sites from the examined period.

Data for wild mammal hunting were collected and published by Piątkowska-Małecka (2013). The data not included in Piątkowska-Małecka's work and added to the list in this review generally support those observations. The wild mammal bones constitute no more than 6% of the total species composition recorded at archaeological sites.

No apparent differences were found between fortified settlements and open ones. Both cases, red and roe deer and wild boar, supplemented by small animals such as hare or beaver, are the most frequent species identified. Red deer bones occurred at 42 of the 52 sites listed here, while roe deer remains were found at 26 of them.

A detailed analysis of bone composition compared to the model skeleton element was not performed for this study. However, the antler is overrepresented (28%). By contrast, the trunk bones are significantly underrepresented (4%). Excluding antler, head and leg bones were represented in similar frequency – they formed approximately 15%. Moreover, roe deer and wild boar bone compositions show a similar pattern: the trunk bones and phalanges are underrepresented in relation to leg bones (Piątkowska-Małecka, 2013, pp. 69–74) (Table 8). These observations can serve as an argument favouring the thesis, suggesting that incomplete animal carcasses were present on the sites – the preliminary selection at the place of the animal's killing. People might have preferred only some parts of the animal carcass for consumption.

Only the preferred parts were brought to the settlement. However, human hunting practices can only be one potential explanation for the observed element representation. Assessing the possibility of transporting to the settlement only the preferred part of the body, other possibilities, such as taphonomic impact, have to be considered. Long and compact bones tend to preserve better than flat spongy bones. Phalanges can be easily overlooked during the process of excavation. Table 7 provides data on the alteration observed within the assemblages analysed.

The antler overrepresentation can relate to the retrieval of shed antlers, a precious raw material for tool production. The traces of antler processing were identified within the material analysed by Piątkowska-Malecka. The shed antler collecting is also supported by the proportion of antler numbers with head bones. The index below one would rule out shed antler collecting. The index over two can serve as an argument favouring the thesis on shed antler collecting (see Table 8 – index for red and roe deer) (Piątkowska-Malecka, 2013, p. 34). Antler ornaments and tools are frequently identified at various sites of this time. However, this aspect is beyond the presented study's scope (see also Drzewicz, 2004).

Bones of large herbivores – auroch, European bison, and elk – also occur in the assemblages but less frequently than smaller Cervidae (red deer and roe deer). A relatively small number of bones of large predators such as bears, lynx, and wolves were found in the analysed collections. The most hunted species were deer (red deer and roe deer) and wild boar, but small hunted animals, such as hare and beaver, also remain. The small and large herbivores' disproportion is challenging to explain. One possible explanation is accessibility. It can also be related to animal behaviour and people's judgement whether the particular animal would be an easy target at a particular moment. As a smaller animal, red and roe deer could have been perceived as an easier target than larger and more dangerous elks, wisents, and aurochs.

6.2 Plantae

Plants growing around the residence places were probably used more widely than remains from archaeological sites would suggest. Some plants were consumed often, while others were only exceptionally. The knowledge of plant quality was essential to guarantee the well-being of people and animals. The preserved material from archaeological sites is a kind of palimpsest reflecting times abundant in food and periods affected by the crisis. Today, we are not able to assess the mutual interrelating of those periods.

Table 7: Anatomical distribution of red and roe deer, wild boar, and hare (based on Piątkowska-Malecka, 2013, Table XII.2b)

Anatomical part	Red deer		Red deer antler excluded		Roe deer		Roe deer antler excluded		Wild boar		Hare	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Antler	383	28.6	—	—	75	13.2	—	—	—	—	—	—
Head	177	13.2	177	18.5	113	19.8	113	22.8	92	32.6	0	0
Trunk	39	2.9	39	4.1	6	1.1	6	1.2	35	12.8	2	3
Proximal part of front legs	174	13	174	18.2	99	17.4	99	20	62	22.6	26	43.3
Distal part of front legs	132	9.8	132	13.8	60	10.5	60	12.1	8	2.9	5	8.3
Proximal part of back legs	130	9.8	130	13.6	66	11.6	66	13.3	42	15.3	22	36.7
Distal part of back legs	193	14.4	193	20.1	95	16.7	95	19.2	32	11.7	4	6.7
Phalanges	113	8.4	113	11.8	56	9.8	56	11.3	3	1.1	1	1.7
Σ	1,341	100.1	958	100.1	570	100.1	495	99.9	274	99	60	99.7
Antler Number/head bone number ratio	383/177	2.2			75/113	0.7						

The remains of vascular plants provide the most data. Seeds and vegetative parts can survive in humid conditions or charred. The study of seed imprints in clay (on vessels and daub fragments) complements the analysis of preserved seeds. Seeds of wild plants are relatively frequent in soil samples. It is often the case that they could come into archaeological contexts without a deliberate human action, e.g. intentional harvesting. A significant group of seeds identified in soil samples come from plants growing in the human environment. It could also be the case that the people brought seeds of some wild species into the settlement randomly with other resources such as, for example, harvested cultivated plants. The non-cultivated plants are often harvested together with cultivated species. However, the wild plant seeds also occur frequently in separate assemblages that would suggest their deliberate selection. Apart from the set's uniformity, the preservation of plant remains can also indicate intentional gathering. The finds bearing signs of heat treatment (charring) or cleaning (acorns without cupulae) are cases of its type.

Table 8: Bone alteration observed within analysed assemblages (based on Piątkowska-Matecka, 2013, Table XII.5)

Species	Site	Anatomical fragment	Type of modification
Red deer	Grodziec-Dorotka site 1	2 Antlers	Processed
	Woryty site 2	2 Antler	Cutting, finished objects: 1 axe made of antlers stem, 2 pendant
	Biskupin site 4	190 Bone fragments	Finished objects: 42 burnishers, 103 scrapers, 27 awls, 1 graver, 1 pendant
	Grodno site 6	Antler	Cutting
	Grzybiany site 1	2 Antler, rib, humerus, radius, 2 femurs, 2 tibias	Chopping
	Izdebno site 5	Antler	Burning
		Ulna	Dog-gnawing
	Komorowo site 1	2 Antlers	Cutting, polishing, piercing
		Humerus, radius	Polishing
	Kotlin site 1	Antler	Polishing, sharpening
		Metatarsal, metacarpal	Finished objects: awls
	Koziegłowy site 1	Radius	Finished object: tool unidentified
		Antler	Processed
	Smuszewo site 3	Antler	Processed
	Sobiejujchy site 1	Antler	Chopping, burning
		Unidentified bone	Processing, burning
	Białobrzegi	Skull, bone fragments	Food preparation – breaking
	Żółwin site 29	Antler	Processing
Roe deer	Grodziec-Dorotka site 1	Antler	Processing
	Biskupin site 4	34 Bone fragments	Finished objects: 1 burnisher, 1 scraper, 9 graters, 23 awls
	Grodno site 6	Antler	Chopping
	Sobiejujchy site 1	Antler	Processing
Elm	Komorowo site 1	Antler	Processing
Wild boar	Grodno site 6	Rib	Food preparation – boiling, filleting
	Komorowo site 1	Tibia	Processing
	Sobiejujchy site 1	Bone fragments	Chopping, burning
	Białobrzegi	Lower canine	Processing
Aurochs	Komorowo site 1	Skull pedicle	Circumferential base cut
Beaver	Komorowo site 1	Pelvis	Dog-gnawing
Hare	Biskupin site 4	2 Bone fragments	Finished objects: graver, pendant
Bear	Biskupin site 4	2 Bone fragments	Finished objects: 2 pendants
Marten	Biskupin site 4	Bone fragment	Finished objects: pendant

The list presented in this review covers only a tiny portion of plants that could be potentially consumed. Fleshy fruits are represented solely by *Sambucus* stones. However, this type of finding is rare. We can assume that fruits were consumed fresh at the time of ripening without undergoing any processing. They are perishable and pose difficulties in the long-term storing. However, if they were meant for more extended storage, they could be pitted and the stones discarded after drying.

Unfortunately, data concerning nuts and acorns, although present in archaeological contexts, are also not frequent. The same situation applies to grass and perennial plants. The data on wild plant remains are restricted to species that produce seeds or fruits, thus preserving fossil records. There is barely any proof that any of the plant's vegetative parts were harvested and consumed: leaves, stems, inflorescences, and underground parts of the plant preserved only in exceptional conditions. However, there is almost no archaeological record, except with the analysis of peat-bog bodies' digestive tract content. When considering the Polish area, only the peat-bog mummy of the Girl of Dröbnitz and the Polanowo hoard contained the vegetative plant tissues. The bog mummy's last meal was analysed and published in the 1940s. The results have proven the presence of lungwort (*Pulmonaria officinalis*), shepherd's purse (*Capsella bursa-pastoris*), and an unidentified plant of the genus *Rumex*. These plants were an addition to the pulp consisting of meat, cereals, and peas (La Baume, 1940, pp. 17–22). Unfortunately, we cannot re-examine the mummy herself and her stomach content again. Her body was destroyed in the Second World War during the fire of the Kaliningrad Museum. The “water” deposit recovered at Polanowo poses difficulties in interpretation. It contained very diverse remains of plants that could not be associated with consumption without a doubt (Latałowa & Pińska, 2010). Both authors agree that the vessel was used as threshold offerings having an unusually eclectic character – the pots contained cultivated and wild plants for various uses. It is hard to conceive what would be behind this sacrifice. So many different plants, also in a semantic sense, have been deposited.

7 Discussion

The data review results can serve as an argument favouring plants and invertebrate gathering, fishing and hunting as a crucial activity in the Late Bronze and Early Iron Age. Historical ethnographic data also suggest that natural resources play a vital role in the economy, even in relatively recent time. Cultivation of plants and animal husbandry (subsistence economy) are not opposed to the economy based on hunting, gathering, and fishing. There is evidence of some resource diversification.

7.1 Acquisition Stage

Concerning the acquisition techniques of natural resources, this activity usually started with a stage where the people located the desirable resources and gained knowledge of their seasonal availability. All these activities, we can attest to ethnographic data, written sources, and accounts of tested societies in historical times. However, it is not possible to find any direct evidence from prehistoric times. However, judging from the remains occurring in the archaeological record, we can assume that the people living in the period in question must have had relevant knowledge concerning this matter. The sourcing of resources could have involved diverse techniques. Several organisms, especially living in the water (e.g. crayfish, catfish, and eel), are acknowledged even today as an excellent delicacy. The remains of aquatic organisms at archaeological sites can attest to hunting/collecting. Most of these organisms would not be capable of relocating to the land environment without human involvement, not to mention that they would not survive in such an environment. A counterargument for that can be periodic changes to the environment: temporary flooding of the regions undergoing excavation. In this case, however, there would be more arguments to support this interpretation than just the presence of remains of aquatic organisms.

Amid the group of aquatic invertebrates, molluscs and crustaceans belong undoubtedly to the animals that gained recognition in many present societies' cuisines. At the Late Bronze and Early Iron Age sites, the evidence for gathering molluscs and crustaceans by people is relatively scarce. The remains of crayfish have not been identified so far, although they are still a delicacy according to the old Polish kitchen tradition. In the past, the number of crayfish must have been higher in water bodies, not polluted by industrial waste. There was no process of eutrophication triggered by an intensive run of fertilisers. The remains of mussels of the family Unionidae (*Unio* and *Anodonta*) predominate, composing the largest freshwater mussel group.

Animal resources were available through gathering (e.g. molluscs) as well as active or passive hunting and fishing. The passive hunting and fishing methods involve preparing different traps that do not need to be watched by people. All the hunters had to do would have been a regular checking of traps.

Molluscs can be sourced from shallow waters by hand or gathered with the aid of instruments like baskets. To assess the technique, we should estimate how diversified is the assemblage in terms of size. A homogenous assemblage consisting of large shells alone may suggest gathering by hand. The collection containing different sizes of shells may be the evidence of a mechanical collecting of molluscs, for example, with baskets (Kurzawska, 2012, p. 377). Mussels quickly decay, so they are not suitable for storage. Instead they were collected to meet short-term needs and be consumed after cooking or roasting, which made it easier to get the meat out of the shell. Heat treatment is the easiest way to check whether a mollusc is alive and thus fresh. Those shells which are closed after roasting or boiling are discarded as they are not suitable for eating.

The question remains, who or what was the consumer of mussels – people or livestock? Both man and omnivorous animals can eat mussels, although the opinion that mussels were animal feed prevails. The written sources attest that the mussels and stock produced during the cooking was the component given to pigs, ducks, and hens (Zabilska, 2012, p. 280). This view is arguable as there is still not much known about pig husbandry. If fully closed, they need to be fed, but the animals feed themselves in the forest grazing system.

Two possible ways of acquiring fish are active (angling, hunting with a harpoon or fishgig) and passive techniques involving leaving traps such as baskets and nets containing properly chosen baits. Unfortunately, apart from hooks' finds as fishing equipment, no data are available on other fishing techniques. The behaviour of these animals was definitely behind the seasonality of fishing. Since the fish are poikilotherm, they are not prone to forage during winter – the freshwater fish hibernate. In contrast, saltwater fish stay through winter in deep waters (van Amerongen, 2016, p. 66). Fishing was the seasonal activity during the period of fish foraging or spawning in the early spring months. According to Makowiecki, the morphological features of fish remains from the late Bronze and Early Iron Age attest to the theory that fishing caught mostly during their breeding period (Makowiecki, 2003, pp. 95–103). Although some ethnographic sources also mention the possibility of catching fish during winter, when oxygen deficiency occurs, and fish seek fresh oxygen-rich water (Moszyński, 1929, pp. 64–65).

The majority of vertebrate and invertebrate species occurring in Central Europe are edible, as present-day survival enthusiasts claim. Some of them were consumed exclusively in the state of severe food deficiency. The end of winter and the beginning of spring would probably be the time of including wild resources into a diet. For many species, this is the breeding time when they are more prone to migrate. The green frogs (water frogs), also known as edible frogs, commence their mating season in May, and that is when they become easy prey. A tortoise is a water-living animal; and when in danger, it hides underwater. Since the tortoise forages on dead prey, one can use traps with bait to catch it. It could also have become relatively easy prey in the season of laying eggs when females travel in search of a dry place. In contrast to mussels, tortoises could have lived in captivity for some time to be eaten later or for entertainment, as can be deduced from intact remains (Makowiecki & Rybacki, 2001).

The acquisition of animal resources such as mussels, fish, or small vertebrates (e.g. frogs or tortoises) is not an arduous or time-consuming activity. These resources require neither substantial work investment nor complicated equipment to obtain them. This supply type is practically on hand and can be gained, so to speak, “on occasion.” For example, by children, while keeping watch on grazing herds or during a gathering of green parts of plants.

Understanding birds' behaviour could have been the essential element in exploiting this type of resources. Along with active hunting, people would also have taken eggs and nestlings during the breeding season. These economic strategies are primarily undetectable in the archaeological material. Birds are relatively easy to catch during the moulting period. Waterfowls, geese, ducks, and swans alter their flight feathers in this period, making them unable to fly for 4–6 weeks, thus becoming easy prey (van Amerongen, 2016, p. 67). This season comes in the summer among most water birds, so that the migratory birds can fly before the migration starts. The migratory season alone in spring or autumn is when birds could have been easy victims to hunters because they form large groups. During the pauses in foraging, some of them are weak and unable to escape. This aspect of birds' behaviour did not escape people's attention in the past. According to historical sources, the water and marsh birds' hunting season comes during the summer heat, when the waterfowls are moulting, and autumn, when the birds begin to migrate (Moszyński, 1929, p. 27). The author also described different ways the smaller birds were caught: using glues, nets, and spreading out the feed soaked in poison or vodka (Moszyński, 1929, p. 34). This last technique – peas soaked in vodka – was used in Belarus to catch partridges. It would be possible to employ this method in the Bronze and Iron Age, provided we assume that high-percentage alcohols were known and produced at those times.

The mating season and rearing offspring can be when hunters may expect more successful hunting of mammals. Males who are busy looking for partners are less cautious, and females are potentially more vulnerable when raising young. The bone evidence shows, however, that most animals were adults. In wild species, forest individuals mostly recur, such as red deer, roe deer, and wild boar (Piątkowska-Małecka, 2013). Those species stick to the herds throughout most of the year and forage in open lands and clearings, significantly impacting hunting opportunities.

7.2 Preferences

With the establishment of farming, bred animals provided most of the food, leading to an inevitable decline in hunting, fishing, and gathering. The data collected from different parts of Europe have shown that hunting would not have been a crucial activity for surviving and obtaining meat. However, still, it could occur on the occasional basis when needed (Bartosiewicz, 2013, pp. 328–347). Furthermore, we should not forget about manure, which is another animal-derived product important for agriculture. It is a renewable resource as long as animals are alive. We should also keep in mind that domestic meat was probably not available all the time. The excess of meat from the slaughter must be necessarily processed to be suitable and safe for eating. Salting was one of the food preservation methods in prehistoric times. The Hallstatt region's wealth grew from salt trading profits, indicating that this commodity would have been exceptionally precious. Drying or smoking meat may be an alternative to salting, but, in Central European conditions, they can only occur in a season when there is no activity of insects. There is a saying in Polish, perhaps a little exaggerated and anecdotal – “When does a farmer eat a hen?” When the farmer is sick or the hen is ill, that suggests no thoughtful reason to slaughter the animals in circumstances other than illness or planned celebration. Their breeding is not just about having easy access to meat. It also involves a considerable investment of time and labour, and meat is a non-renewable resource, in clear contrast to milk, fibre, manure, and animal labour.

The taste of food is another issue that, as it seems, is strikingly underrated today. It is worth quoting here an excerpt from a seventeenth-century record cited by Zabilska (2012, p. 280): “In January, snails are the best for those who like” (Zawadzki & Rostofski, 1616, p. 13). What kind of snails would be available in January? It seems that not all enjoy the taste of this food. It is worth presenting the research results concerning the Central England inhabitants' diet in the Late Medieval period. The authors explicitly state that the villagers' diets are based on plant products supplemented with milk and dairy products, eggs, and, of course, mussels. The text mentions that marine mussels were a cheap supplement to the diet among the lower social classes. The nutrition regime of societies living in the feudal state was regulated by religious recommendations, which also controlled access to food products (Müdner & Richards, 2005, p. 41).

Today, water molluscs are especially appreciated in many cuisines globally, particularly in the Mediterranean area, Western Europe, on the coasts of the Pacific and Atlantic, and East Asia. In Poland, locally occurring mollusc species are occasionally picked up with *Lemna* (duckweed) from small water bodies to supplement breeding ducks. Nevertheless, clams are not perceived as potentially edible any more.

The capacity of present research methods heavily limits our understanding of natural resources importance in the past economy. What is crucial here, is the very nature of the resources mentioned above contributing to losing potential information. Most of these resources leave no trace in the archaeological record. Tree sap is the best example. Many Central European cuisines obtain and consume birch sap even today. The sourcing and processing of it does not require any special equipment. Thus, this process remains completely intangible from the viewpoint of the material culture. Today birch sap is perceived as a “healthy diet product” or “delicacy.” Considering the content of sugars, minerals, and vitamins, we can admit that birch sap might significantly diversify the diet in the early spring period.

In ethnobotanical literature, one can find many references describing the process of sap production from different species of trees, not just birch (Svanberg et al., 2012). Written sources tell how the sap was vaporised by heat to obtain a syrup. It can be fermented or used to prepare food as an ingredient instead of water. In some countries, the period of sap production has become the name of the month (in Belarusian “Сакавік” – the month of sap, and Ukrainian “Бережень” – birch month, both of which refer to the month March). Finnish tradition calls the birch a “cow of a poor man” (Svanberg et al., 2012). Significant quantities of sap can only be acquired in the period when the growth starts and just before the tree leaves appear. In the absence of archaeological evidence, we cannot directly confirm tree sap was used in the Bronze and Early Iron Age. Nevertheless, we cannot completely rule out the possibility of collecting birch sap in the discussed period, given the high content of birch in North and Central Europe’s forests.

The ethnobotanical data on rural communities cuisines and culinary traditions demonstrate the gathering of the green parts of plants had been a regular practice, no matter how diverse plant species were cultivated at the same time (Moszyński, 1929; Łuczaj, 2010). Vegetative parts of plants were the primary ingredient or flavouring additive in making soups and pulps.² A nettle stew preparation was confirmed some years ago by the discovery at the Iron Age settlement at Flag Fen, England. The vessel with a wooden spoon and remains of the meal comprising nettles have been found there (Alberge, 2011).

Acorn use already has a broad literature. However, the data collected in this study do not support the importance of acorns in the human diet during the period concerned (Mason, 1992; Mueller-Bieniek & Kapcia, 2017). Taking into account the forest composition in Central Europe, acorns were in abundance. Their nutritional value is almost comparable with cereals. They are also suitable for quite long storage.

Moreover, the storage even improves their edibility. Acorns do not require any special tools for processing except those used for processing cereals. Written sources from different regions offer a broad range of examples of culinary use of acorns either in everyday diet or in times of shortage (Mason, 1992, pp. 80–83).

A similar approach can be applied to *Chenopodium* sp. Although there is a vivid discussion as to whether it was collected from natural sites, cultivated or whether its frequent presence in archaeological contexts is merely due to the fact than it is a segetal plant (Mueller-Bieniek, Bogucki, Pyzel, Kapcia, Moskal-del Hoyo, & Nalepka, 2019; Rowley-Conwy & Stokes, 2002).

8 Conclusion

The data for assessing the wild resource role in consumption strategies are scarce and, as a general rule, confined to some activity spheres. Unfortunately, plant and animal remains preserved within

² I know spring meals that my family use to prepare using goosefoot, nettle, sorrel, and sowthistle. In my family, there is also a tale of the gathering of *Bromus secalinus* spikes and then threshing them for gaining grains in the early spring season – this refers to the period shortly after the the Second World War.

archaeological sites represent one of the very few information sources. At that time, the dominant funeral rites give no insight into the human bones' diet composition. Moreover, the vessels' analyses to detect any biomarkers have not been conducted for the discussed period. Thus, we do not even have indirect data for determining the presence of proteins of "water" and "land" origin, vegetable, and milk or animal-derived fats inherently present in the prepared food. A pilot project of such research would undoubtedly increase the diet's understanding significantly, including the food based on cultivation and breeding products. Combining the information on diet and microregional man-induced environmental change would allow for a more comprehensive study of the economy's issues in the societies of the late phases of the Bronze and Early Iron Age. Standard features filling flotation on settlement sites could help evaluate whether the lack of "wild resources" results from their preservation state or their absence in the economy.

Bearing in mind the controversy regarding applying ethnobotanical and historical records to reconstruct economic behaviours in prehistoric times, they still provide valuable input into the range of potential behaviours. The preserved material at archaeological sites comprises merely a tiny fraction of the past world. We can reconstruct at best only a partial fragment of their reality, even if we would have at our disposal the whole range of complex analytical tools. Archaeological studies, supported by the bulk of analytical methods, allow for an incomplete glimpse into the past reality. We can compare our view of the past with the image we see looking through the keyhole or *camera obscura*. Not knowing the more significant part of the scene, we cannot assess the distortion view scale.

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