Ph.D. Thesis

Viktor Ulicsni

University of Szeged

Doctoral School of Biology

SZEGED

2021

Ph.D. Thesis

Investigation of traditional ecological knowledge of wild animal species in the Carpathian Basin

Viktor Ulicsni

Supervisors:

Dr. Zsolt Molnár

Dr. Attila Gyula Torma

Consultant mentor:

Dr. Biró Marianna

Ph.D. School in Biology

Department of Ecology

Faculty of Science and Informatics

University of Szeged

SZEGED

2021

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

CBD – Convention on Biological Diversity

ILK – indigenous and local knowledge

IPBES – Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (UNESCO)

IPLC – Indigenous Peoples and Local Communities

KLI – knowledgeable local informant

RLI – randomly-selected local informant

SCE – scientific and conservation expert

TEK – traditional ecological knowledge

1. INTRODUCTION

1.1 General scope

Research on ecological knowledge of people living in rural areas is receiving increased attention worldwide (see e.g. IPBES – Pascual et al. 2017 or Díaz et al. 2018), and research on this field has also become more significant in Hungary in the last 10 years (Molnár et al. 2008). Traditionally, ethnozoologists were primarily interested in basic research on the folk taxonomy of vertebrate species and more direct examination of some highly salient taxa which have direct relevance to people. In this thesis, in addition to the examination of these two topics, a more focused study of invertebrate-related knowledge and ecological/conservation issues were targeted. Besides recording folk taxonomy, our aim was to describe the morphological, ecological and cultural salient features of wild animal species in three landscapes of the Carpathian Basin. Additionally to these necessarily exploratory basic research, we examined the local perceptions of ecosystem services and disservices related to a reintroduced and invasively spreading keystone species, the Eurasian Beaver (*Castor fiber*) in three landscapes of the Carpathian Basin. The last main topic of the thesis has been spranged by the fact that there is a lack of experience among academic scientists regarding where and how traditional knowledge can be found and obtained (Tengö et al. 2014). Experience shows that, a more efficient bridging of knowledge systems could increase the chances of success and lead to improved cooperation between conservation practitioners, academic scientists, and indigenous and traditional knowledge holders. For that reason, we examined the expert judgment of academic zoologists' and a feature-based linear model's predictions for the observed level of local familiarity with wild animal species.

1.2 Folk knowledge of wild animal species

Traditional knowledge systems about the landscape and the biota have been fundamental for human development since the times of pre-modern and pre-industrial societies in Europe. Humans living in close contact with the landscape as herdsmen and peasants have long possessed unified, systematic knowledge, including folk taxonomies, about phenomena that were of importance to them. The use and management of natural resources was based on centuries-old, often millennia-old ecological experience, on multi-generational knowledge passed down from generation to generation (Menzies and Butler 2006; Berkes et al. 2008). According to Fikret Berkes (Berkes 2012) traditional ecological knowledge is a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment. In our work, we also focused on the study of traditional ecological knowledge within the meaning of Berkes' definition.

Ethnozoology is the scientific study of the dynamic relationships among people and animals. Traditional ethnozoological knowledge has great cultural and economical importance. It is widely studied in the tropics and North America (e.g. Ellen 2006; Hunn 2011; Alves 2012), but much less in Europe (e.g. Iturralde et al. 2003; Fridell and Svanberg 2007). Wild animal-based natural resources are often among the key resources local communities depend on (Fischer-Kowalski and Weisz 1999; Nishida et al. 2006). A major goal of these communities is to use and manage these resources sustainably (e.g. taboos: Colding and FOlke 2001; social rules: Primack 2006; Molnár et al. 2015). Long-term sustainability in the use and management of natural resources requires healthy ecosystems, while at the same time, sustainable management often contributes to maintaining the health of ecosystems (Davidson-Hunt and Berkes 2005; Gunderson 2005).

The knowledge passed by local traditional communities, however, not only serves sustainable use and maintenance of the local community and its environment but may also provide valuable data, information and knowledge to science and conservation. Among the potential benefits of traditional ecological knowledge, it can help science to recognize new species (e.g. Diamond and Bishop 1999), provide data on population sizes and dynamics of species that are difficult to observe (Huntington 2000; Roba and Oba 2009a), support the monitoring of ecosystem health, incl. pasture conditions (Mapinduzi et al. 2003; Roba and Oba 2009b), and develop efficient conservation managament strategies and practices (Gadgil et al. 2005; Gilchrist et al. 2005; Gomez-Baggethum et al. 2010; Bonta 2010).

1.3 Introduction for the case studies

1.3.1 Folk knowledge of mammals

There has been much ethnobiological research on the relationship between biota, landscape and folk knowledge of plants, birds, insects, medicinal uses, habitats, etc. However, research on local knowledge of mammals has mostly focused on domesticated species and largely ignored wild taxa (a few exceptions are Malkin 1962; Broch 2009; Ziembicki et al. 2013; Solís and Casas 2019).

Only a small number of studies have been published in Europe and Northern Eurasia (Svanberg et al. 2011). The majority of them were aimed to present folk knowledge on individual species (including biological identification and local naming). One comprehensive study by Fridell and Svanberg (2007), was published as a book which summarised folk knowledge on mammals in Sweden. Ståhlberg and Svanberg (2010) analyzed the relationship between rodents and nomads in Siberia. Lescureux and Linnell (2010) studied traditional knowledge and cognitive processes in relation to Grey Wolf (*Canis lupus*), Brown Bear (*Ursus arctos*), and Eurasian Lynx (*Lynx lynx*) in Macedonia. There was also an ethnozoological study regarding human-wolf relationship in the Iberian Peninsula (Álvares et al 2011).

Large-scale ethnozoological data among ethnic Hungarians has been collected so far for only one region (Sóvidék, Szeklerland, Romania). Gub (1996) gathered data on traditional ecological knowledge of 40 mammal species in a landscape dominated by coniferous and beech forest. He provided the most elaborate documentation on the knowledge related to cultural salience by bringing together proverbs and riddles as well as collected the traditional knowledge on morphological and ecological characteristics of all folk mammal taxa occurring in Sóvidék region. These data closely correspond to scientific opinions. Kovács (1987) studied the folk knowledge of 31 mammal species along the Danube (Szigetköz, NW Hungary), which were sometimes surprisingly precise even if judged by scientific standards.

Identification, naming, and classification of folk taxa in most cases are accomplished using three criteria. These are the morphological appearance of animals (i.e. size, shape, colour), the ecological distinctiveness (i.e. behaviour, habitat, abundance), and the cultural significance (harm, either supposed or real, and benefit) (Hunn 1982). Considering the degree of familiarity with a species, the most important factors are morphological characteristics, particularly the body size, and the potency to cause damage (Hunn, 1999). Babai (2011) found the life form categories of Brown (1979) as the most influential method in separating animals (particularly between the categories of wild and forest animals).

1.3.2 Folk knowledge of invertebrates

There is scarce information about European folk knowledge of wild invertebrate fauna, including their use in healing and nutrition. Researchers in ethnobiology seldom pay attention to invertebrates in the European context (Svanberg et al. 2011). By contrast, several comprehensive studies have been conducted in other parts of the world. However, there is no reason to imagine that European peasant and herder communities differ fundamentally from native societies in other parts of the world with regard to their ecological knowledge (Lévi-Strauss 1962).

As early as 1887, Stearns published an ethnoconchological work on the use of shells as money among aboriginals of North America (Stearns 1887). This was actually the first time the prefix "ethno-" was combined with a research field, thus preceding Harshberger's term "ethnobotany", coined in 1895 (Harshberger 1895). Another pioneering study was Henderson´s and Harrrington's ethnozoology of the Tewa people in New Mexico. This study gives a full list of animals, including invertebrates, by order and gives their Tewa names as well as their scientific names (Henderson and Harrington 1914). In a comprehensive study Bodenheimer (1951) reviewed the ethnographical literature of the use of insects as food worldwide. Nowadays there are several important studies available dealing with ethnobiological aspects of invertebrates. We can, for instance, mention Bentley and Rodríguez (2001) on the entire invertebrate fauna of Honduras, and Krause et al. (2010) on the insect fauna knowledge of the Roviana people (Solomon Islands). Gurung (2003) detailed the knowledge of arthropods among Tharu farmers in Nepal, while Hemp (Hemp 2001) described what the peoples living near Mount Kilimanjaro (Tanzania) knew about invertebrates. A particularly impressive ethnozoological study is Morris (Morris 2004), dealing with the impact of insects and their classification in Malawi folk culture. In addition, the literature on aquatic and coastal-marine invertebrates is particularly rich (e.g. Pawley 1994; Svanberg 2007; Groesbeck et al. 2014).

The general experience is that many invertebrate species have specific and relevant benefits or detriments, although the number of locally known folk taxa is higher than this (Krause et al. 2010). Some culturally salient invertebrate species may even be important keystone species in the lives of certain communities. The majority of these are coastal-marine invertebrates (e.g. shellfish in British Columbia – Groesbeck et al. 2014; crabs (*Ucides cordatus*) in Brazil – Nordi et al. 2009; Alves and Souto 2015). There are fewer culturally salient species among terrestrial invertebrates, and relatively few species have known folk uses (cf. Gurung 2003; Kato and Gopi 2009). Keystone species include, among spiders for example, the bird-eating spiders for Afro-Brazilians in Bahia (Neto 2006), while among lepidopterans there is the Brahmaeid moth on Taiwan (Chao et al. 1993).

European folk knowledge about invertebrates has, since the nineteenth century, been researched mostly by folklorists and linguists. In 1879–80 the Swedish author Strindberg used a questionnaire to gather valuable data regarding folk names and rhymes connected with the ladybird. His research, using mapping as a method, is a pioneering work in folklore about animals (Strindberg 1882). In Poland Bronisław Gustawicz collected superstitions, folk names and other knowledge about 75 wild animal species, among them 20 highly salient invertebrates (Gustawicz 1881). Also one of the most influential ethnographer of Poland in the late 19th century, Oskar Kolberg described in details the folk beliefs, traditions and magical abilities attributed to fauna and flora (Kolberg 1881). An encyclopedia was published about Romanian insect folklore, including local names, legends, fables and myths, the role of insects in witchcraft, and beliefs about insects as pests or as omens (Marian 1903). Herman published the local names of insects and invertebrate pest species known by Hungarian herders (Herman 1914). We can also mention an interesting article on folk knowledge about botflies (Oestridae) found as parasites on domesticated reindeer, published by the ethnographer and linguist Wiklund (1916). This kind of ethnographic folklore-linguistic research tradition continues today in Europe. Wiggen, for instance, inspired by current ethnobiologists, has recently published an exciting study on the traditional names of invertebrates in Norway (Wiggen 2008). In European cultures, it is generally quite uncommon to use or consume invertebrates (Zagrobelny et al. 2009; Durst et al. 2010). The only invertebrates with any significant ethnobiological literature are for the taxa of snails (Duhart 2009), slugs (Svanberg 2006), leeches (Vallejo and González 2015), ladybirds (Iturralde et al. 2003), crustaceans (Swahn 2004), oil beetles (Percino-Daniel et al. 2013) and head lice (Vallejo and González 2013), but none of these are cultural keystone species. Here we should also mention a small but intriguing study on Sami children’s knowledge and use of small invertebrates for amusement and to play with (Anderson 2000). In 2006, Svanberg (Svanberg 2006) published a small book with ethnozoological studies on the human relationship with bumblebees, earthworms, froghoppers, isopods, liver flukes, moonjellies and starfish in Scandinavia and Estonia. There is of course extensive biological literature on pests, but very little detailed documentation of folk knowledge has yet been carried out in Europe (Sõukand et al. 2010; Seidel and Reinhardt 2013). We are, however, of the opinion that further data may exist in local languages, in works on ethnography, local history and perhaps even linguistics, but these have not yet entered the international ethnobiological literature (e.g. Rolland 1877).

There is also very little Hungarian literature on folk knowledge of invertebrates. Linguistic (dialectic), ethnographic and ethnobiological literature is available concerning 161 invertebrate species in the Sóvidék region in Transylvania (Gub 1996), 67 taxa along the Danube (Kovács 1987), the beetle taxa *Melolontha melolontha, Lucanus cervus* and *Lytta vesicatoria* (Kicsi 2015), and the snail species *Helix* spp. (Bihari-Horváth 2011). Sporadic data may also appear in ethnographic and linguistic literature written in the Hungarian language, for example in monographs on farming and forest ethnography, e.g. in Hegyi (Hegyi 1978) on *Lytta vesicatoria* and *Melolantha melolantha*. Before our paper (Ulicsni et al. 2016), nothing has been published in English about the folk knowledge of invertebrates of the Carpathian Basin, and this is the first article in Europe to deal comprehensively with an entire invertebrate fauna.

1.3.3 Bridging conservation science and traditional knowledge

Species and ecosystem conservation and the sustainable use of natural resources all require reliable information. Most evidence, however, originates from academic science, while other knowledge systems are largely ignored (Tengö et al. 2014; Asselin 2015). Recent evidence shows that indigenous peoples and local communities contribute highly valuable knowledge to conservation science and practices, including achieving conservation targets (Berkes et al. 2000; Huntington 2000; Uprety et al. 2012; Forest Peoples Program et al. 2016).

The use of traditional knowledge in conservation science, practice and policy is, however, limited by a number of epistemological differences, uncertainties of knowledge validation, and power asymmetries (Berkes et al. 2000; Huntington 2000; Nadasdy 2005; Molnár et al. 2008). For these reasons academic zoologists (i.e. those not familiar with traditional knowledge) are often reluctant (to the point of refusal) to cooperate with local knowledge systems (Gilchrist & Mallory 2007).

Expanding knowledge sources and collaborating with other knowledge systems is supported also in the policy arena by CBD (Convention on Biological Diversity) and IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services). IPBES emphasizes in its assessments the importance of strengthening dialogue and knowledge co-production between knowledge systems. IPBES also recognize and respect the contribution of indigenous and local knowledge (ILK) and Indigenous Peoples and Local Communities (IPLC) to the conservation and sustainable use of biodiversity and nature's contribution to people (Díaz et al. 2015; Lundquist et al. 2015). Scientists are motivated (urged) to bridge knowledge systems.

While local knowledge of wild plants (especially medicinal and edible species) is widely respected and used in science (Łuczaj & Szymański 2007; Turner 2014), this is less common in the case of wild animal species (Gilchrist & Mallory 2007). Ethnozoology, as a branch of ethnobiology, studies the interactions between humans and animals, such as traditional ecological knowledge on wild animals (Hunn 2011; Alves 2012). Research into traditional zoological knowledge has ramifications for many other fields, including ethnology, cultural anthropology, monitoring, population biology, conservation biology, biodiversity assessments, and conservation practice and policy (Table 1).

Table 1. Examples of traditional zoological knowledge relevant to the conservation of wild animal species.

Topics	References
Folk nomenclature, folk taxonomies, identification of species hitherto unknown to academic science	Diamond & Bishop 1999, Beaudreau et al. 2011
Location of new populations and habitats of endangered species	Huntington 2000, Rea 2007, Alves 2012
Monitoring data on rare, protected and invasive species, developing monitoring indicators	Huntington 2000, Colding & Folke 2001, Nadasdy 2005, Danielsen et al. 2011
New information on behaviour, food spectra, life histories and reproductive cycles of less known (and threatened) species	Huntington 2000, Tideman & Gosler 2010, Idrobo & Berkes 2012
Knowledge on the local impacts of resource use on biodiversity (incl. land-use history)	Huntington 2000, Molnár et al. 2008, Tideman & Gosler 2010, Alves 2012
Old-new extensive land-use practices to be rediscovered for better conservation management	Berkes et al. 2000, Johnson & Hunn 2010, Gilchrist & Mallory 2007
Insights into local population regulation practices of game and fish species, incl. taboos and other social norms	Colding & Folke 2001, Neto & Pacheco 2005, Rea 2007, Silvano & Jørgensen 2008, Alves 2012, FPP et al. 2016
Local knowledge on how to prevent overexploitation of globally traded species used in medicine, handcrafts, etc.	Neto & Pacheco 2005, Alves 2012, Berkes 2012
Insights into motivations, decision-making strategies and worldviews (incl. cultural, symbolic and spiritual connections) of local stakeholders on land management to help resolve conflicts about protected areas, large predators, game species, scavengers and "less appreciated species" (e.g. snakes)	Nadasdy 2005, Berkes 2012, Lescureux & Linnell 2013, Morales-Reyes et al. 2017
Traditional knowledge to be brought into local formal education in a culturally appropriate way to prevent cultural erosion	Kimmerer 2002

Zoologists and conservationists often seek species-specific local knowledge. A major barrier to cooperation with local knowledge holders seems to be a lack of experience on where and how traditional knowledge (e.g. on wild animal species) can be found and obtained, and how to work together with local knowledge holders to generate new knowledge for conservation (Idrobo & Berkes 2012; Turvey et al. 2014). Zoologists motivated by CBD, IPBES or other organizations to bridge knowledge systems would benefit from having greater advance knowledge of which species are locally known and the depth of this knowledge, enhancing their chances of success (Ens et al. 2014).

In order to make better predictions of the availability of local knowledge on wild animal species, there needs to be greater understanding of how such knowledge may be affected by certain features of the species (e.g. size, abundance, habitat and usefulness).

1.3.4 Local people's perception of the Eurasian Beaver's impact on ecosystem services

Ethnozoology, the study of traditional and local knowledge can greatly help in managing some nature conservational problems (Alves et al. 2018). Ecosystem engineer species can contribute considerably to local biodiversity by transforming their environment (Jones et al. 1997, Wright et al. 2002, Kremen 2005, Petrosillo and Zurlini 2016, Law et al. 2017). This impact is, however, conflicting in many cases. While ecosystem engineer species provide habitats for certain species, they are disadvantageous for others (Collen and Gibson 2001, Kremen 2005). Both the Canadian and Eurasian Beaver (*Castor canadensis* and *Castor fiber*) are good examples of ecosystem engineer species (Wright et al. 2002, Anderson et al. 2006, Hood and Larson 2015). The role of beavers in watershed restoration was extensively investigated in the case of the Canadian beaver which performs a significant 'construction activity' (Burchsted et al. 2010, Pollock et al. 2012).

The Eurasian Beaver disappeared from most parts of Europe in the second half of the 19th century (Rosell et al. 2005). Consequently, their activity in modifying water courses and contribution to biodiversity also disappeared. In Europe, the main purpose of reintroduction was to restore beaver populations, and contrary to the U.S. conservation management, watershed restoration was rarely listed among the specific aims of beaver reintroduction projects (South et al. 2000, Rosell et al. 2005). Beavers have mostly recolonized their former distribution range (Halley and Rosell 2003, Rossel et al. 2005, Stringer and Gaywood 2016, Smeraldo et al. 2017, Gorczyca et al. 2018). Although the Eurasian Beaver is a native species in Central Europe, in some areas its spread shows an invasive pattern just like that of the Golden Jackal (*Canis aureus*) in Southeast and Central Europe (Szabó et al. 2007). As a result, a conflicting situation has unfolded: beavers are protected and their reintroduction is regarded as a success story by conservationists (Čanády et al. 2016), while their activity is becoming a source of conflict between locals and nature conservationists (Schüttler et al. 2011). However, conservationists often fail to consider the diversity of local perceptions (Fischer and Young 2007, De Groot 2010) and do not acknowledge the harm caused by beavers to local people.

There are several knowledge gaps concerning the social factors affecting local perceptions and human-wildlife coexistence. One example is the relation between the actual harm caused by wild animals and their local perception (Dickman 2010). Local perception can also be influenced by local ecological knowledge about the given species (Caballero-Serrano et al. 2017, Duenn et al. 2017). Despite the fact that European beavers play a significant role in forming the floodplain ecosystem services, the local perception of its impacts is understudied. Studies about the local perception of the impact of beavers' activity on ecosystem services are mostly limited to *Castor canadensis*. The main conclusions of these studies are that local perception primarily refers to provisioning ecosystem services (Santo et al. 2017) and that the attitude of locals could be changed considerably by defining the actual economic loss (Schüttler et al. 2011).

Local knowledge, perception and attitude related to wild animals' activity has important policy and nature conservation relevance (Berkes et al. 2000, Törnblom et al. 2011, Martín-López et al. 2012, Levine et al. 2017). There is, however, a considerable knowledge gap concerning the Eurasian Beavers' impacts on ecosystem services, local perception of the beavers and local attitudes towards them (cf. Panait 2012, Manikowska-Ślepowrońska et al. 2016, Meyer 2005). A better understanding of local perceptions could play an important role both in nature conservation and sustainable beaver management, for example, by promoting the efficiency of social learning and resolving or avoiding further conflicts (Dickman 2010, Törnblom et al. 2011). This has been shown by several studies about the local perception of and knowledge on *Castor canadensis* (Enck et al. 1992, McKinstry and Anderson 1999) and about the attitude of locals towards the species (Jonker et al. 2006, Payne and Peterson 1986 and Wigley and Garner 1987).

Because of the complexity of the conflicts regarding the beaver's activity and its dependence on local social and environmental contexts, it is necessary to conduct policy-relevant interdisciplinary research in multiple, distinct landscapes (Törnblom et al. 2011, see also Schüttler et al. 2011).

2. OBJECTIVES

Our research has the objective of presenting the folk knowledge of wild animals in Hungarian communities; examine the possibilities of knowledge coproduction between indigenous and local knowledge holders and the science; and study the local knowledge and perception of the European beaver's impact on local ecosystem services. The objectives in detail were:

1) make a list of folk taxa of invertebrates and wild mammal species,

2) describe folk biological classifications and nomenclatures of invertebrates and wild mammal species,

3) collect the salient features of invertebrates and wild mammal species,

4) collect the uses, related proverbs and sayings, and their conservation of invertebrates and wild mammal species,

5) examine the expert judgment of academic zoologists (with little or no expertise in traditional knowledge) and a feature-based linear model at predicting the observed level of local familiarity with wild animal species,

6) define the most useful morphological, ethological, ecological and cultural features for predicting the level of local familiarity with wild animal species,

7) describe the local knowledge about the Eurasian Beaver (e.g. protection status, reintroduction history, local distribution, feeding habits),

8) examine the local perception of negative or positive impacts of beavers on local provisioning, regulating and cultural ecosystem services, on nature and local livelihoods in general,

9) examine the local perceptions on the harmfulness and usefulness of beavers and its impacts on nature and the lives of locals.

3. STUDY AREAS, DATA COLLECTION AND ANALYSIS

3.1 Study areas

In our first research we collected data among Hungarians practicing traditional agriculture in Szilágynagyfalu (Nuşfalău village – 47° 11’ 58” N 22° 42’ 35” E) in the micro region along the upper reaches of the Berettyó River in north-western Romania (Fig. 1). The choice of this village was justified by the still existing traditional life-style, a varied natural environment, and the population size of inhabitants, which could ensure a larger number of knowledgeable informants. As people in Nuşfalău spend lots of time in the fields and forests during their everyday activities, their connection to the natural environment is direct.

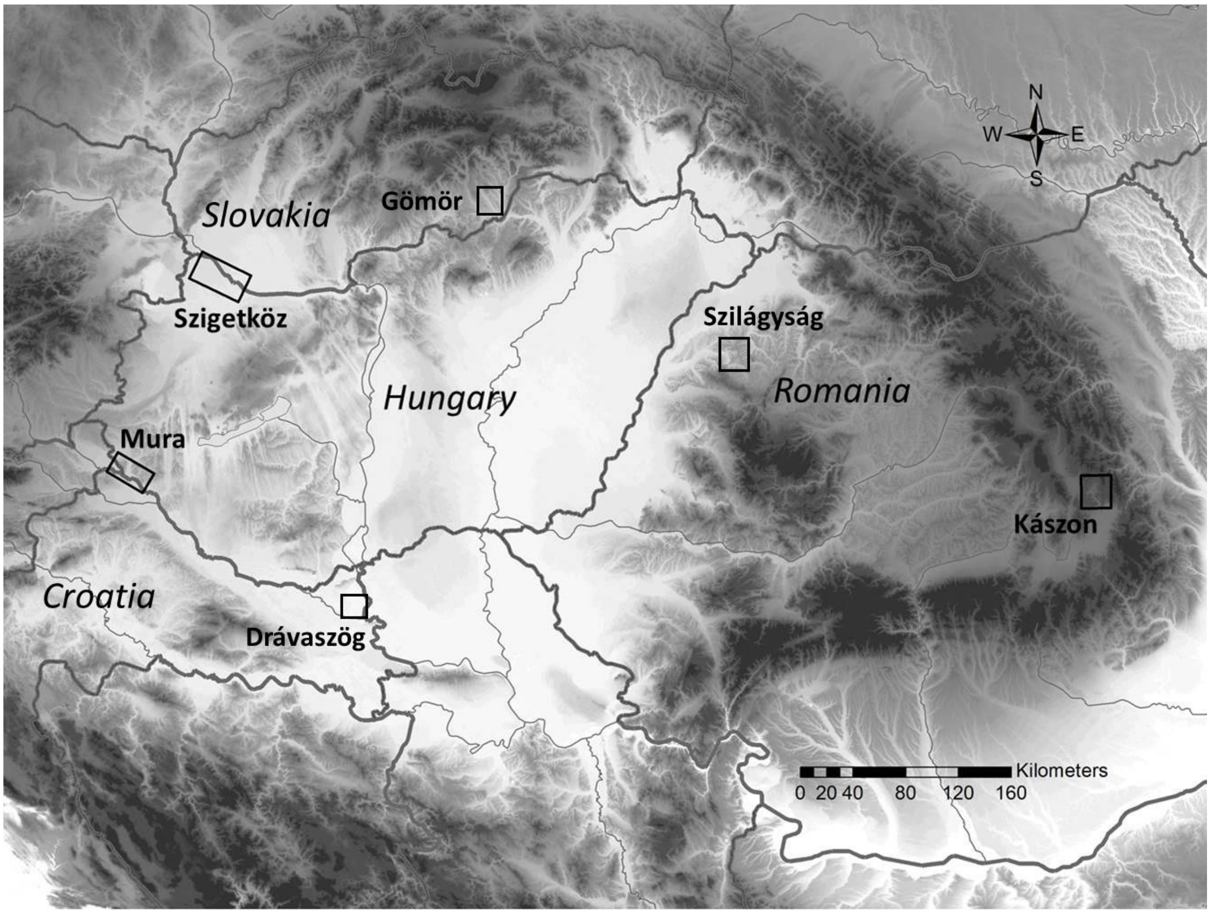


Figure 1. Map of the study areas in the Carpathian Basin, Central Europe. Rectangles indicate localities of data collections. Country borders: thick grey lines, main rivers: thin grey lines (source: Natural Earth). Source of base map: ASTER-DEM, USGS, 2009

The axis of the micro region is the river valley, which, on average, lies 200 meters above the sea level. The studied population lives in a village that is situated on the bank on both sides of the Berettyó River. Although the section of the river within the village has been partially regulated, it still preserved most of its natural conditions. On the alluvial soils that characterizes the lowermost parts of the valley, mainly cereal crops are grown. The area was formerly used partly as a pasture, when this utilization was economical. The hills reaching an altitude of 300-350 meters a.s.l. are covered with brown forest soils, on which mainly orchards and vineyards grow, although patches of rather natural forests of sessile oak and Turkey oak also occur. The area is characterized by moderately continental climate, with a mean annual precipitation of 600 mm. The monthly mean temperature is highest in July (19°C) and lowest in January (-4°C). The overall mean temperature is around 8°C.

In our work about traditional ecological knowledge on invertebtrates we collected data among ethnic Hungarians practising small-scale, traditional agriculture. Our research was conducted in Romania (Szilágyság [Sălaj county], Szilágynagyfalu [Nușfalău] commune), Slovakia (Gömör [Gemer] region, primarily in the municipalities of Felsővály [Vyšné Valice] and Gömörmihályfalva [Gemerské Michalovce]), and Croatia (Drávaszög region [Baranja], mainly around the villages of Laskó [Lug], Várdaróc [Vardarac] and Kopács [Kopačevo]). As the people we studied spend a lot of time in the fields and forests during their everyday activities, they still have a close, direct connection to their natural environment. The settlements where the data were collected, each with between 100 and 2500 inhabitants, are characterised by a large amount of abandoned agricultural land, and by ageing populations.

The three study areas are characterised by a moderate continental climate, with a mean annual precipitation of 600–700 mm. The mean annual temperature in the two northern areas is 8–8.5ºC (July mean 19°C, January mean –4°C), while in Drávaszög, further south, it is slightly higher, around 10°C (July mean 21°C, January mean –4°C) (Bartholy and Bozó 2003). The elevation is 75–90 m.a.s.l. in Drávaszög, 200–350 m.a.s.l. in Szilágyság, and 190–500 m.a.s.l. in Gömör. Gömör and Szilágyság typically have closed broadleaved forests (oak), while in Drávaszög there is a mixture of riparian vegetation, marshland and mixed hardwood gallery forests (oak, ash and elm).

For the investigation of local people’s perceptions on the Eurasian Beaver three regions in the Carpathian Basin were chosen where beavers are present in waters close to settlements and where their activity affects the floodplains considerably. The study areas are in different types of watersheds (streams, small rivers and river branches of large rivers) and the local communities are in different socio-economic situations (traditionally farming and partially modernized).

Studies were carried out in the Kászon Basin (Romania), in the Szigetköz (Hungary) and in the Mura River valley (Hungary) (Fig. 1). Human populations of the three areas were approximately 2100, 1600 and 1200, respectively (internet-1). In the Kászon study site, smaller streams are accompanied by small-scale hay meadows, *Salix fragilis*, *Salix purpurea* and *Alnus incana* forests, and settlements. About 60% of the population makes a living out of small-scale farming (internet-1). Beavers build dams which impound the water of the streams. Along the Mura River, the hay meadows abandoned in the 1950s are occupied today by *Salix alba*, *S. fragilis* and *Populus alba* forests. On the large-scale arable fields often extending to riverbanks, the most important crop is maize, and about 15% of the population makes a living out of agriculture (KSH 2015). The area was designated as protected in 2007 (FM-2017). The Szigetköz study site is entwined by river branches of the Danube River. Mixed *Salix alba*, *S. fragilis*, *Populus* x *canescens* and *P. nigra* forests and *Populus* x *canadensis* plantations extending to the river banks are typical. Only a very small ratio of the population lives off of agriculture (KSH 2013). The landscape was considerably transformed by the river regulations and the Bős-Nagymaros hydroelectric dam. The area has been protected since 1987, and it is an important tourist destination (FM 2017).

As a result of overexploitation, the Eurasian Beaver went extinct in the Carpathian Basin in the 19^{th} century (the last record in Romania: 1824 (Ionescu et al. 2010), in Hungary: 1865 (Brehm 1989)). The species has spontaneously recolonized all the three study sites from nearby (less than 100 km) areas where they were reintroduced. Beavers appeared in Kászon around 2009 (introduced between 1998 and 2001 along the Olt river (Ionescu et al. 2010)). In the Szigetköz, beavers were first recorded in 1985-86 (recolonizing from Austria). They appeared in 1997 along the Mura River (A. Lelkes - personal communication, January 22, 2017). Reintroduction was carried out in 1997 in neighboring Croatia along the Dráva river (Haarberg 2007). The Eurasian Beaver is protected in both countries. In Hungary at the time of the interviewing, legislation did not allow the control of beaver populations (internet-1). From 2016 on, removal permits for a given number of beavers were granted. There is no data on the size of the beaver population in Kászon. Beavers occur in most streams but the population is presumably under one hundred individuals. In the Mura region there were 35-45 families present in the studied period (Lelkes 2013). It was estimated that there were 352 families in the Szigetköz in 2017 (Czabán 2017).

3.2. Data collection and analysis

3.2.1 Collection of ethnozoological data

Data was collected in Szilágyság in summer 2010, and in Drávaszög and Gömör in summer 2012. In each area, the objective was to identify and interview local people with the most extensive knowledge. We employed a number of techniques: in Szilágyság we first consulted the local Calvinist priest, and then followed the snowball method; in Gömör we also followed the snowball method, but this time starting with the best informants from earlier ethnobotanical researches; in Drávaszög we collaborated with the local nature conservation warden, István Tórizs, to meet the people who, in the warden's view, had the greatest traditional folk knowledge. In total we interviewed 58 people. The overall average age of the interviewees was 75 years (within a range from 36 to 90 years), and the regional average ages were 78 in Szilágyság, 74 in Drávaszög, and 71 in Gömör. All the informants retained memories of traditional forest use and smallholder farming, and some were still practitioners. Because the main aim of the study was to record as much knowledge as possible and not to represent the knowledge of the entire population, we only relied on suggestions from local people to find the most knowledgeable informants. This method resulted in a much higher average age among our informants than it is in the total population. We conducted indoor interviews recorded on a dictaphone (approximately 88 hours of recording), since the presentation of living specimens and direct observation of animals in the wild would have been greatly inconvenient for most of the informants. Prior informed consent was obtained before all the interviews, and ethical guidelines suggested by the International Society of Ethnobiology (ISE 2006) were followed. We studied "all" mammal and invertebrate species or species groups potentially occurring in the vicinity of the settlements under investigation. We placed an average of 12 photos of species of similar habitat and size on a sheet of A4 paper, to give interviewees a sense of the context and relative size of each taxon. In many instances during our preliminary study, the differing scale of the pictures had greatly inhibited recognition. Where ambiguous descriptions occurred, further enquiries of the characteristics of the species in question were made in order to facilitate identification of the animal at the finest possible taxonomic level. The use of voucher specimens can be very beneficial in ethnobotany (Łuczaj 2010), but in ethnozoology it is less practical (taxidermy specimens do not show ecological /behavioural/ salient feature, while the use of live specimens rises technical and ethical questions). For mammals, we prepared a list of 62 species that are likely to occur on the basis of the mammalian fauna of areas with similar habitats (according to

Dobrosi 1999; Gombkötő and Estók 1999). Some lists of invertebrate taxa documented by zoologists were available for the regions studied or for ecologically similar neighbouring regions (e.g. Varga 1997; Kutasi 2002; Răescu et al. 2011; Erőss 2015). We used these data and our own earlier experiences to compile a list of species wich were shown during the interviews. This list contained almost all species that are presumably (and in deed) distinguishable for lay people. We also included a few species that do not occur in the areas under investigation, in order to check the authenticity of local folk knowledge. Latin names follow de Jong et al. (2014).

In total we collected 523 individual data on 42 folk generics and specifics (Ulicsni et al. 2013) for mammals and 3465 individual data records on 208 folk taxa for invertebrates. We also conducted semi-structured interviews with the majority of informants and carried out picture sorting, during which they were asked to group species according to their own systems. Separate images of species known to the interviewees were provided mostly during the second interview. The grouping of the images shown on the A4 sheet shown during the first interview had no appreciable effect on this grouping. We used these results to reconstruct the folk taxonomy. Figures (Fig. 2-5, 8-19) depicting taxonomic relations were prepared following the method used by Berlin (1992). Circles drawn in solid lines on these figures indicate scientific taxa (one species, one genus, one order, one family), whereas those drawn in small and large dashes represent, respectively, folk taxa and more inclusive folk categories. When circles of scientific taxa overlap, this indicates that certain scientific taxa were viewed as alike (e.g. “it is a house mouse, but of a different kind”). Inclusive categories were established on the basis of data collected by pile sorting, co-references and direct questions. However, it was not our intention to arrange individual taxa according to Berlin’s system of taxonomic levels, since the communities we examined are too heterogeneous for this. For each of the taxa, where possible, we documented the local name (or names), their salient features, their uses, any damage they cause, any personal attitudes expressed towards the taxa (positive, negative or neutral), and related folklore issues. The habitats of the species (see Appendix 1) were determined based on the interviews, on our own experiences and on the scientific literature.

We have listed our data in tables, and summarised the results broken down according to informant and taxon. We have not carried out a quantitative comparison of the knowledge among the three communities, for the data sets have, in many cases, low sample sizes. The differences between the three areas which are important from a qualitative aspect are presented in the results and discussion. Literal quotations are in italics, and comments by individual interviewees are separated by a slash.

3.2.2 The reference dataset and the observed level of familiarity

An exceptionally large dataset is available on the local traditional zoological knowledge of three local faunas (171 vertebrate and 212 invertebrate taxa) of Central Europe from which the local knowledge was obtained for the current analysis (see Ulicsni 2012, Ulicsni et al. 2013, 2016, unpubl.). We determined the level of observed familiarity, that is, the proportion of local knowledgeable informants who know the species at least moderately, i.e. can list at least 3 independent memes (information units e.g. sound of a species, habitat of a species, smell of the Spanish fly, special food storage mounds of steppe mice) related to the species – an admittedly arbitrary decision.

3.2.3 Model estimation of expected familiarity

A linear model was constructed to quantify how particular features (morphological, ethological, etc.; i.e. explanatory variables) contribute to the level of observed familiarity (i.e. the dependent variable). Explanatory variables of the model were represented by 10 relevant features (traits and others) identified by traditional knowledge studies covering whole faunas (e.g. Ellen 2006). These features were size, morphological salience, ethological salience, abundance, habitat, danger to humans, harmfulness, usefulness, richness of national folklore, and nature conservational value. Each feature had 6 categories (0: no importance/no relation, 1: little importance, …, 5: great importance for humans). Each category of each feature was included as a factor in further analyses. Parametrization was based on published literature data. Only elements of traditional knowledge that are part of an average biologist's or zoologist's knowledge (who are not experts in traditional knowledge) were taken into account during parametrization (e.g., folk songs about ladybirds known to all Hungarians). The elements of this very basic common traditional knowledge were defined by the authors. The explanation of values of the different features is detailed in Appendix 2.

The species included in this analysis were those for which there was sufficient information (data from at least 20 informants) in our dataset (166 species (Appendix 3 and Appendix 4)). Bird and fish species were omitted because sufficient data about these taxa are not yet available (our past interviews focused on lesser-known animal species and less on birds).

For variable selection (i.e. for separating the significant and the redundant variables), a forward stepwise procedure was used, based on the corrected Akaike's Information Criterion

(AICc), applying the stepAIC() function of MASS package of R (Venables & Ripley 2002). This resulted in a set of candidate models.

Coefficients of the final linear model were calculated via model averaging. All the candidate models with significant explanatory power (with ΔAICc≤4) were included in the model averaging (Table 2). Using the coefficients, a derived variable – the level of estimated familiarity – was calculated for each species. The level of estimated familiarity for a certain species was calculated as the sum of the values of coefficients of the relevant factors.

Table 2. Attributes of the candidate model set (limited to models with significant explanatory power)

Modell	AICc	DAICc	rel.likelihood	weight
familiarity ~ abundance + folklore + size + habitat + morphology	1130,5	0	1	0,478
familiarity ~ abundance + folklore + size + habitat + morphology + gs	1132,1	1,6	0,4493	0,2148
familiarity ~ abundance + folklore + size + habitat + morphology + danger to humans	1132,6	2,1	0,3499	0,1673
familiarity ~ abundance + folklore + size + habitat	1134,2	3,7	0,1572	0,0752
familiarity ~ abundance + folklore + size + habitat + morphology + nature conservation value	1134,5	4	0,1353	0,0647

The differences between the levels of estimated and observed familiarity were calculated for the 81 species selected for the zoologist prediction (see below). We decided arbitrarily to analyse the top and bottom 20% (the most over- and underestimated species), that is, 2x16 species, in more detail.

3.2.4 Zoologists' expert judgment of local familiarity

81 of the 166 taxa were selected by random stratified sampling for a questionnaire, ensuring that all the main taxonomic groups (mammals, reptiles, amphibians, molluscs, insects, and "other invertebrates") were represented. Three roughly equal groups contained species that were locally well known, moderately known and almost unknown (based on Ulicsni 2012; Ulicsni et al. 2013, 2016) (see also Appendix 3).

We asked 20 zoologists from Hungary and Romania who are familiar with the studied areas (researchers working at universities, museums and research institutes, zoology teachers, governmental and civil conservationists) to complete the questionnaire. Specialists in single species or small taxonomic groups (according to publication lists) were excluded. Of the 42 zoologists who qualified, 20 selected at random were asked to classify each species into four categories based on the level of familiarity they would expect: almost everybody will know the species (3 points), many people (ca. 40-60% of the informants) will know the species (2 points), only a few people will know the species (1 point), or the species will be unknown to locals (0 points). For each species the average value of the 20 answers was calculated.

Spearman's rank correlation was applied in order to test the statistical dependence between a) the ranking of specific explanatory variables and the level of familiarity expected by zoologists and b) the ranking of specific explanatory variables and over- or underestimation of familiarity by zoologists.

Species were ranked according to the observed levels of familiarity based on traditional knowledge holders, and by the level of familiarity predicted by the zoologists. The differences between the two ranks were calculated. Again, we analysed the top and bottom 20% (the most over- and underestimated species), that is, 2x16 species, in more detail.

3.2.5 Data collection for local people's perception of the Eurasian Beaver's impact on ecosystem services

Between 2014 and 2016, structured interviews were conducted with 30 local people for each of the three study sites in the following settlements: Plăiesii de Sus, Plăiesii de Jos, Casinu Nou, Imper, Iacobeni (Kászon); Dunasziget, Kisbodak, Ásványráró (Szigetköz); Kerkaszentkirály, Muraszemenye and Murarátka (Mura). Half of the informants (altogether 45 people) were recommended by residents and local community leaders as 'inhabitants knowledgeable about beavers' for various reasons, e.g. having hay medow close to the creek, fishermen, hunter etc. (they are called knowledgeable local informants – KLI). They were expected to have more extensive knowledge about beavers than the general public and more personal experience as well. The other half of the informants helped in representing the average population's knowledge and were chosen randomly (randomly-selected local informants – RLI), without any special recommendation (met on the street, knocked at a random house, etc.). These people could be either under-informed or knowledgeable regarding beavers. To avoid the distortion resulting from the different methodologies we used the same method for interviewing RLIs as for KLIs. The average age of the 90 informants was 51 years (Kászon: 45, Szigetköz: 54, Mura: 55), and 18 informants were female. The initials (K, S, and M) after KLI and RLI refer to the study areas Kászon, Szigetköz, and Mura, respectively.

The majority of the interviews were recorded with a voice recorder and then transcribed (altogether 84 hours and 42 minutes of recordings with an average length of 46 minutes per interview (Kászon: 48, Szigetköz: 53, Mura: 45).

Twelve scientific and conservation experts (SCE) from Hungary and 6 from Romania were also interviewed in the same time period, using the same interview sheet, to improve our understanding about the local situations. Neither detailed analysis of the SCE interviews nor direct comparison of their content with the local peoples' interviews were objectives of this study. In our experience, Hungarian, Romanian, and European literature in general was not enough to keep pace with changes in the local beaver situations and these expert answers helped considerably in the discussion of our results (direct comparison with the local peoples' interviews was not an objective of the data gathering).

The interview sheet included both closed and open-ended questions (Appendix 5). Questions were phrased and selected to allow both quantitative and qualitative analysis. As most of the informants were not aware of certain scientific concepts (e.g. 'ecosystem services' or 'biodiversity'), we needed to change questions with ecological terminology to questions with basic terms in the interview sheet.

3.2.6 Methods of data analysis of local people's perception of the Eurasian Beaver's impact on ecosystem services

The answers to the questions eliciting encyclopaedic knowledge (protection and hunting status, time of introduction, local distribution, predation, dangerousness, feeding habit, population dynamics) were summarized based on the ratio of respondents giving 'correct' answers. To decide which answers were 'correct,' we used the scientific literature and answers of the scientific and conservation experts (see in 2.1. and 2.2.) from the two countries.

We used CICES 4.3 classes for ecosystem service categories (Haines-Young and Potschin 2013). The impact of beavers on ecosystem services was analysed by extracting all information from the transcribed texts about each service mentioned by the 90 informants to Microsoft Office Excel data-sheets. The beavers' negative and positive impacts on provisioning ecosystem services were analysed based on the number of respondents who mentioned certain categories. For regulating and cultural ecosystem services, the total number of informants mentioning them, and the mentioned memes (information units) were counted. Comments like “they slow down water” or “I like them” were considered as one meme (information unit, see also Appendix 6). The informants’ personal involvement (direct effect on informants’ property) was also estimated by defining the number of the personally (directly) affected informants.

Overall perception of beavers’ usefulness and harmfulness was elicited using multiple-choice questions (“Are beavers useful or harmful?”) and also free listing ones (“What kind of benefits could you mention?”) and a 3-grade scale (negative, -1; neutral, 0; positive, +1, e.g. “What impact do the beavers have on your life?”) (Appendix 5). Both the overall perception of beavers’ usefulness and harmfulness and the informants’ personal involvement were analysed by the number of respondents and the number of mentioned memes. We counted number of respondents based on number of informants giving answer or ‘I don’t know’ in the interviews. Statistical analyses (basic statistics, mean and relative frequency calculation) and figures were constructed in Microsoft Office Excel program.

4. RESULTS

4.1 Folk knowledge of non-domestic mammals in North-Western Romania

4.1.1 Folk taxonomy of wild mammal species

The supposed 62 scientific mammal species (in virtue of Endes 1987; Endes 2003; Fügedi 1992 Table 3) were classified by the people in Szilágyság into 42 folk species (68 %). By reducing the bats into a single taxon, the total number of species was 50, which was classified into 42 folk species (82 %). The 42 taxa were grouped into 11 larger sets. Four of the eleven inclusive groups contained two independent elements (the two folk taxa for the Northern White-breasted Hedgehog, mole and mole rat, European hare and rabbit, otter and beaver). The most species-rich group contained mainly rodents (29 species including bats and shrews). The groups of even-toed mammals and large carnivores were clearly distinct (5 and 6 species were placed into these groups, respectively). The 15 species of the most harmful small carnivores and the usually larger rodents made up a rather complex group. Although morphological characters played the most important role in folk mammal classification, the tendency of causing economic damage or gain also had a significant impact.

Table 3. The mammal fauna around Szilágyság (Romania)

	common name	**scientific name**	**species authority**
1.	Northern White-Breasted Hedgehog	*Erinaceus roumanicus*	Barrett-Hamilton, 1900
2.	Shrews	*Sorex, Crocidura* spp.	
3.	Common Mole	*Talpa europaea*	Linnaeus, 1758
4.	Bats	Chiroptera	
5.	Brown Hare	*Lepus europaeus*	Pallas, 1778
6.	European Rabbit	*Oryctolagus cuniculus*	(Linnaeus, 1758)
7.	Eurasian Red Squirrel	*Sciurus vulgaris*	Linnaeus, 1758
8.	European Ground Squirrel	*Spermophilus citellus*	(Linnaeus, 1766)
9.	Forest Dormouse	*Dryomys nitedula*	(Pallas, 1778)
10.	Edible Dormouse	*Glis glis*	(Linnaeus, 1766)
11.	Common Dormouse	*Muscardinus avellanarius*	(Linnaeus, 1758)
12.	Lesser Blind Mole Rat	*Spalax leucodon*	Nordmann, 1840
13.	Eurasian Beaver	*Castor fiber*	Linnaeus, 1758
14.	Muskrat	*Ondatra zibethicus*	(Linnaeus, 1766)

Table 3. (continuation)

	common name	scientific name	species authority
15.	Coypu	*Myocastor coypus*	Molina, 1782
16.	Common Hamster	*Cricetus cricetus*	(Linnaeus, 1758)
17.	Eurasian Harvest Mouse	*Micromys minutus*	(Pallas, 1771)
18.	Striped Field Mouse	*Apodemus agrarius*	(Pallas, 1771)
19.	Common Vole	*Microtus arvalis*	(Pallas, 1778)
20.	Steppe Mouse	*Mus spicilegus*	Petényi, 1882
21.	House Mouse	*Mus musculus*	Linnaeus, 1758
22.	Brown Rat	*Rattus norvegicus*	(Berkenhout, 1769)
23.	Wildcat	*Felis silvestris*	Schreber, 1777
24.	Eurasian Lynx	*Lynx lynx*	(Linnaeus, 1758)
25.	Red Fox	*Vulpes vulpes*	(Linnaeus, 1758)
26.	Grey Wolf	*Canis lupus*	Linnaeus, 1758
27.	Golden Jackal	*Canis aureus*	Linnaeus, 1758
28.	Brown Bear	*Ursus arctos*	Linnaeus, 1758
29.	Stoat	*Mustela erminea*	Linnaeus, 1758
30.	Eurasian Weasel	*Mustela nivalis*	Linnaeus, 1766
31.	European Polecat	*Mustela putorius*	Linnaeus, 1758
32.	Steppe Polecat	*Mustela eversmanni*	Lesson, 1827
33.	Beech Marten	*Martes foina*	(Erxleben, 1777)
34.	European Pine Marten	*Martes martes*	(Linnaeus, 1758)
35.	Eurasian Badger	*Meles meles*	(Linnaeus, 1758)
36.	Eurasian Otter	*Lutra lutra*	(Linnaeus, 1758)
37.	Wild Boar	*Sus scrofa*	(Linnaeus, 1758)
38.	European Roe Deer	*Capreolus capreolus*	(Linnaeus, 1758)
39.	Red Deer	*Cervus elaphus*	Linnaeus, 1758
40.	Fallow Deer	*Dama dama*	(Linnaeus, 1758)
41.	Mouflon	*Ovis aries*	Linnaeus, 1758

The 21 species of rodents were classified into 15 folk taxa (71 % identity). Groups were completely identical to the groups of the scientific classification except for mice and voles (Fig. 2). In these groups, the similar species were merged into a single taxon, although most people could identify individual species by very small differences (House Mouse were separated from Steppe Mouse by habitat differences, and Meadow Vole was distinguished from house mouse by tail length).

All currently present or once occurred, but now locally extinct species of carnivores and even-toed mammals were classified in the same way as in scientific classification (Figs. 3-4.).

Uniquely among the taxa, the Northern White-breasted Hedgehog was divided into two separate folk taxa (Fig. 5). The lighter coloured and rather narrow headed (proportionally longer nosed) specimens are called *sünkutya* (literally hedgehog dog), whereas the broader headed, darker coloured animals are called *sündisznó* (literally, hedgehog hog). An additional difference people used to mention is similarity of the legs to those of pigs or dogs. Among insectivores, only mole and shrews were identified, but shrews were not further distinguished. Although twelve species of bats are likely to occur in the area, they were not distinguished either. People knew both species of lagomorphs, although rabbits had already disappeared from the area.

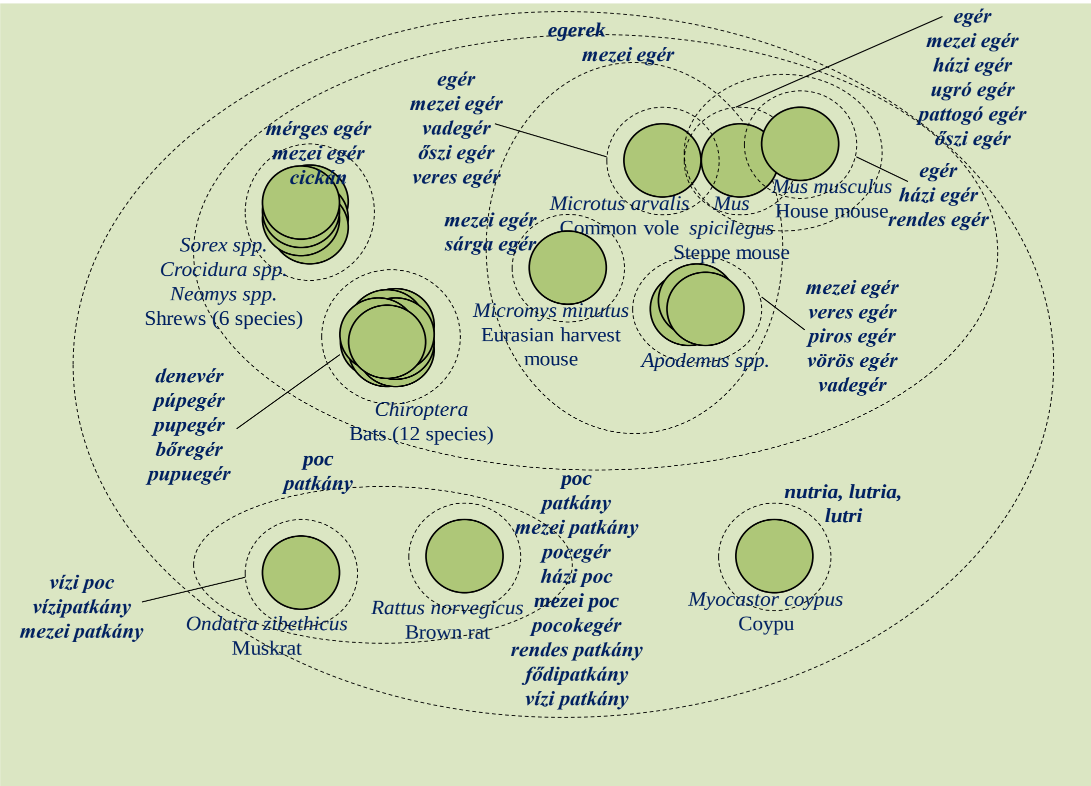


Figure 2. Grouping of the smaller rodents in the folk taxonomy in Nuşfalău, bats (12 species) and shrews (6 species) were also placed into this set. The folk names are listed in the order of frequency of mentions.

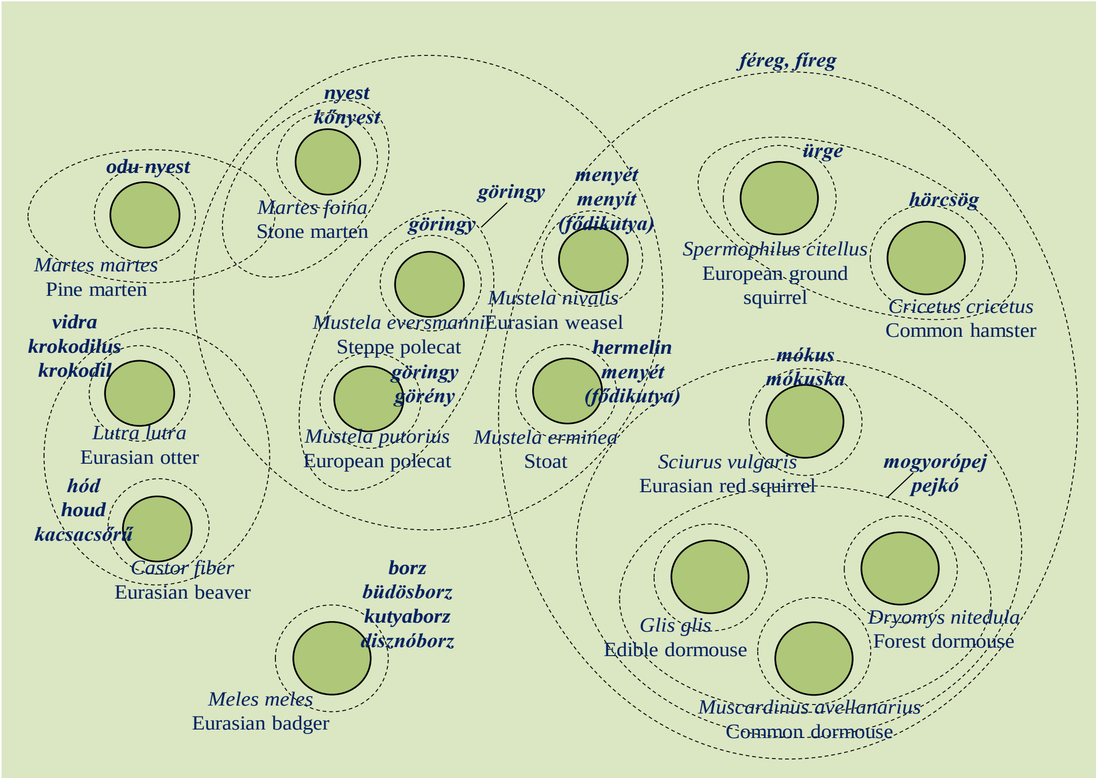


Figure 3. Grouping of small carnivores and some rodents in the folk taxonomy in Nuşfalău. The folk names are listed in the order of frequency of mentions.

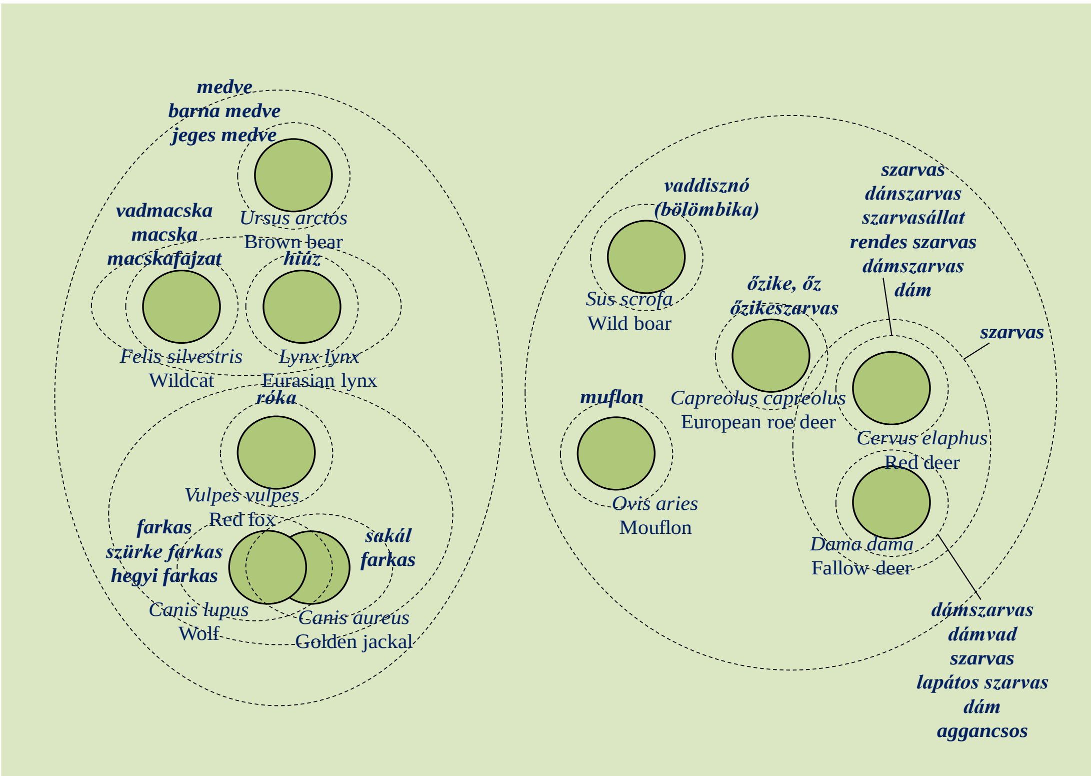


Figure 4. Grouping of large carnivores and even-toed mammals in the folk taxonomy in Nuşfalău. The folk names are listed in the order of frequency of mentions.

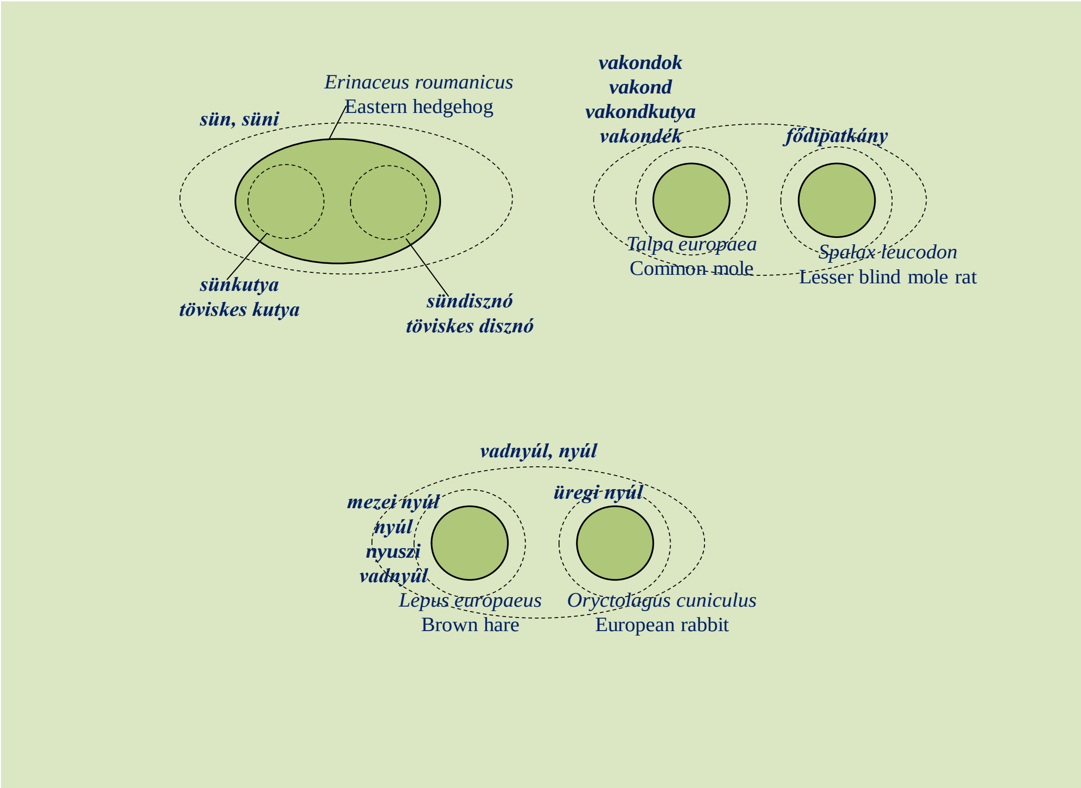


Figure 5. Grouping of 5 additional mammal species in the folk taxonomy in Nuşfalău. The folk names are listed in the order of frequency of mentions.

4.1.2 Salience of folk taxa

The characteristics of folk taxa are described below according to their salience. In the tables (Table 4, 5, 6) all the information rich answers are collated.

Morphological salience: In the case of physical appearance (Table 4), naming of a prototype and comparison to it was typical, as in the case of House Mouse, to which the related species were compared. Similar relation was observed in the case of Red Deer and its relatives. Reference to conspicuous body parts such as the tail, ear, and sometimes limbs, and detailing of the coloration of the hair were also frequent. It was also typical that external characteristics of humans were paralleled with those of animals. Comparison of the look of Beech Marten to that of humans was widespread, for example.

Table 4. Descriptions by local farmers of morphological features of mammalian folk taxa in Szilágyság (Romania)

scientific name	**morphological features**
Erinaceus roumanicus	has characteristic nose, spiny, there is a light and a dark type, has small feet
	This is surely a dog (hedgehog dog), *because its nose is long. There is one, which is perhaps a bit darker. But this one is surely a dog, as you can see by its leg. All live here. / Neither the dog, nor the fox and wolf can harm them, because it pulls itself back, and they cannot bite its spines.*
Sorex, *Crocidura* spp.	has pointed nose, small, mouse like
	It is not this fat, but elongated. This is the furious mouse. / This is a type of the mouse.
Talpa europaea	blind, has short tail, black
	There are grey ones of it, for example. But there are fully black ones, too.
Chiroptera species	winged mouse, humpbacked
	It is hump mouse, 'cause it has a wing, 'cause the ordinary mouse dos not have wings, but this one has wings. / It has a hump on its back, like the one of the elephant. The normal mouse does not have one. / It is a species of mouse. It is exactly like a mouse. Its head, even the teeth, and its ears, like those of the mouse. And it climbs up with its two hind legs, then hangs head down.
Lepus europaeus	reddish brown, bicolored, larger
Oryctolagus cuniculus	greyish, has shorter ears, smaller
Sciurus vulgaris	has bushy tail and tufted ears, greyish brown or red
	The tail of the squirrel is not flat. It is rounded. / ...The tip of its ear is a sort of tufted.
Spermophilus citellus	has rounded ears, yellowish brown
	This is the ground squirrel, because it is spotted like this. [...] *It is with its small dull ears.*
Dryomys nitedula	masked, has bushy tail, smaller in size
	At his eyes, it is black, dark like this. Here, this part also is dark. Then its belly bottom is white. And here, this part of the neck also is white on this pejkó.
Glis glis	has bushy tail, fat, grey, has sharp claws
	The stick of its tail is flat. The tail of the squirrel is not flat. Its tail is round.
Muscardinus avellanarius	has bushy tail, brown, small in size
	The mogyorópej has the colour of the squirrel. The squirrel has a tuft on the tip of its ears. The mogyorópej does not have one. There are more than one kind. The tail of the mogyorópej is flat. [...] *They are in size like a two months old kitten.*
Spalax leucodon	brown, has short nose, blind
	Its nose is blunt like this. The mole has a little longer nose.
Castor fiber	has big teeth and flat tail like fish

Table 4. (Continued)

scientific name	morphological features
Ondatra zibethicus	larger than the Brown rat, lighter in colour, has characteristic tail
	...looks like the common rat, but its fur is lighter.../ The muskrat is bigger than the ordinary rat. / This is about a muskrat, because the tail itself looks like that.
Myocastor coypus	big, ugly
Cricetus cricetus	has polecat-like coloration, has big mouth pouches
Micromys minutus	yellow, tiny
	It is this small yellow one that is on the corn. These small yellow ones that are in the nest have no streak on the back. It is only a small ground mouse.
Apodemus agrarius	has streak on back, reddish brown
Microtus arvalis	has short tail and smaller ears
	And then there are among these mice, one of them has a tail this long, the other has only this short and small one. As I see, this is the short tailed one.
Mus spicilegus	looks identical to House mouse
Mus musculus	compared to rat: lighter, smaller
Rattus norvegicus	unattractive, has long tail
Felis silvestris	has wild looks, larger and darker
	It is almost like a normal domestic cat, but it is rather grey. And bigger.
Lynx lynx	has tufts on ears
Vulpes vulpes	has bushy tail, ugly when shedding hair
Canis lupus	has long tail, wild looks, grey, looks like a German shepherd dog
	It is as large as a German shepherd. But looks somewhat wilder. Its tail is a sort of bigger...
Canis aureus	a smaller wolf
Ursus arctos	large, brown
Mustela erminea	slim and long, white
	It is so beautiful as it is white, like an Angora rabbit.
Mustela nivalis	long, may be also white, the smallest carnivore around buildings
	...only the small chicks...'Cause she is small. There are white ones in weasels.
Mustela putorius	belly is darker, has bushy tail, variegated
Mustela eversmanni	very light kind of polecat
Martes foina	has white throat and bushy tail, reddish brown
	Its face looks really like the one of a man. It has a long neck, and its head is like that of a man.
Martes martes	darker kind of marten
	It has a bushy tail like this, eh. This is grey like this, and has a bushy tail like this. The other one is black like this. The Beech Marten is the lighter.

Table 4. (Continued)

scientific name	**morphological features**
Meles meles	fat, short in stature, bear-like, variegated in colour
	It is like a smaller dog.
Lutra lutra	big, brownish, has white throat, marten-like
	It is also in water, catching fish. It is bigger than a marten.
Sus scrofa	big and strong
Capreolus capreolus	smaller and red (compared to Red Deer as the prototype of wild game)
Cervus elaphus	the bull is like a king, big, majestic with antlers
Dama dama	It is smaller and has shovel-shaped antlers, conspicuous white on buttocks
Ovis aries	*It looks like a ram.*

Ethological and ecological salience: In terms of ecological salience (Table 5), the following characteristics were the most frequently mentioned: feeding habit, characteristics of movement, habitat, breeding habit, bashfulness, voice, annual and daily pattern of behaviour (especially in nocturnal animals), and observability. Comparison to humans was particularly important when describing behaviour. Comparison to a prototype also often occurred. In such cases, the distinguishing characteristic usually was ferocity (Brown hare, Wild cat). Certainly, the most frequently mentioned behaviours and habitat characteristics were the ones considered important in terms of harm and benefit for humans.

Table 5. Descriptions by local farmers of ethological and ecological features of mammalian folk taxa in Szilágyság (Romania)

scientific name	**ethological and ecological features**
Erinaceus roumanicus	nocturnal, follows humans, barks and grunts
	But it is said that the one that barks is a dog (hedgehog dog).
Sorex, Crocidura spp.	nocturnal, poisonous
	I say, it comes over from the outhouse, through the foundation, 'cause it was not coated.../ It eats, then throws it up within 10 minutes.
Talpa europaea	digs blindfolded, feeds on earthworms, helpless on the surface, sensitive
	This, if sees sunlight, is said to die. / As I know, elder is stuck into the way of the mole. Where there are many, it deters them away. / When it comes out to sunlight, it does not run, because cannot see. You can even strike it dead. [...] *This mole is so sensitive that when we walk and I stamp with may feet, it hears it in the ground that well, they are coming*. [...] *It is very sensitive an animal.*

Table 5. (Continued)

scientific name	ethological and ecological features
Chiroptera species	flying mouse, may be placed among birds, nocturnal insectivore, hangs upside down, sleeps over winter *It cannot be said that the bat is a beneficial animal, nor that it is a wild animal. I have not a hint where it should be (placed). The bat shall be placed rather among the winged animals, because it flies. / These live a double life. When it hangs itself or what, and then it does not even move for 5-6 months. It is like a bear. / It even eats its own droppings, takes it back. At night it feeds on bugs, when it is outside, catches them.*
Lepus europaeus	wilder, alert, does not dig burrows *...only a small pit, or takes something for itself to the base of a tree or to the hay. It is in the field all the time in summer. But in winter, they move to the woods, because there are fallen leaves and it makes a nest there. / Sharpening their ears, are they not? They are very sensitive animals. This bunny.*
Oryctolagus cuniculus	lives in burrows in groups *This lives in ground holes, burrows. The other only scrapes a small pit...*
Sciurus vulgaris	consumes lots of walnuts, jumps long
Spermophilus citellus	lives in burrows in the grassland, stands up like a stake
Dryomys nitedula	eats mainly hazelnuts, but also walnuts
Glis glis	likes hazelnuts, makes a nest, screams, bites, fast and can run on the wall *Now, as the young magpies have left the nest, it takes it over. It stacks (the nest) up with the flowers of Clematis. And it has that white, that downy thing, which it takes into the magpie nest, and gives birth into that.*
Muscardinus avellanarius	likes hazelnut, builds nest, screams, bites *The one that I saw and also caught has bitten my hand.* [...] *Screams like a mouse.*
Spalax leucodon	an underground vegetarian *The ground rat also eats potato.*
Ondatra zibethicus	aquatic, has aquatic life style, rodent *Well, I often see this fishing, it moves like a traveling circus.*
Myocastor coypus	exclusively vegetarian, clean, lives in wet places *He gave it carrots, but this does not eat it. It takes* (the carrot) *with its claws, washes and sprinkles it, peels it, and then eats it. / This eats neither mice nor any animals.*
Cricetus cricetus	lives underground, has bad nature, hoarding *It takes 30-40 kg of corn into each burrow. It goes down as much as it cannot be reached even by a plough... / It hoards corn into its mouth pouch and places... / It prepares a kind of hancsuk.*

Table 5. (Continued)

scientific name	ethological and ecological features
Micromys minutus	builds a nest among crops, not harmful
	I also saw this nest high among the crop.
Apodemus agrarius	mostly observable in autumn
Microtus arvalis	lives in agricultural areas
Mus spicilegus	characteristically leaps, lives in agricultural areas
	Well, this is a jumping mouse. I don't know, but it hops. 'cause some of them are just hopping. Well it lives free.
Mus musculus	found around buildings all year round
Rattus norvegicus	a common pest
	This is a pocegér. But as it is written, a rat. / ...which were born this month will, if not in the next, but by the second month, have had their own young.
Felis silvestris	ferocious
	...like that of the lynx. And its nature is like that.
Lynx lynx	very large, cat-like
Vulpes vulpes	a common predator
	..it had a large den at the end of the third parcel. We heard so many times, even from the hills many times, as the fox was barking from there.
Canis lupus	predator, attacks sheep and maybe horse, nocturnal, may be dangerous
	It cannot the horse, but already can the Red deer...
Canis aureus	a small kind of wolf in the reedbeds
	This is down in the reedbed...
Ursus arctos	mainly carnivorous, rare
Mustela erminea	proceeds by leaps, avoids humans, more common in wet places
	likes water.../... it is bouncing, because it does not walk smoothly like this, but with leaps.
Mustela nivalis	fast, fits into mouse burrows
	The weasel stands like a peg / ...extends itself so, as is said, it fits in every small burrow.
Mustela putorius	most harmful small predator around houses
	...when dusk sets in, it is already searching around.
Mustela eversmanni	occurs in flat terrain
Martes foina	occurs in the attic, aerial acrobat, steals many eggs
	It turned over (things) *when it lived with us, I said on the attic, it toppled (everything) that sleeping was impossible. It carried walnuts, corn from one corner to another. By morning, nothing was in place where was left in the evening* [...] *When I noticed it, it was fleeing along the rafter like a phenomenon.*
Martes martes	occurs in the forest, avoids humans
	The treehole marten is there, up in the mountains. It dos not like the noise. By itself.

Table 5. (Continued)

scientific name	ethological and ecological features
Meles meles	moves around in dusk
	This has loads of fleas, and even the den is filled with fleas. This is foul smelling, very much. / It even turns against man when gets in trouble.
Lutra lutra	feeds on fish, voracious
	This can enter the water like a rifle bullet.
Sus scrofa	has a wild nature, nocturnal, grubs everything
Capreolus capreolus	lives in agricultural areas, develops antlers
	...Even of the small roe deer that are running out in the field. First, when they grow, they are two small sticks like this. And (the roe deer) *shed them in April-May every year. A month or one and a half, and* (the antlers) *regrow. When they develop, they are soft and jelly-like. And there is hair on them, quite much. As they start to harden, they also begin to thin. Then* (the roe deer) *begins to scrape them clean.*
Cervus elaphus	prototype of game animals, comes to graze in evenings
	...if she gives birth just in a shrub, and there is anyone passing by, or strokes that little one, she never returns to it.
Dama dama	considered an alien
Ovis aries	wild, bashful
Castor fiber	feeds on twigs

Cultural salience: In terms of cultural salience (Table 6), characterization of harm caused and benefit gained was unequivocally dominant. Interviewees considered Brown Rat and animals in the group of *férgek* the most detrimental. In several cases, a species was considered harmful, although not causing considerable damage (species of mouse and vole). Hedgehog, hare and rabbit were expressly considered useful. Brown Hare, Red Fox, Stoat, European Pine Marten, Badger, Wild Boar, Roe Deer, Red Deer and Fallow Deer were or still are hunted for meat or fur. Purposeful extermination was reported in the case of European Ground Squirrel, Fat Dormouse, Common Hamster, Brown Rat, Weasel, Western Polecat, and Beech Marten. Some of the beliefs were widely known (i.e. feeding habit of Common Hamster, blood sucking of Weasel), but their justification was unknown by the informants.

Table 6. Descriptions by local farmers of culturally salient features of mammalian folk taxa in Szilágyság (Romania)

scientific name	cultural features
Erinaceus roumanicus	useful, mystical
	It is a beneficial animal, because where it lives, there are no mice, 'cause this catches mice and the poc. It captures even the big poc. (poc= rat).
Sorex, *Crocidura* spp.	hardly observable, insignificant, not harmful
	This used to occur in barns. It does not harm hens or others.
Talpa europaea	causes harm with its mounds, dies of sunshine
	This is a harmful animal, because it makes burrows in the ground and searches for earthworms and everything [...] *And if it passes by the root of the vegetables, (the plants) are pushed out. It destroys them.*
Chiroptera species	not dangerous, may be frightening, useful
	It happened in the evening or at night that it stroke my forehead, but otherwise it is not a dangerous animal.
Lepus europaeus	has economical benefits, causes no particular harm
	This then is beneficial in the sense that its meat is also good, because it can be prepared as wild game to make a sort of delicious stew of it...
Oryctolagus cuniculus	was hunted in the past, similar to domestic rabbit
Sciurus vulgaris	very harmful, has bad nature
	It takes out the meat of the walnut. Can climb the walnut tree whatever tall it is. Then it holds the walnut in its two small hands, then [...] *it was pelted, and then it took a walnut and threw it down.*
Spermophilus citellus	very harmful, used as a curse word
	Snake province, mosquito swarms, ground squirrel town / When we filled (the hole) *with three buckets* (of water), *the ground squirrel came out.*
Dryomys nitedula	bad pest
	Picks hazelnuts and walnuts. It holes them on the tree. We had lots of walnuts, then the pejkó picked them, holed them, and threw the holed ones onto the ground.
Glis glis	the worst pest, causes the greatest damage in walnut, chews everything into pieces
	..it chews up everything in the building. / When there are walnuts, it damages them badly. If it is a certain kind of walnut, it destroys half of it. If it has a family, small, it collects not only what it eats, but also for reserve. My neighbor also has a walnut tree, yet she can hardly harvest some walnuts. By the time she notices it, it has emptied and holed them.
Muscardinus avellanarius	bad pest, harmful
Spalax leucodon	become very rare, harmful
Ondatra zibethicus	causes no significant harm due to its aquatic habit

Table 6. (Continued)

scientific name	cultural features
Myocastor coypus	its flesh and fur is expensive
	Because the flesh of it, and the fur, are very expensive. / It is kept for its pelt. It is said that its meat also is very tasty.
Cricetus cricetus	the most dangerous and detrimental pest
	...you are like a hamster, you gather food for yourself.../ Hamsters are such a clever animal, one lies on its back and spreads its four legs, and the other packs 3-4 ears of corn in between them, then grabs by its tail and pulls into the hole.
Micromys minutus	weather forecaster
	...Gosh, if the mouse builds a nest up here, there will be a heavy winter, lots of snow...
Apodemus agrarius	less harmful
	I cannot extirpate them. I have this kind in the garden. I got these cartridges. That one with the streaked back. It eats vegetables. / It can be encountered at harvest time, then in the fall, at the time of corn picking.
Microtus arvalis	least harmful rodent
	It only likes cereals, but otherwise does not do anything (i.e. harm). */ one does not like it when it enters* (the house), *for that matter, but they have not a big harmful effect on anything* [...], *but they also have to live on, they are also under the heaven of God.*
Mus spicilegus	no apparent harm is caused
Mus musculus	not really harmful
	They are not harmful. They eat only wheat. This takes neither chicken, nor eggs. It enters only the barn or the storeroom and grinds the crop grains. But otherwise it does not make any harm.
Rattus norvegicus	the most dangerous and harmful of all pests around buildings
	I feel frightened when I see it. This is an ugly animal. Uh, it is so ugly. / Well, it eats the chicken. Ducklings. It gnaws the wheat grain. / If it can get into the hutch, it even eats the small rabbits. / The poc, when bites you, you have to go immediately to see a doctor.
Felis silvestris	may be dangerous to humans, but mainly loots bird nests
	It is a little dangerous animal. It is in the forest and does not like people, but if it finds them by chance, the wild cat can attack humans.
Lynx lynx	almost unobservable, may be dangerous
Vulpes vulpes	shrewd poultry stealer
	It happened that it returned three times at one night. Then they even took poultry.

Table 6. (Continued)

scientific name	cultural features
Canis lupus	generally not dangerous to humans, but precaution needed
	The wolf is dangerous, but not to humans. It is dangerous to animals. / And the stinky wolf does not attack humans, as long as the one is conscious. No. But when there is lots of snow, it covers with snow. / They often decimate the flocks of sheep.
Canis aureus	mystical, bad kind
	But as is said, when it is, say, someone speaks too loud or shouts, it is said, like a jackal.
Ursus arctos	dangerous to humans, but rare
Mustela erminea	hunted for its fur
Mustela nivalis	blood sucker
	It bites the nipple of the animal. The weasel. It sucks the blood of the animal, then it swells up, and the nipple gets ill. / It sucks only the blood, and the flesh itself is not eaten. It sucks the blood, and the animal dies. This is a very bad animal, it harms the chickens and the farmstead very badly.
Mustela putorius	kills with bad odor
	It makes a foul odor, and then the animals get dizzy. / The polecat likes the farmstead. This polecat is a nice animal, but very dangerous.
Mustela eversmanni	unknown, whether it is useful or harmful is not known
Martes foina	very harmful, smart, human-like
	It strangles the farmstead.
Martes martes	hunted for its excellent fur
Meles meles	its fat has medicinal properties, damages grape and corn, hoarding
	Badger. It was very long ago, when it used to be caught, and loaves of soap were made of it, if it was fat. Yes, I heard it from my dad. But it was forbidden. / And it eats corn. And it collects, it has a nest, and gathers what it needs for winter. And there is a saying that collects like the badger for winter. / The badger then gnaws up everything that gets into its way.
Lutra lutra	hunted for its fur
	It is also captured. Fur is made of it.
Sus scrofa	harmful, may be dangerous
	It does not hurt anyone. In the month of May, when they have piglets, then the boar still does not hurt, only the sow. But she is only when a piglet screams, or you have a dog with you, […] *then the dog snaps and the piglet screams / ...this is a hateful job, because it hurts one, if not taking care.../ ...I cannot plant anything in there, 'cause the wild boar grunts everything out.*

Table 6. (Continued)

scientific name	cultural features
Capreolus capreolus	beloved
Cervus elaphus	called *szarvas állat* (lit. animal with antler)
	He got free, then walked down the street. He was like a king. Wow, how beautiful he was.
Dama dama	introduced
	It likes fruits and grape very much. [...] *well, the fallow deer were here again.*
Ovis aries	alien
Castor fiber	edible, was hunted, has excellent fur

4.2 Folk knowledge of invertebrates in the Carpathian Basin

4.2.1 Folk taxa and unknown taxa

Folk generics and specifics were documented for a total of 208 invertebrate folk taxa altogedher in three regions (Szilágyság, Drávaszög, Gömör). The majority of these were Coleoptera, Diptera, Lepidoptera, Arachnida and Hymenoptera, while Myriapoda, Crustacea and Annelida were represented with fewer folk taxa (Fig. 6).

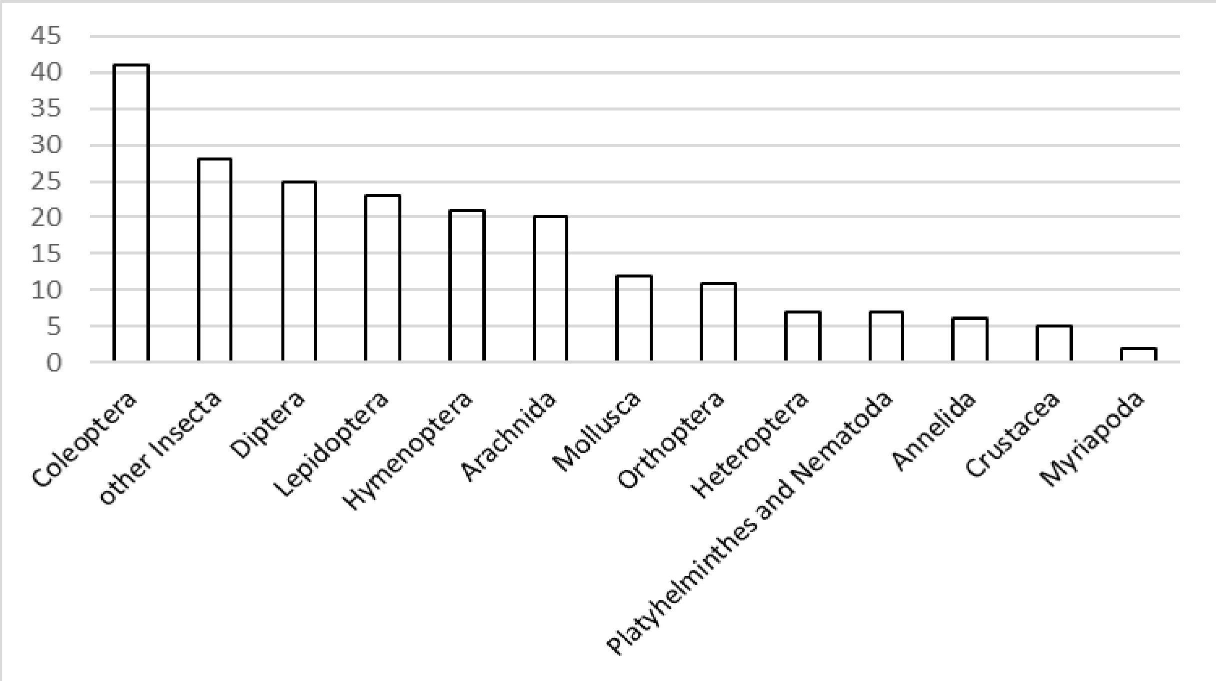


Figure 6. The taxonomic structure of the 208 Hungarian folk taxa of invertebrates documented among ethnic Hungarians in Szilágyság, Gömör and Drávaszög.

Of the 208 folk taxa, in 135 cases (65%) they could be identified with one or two scientific species, in 28 cases (13%) with several (3–6) scientific species, and in 45 cases (22%) with many (more than 6) scientific species. Certain species were exceptionally well known, but 37.5 % of the taxa were familiar only to between 1 and 3 people (Fig. 7). 45 taxa (22%) were known to almost all the informants.

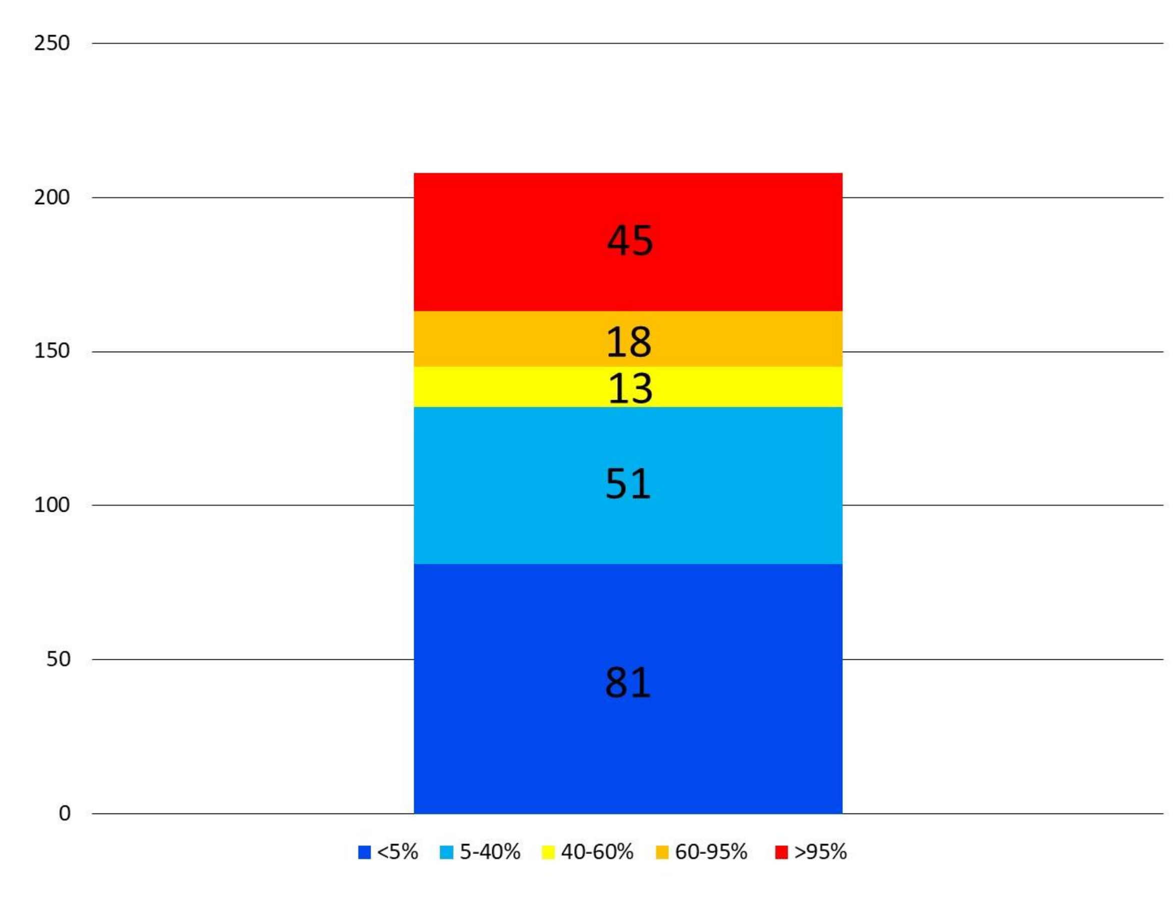


Figure 7. Proportions of species known by different numbers of informants: known by very few (1-3) informant(s) (<5%); known by 3-23 informants (5-40%); known by 24-35 informants (40-60%); known by 36-55 informants (60-95%); known by “everybody” (56-58 informants) (>95%)

Compared with four studies that covered entire faunas (Henderson and Harrington 1914; Wepukhulu 1992; Bentley and Rodríguez 2001; Hemp 2001), the ratio of invertebrate to vertebrate taxa in our region was significant (54% of specific level taxa). Apart from a single exception (bivalves-frogs, see below), the invertebrates were classified into separate supraspecific groups from the vertebrates, although invertebrates did not constitute a unified group, i.e., an inclusive folk taxon with clearly defined boundaries. This distinction is much sharper, for example, among Mongolians (Avar 2012).

The faunas of the three areas are similar, as they all contain mostly common, generalist species. The proportion of folk taxa that were restricted to just one of the three areas amounted to only 3.8% (8 species). For this reason, our analyses treated all the data uniformly. The distribution of knowledge was not even. Only 36% of the species were known to at least half of the informants. Larger species, those occurring more frequently and those with more distinctive morphologies were more widely known. There was also a greater degree of knowledge of species living in habitats closest to the homes of the informants, but there were also many known invertebrate species which have, to our knowledge, no economic significance: a quarter of invertebrate taxa were known to an extent which was comparable to that of the best known vertebrate species.

Sometimes only the larval form of an animal is known, such as those of the click beetles (*Agriotes* spp.). In such cases, their place in the taxonomy was less consistent, and often haphazard. Informants made no distinction between a significant number of diverse and morphologically easy-to-distinguish lepidopteran species. The Hummingbird Hawk-moth (*Macroglossum stellatarum*), with its remarkably unique behaviour, was a relatively frequently seen species. Despite being widely known, it was only given a name in one case, and even this was just the name used within the informant’s family.

We did not find any mythical creatures among invertebrate folk taxa, whereas ethnic Hungarians identify several such animal taxa among vertebrates (e.g. house snake, whistling snake), which are still considered living mythical creatures in the areas under investigation.

4.2.2 Names – main features and points of interest, unnamed species, modern names

93% of folk taxa had their own individual folk names. Among the most expert informants the proportion of covert categories was low. The descriptive names used in the case of folk specifics most frequently referred to their morphology or their habitat. A few taxa were only named with the name of the inclusive category.

With some of the taxa, the names given to them within the same community were not consistent. In a few cases, two or more taxa were given an identical name, even though the fact of their separateness as taxa was widely recognised (e.g. *Lampyris noctiluca*, *Lamprohiza splendidula* and *Cetonia aurata*). The first two are glow worms that light up at night, while the third is a bug (Rose Chafer) that shines remarkably in sunlight. In our experience, if it was necessary to make a distinction between the first two and the third species, then more knowledgeable informants would, in every case, separate them by adding epithets to the name (e.g. *nappali szentjánosbogár* [daytime Saint John's Bug], or: "the one, which is just a *féreg*").

On other occasions, the same folk name was used for completely unrelated and well distinguished taxonomic groups (e.g. *bolha* [flea]: *Pulex irritans* - *Chaetocnema* spp.; *giliszta* [worm]: *Lumbricus* spp. – e.g. *Taenia solium*). The names of folk specifics typically made reference to morphological, habitat and ecological properties. There were also instances of the usefulness of the creature being referred to in its name (*jópióka – lópióka,* 'good leech – horse leech', *Hirudo verbana – Haemopis sanguisuga*). Larval forms were given separate names in several instances (e.g. *Hypoderma bovis*, *Melolontha melolontha*, *Pediculus humanus capitis*), even if the larva and the imago comprised the same folk taxon.

There were several taxa with multiple names. The Firebug (*Pyrrhocoris apterus*) is a generally known species not only in the areas of our investigation, but generally in regions where Hungarian is spoken (Kovács 1987; Gub 1996) and was given a wide range of diverse names in our regions too.

There were far fewer instances of modern names or names used by only one family or individual. Some of these names were humorous, such as *pizsamás bogár* [pyjama beetle] for *Leptinotarsa decemlineata*, or *vízibizigli* (paddled boat) for the waterstriders.

The overwhelming majority of the knowledge recorded in our study had a traditional, folk background. Only rarely did some names come to light which derived from formal education or from the media (e.g. *aranyos virágbogár* [golden flower bug] - *Cetonia aurata*; *aranyszemű fátyolka* [gold-eyed veil] - *Chrysopa perla*). The balance in favour of traditional knowledge is stronger for invertebrates than it is for vertebrates (Ulicsni et al. 2013). In Appendix 1, all the names used by local people which demonstrably originate from "modern" sources (school, media, books, etc.) have been marked with "#".

4.2.3 Folk taxonomy, folk nomenclature and salient features

The folk taxonomy and nomenclature for the 208 folk taxa are presented in Figs. 8–19. Further data (English equivalents, salient features, main habitats and proportion of people who knew the taxon) are contained in Appendix 1. 20 prototypic species have been recognised, sharing the following features: their names consisted mostly of one simple noun, and within each inclusive taxon they represented the most typical behaviour. These species are *Apis mellifera*; *Vespula vulgaris – Polistes gallicus*; *Musca domestica*; Carabidae; *Blaps lethifera*; *Hydrous piceus*; *Coccinella septempunctata*; *Dolycoris baccarum*; *Gryllus campestris*; *Menacanthus stramineus*; *Pulex irritans*; *Pediculus humanus capitis*; *Cimex* *lectularius*; green Aphididae; „little black ant", ca. *Tetramorium caespitum*; *Hirudo verbana*; *Lumbricus* spp.; *Helix pomatia*; *Astacus astacus – A. leptodactylus*; *Aedes* spp.

The group containing all the hymenopteran taxa except for ants and gall wasps (Fig. 8) did not have its own separate name. Informants tended to divide this group into three parts: *méhek* (bees), *darazsak* (wasps), and *dongók* (bumblebees), the latter of which had a certain overlap with the *méhek* (bees) taxon. Prototypic species could only be identified for the first two, more stable groups.

The group called *légy* (fly) included a significant proportion of true fly (Diptera) species, and not a single group belonging to a different scientific taxon (Fig. 9). The dipteran folk taxa were distinguished primarily according to ecological salience, and secondarily according to morphological salience, into widely known taxa. The dipteran taxa *Fannia canicularis*, *Stomoxys calcitrans* and *Haematobia irritans* were not known to many informants, and could only be partly differentiated, never entirely. This state of uncertainty is reflected in the diagram with overlapping circles. We recorded knowledge of a total of 24 dipteran species, although informants did not include them all and always to the inclusive Diptera category.

The sole group to contain a large number of taxa was the one referred to as *bogár* (beetle or bug, *cf.* Herman 1914), which totalled 48 folk taxa (Fig. 10). As with many of the inclusive folk taxa, there were no sharp divisions here either. With species that do not strictly belong in the group of beetles there were further instances of the name *bogár* (beetle) being used, but the species that feature in Figure 10 are the ones that could be classified with greater certainty in the folk taxon of *bogár* (beetle).

The folk prototypic species for the entire group of beetle (*bogár*) were primarily the black-coloured members of the family of ground beetles (Carabidae). The prototypic species for inclusive taxa with fewer members were the Seven-spot Ladybird (*Coccinella septempunctata*), the Great Silver Water Beetle (*Hydrous piceus*), and so on. There were examples of taxa at two separate levels being given the same name, even though the informants could clearly distinguish between the levels (see *vízibogár* [water beetle]).

The flea beetles (*Chaetocnema* spp.) constituted a special case. Here, the complex phenomenon was identified using a single taxon, the combined presence of a *Chaetocnema* species and an *Erwinia* bacterium species, which causes leaf dieback that forms a distinctive pattern.

Among ladybirds (Coccinellidae), informants could distinguish 5 or 6 species. The Harlequin Ladybird (*Harmonia axyridis*), a recently arrived invasive species, was almost universally known. In the year it appeared, this species was immediately noticed everywhere, and viewed as alien and harmful. The Firebug (*Pyrrhocoris apterus*) is well known in every settlement, and has a wide variety of names (13 different names in the three areas).

Within the inclusive taxon of *bogár* (beetle), there were also instances of species with markedly different appearances (even to an untrained eye) being classified together. For example, the mole crickets (*Gryllotalpa gryllotalpa* and *G. stepposa*) was associated with the dor beetles (*Geotrupes* spp.), with the reason given that these species are found close to animal faeces.

The Cockchafer (*Melolontha melolontha*) and its larva appeared in two (sometimes three) separate places within the folk taxonomy. In addition to the separation of the larva and the imago, the caterpillar of the Large White Butterfly (*Pieris brassicae*) (and, to a lesser extent, other species of butterfly) as well as its imago were regarded as stages in the ontogenetic development of the cockchafer in Szilágyság area.

The folk taxon containing mostly orthopteran species only differed from the scientific classification in the absence of the mole crickets (*Gryllotalpa gryllotalpa* and *G. stepposa*). It did, however, contain the majority of cicadas (Fig. 11). The prototypic species in this taxon was the Field Cricket (*Gryllus campestris*). The distinction between this and the Italian Tree Cricket (*Oecanthus pellucens*), and therefore the entire classification as well, differed significantly among the different areas (in Szilágyság all informants knew the distinction, but only one made the distinction in Gömör).

The harvestmen (Opiliones) and cellar spiders (Pholcidae) are different groups at ordinal level, but the informants treated them as a single folk specific (Fig. 12). The waterstriders (*Gerris* spp.), although belonging to the Heteroptera, were also included among folk spider species.

There was justification for classifying smaller parasites, plant pests and other similar species together (Fig. 13), although it was not possible to confine this group within an inclusive taxon that ruled out all uncertainty. The group was heterogeneous in terms of both the scientific taxonomy and the various folk saliences. The number of known species is high, and they were very accurately identified. There was a high number of taxa that had their own prototypic species [species of green aphid, Chicken Body Louse (*Menacanthus stramineus*), Bed Bug (*Cimex lectularius*), Head Louse (*Pediculus humanus capitis*), Human Flea (*Pulex irritans*)].

Figure 14 shows the majority of the larvae of insect species. This was the most uncertain of the inclusive taxa, and was not regarded as an independent group by many of the informants.

Within the category of ants, there was one clearly defined folk taxon, namely the winged castes of many biological ant species' (Fig. 15).

Figure 16 shows the ringed worms (Annelida), flatworms (Platyhelminthes) and roundworms (Nematoda). The folk taxonomy of the ringed worms completely mirrored the scientific taxonomy, even at the level of two supraspecific taxa. In the case of the flatworms and roundworms, less information is available.

Within the molluscs, the group of snails and slugs was very clearly defined (Fig. 17). The bivalves sometimes shared associations with other molluscs (in their names, for example), but they were more frequently linked with frogs. Informants whose folk knowledge had suffered from the least amount of erosion almost exclusively regarded bivalves as the *eggs* of certain frog species (mostly *Pelophylax* and *Rana*).

Apart from the overlap with the Cockchafer *(Melolontha melolontha)* and the special classification of lepidopteran caterpillars, the folk taxon of lepidopterans was also quite intact, and largely in agreement with scientific taxonomy (Fig. 18). Two additional folk taxa were included here which are classified differently according to entomologists: the moth flies (Psychodidae) and the lacewings (*Chrysopa* spp.).

Only a few invertebrate taxa were left out of all inclusive categories. Most of these remained alone during the pile sorting exercises. They could, on very rare occasions, be sorted into one group or other, although inconsistently, and without true conviction. Such taxa included e.g. the Tisa Mayfly (*Palingenia longicauda*) and the froghoppers (Cercopidae) (Fig. 19).

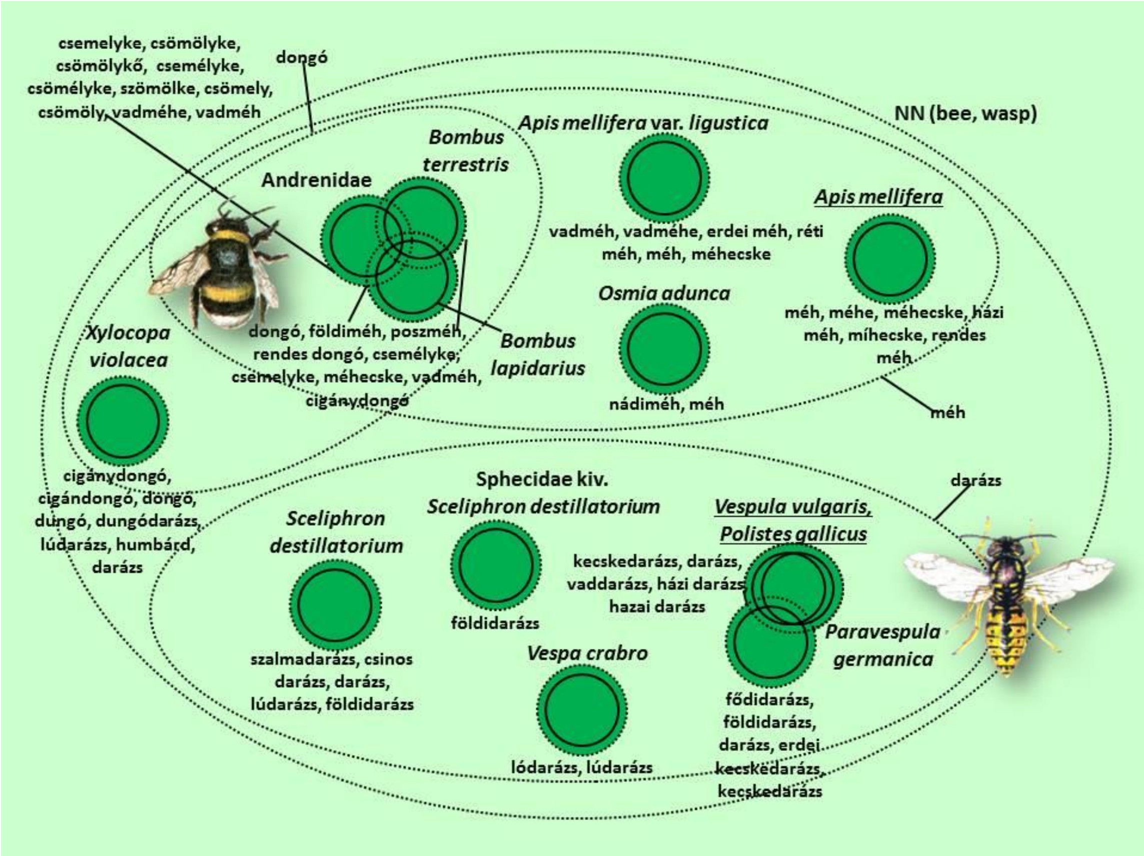


Figure 8. Folk taxa containing bees (Apidae), as well as mining bees (Andrenidae), wasp species (Vespidae) and family of parasitoidal wasps (Sphecidae). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

Continuous circles on these figures indicate scientific taxa (one species, one genus, one ordo, one family), whereas small and large dashed circles represent folk taxa and more inclusive folk categories, respectively. The overlap of the circles of scientific taxa indicates that certain scientific taxa are viewed as ’alike’. Prototypic species are marked with undelining. NN means the inclusive taxon is not named.

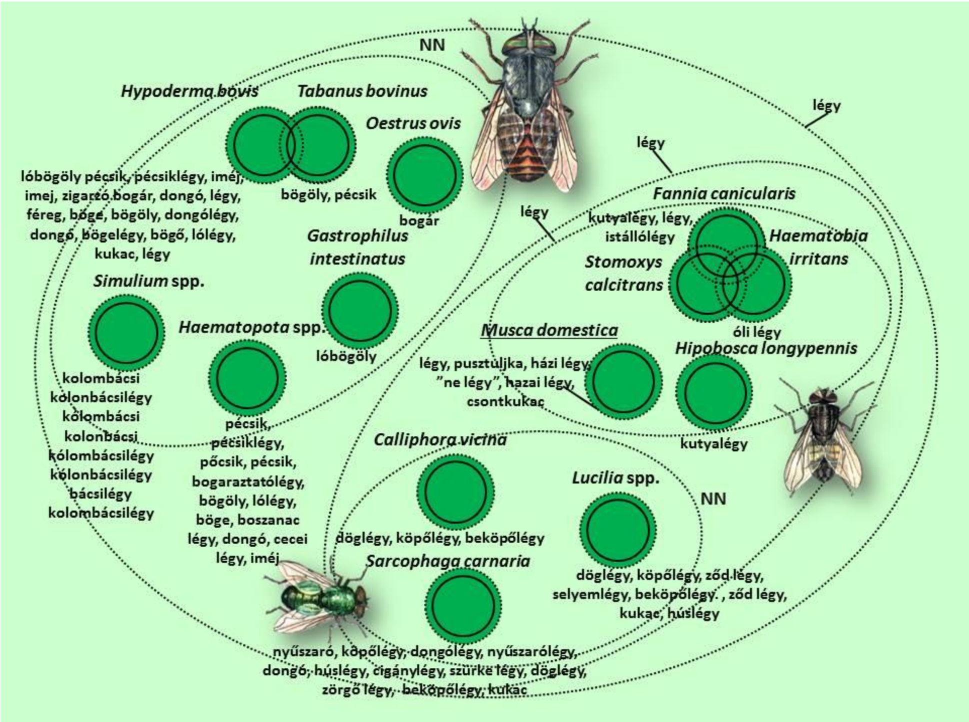


Figure 9. Folk taxa containing most of the true flies (Diptera). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

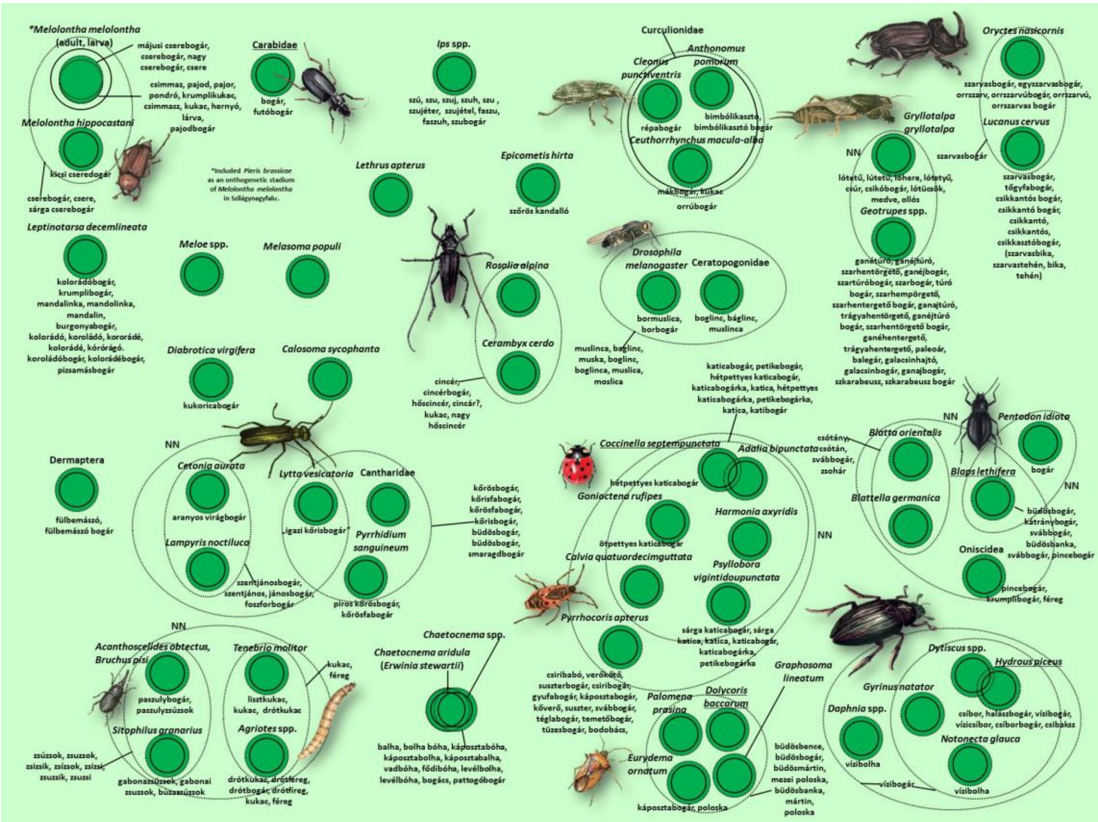


Figure 10. Folk taxa of the *bogár* (beetle) inclusive category, containing beetles (Coleoptera), as well as some true bugs (Heteroptera), crustaceans (Crustacea) and cockroaches (Blattodea), etc. The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

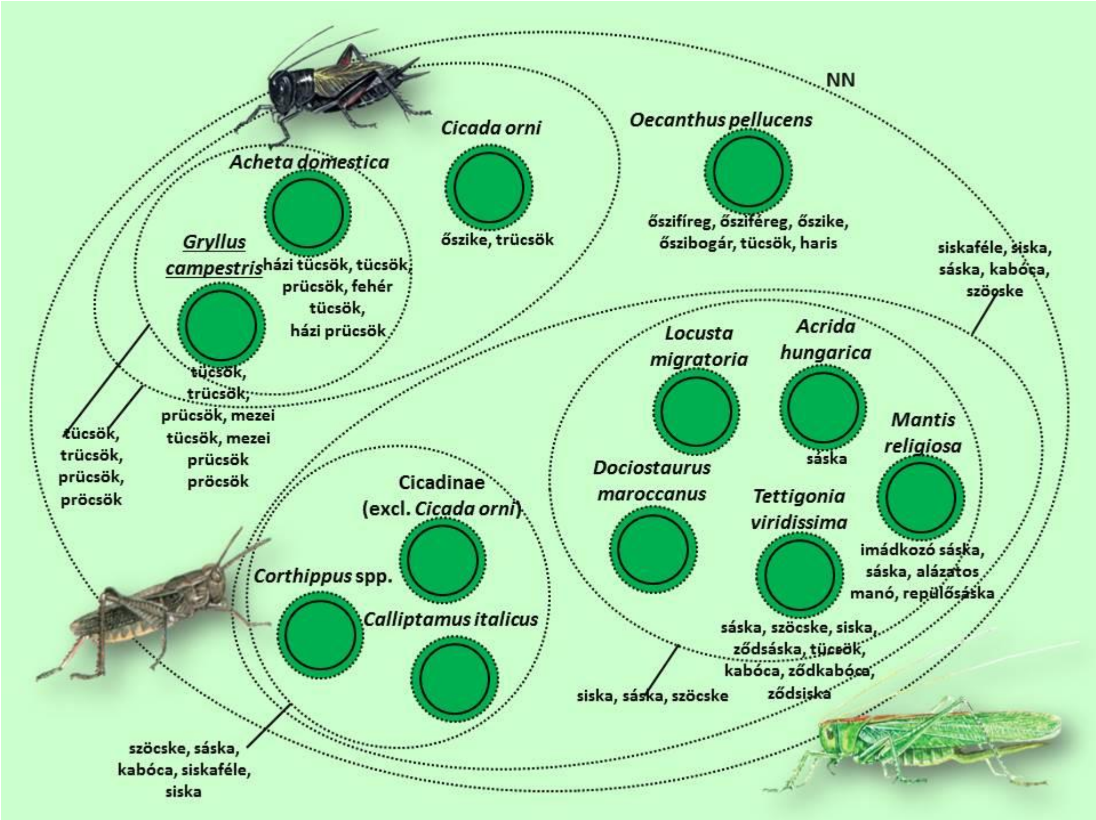


Figure 11. Folk taxa containing most grasshoppers, crickets and locusts (Orthoptera). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

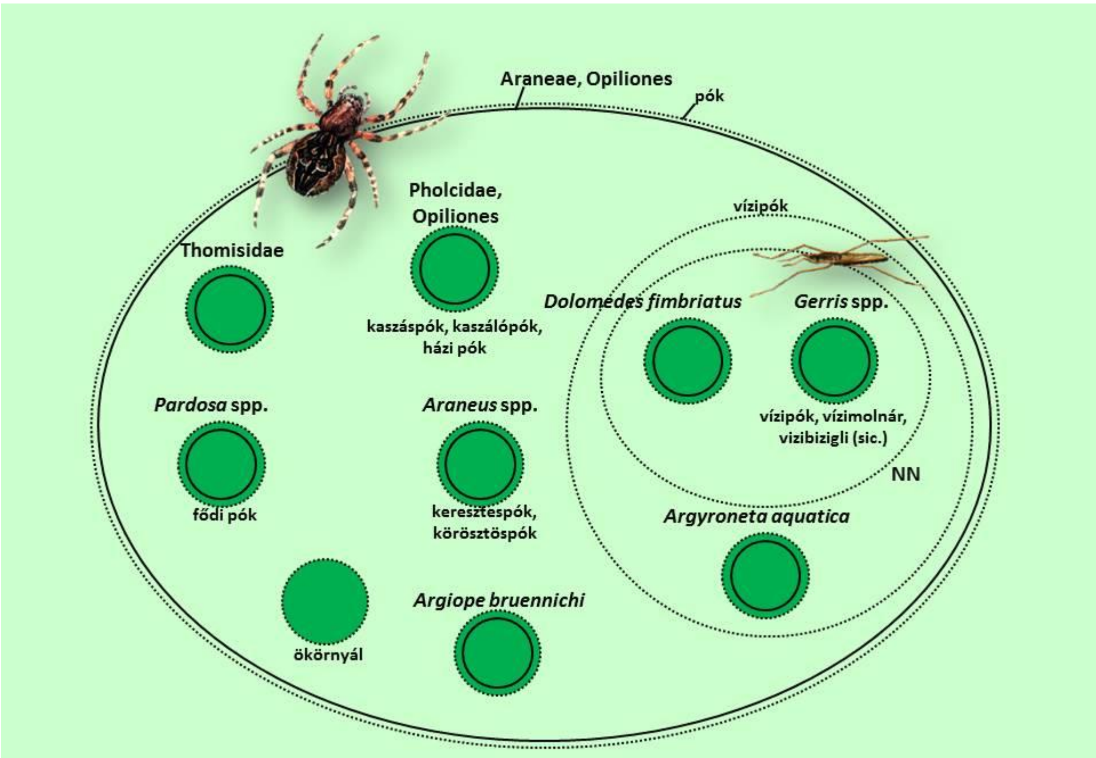


Figure 12. Folk taxa containing spiders (Araneae), and harvestmen (Opiliones). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

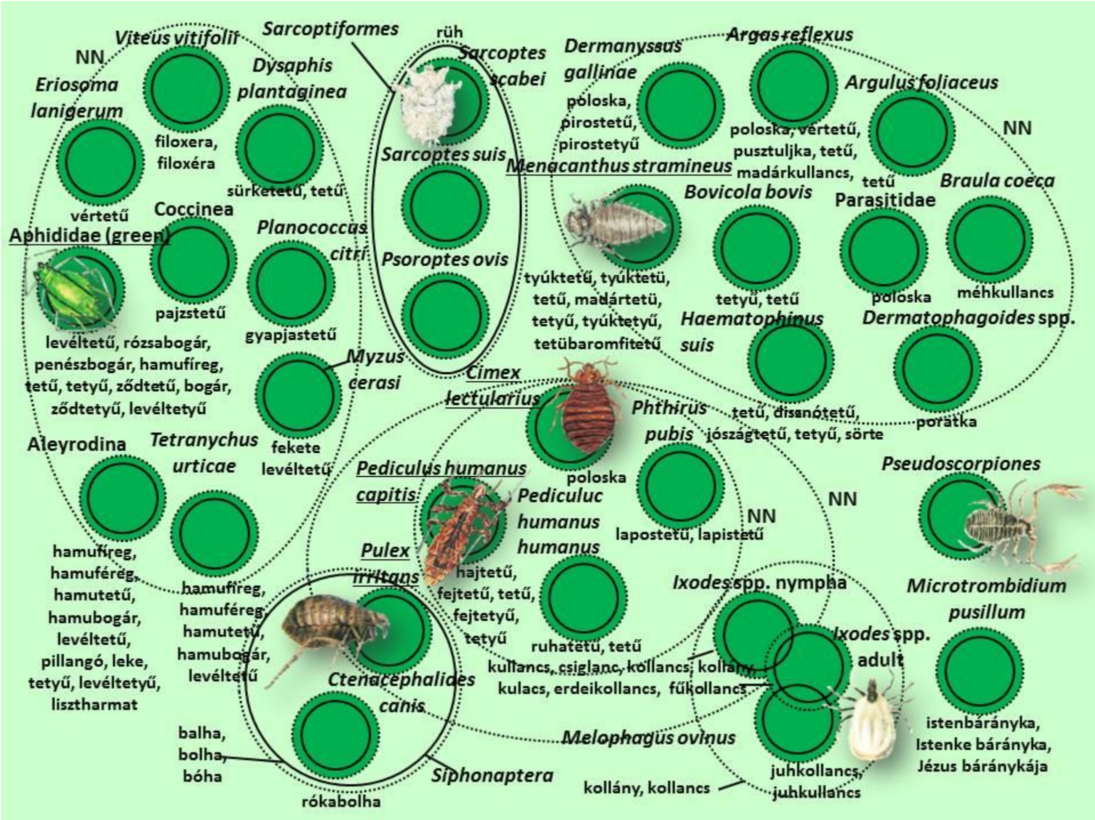


Figure 13. Folk taxa containing small parasites, herbivore pests and similar taxa. The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

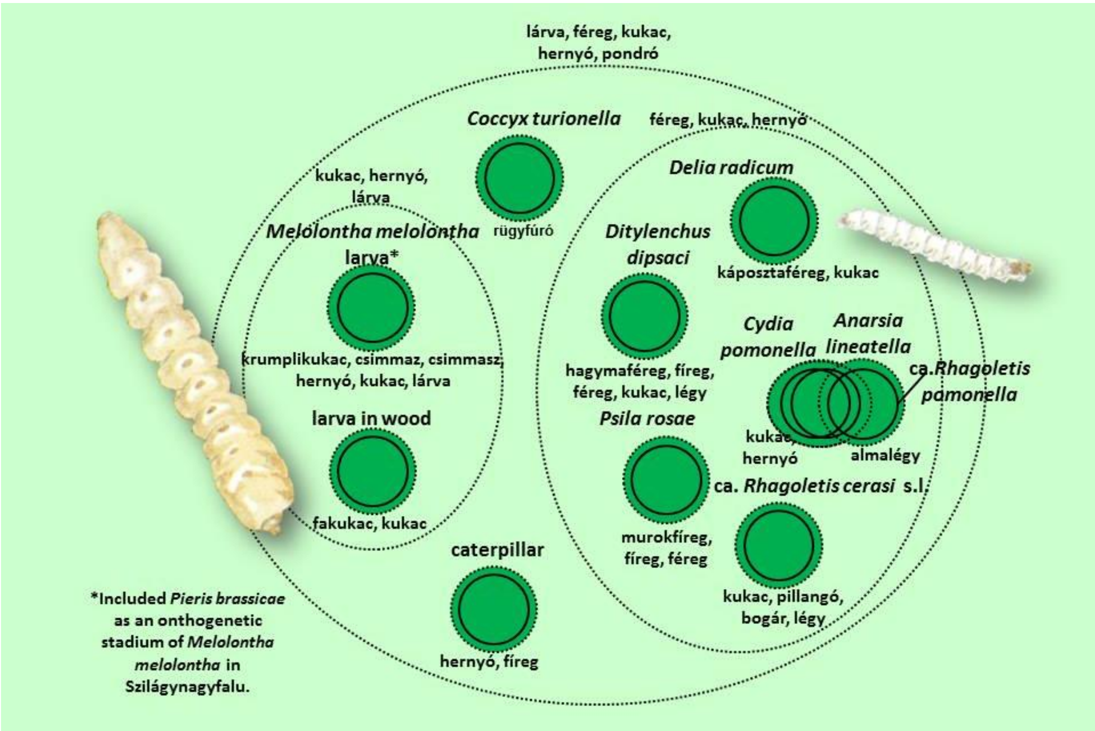


Figure 14. Folk taxa containing the larvae of some arthropods. The folk names are listed in the order of frequency of mentions.

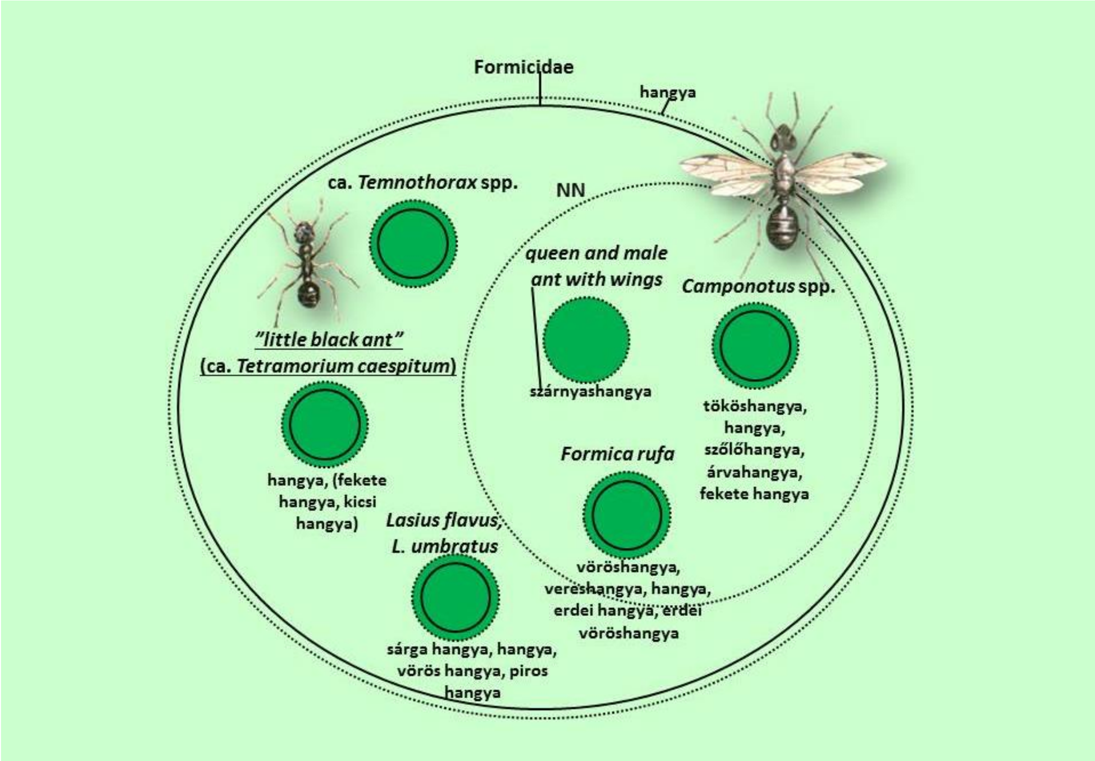


Figure 15. Folk taxa containing ant species (Formicidae). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

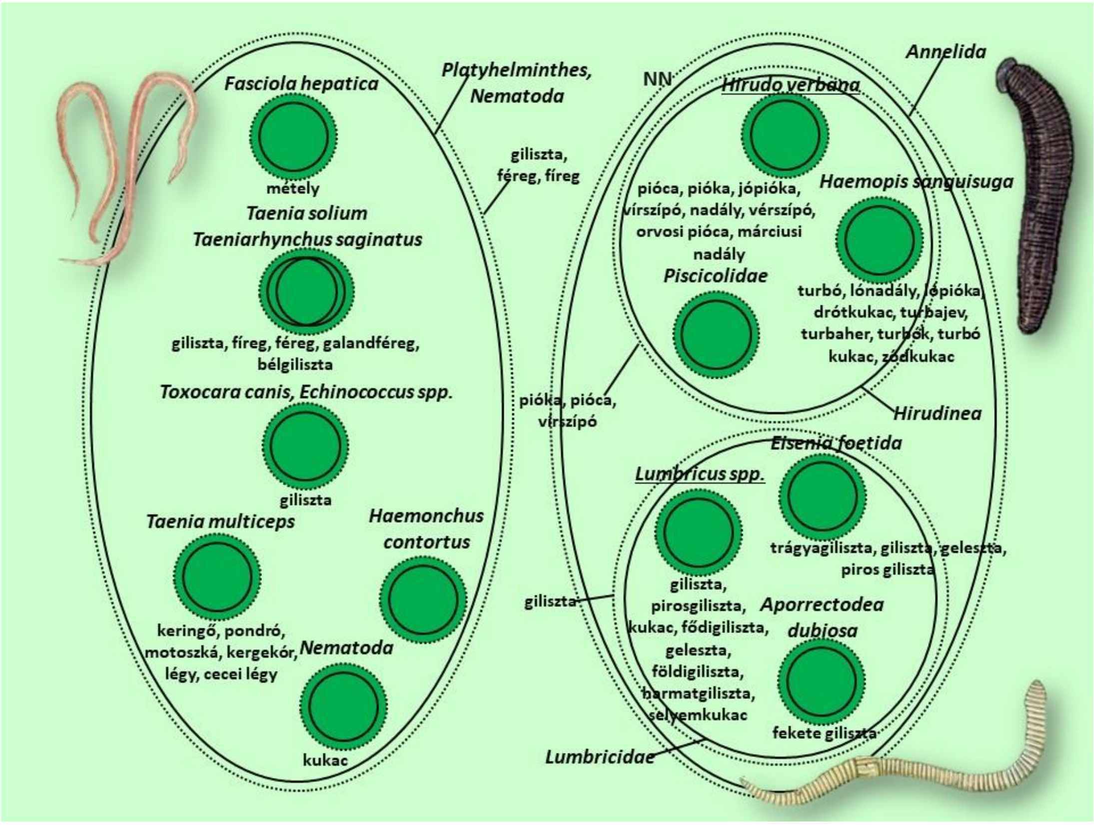


Figure 16. Folk taxa containing flatworms (Platyhelminthes), as well as roundworms (Nematoda), and ringed worms (Annelida). The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

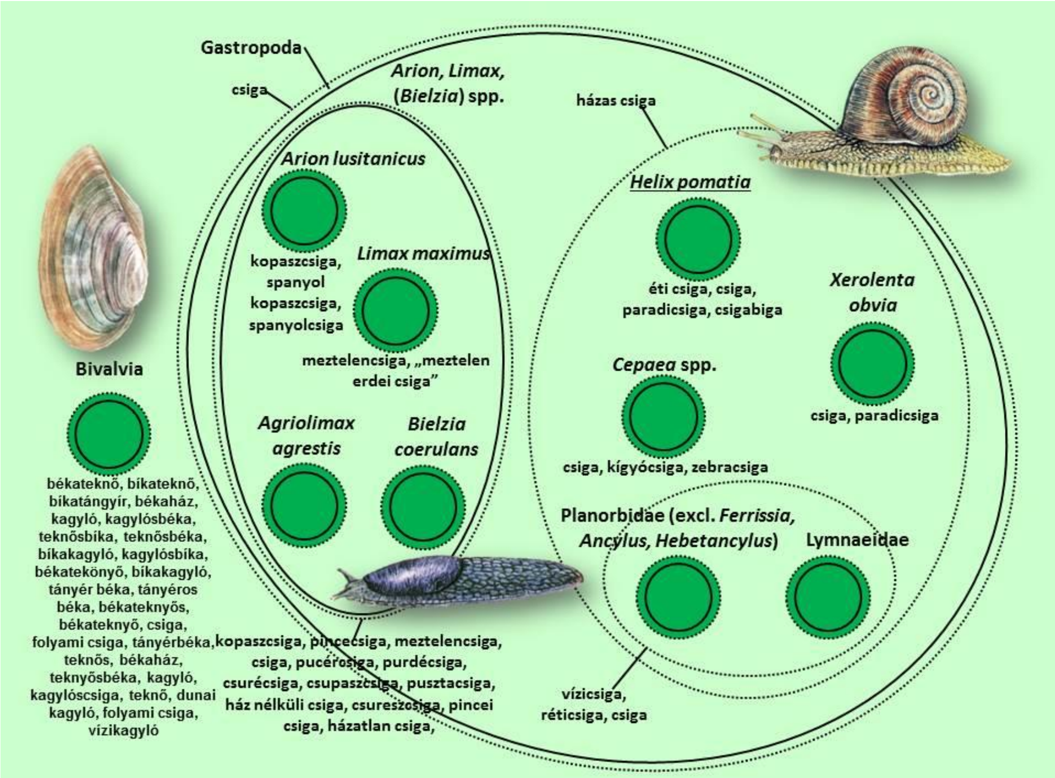


Figure 17. Folk taxa containing most of the molluscs (Mollusca). The folk names are listed in the order of frequency of mentions.

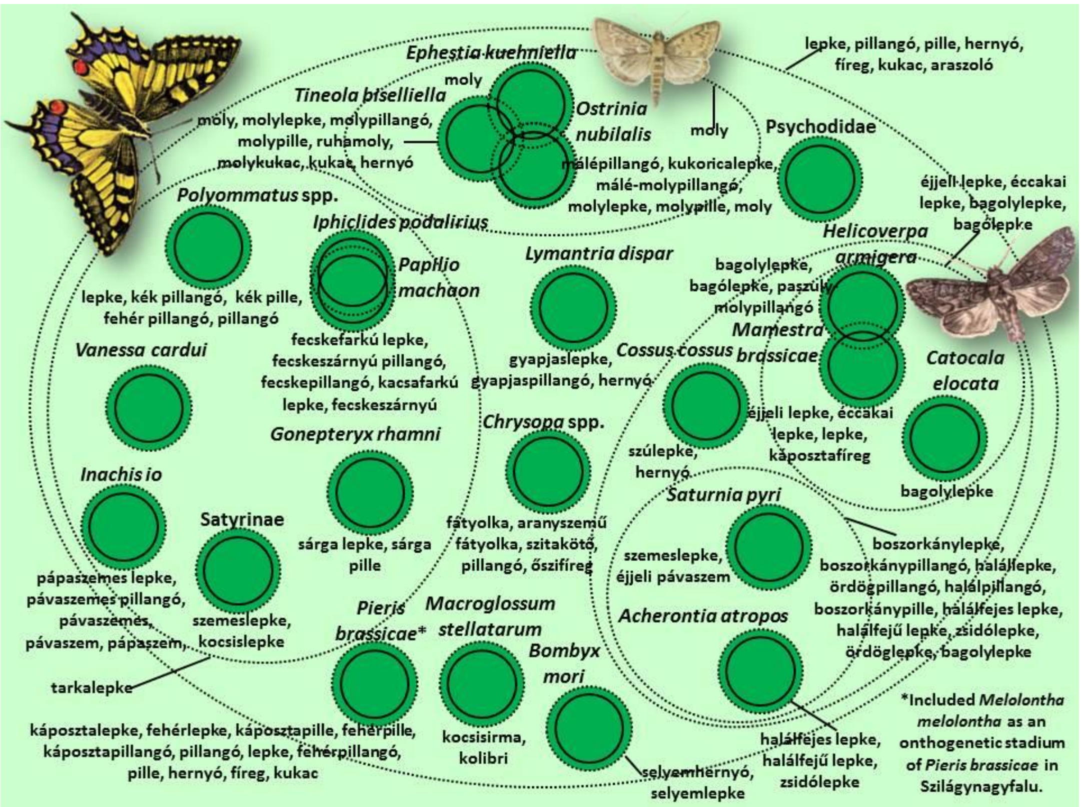


Figure 18. Folk taxa containing moths and butterflies (Lepidoptera) and some other taxa. The folk names are listed in the order of frequency of mentions. NN denotes unnamed folk taxa.

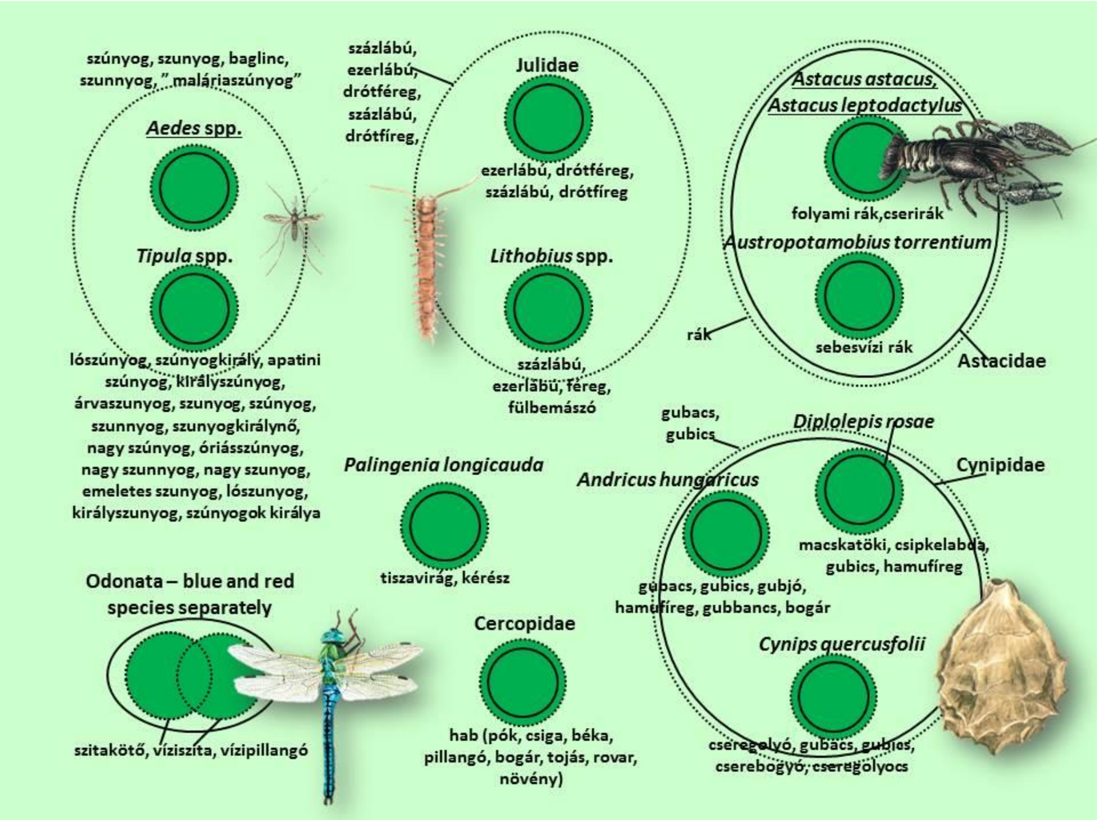


Figure 19. Smaller folk taxa containing other arthropods. The folk names are listed in the order of frequency of mentions.

Fig. 8-19 show that 90% of the taxa were embedded in the taxonomy, with generics and specifics dominating. The greatest degree of knowledge was connected to the more inclusive categories (and not to generics or specifics) primarily in the case of spiders, and to a lesser extent the snails, ants and lepidopterans.

Within a folk specific, we generally found species that were related from a scientific point of view. It was rare to find taxa that were far removed from each other according to scientific classification. As an example one of the greatest distance, harvestmen (Opiliones) and cellar spiders (Pholcidae) (2 scientific orders) were identified as a single folk specific. The parallel with the scientific taxonomy was therefore surprisingly precise (especially in the case of ringed worms).

One interesting belief resulted in a quite remarkable taxonomy. The connection between bivalves and frogs is generally known in Szilágyság, but was only reported by the most knowledgeable informants in Drávaszög. The connection between the two folk taxa is reflected in the name of the bivalves (*békateknő* – "frog tub"). Thanks to the media, and perhaps from speaking to relatives who have been to the seaside, many informants have now heard of seashells. The majority of these were called *kagyló* (shell), and they were sharply distinguished from freshwater species. More knowledgeable informants said that the seashells were, like their freshwater equivalents, the eggs of frogs. However, slight majority recognised that they are separate species.

A few species were included in the taxonomy which were not universally viewed as animals, with some informants describing them as diseases rather than species of fauna. These included the liver fluke, a species of mite, meadow froghopper larvae in their foam nest and gossamer.

Among the inclusive taxonomic categories, the one known as *bogár* [beetle] is closest to the “wug” taxon introduced by Brown (1984). “Wug” in the three regions studied included most invertebrate species, such as beetles, butterflies, bees and flies; it did not include molluscs, and only rarely did it also include flatworms, roundworms or ringed worms, so as a category it more or less covered the arthropods. The name *férgek* [worms], also often used as an inclusive category, was less readily applicable to the folk taxonomy. Sometimes the name was used for worm-like creatures, at other times it was applied to other invertebrate pests. In extreme instances, it even encompassed the House Mouse, the wolf, the bear (*cf*. Kicsi 2015), or indeed any animal regarded as harmful in any way.

4.2.4 Human uses of invertebrate taxa

A total of 24 invertebrate species were documented as being of direct use to humans (Table 7). Four species were used for medicinal purposes, 5 species were consumed, 11 were used as bait for fishing, and 2 species were used as playthings.

Andricus hungaricus and *Cynips quercusfolii* were known to be used for tanning leather, although rarely. Even less commonly, *Lytta vesicatoria* was mentioned as an aphrodisiac, and *Daphnia* spp. were used as food for aquarium fish. In Szilágyság, the honey stomachs of black-coloured carpenter bees (*Xylocopa violacea*, *X. valga*) were consumed even when there was no shortage of alternative foods.

The consumption of *nádiméz* (honey in the tube of the reed) from thatched roofs was quite widespread among children in the past. Molluscs are consumed relatively commonly across the globe (Stearns 1887; Gunderson 2005), and this was also true for the three study areas in the past (Gulyás and Sümegi 2011). Surprisingly, the idea of consuming edible snails was mostly rejected as disgusting by the informants, and it was only among the most elderly informants in Drávaszög that there was any tradition of eating edible snails.

Table 7. List of invertebrate taxa for medicinal use, food, angling, toy and other purposes. The last column indicates which species are traditionally protected by locals.

No.	see taxonomy in Fig. no	Latin and proper name of folk taxa (serial number in appendix 1)	saliences	medicinal	consumption	bait	toy	other usage	protection
1.	12	Araneae e.g. *Tegenaria domestica* spiders (34)	*If you cut your feet, you would pick spider net in the stable and covered the cut to heal.*	x				x	x
2.	10	*Lytta vesicatoria* Spanish Fly (86)	*If the rabid dog bit someone, you had to feed nine piece of it to the man. / If you pour (the tincture prepared from the beetle) onto the head of the man, he did not shiver any more.* There are also some mentions on its usage as an aphrodisiac.	x				x	
3.	8	*Apis mellifera* European Honey Bee (113)	*When the bees are gone we will be gone as well because there will be nothing to eat. / Honey is good for a lot of things.*	x	x			x	
4.	16	*Hirudo verbana* Mediterranean Medicinal Leech (8)	*My aunt had them in a jar, when she had a headache or neck ache you would put them on. / Only March leech would be good. / If your tooth aches, put to your gums, it would suck the bad blood from it.*	x		x			
5.	8	*Xylocopa violacea, X. valga* black coloured carpenter bees (112)	*Eats nectar, it doesn't do you any harm. / Drills the wood like a machine. / We frequently caught it, took apart and ate the honey from it.*		x				
6.	17	*Helix* spp. mainly *Helix pomatia* edible snails (20)	*The poor cooked it. / They were collected in springtime. / They were washed at least ten times. It was scalded and the foot cut off. It was soaked in lukewarm water, in cold water, lukewarm again, a lot of work. / Snails are best before the weeds grow too high.*		x				
7.	19	*Astacus astacus, Astacus leptodactylus* European Crayfish, Danubian Crayfish (48)	*The old of long time ago caught it, it became red when cooked. / My father caught many on the Rét* (a marsh)*, we cooked them in a big pot. In salty water. / The tail and the nippers are good to eat.*		x				
8.	10	*Osmia adunca* mason bee species (115)	*We picked out the reed* (from the roof)*, when we saw that there was reed honey in it. My grandmother was very angry and scored at us because we destroyed the reed roof beehive and we then ate the reed honey.*		x				
9.	10	*Pyrrhidium sanguineum* Welsh Oak Longhorn Beetle (92)	*We would use them for fishing long time ago.*			x			

Table 7. (continuation)

No.	see taxonomy in Fig. no.	Latin and proper name of folk taxa (serial number in appendix 1)	saliences	medicinal	consumption	bait	toy	other usage	protection
10.	17	Bivalvia e.g. *Anodonta cygnea* clams (24)	*There were many, fed to the pigs. / You would make buttons of it. It is good for bait to catch carp and predatory fish.*			x		x	
11.	16	*Haemopis sanguisuga* Horse-leech (10)	*It's like the leech but only more gentle. / We would pick them to catch catfish.*			x			
12.	17	*Arion, Limax* spp. e.g. *Limax maximus* slug species (14)	*They are very good for baits (i.e.: for angling).*			x			
13.	16	*Lumbricus* spp. e.g. *Lumbricus terrestris* earthworms (11)	*My husband would know them because he was a fisherman and would collect them.*			x			
14.	16	*Eisenia fetida* Redworm (12)	*Not all earthworms would do for angling. This is the best one.*			x			
15.	10	*Gryllotalpa gryllotalpa, G. stepposa* European and Steppe Mole Cricket (63)	*This is a good bait* (to angle). */ They were gathered to put on bottom hooks, there were some 200 bottom hooks attached on a single string.*			x			
16.	10	*Cerambyx cerdo* Great Capricorn Beetle (90)	*I would pick them out for bait* (from firewood). *In winter, when I can't get earthworms.*			x			
17.	10, 14	*Melolontha melolontha* Cockchafer (88)	*You can angle with it nicely. When it has time* (swarming), *fishes like it.*			x			
18.	16	*Aporrectodea dubiosa* earthworm species (13)	*This is harder and it* (the fish) *can not pull it down* (from the hook).			x			
19.	19	*Cynips quercusfolii* gall wasp species (130)	*We were kids and made pipe of it. It was a toy. / Oak galls would be used for tanning leather in the past.*				x	x	
20.	19	*Andricus hungaricus* Hungarian Gall Wasp (132)	*Used for tanning, but collected here mainly for sale.*				x	x	
21.	-	different beetles and other bigger insects	cruel playing with living individuals				x		

Table 7. (continuation)

No.	see taxonomy in Fig. no.	Latin and proper name of folk taxa (serial number in appendix 1)	saliences	medicinal	consumption	bait	toy	other usage	protection
22.	10	*Daphnia* spp. e.g. *Daphnia magna* water fleas (50)	*There was a doctor here when we were kids who had an aquarium and he gave them to the fish. We would go to collect them with a little dipping net.*					x	
23.	10	*Coccinella septempunctata* Seven-spot Ladybird (97)	*We are scared that they* (*Harmonia axyridis*) *will kill off all of our nice little ladybugs. Oh, those littles. Which is a pity, because they are good.*						x
24.	13	*Microtrombidium pusillum* Dwarf Velvet Mite (46)	Sometime it is protected like a taboo. *God's Lamb. It has a cross on its back.*						x
25.	18	Lepidoptera e.g. *Melitaea athalia* butterflies (135)	*This is indeed not a pest. We were glad to see it before.* They are aware of the harm many species do, yet adult individuals are not destroyed.						x

The use of Spanish Fly (*Lytta vesicatoria*) was well known, although very few informants had actually seen it used in practice. Its consumption was sometimes linked to superstitious elements such as consuming a "magic number" (9) of beetles placed in palinka (distilled fruit spirit), and mixing them with "randomly" found dog faeces. Blister beetles are used over the world to treat incurable or barely curable illnesses (Meyer-Rochow 2013), and in our study areas, they were previously used as an antidote to rabies.

We found that leeches were used in four ways: 1) placed on the neck to reduce blood pressure, 2) placed on the gum for treating symptoms of periodontitis, 3) placed on various body parts as a painkiller, by increasing the flow of blood as well as from the analgesic entering the bloodstream, 4) as a fishing bait. One species (Mediterranean Medicinal Leech - *Hirudo verbana* /formerly *Hirudo officinalis*/) has a medicinal effect and has been used for centuries, while the other (Horse-leech - *Haemopis sanguisuga*) does not (Bonow and Svanberg 2017). Detailed morphological knowledge was of great importance here. In the Carpathian Basin, it is common for medicinal and non-medicinal plant species also to be given the prefix of *orvosi* (medicinal) or *ló-/kutya-* (horse/dog), respectively (Molnár 2012; Babai et al. 2014).

The use of invertebrate taxa for veterinary medicine was not documented in any of the areas under investigation, although such practices are known in the region. In north-east Romania, for example, spiders are used to treat flatulence in cattle by rubbing the spider into the animal's side (Ulicsni unpubl.).

4.2.5 Proverbs and sayings

Invertebrates are featured in a number of proverbs and sayings (Table 8). During data collection, a total of 30 taxa were associated with a proverb or some other folk wisdom [such as weather forecasting, harvest predicting, similarly to the way in which birds, for instance, are associated in many human cultures (Tidemann and Gosler 2010)]. Forecasts of weather phenomena based on the behaviour of various invertebrates (e.g. winged ants mean that rain is coming) occurred frequently.

Games with the invertebrates, and the ill-treatment of animals were quite widespread in the past, although they were not confined to particular species. Nevertheless, larger and more easily caught species, such as *Melolontha melolontha*, *Lucanus cervus* and *Oryctes nasicornis*, were more likely to fall victim.

One belief that made a scattered appearance in the areas under investigation stated that a dragonfly hovering about the water indicated that there was no snake in the water. The name recorded for the dragonfly by Gub (1996), *kígyópásztor* (snake-shepherd) may also derive from this belief.

Table 8. Proverbs and common sayings referring to invertebrates

Latin name, proper name (serial number in appendix 1)	Proverbs, their meanings and explanations
Coccinella septempunctata Seven-spot Ladybird (21)	*We said to it: ladybug, where do you take me to get married? Then we married in the direction where it flew.* Vernacular prophecy.
Planorbidae (excl. *Ferrissia, Ancylus, Hebetancylus*) e.g. *Planorbis planorbis* ramshorn snails (23)	*If the snail climbs up from water onto something, it means the flood is coming.* Vernacular prophecy.
Gastropoda (excl. slugs) e.g. *Zebrina detrita* snails (25)	*Snail. This is the strongest animal carrying its house on its shoulder.* Joking comparison frequently quoted to kids.

Table 8. (continuation)

Latin name, proper name (serial number in appendix 1)	Proverbs, their meanings and explanations
Ixodes spp. e.g. *Ixodes ricinus* ticks (28)	*You're like a tick.* Said mostly to kids with an affectionate joking gesture because of their attachment.
gossamer air-threads (44)	*There will be no rain because it stretches.* Vernacular weather forecast.
Microtrombidium pusillum Dwarf Velvet Mite (46)	*Shine, sun, shine, Jesus' lamb is freezing to death under the gardens. And then the Sun shone.* A superstition wishing to change the weather.
Oecanthus pellucens Italian Tree Cricket (55)	*Autumn is here because the cricket chirps, saying 'gather, gather'.* Wisdom based on observations impersonating the species.
Gryllus campestris Field Cricket (61)	*You could not put down your clothing in the grass because old people said: the cricket would gnaw a hole in it.* Might be a belief.
Gryllus campestris Field Cricket (61)	*If you draw a cross on the back of a cricket, it would not jump any more.* Fun for kids based on belief.
Pyrrhocoris apterus Firebug (64)	*They stick together like the firebug.* The firebug (*Pyrrhocoris apterus*) can be seen in dense masses in springtime.
Lytta vesicatoria Spanish Fly (86)	*The ash tree is stinky, it will rain.* Prophecy connected to Spanish fly invasion.
Melolontha melolontha Cockchafer (88)	*If there are too many maybeetles, corn yields will be good.* Maybe vernacular experience or possibly only a belief.
Cerambyx cerdo Great Capricorn Beetle (90)	*Your moustache stands up like that of a capricorn beetle.* An analogy on the long moustache bending upwards.
Apis mellifera and Araneae European Honey Bee (113), spiders (34)	*Bees collect honey, spiders poison from the same flower.* Meaning of the proverb: there is no universal truth.
winged ant castes (120) e.g. *Tetramorium caespitum*	*When the winged ant comes out, it will rain.* Vernacular weather forecast.
Tetramorium caespitum and similar species Pavement Ant (124)	*Be like the ant and work!* Ants were considered 'diligent' animals (busy as an ant).

Table 8. (continuation)

Latin name, proper name (serial number in appendix 1)	Proverbs, their meanings and explanations
Vespa crabro European Hornet (127)	*Nine hornet bites kill a horse.*
Vespula vulgaris and similar species Common Wasp (128)	*Yellow wasp, small wasp, large wasp, they all scratch on a bunch of grapes.* Pun made of a vernacular observation.
Andricus hungaricus Hungarian Gall Wasp (132)	*My mother made us thrown them away. You must not keep it at the house because brood will not hatch the eggs.* Belief says it prevents brooding of the hen.
Lepidoptera e.g. *Melitaea athalia* butterflies (135)	*The superstition was that if you see a yellow butterfly in spring, you would fall ill. If you see a red one, you will remain healthy and fall in love, if a black one, someone would die.* Vernacular prophecy. The yellow butterfly may be *Gonopteryx rhamni*, red ones may be several other species.
Lepidoptera e.g. *Melitaea athalia* butterflies (135)	*Even the mottled butterfly came from a caterpillar.* You do not necessarily worth more just because of your better appearance or even something ugly may become beautiful one day.
Saturnia pyri Giant Peacock Moth (151)	*The boszorkánylepke* (witch butterfly) *were nailed above the door for superstition.* It was used as a superstitious protection against the Devil.
Drosophila spp. e.g. *Drosophila melanogaster* fruit flies (159)	*Fruit flies cause the wine to ferment.* In their opinion the presence of fruit flies cause the wine to ferment.
Drosophila spp. e.g. *Drosophila melanogaster* fruit flies (159)	*The man from Vörösmart swallowed the frog; he thought it was a fruit fly.* Mocking a village.
Tipula spp. e.g. *Tipula maxima* crane flies (160)	*We stroke the mosquito king to death; there will be no mosquitos now.* The *Tipula* species which are much greater than biting mosquitos but are related to them are presented by the saying as a kind of king.

Table 8. (continuation)

Latin name, proper name (serial number in appendix 1)	Proverbs, their meanings and explanations
Musca domestica Housefly (169)	*Noah wanted to chase them out from the Bark. He could not. Well, fly, then. He said. And the name stuck.* Folk etymology for the name of the fly. He blames Noah for the existence of flies. *Légy* in Hungarian also means: be (you should exist).
Musca domestica Housefly (169)	*If flies bite, rain comes.* Vernacular weather forecast.
Pediculus humanus capitis Head Louse (191)	*It's not a shame to get it, only to keep it.* Educating saying on responsibility.
Haematopinus suis Hog Louse (193)	*You can find a louse only in a good hog.* In their opinion louses occur on healthy pigs only.
Odonata e.g. *Sympetrum sanguineum* dragonflies (207-208)	*Where there are dragonflies, there are no snakes.* It was held that wherever a dragonfly hovers over the water there will be no snakes in it.

4.2.6 Invertebrate species that enjoy folk conservation or state protection

Conscious ideas about conserving invertebrates only occurred with a few taxa (see the last column in Table 7). Seven-spot Ladybirds, Dwarf Velvet Mites and often spiders were said to enjoy protection, but informants would generally – but not universally – refrain from harming firebugs, field crickets and most butterflies.

Many informants knew that ladybirds they help reduce aphid populations and thus protect them, while butterflies were only respected for their beauty. The taboo about destroying dwarf velvet mites was explained by a few informants as being due to the cross-shaped marking on their backs. Many stated that hurting spiders brought bad luck. Field and House Crickets were also generally left unharmed.

A kind of tolerance was exhibited, especially in connection with species that people were fond of for whatever reason, or regarded as relatively harmless, in phrases such as “they have to eat too”, or “they are also God’s creations”. The damage caused by such species is often accepted, and regarded as tolerable and natural.

Most people knew nothing about legal protection for invertebrates and almost every invertebrate species was regarded as basically harmful. Where possible they were destroyed or at least regarded as being worth eradicating. Informants reported little information about the benefits of invertebrates, or did not regard the benefits as significant. Because they are very common, even species that were regarded as useful were not given any protection (for example, fruit flies are believed to aid fermentation). However, we could not find any information to suggest that any invertebrate species had disappeared or become rarer as a result of conscious destruction.

4.3 Predicting the observed level of local familiarity with wild animal species

We examined whether the expert judgment of academic zoologists or a feature-based linear model is better at predicting the observed level of local familiarity with wild animal species. Following the stepwise variable selection, the key features included in the final linear model were: abundance, folklore, size, habitat, morphology, danger to human and nature conservational value. None of the single features had significant explanatory power (Appendix 7). The best explanatory power was provided by the combination of the variables listed in Appendix 7. The constructed linear model predicted the level of familiarity accurately in ca. 70% of the species (see species close to the axis in Fig. 20). On average the constructed linear model underestimated the level of familiarity by just 2.9%. For individual species, however, the difference between the observed and calculated familiarities was much higher (21.8%). Based on the 2x16 most over- or underestimated species, the chance of overestimation increased with the usefulness of the species, while underestimation increased with the richness of folklore, and also if the size and abundance of the species were below average.

Zoologists' predictions of the level of local familiarity were accurate for ca. 60% of the species (Fig. 21). In the case of the zoologists' predictions, significant dependencies were found between explanatory variables: size, ethological salience, abundance, habitat, danger to humans, usefulness and the level of familiarity expected by zoologists (Appendix 3). Overestimation occurred with species characterised by less than expected local usefulness, and less than expected danger to humans; underestimation occurred with species unexpectedly frequently encountered by villagers, more than expected harmfulness, more than expected nature conservational value, and rare small-bodied species.

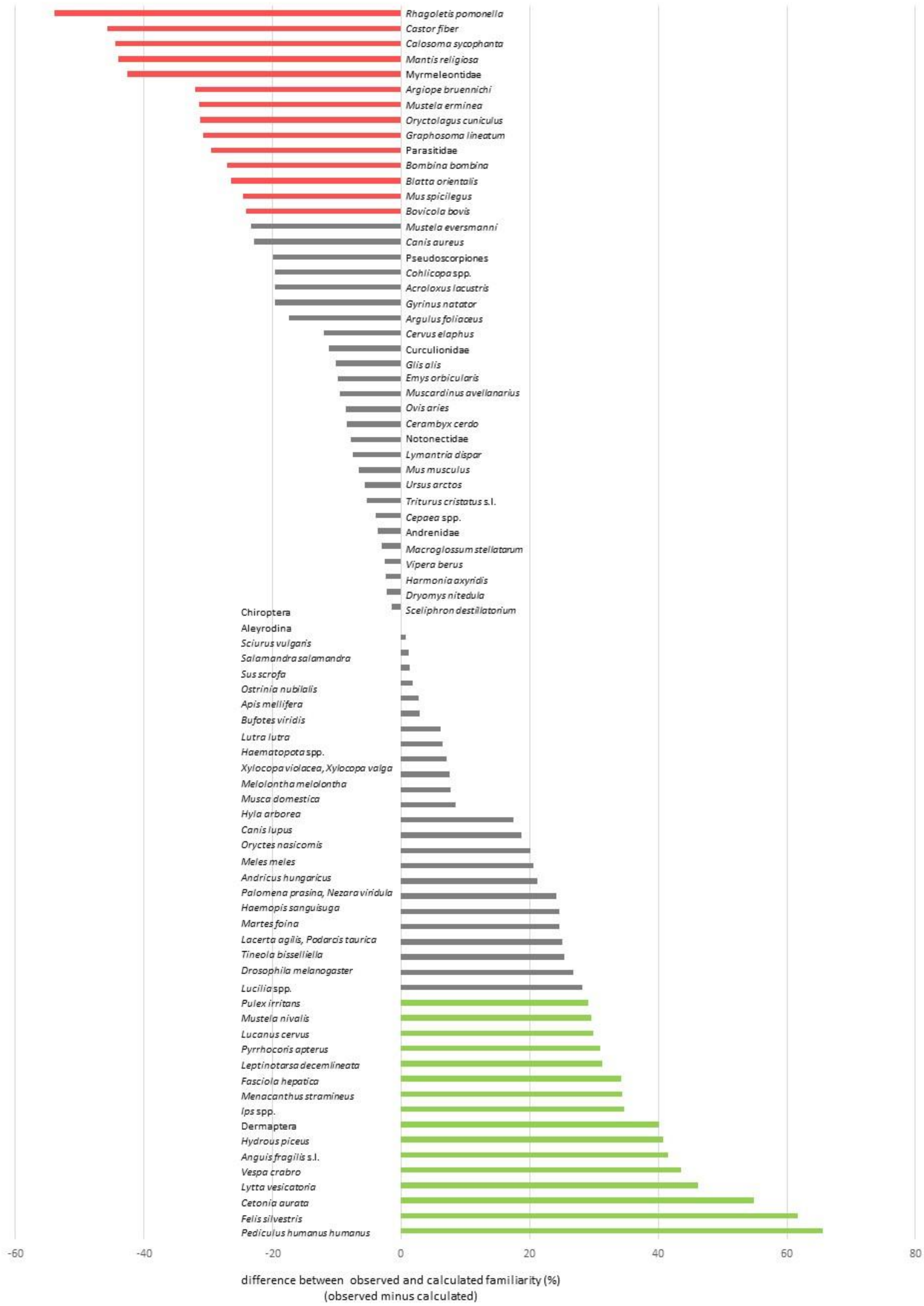


Figure 20. Difference in the level of familiarity (in percentage) with 81 wild animal taxa, calculated by the linear model (percentage of knowledgeable informants expected to know the taxon) and observed locally. The most over- and underestimated 2x16 species (20%) are indicated by red and green marks, respectively (see also Table 2).

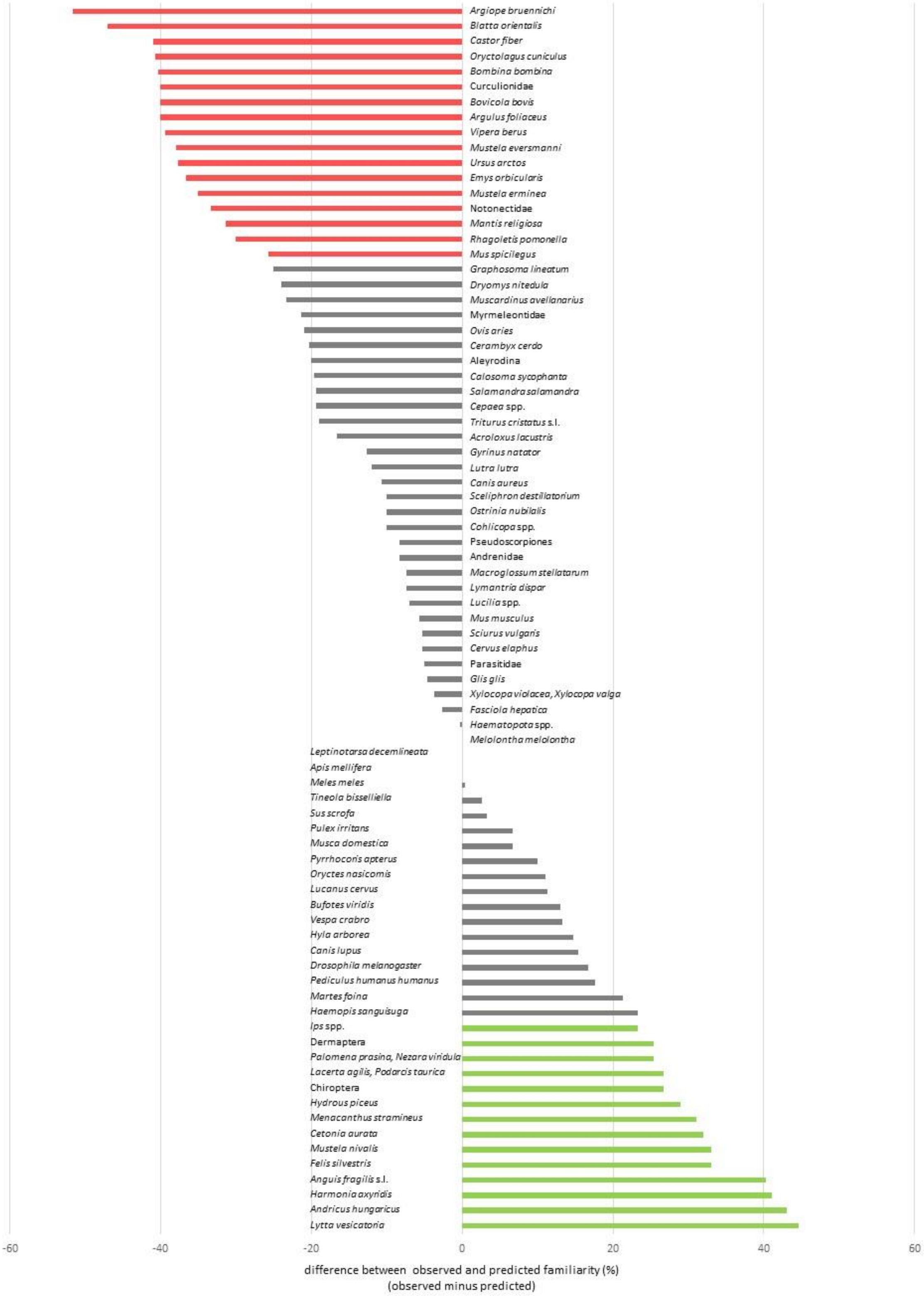


Figure 21. Difference in the level of local familiarity (in percentage) with 81 wild animal taxa, as predicted by zoologists (almost all locals know it = 100%, no locals know it = 0%) and observed among local knowledgeable informants (%). The most over- and underestimated 2x16 species are indicated by red and green marks, respectively (see also Table 2).

Nine species were underestimated by both the model and the zoologists: Rose Chafer (*Cetonia aurata*), Eurasian Weasel (*Mustela nivalis*), earwigs (Dermaptera), Chicken Body Louse (*Menacanthus stramineus*), Spanish Fly (*Lytta vesicatoria*), Great Silver Water Beetle (*Hydrous piceus*), slow worm species (*Anguis fragilis* s.l.), engraver beetles (*Ips* spp.), and Wildcat (*Felis silvestris*), while also nine species were overestimated by both the zoologists and the model: Apple Maggot (*Rhagoletis pomonella*), wasp spider (*Argiope bruennichi*), Red Louse (*Bovicola bovis*), Eurasian Beaver (*Castor fiber*), Stoat (*Mustela erminea*), European Praying Mantis (*Mantis religiosa*), Oriental Cockroach (*Blatta orientalis*), European Rabbit (*Oryctolagus cuniculus*), and European Fire-bellied Toad (*Bombina bombina*).

Zoologists underestimated Sand Lizard/Balkan Wall Lizard taxon (*Lacerta agilis/Podarcis taurica*), Harlequin Ladybird (*Harmonia axyridis*), Horse-Leech (*Haemopis sanguisuga*), Hungarian Gall Wasp (*Andricus hungaricus*), Green Shield Bug/Southern Green Stink Bug taxon (*Palomena prasina/Nezara viridula*), bats (Chiroptera), and Beech Marten (*Martes foina*); while overestimated Brown Bear (*Ursus arctos*), backswimmers (Notonectidae), Adder (*Vipera berus*), European Pond Turtle (*Emys orbicularis*), Steppe Polecat (*Mustela eversmanni*), Common Fish Louse (*Argulus foliaceus*) and true weevils (Curculionidae).

The model underestimated European Hornet (*Vespa crabro*), Common Liver Fluke (*Fasciola hepatica*), European Stag Beetle (*Lucanus cervus*), Firebug (*Pyrrhocoris apterus*), Body Louse (*Pediculus humanus humanus*), Colorado Potato Beetle (*Leptinotarsa decemlineata*), and Common Clothes Moth (*Tineola bisselliella*); while overestimated Forest Caterpillar Hunter (*Calosoma sycophanta*), a family of predatory mites (Parasitidae), Italian Striped-bug (*Graphosoma lineatum*), Red Deer (*Cervus elaphus*), antlions (Myrmeleontidae), Steppe Mouse (*Mus spicilegus*) and Golden Jackal (*Canis aureus*).

4.4 Local knowledge of some key features of Eurasian Beavers

Locals had a deep and detailed knowledge on beavers' legal status, biology and behaviour in all three study areas. The protected status of beavers was known to 95% of the respondents (95% of both RLI and KLI) (Appendix 8). The RLI-K group knew much less about the shooting of beavers (45%) than any of the other 5 groups (80-100%). The method of reintroduction was moderately known by both the RLI and KLI groups. All informants in the Mura and Szigetköz study areas perceived a trend of population growth, and nobody indicated population decrease.

Sixty-two percent of the respondents were of the opinion that beavers have no natural enemies today (RLI and KLI groups: 67% and 57%, respectively). In some cases, wolves, bears and stray dogs (especially in Kászon) as well as humans were mentioned as predators. Ninety-eight percent of respondents did not consider beavers to be a threat to humans. A higher ratio of informants in the KLI groups (compared to the RLI group) thought that beavers were exclusively herbivores. The proportion of respondents supposing beavers to be exclusively herbivores was the lowest in Kászon (38%). Two-thirds of the informants knew which parts of trees are used by beavers.

The date of local reappearance of beavers and how far they would go from water bodies were known to 79% and 84% of the respondents, respectively, with no considerable difference between the RLI and KLI groups (Appendix 9). Concerning the date of reappearance, the highest deviation was found in the Szigetköz region.

4.4.1 Perceptions of the impact of beavers on ecosystem services

4.4.1.1 Provisioning services

The impact of beavers on provisioning ecosystem services was perceived as negative or neutral (Fig. 22). Positive impacts were perceived only in 9 cases. Damage to crops was perceived as negative or neutral. Both the RLI and KLI groups were of a similar opinion. Informants were aware of the damage in all three regions (Mura: feeding on maize and using it as building material, Szigetköz: feeding on maize, peas, sunflowers, sugar beets, cereals and fruit trees, Kászon: feeding on mangel beets), but considerable loss of their own crops was not mentioned. Only 2% of informants experienced loss of their own crops.

The beavers' impact on hay was perceived as slightly negative in Kászon. The impact of the Eurasian Beaver on fish as a provisioning service was perceived as negative or neutral in all three regions. The worst opinion was formed in Kászon. In the other two regions, informants noted that beavers disturbed fish and their movement hindered access to the service and interfered with fishing.

The perception of the impact on fuel and timber wood was outstandingly negative in both groups of the Szigetköz region. As for timber, the damage in poplar plantations was regarded as almost exclusively negative in Szigetköz area (100% RLI-S, 86% KLI-S respondents). The beavers' impact on fuel wood was considered slightly positive in Kászon: "*They* [the poor people] *take home the wood that the beaver has felled, and so have fuel for winter.*" In the Mura region, the impact on timber extraction was not relevant as it is forbidden by law in the studied area. "*It is a protected area. Felling is not allowed. After the tree falls, it remains there to decompose.*"

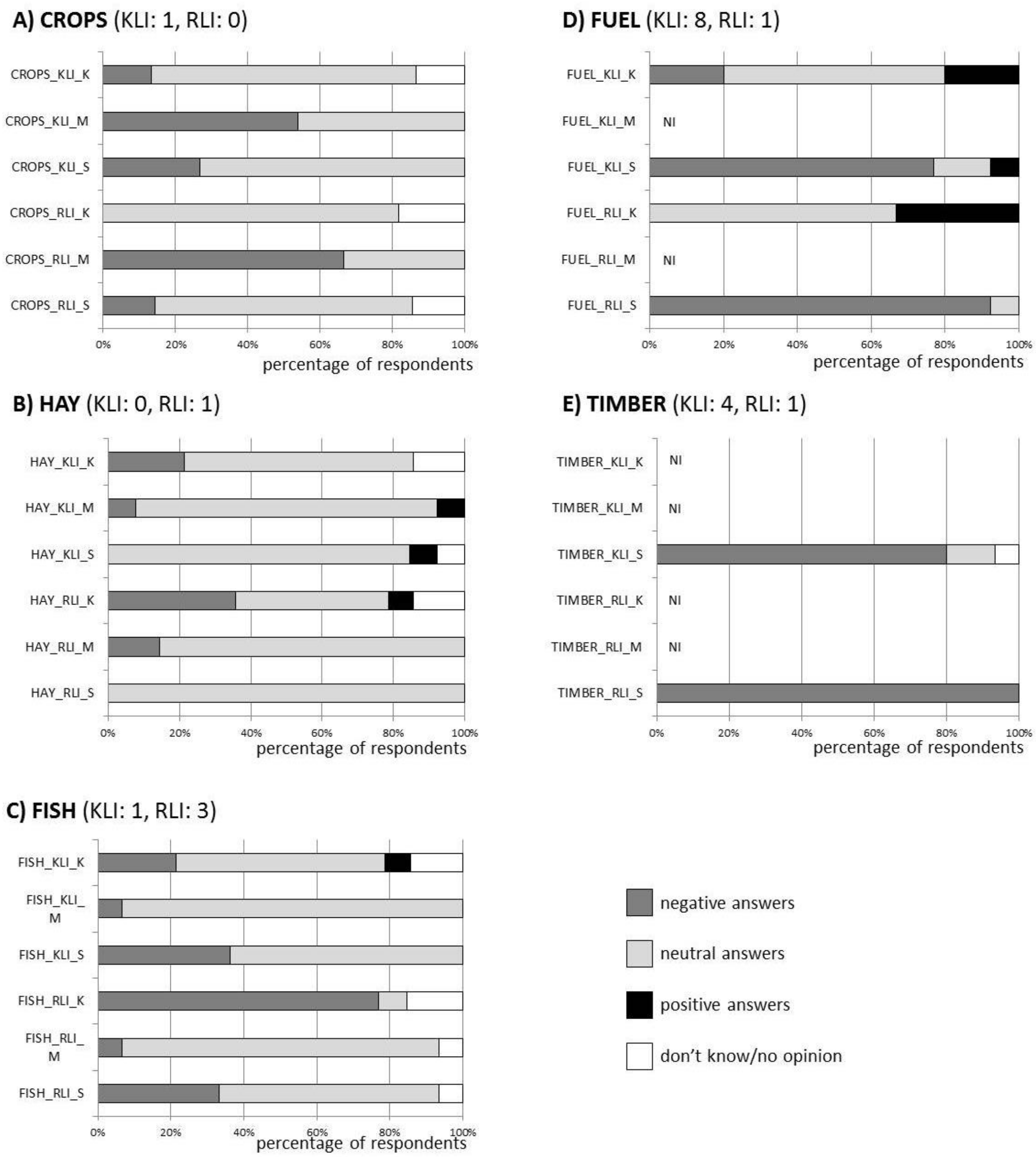


Figure 22. Perceived impacts of beavers on provisioning ecosystem services based on using CICES 4.3 classes (KLI: knowledgeable local informants, RLI: randomly-selected local informants). First axes show percentage values of perceived negative, neutral and positive impacts. (negative, -1; neutral, 0; positive, +1). PAI: numbers of personally-affected informants in the given service class. NI: not interpreted as either there is no timber production along rivers (Kászon) or the riverine forests are protected and thus fuel or timber cannot be exploited (Mura). PAI numers are behind the different ecosystem services' names, separately for KLIs and RLIs.

4.4.1.2 Regulating services

Impacts of beavers on regulating services were perceived as both positive and negative (Fig. 23a). Almost everybody (25 informants) in Kászon mentioned the beavers' negative impact on water regulation, but positive impacts were also recognized (e.g. the level of ground water rises, the water regime is more balanced, floods are moderated and water is available even in drought). Little information was mentioned on beavers' impact on flood protection but flood risk as an ecosystem disservice caused by beavers' activity was mentioned several times (2 and 12 memes, respectively). In Kászon, beaver dams swept away by floods were mentioned as a potential flood risk for villages. On the other two sites, the damage to man-made dykes, especially burrows, was mentioned. The trees cut by beavers may also get caught, for example by bridges, and cause flooding.

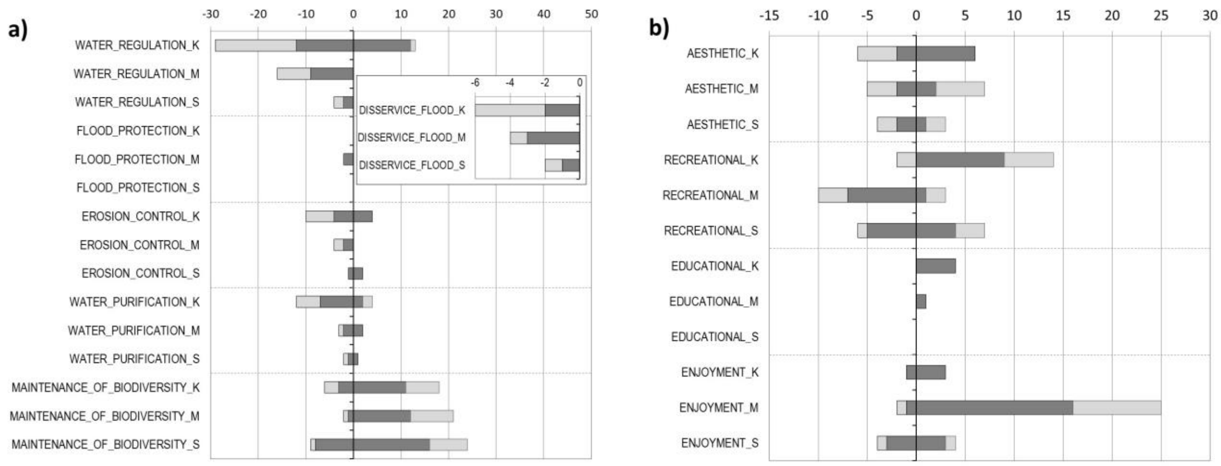


Figure 23. Perceived impacts of beavers on regulating (a) and cultural (b) ecosystem services (in three regions: K: Kászon, M: Mura, S: Szigetköz). First axes show the total number of memes mentioned by the 90 informants. Dark grey: knowledgeable local informants (KLI), light grey: randomly-selected local informants (RLI). Inserted graph shows perceived ecosystem disservices on flood protection infrastructure in the three regions.

The impact of beavers on erosion control was mentioned by only a few informants and their opinion was mostly negative: "*the banks become unstable, water cuts in* [after trees were removed by beavers]," "*river beds become deeper*," "*they burrow the banks, make dens; water can cut in more easily and deeply*." On the other hand, some informants of the KLI groups mentioned positive impacts as well: "*they are beneficial because they slow down the flow of the water and so water becomes less erosive*," "*they stop riverside erosion* [by felling trees and steering water away from the banks]."

Beavers' impact on water purification and water quality regulation was also mentioned several times, especially in Kászon. It is mostly considered negative: "*water slows down, gets warmer and poorer in oxygen*," "*water is full of decomposing plants*," "*the stream is befouled* [by having all kinds of things stuck]," "*branches and logs are floating*," and "*mud is stirred up*." "*Filtering water*" was mentioned as a positive effect.

Maintenance of life cycles and conservation of habitat and genetic diversity was mentioned by the same proportion of informants in both the RLI and KLI groups. Almost two-thirds of the informants (62%) brought it up and most of them referred to it as positive. KLI groups mentioned more memes than RLI groups. A few people declared that hay meadows are spoiled by flooding caused by beavers (as the proportion of sedges rises), but most of the informants pointed out the increase in biodiversity (more amphibians, fish, aquatic birds, new plant species). In some cases, beavers' positive role in the ecosystem was not even questioned as it is a native species ("*they do have a role in nature*").

Altogether KLIs mentioned positive and negative impacts in similar numbers, 55 and 63 memes, respectively, while RLIs perceived more negative impacts (50) and only 25 positive ones.

4.4.1.3 Cultural services

Impacts of beavers on cultural ecosystem services were mostly perceived as positive (Fig. 23b). Regarding aesthetic services both positive and negative impacts were mentioned. Some people reported that the landscape looks unkempt: "*it becomes chaotic, messy*" and "*untidy*." On the other hand, there were positive comments as well: "*beavers clean the banks*" (i.e. they gnaw off weeds). Beavers are mostly perceived to affect recreation (fishing, tourism) positively in Kászon, and negatively in Mura. In Szigetköz answers were more balanced. Beavers' impact on environmental education and awareness was rarely mentioned (K: 4, M: 1), but when it was, the comments were always positive (*"camps could be organized to show them to children"*). Informants (most often in the Mura region, 58%) reported that they liked beavers and admired their activity (they are cute, build dams and lodges, work with mechanical precision, their gnawing is perfect): "*It's nice to encounter them, I like them very much.*", "*They have such cute faces. You just can't dislike them.*" The feelings were sometimes ambivalent: "*It's good to have them, but there are just too many of them.*" "*They give me half a day of extra work each year, but that's all. I can live with that… I enjoy having them here.*"

4.4.2 Usefulness-harmfulness and overall impact of beavers

Answering the multiple-choice question about usefulness and harmfulness (’Is the beaver useful or harmful?’), most respondents (72%) regarded beavers as harmful and only 5% as useful (Fig. 24a). However, ambivalent perceptions were also common: eight informants (9%, K:5, M:2, S:1) thought them to be both harmful and useful (“*partly good and partly bad*”). When usefulness was explicitly asked about, there were surprisingly many positive answers. In Kászon, 46% of the informants acknowledged the beaver to be useful in some ways in the free listing questions but only half of them gave a positive answer to the previously asked question. Altogether 75 memes referred to harmfulness while only 30 memes to usefulness.

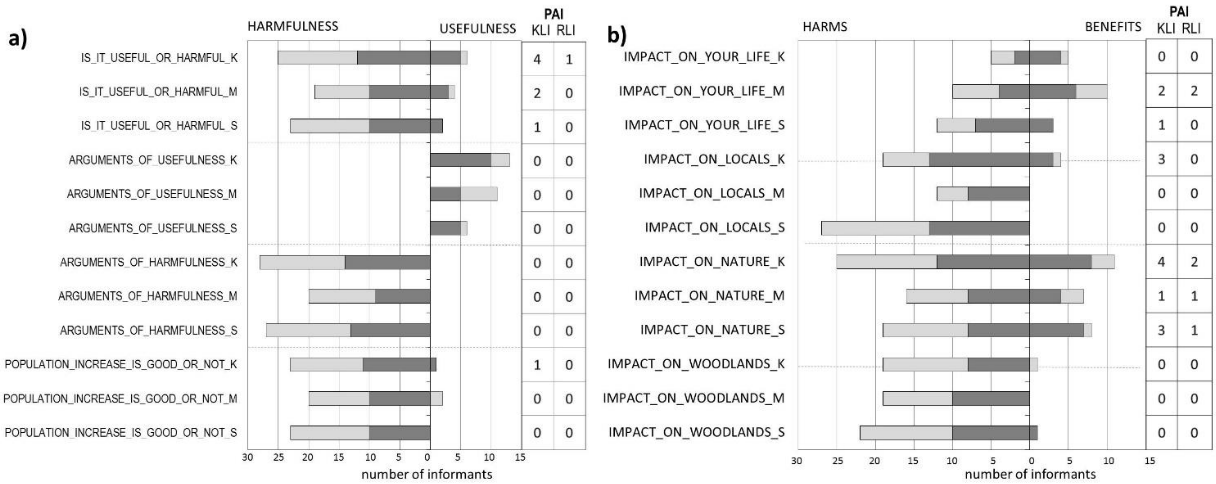


Figure 24a Perceptions of beavers by local informants considering questions on usefulness and harmfulness of beavers (K: Kászon, M: Mura, S: Szigetköz): ’Are beavers useful or harmful?’; ’What kind of benefits could you mention?’; ’What kind of harms could you mention?’; Is this population trend good or bad in your opinion?’; **24b** ’What impact do the beavers have on nature in general / on riparian woodlands / on your life / on other inhabitants of your village?’. Dark grey: knowledgeable local informants (KLI), light grey: randomly-selected local informants (RLI). The numbers in the last two columns are the number of informants giving both positive and negative perceptions.

Growth of the local beaver population was considered negative in all three sites (Fig. 24a). Even those who liked beavers thought that there were too many of them: “*I’m glad that they are here, but there’s more than enough.*”, “*If their population grows we will be in trouble.*” There were a few accepting opinions as well (but only from 7 informants): “*If they are here, let them be!*”, “*I’m an animal lover, it’s just natural that their population increases, I don’t mind that.*”

As far as the beavers' impact on personal life is concerned, half of the informants (44 informants) declared that beavers don't bother them (Fig. 24b). Two people noted that beavers do not affect them but they were annoyed anyway. Negative perceptions mostly referred to damage to provisioning services. In Kászon it was exclusively the hay (5), in Szigetköz timber and fuel wood (9), and fish by the Mura (2).

The questions about informants' personal relationship with beavers revealed many indications of positive attitudes: "*one more curiosity*," "*it is nice to see a beaver lodge, what a complex building*," "*it's a joy for children to observe*," "*they are beautiful*," "*I love them*." Five informants mentioned both positive and negative relationships. Four of them were from Mura: "*They give me a lot of work, but as I've said I like animals. I can live with them even though I have a little bit more work to do because of them*," "*If they didn't gnaw my thujas, I wouldn't mind them. I like animals; it's nice to see them.*"

As for the relationship of the local community with the beavers, mostly negative opinions were expressed (11 informants) and hardly any positive ones. In most cases there was no explanation: "*they don't like them much* [in the village]" In Kászon the damage to hay meadows was mentioned again (by 7 people). Some answers were ambivalent: "*both good and bad*," "*in some parts even properties are threatened,* […but] *wood* [that was felled by the beaver] *can be used as fuel, that's good*." The positive impacts of beavers on the villagers' lives were only expressed in Kászon: water regulation, state of nature and beauty of nature: "*God has created beavers with a purpose*." To the 'Who benefits from the presence of beavers?' question, the most abundant answer was "*no one*" (45%). Informants also declared that they are good for the nature conservationists and tourists (35% of respondents) and only rarely to locals (8%). Analysis of all the answers in Fig. 24 shows that 71% of positive memes were mentioned by KLI group members (67 out of 95), while they contributed only 49% of the negative memes (202 out of 413).

Beavers' impact on nature was perceived as negative by 57% of the respondents (Fig. 24b) but positive things were also mentioned in all three sites (by ca. 30% of respondents). Regarding forests, both groups in all three sites perceived beavers' activity as negative but also noted that it's not really important: "*It's a jungle anyway.*" "*It doesn't make any difference.*", "*there aren't fewer trees because of them*." In Kászon, negative impacts on hay meadows were mentioned but also several positives.

5. DISCUSSION

5.1 Folk knowledge of non-domestic mammals in North-Western Romania

5.1.1 General findings

The majority of the interviewed people still possess surprisingly detailed and precise knowledge about the wild animals living in their surroundings. This is surprising, because we expected to find more eroded knowledge than what Jolsvay and his coworkers (1977), and Lőrincy (1979-2002) reported. The degree of knowledge of species was positively correlated with body size (cf. Hunn 1999). The list of known species strongly corresponded to that of Gub (1996), although the landscape where he conducted his studies in middle Transylvania is more forested and dominated by conifers, and thus people there could more frequently encounter and somewhat better know forest animals.

The percent proportion of folk taxa to scientific taxa was 68 %, or, reducing all bats into a single category, 82 %. Similar values were found by Rea (1998), even if he studied a somewhat less diverse mammalian fauna. Except for a few species, all were called by a folk name. Surprisingly, inclusive categories were named much less frequently here (9 out of 21) than in studies on folk taxonomy in the tropical regions (i.e. Fleck et al. 2002). The inclusive units also closely corresponded to the scientific classification. Deviations were apparent only in the case of bats, shrews, Eurasian Otter, Eurasian Beaver and Lesser Mole Rat. Hunn (1990) and Rea (1998) reached similar conclusions in mammalian folk classifications.

The interviewed people identified all mammal species that can be distinguished by external characteristics occurring in the village and its neighborhood. They all possessed very similar degree of knowledge. Individuals with outstandingly detailed or very little knowledge were only few. Differences (such as between Brown Rat and European Water Vole, for example) were ordinarily understood as consequences of individual variation and as differences in developmental stages. The distinguishing characteristic between House Mouse and Steppe Mouse was entirely behavioural.

Familiarity with species was often inversely proportional to the number of used folk names. The name of larger species that had fewer folk names tended to be more similar to their official Hungarian scientific name. These names were also identical to those used in colloquial Hungarian (Jolsvay 1977).

The name and classification of dormice were particularly interesting and complex. The three species occurring there (Hazel Dormouse, Forest Dormouse, Fat Dormouse) were inclusively called by two variants of a single name (*mogyorópej* and *pejkó*). However, people had surprisingly detailed morphological, behavioural, and ecological knowledge of each. Distinction of species that are called by the same name is rather frequent in traditional animal taxonomy recorded in very distant ethnic groups (birds: Diamond and Bishop 1999; bats: Fleck et al. 2002). There might be two factors contributing to the precise knowledge of nocturnal dormice. In the case of the two species occurring in anthropogenic environments (Fat and Hazel dormouse), one reason may be their occasional, but then often significant damage. This, however, cannot explain the distinction of Forest dormouse, as this species particularly tends to stay away from humans (Bakó 2007). It is known that hunting for dormouse for human consumption was widespread in Central Europe (Toussaint-Samat 1987; Peršič 1998). This custom, however, has faded away by today in our area. We think that part of the personal experience in hunting may have survived till today. This supposition seems to be supported by observations in areas with similar mammalian fauna, where there are no data on dormouse hunting such as the Vály valley in Slovakia. There we could collect many fewer data on dormice (Ulicsni unpubl.). The fact that substantial attention may be directed towards dormice due to their occasionally significant damage may not be neglected either. This habit was considered so important by our informants that they placed dormice into an inclusive category together with Red Squirrel, Weasel, and Stoat, in which all small mammals were considered greatly harmful and called *féreg* or *fíreg* (pest).

In contrast to dormice, members of the species-rich bat fauna were not distinguished in any way. The Matses in the Peruvian Amazon also use a single name for the more than 100 species of bats in their environment, although they have very detailed knowledge on their habitat preference, and morphological and behavioural differences (Fleck el al. 2002). Bats occurring in the vicinity of Nușfalău exhibit far smaller variation in morphology, behaviour and habitat preference than bats in the tropical regions. Besides, the detection of differences in habitat preference has a fairly low likelihood because of the bats' nocturnal habit, and thus the low number of interaction with humans. Bats, a species-rich group with 10-14 species in areas with similar environmental conditions, were classified in a single folk taxon in all studied areas inhabited by Hungarians (Sóvidék, SW Transylvania – Gub 1996; NW Hungary – Kovács 1987; Gyimes, Romania – Babai 2011; SW Slovakia, Central and Eastern Hungary – Ulicsni unpubl.; NE Croatia – Tórizs unpubl.). The knowledge of the species group, particularly that on life history and behaviour, however, is precise (cf. also Gub 1996).

In contrast, shrews, which are widespread and clearly observable, were known perhaps the least and very vaguely in many aspects, compared to our prior expectations and fragmentary data from elsewhere (Jolsvay 1977, Lőrinczy 1979-2002). The reason for this is not known, however. According to Gub (1996), people know rather little about them, although the Water shrew was separated from the other species. Kovács (1987), however, found surprisingly detailed descriptions along the Danube, where three taxa (Dwarf, Forest and Water shrew) are distinguished.

5.1.2 Morphological, ethological-ecological and cultural salience

Interviewees described almost all species from multiple aspects including morphology, ecology and cultural significance, which indicate detailed knowledge of the animals. The two exceptions were the particularly rare (and introduced) Mouflon and Steppe Polecat.

5.1.2.1 Morphological salience

Similarly to the reports of Hunn (1990), Rea (1998), and Fridell and Svanberg (2007), the most salient morphological characteristics were size, colour, tail, ear and limbs in our study.

The most frequent way of evaluation of species characteristics for our informants was the comparison of species with similar characteristics. For example, in comparing Red squirrels and dormice, difference in tail shape and bushiness is often mentioned. Muskrat and Brown rat also is distinguished greatly by the shape of the tail, besides habitat differences (the cross section of the rat's tail is circular, whereas that of muskrat is elliptic).

In the folk taxonomically odd and in all respects very distinctive Northern White-breasted Hedgehog, colour plays a significant role. Although only a single species of hedgehog (*Erinaceous roumanicus*) is recognized in the scientific literature (Bihari et al. 2007), it is divided into two folk taxa by traditional folk classification based on several differences. Interestingly, the pairing of names of the two folk taxa is reversed in the Sóvidék (Gub 1992).

Similar classifications were found in other regions, for instance in the Hungarian speaking areas of Szigetköz (Kovács 1987), Sóvidék (Gub 1992), Detrehemtelep (Keszeg 2012), Felsővály, Nagykőrös, Nádudvar (Ulicsni unpubl.) and among Gypsies in Poland as well (Ficowski 1986). In studies conducted among Hungarians, only the ones in Gyimes did not register this sort of classification (Babai 2011). It also fits into the picture, that where (predominantly Gypsy) people consume the hedgehogs, they also split these two taxons and consider only either of them (the dog-like) edible (Poland – Ficowski 1986, Nagykőrös and Tatárszentgyörgy in Hungary – Ulicsni unpubl.). We are unable to provide an adequate explanation for this almost general treatment of the hedgehog. This hedgehog classification is regarded by Kicsi and Magyar (2007) as part of what some folklorists, according to their devolutionary premises, call a *gesunkenes Kulturgut* (lit. 'sunken cultural relicts') that can be traced back to the 13th century. The terms *disznósün* and *kutyasün* appear even in the 17th century Codex Guelph.

Detailed observation of physical appearance of small carnivores is showed by a common mistake. The Western Polecat and Common Hamster were confused several times when they were to be identified by pictures. This was, however, immediately corrected by the informants after clarifying their way of life. This may be certainly explained by the observation that the two species, uniquely among all other mammal species found in the region, have reversed colour saturation on the back and the belly. They are ventrally darker, and dorsally lighter.

5.1.2.2 Ethological-ecological salience

Evaluations of ecological and behavioural characteristics made by locals were very rich and usually detailed. The following characteristics were the most often described: feeding habit, characteristic movement, habitat, breeding, bashfulness, voice, daily and annual rhythm of behaviour, chance to see it, and rarely, mode of eradication.

In discriminating the two forms of the Northern White-breasted Hedgehog, behavioural differences played a greatly significant role besides morphological differences. The animal was considered very useful, because it catches mice, and even by some, Brown rats (or at least deter them). Owing to these characteristics, it was typical to introduce this animal beyond its natural area of distribution all over Europe, such as in Northern Sweden (Fridell and Svanberg 2007). Although the hedgehog was regarded as a useful animal, hunting for rodents was attributed only to the *sünkutya*. An additional behavioural difference between *sünkutya* and *sündisznó* was vocalization: the *sünkutya* barks, whereas the *sündisznó* grunts.

Southeast European people, including Romanians, have developed a special world of beliefs concerning hedgehogs. They think the *prickly hog* is a *Verbena*-bringer (which brings the herb *Verbena officinalis*, a species considered hard to find) with which he is capable of opening all kinds of padlocks (cf. Svanberg 2011). These beliefs often appear also among Hungarians who live in close contact with Romanians, but it did not among the inhabitants of Nușfalău, where borrowing of Romanian animal names was not typical either.

A nice example of discrimination based on behavioural differences is that of Stoat and Weasel, which are in many ways quite similar. Interviewees described rather precisely the differences between the two species in movement (the former elongates and stands up, the latter leaps). The habitats of both (settlements vs. avoiding humans) were identified particularly precisely.

The observed behavioural patterns of certain species were explained in rather peculiar ways. The Nutria depends on the presence of water bodies, and thus its feeding behaviour may have been observed in such environments. This may have resulted in the belief that it rinses its food and even peels it before consumption.

5.1.2.3 Cultural salience

Culturally salient features include harmfulness and usefulness, as well as beliefs (Hunn 1999). The best known species considered as harmful in the study area were the ones preying on poultry. Those species were characterized very precisely. Eurasian Weasel, Europaean polecat, and Beech Marten exerted such a great influence on household farming (by the consumption of poultry, egg, and fruits) that besides the precise knowledge of their morphological and ecological characteristics, the number of notions associated with them was also significantly high. In addition to Common Hamster and European Ground Squirrel as well as the small carnivores that were considered pests, dormice were also often listed among the species causing much headache to farmers. Some people placed dormice among pests. European mole was also regarded harmful, although to a lesser extent. Our informants were aware that moles provide benefits, as a substantial proportion of their food is composed of invertebrates damaging vegetable gardens. However, while searching for underground prey, a great number of and mostly young garden plants are damaged by the moles, and therefore people expressed their opinion of let them live, but elsewhere.

Surprisingly, the small rodents were not considered harmful, and their presence was accepted. One reason may be that although they are morphologically similar to Brown rat, the harm they cause is much less. It is also interesting that the presence and activity of bats was regarded neutral from the standpoint of humans, even though their feeding habit and behaviour were well known (such as consuming plant pests, among others).

In addition to the biologically precise knowledge stemming from experience, mammals of all wild animals are also associated with the greatest number of legends and beliefs. Their connection to reality has often faded away owing to the large number of generations they have been passed on. Due to general familiarity with these beliefs, questioning the truth of them was not common among our informants. Even the very unlikely story has been treated as true, in which a hamster drags its mate with an ear of corn on its belly to its den.

Anthropomorphism in animals is perhaps most common for mammals (Common Hamster, Harvest Mouse, Red Fox, Grey Wolf, Beech Marten). We found several examples of discovering human features in the looks of animals. In Nușfalău, people most often believed to discover similarities to human beings in Beech Marten. Roma living in the Eastern Beskid Mountains make distinctions among hedgehogs on the basis of the presence or absence of human facial features: those with a human face are left untouched, whereas those without it are hunted for food (Luzcaj, Rzeszów, pers. comm. 2011).

A frequent element of traditional ecological knowledge is the occurrence of taboos (Zelenin 1929–30; Edlund 1992; Nolsøe 1997; Herjulfsdotter and Svanberg 2005). We only found one direct indication for this in the study area. The name of Red Deer, *szarvas* (literally one with antlers), is a circumscription for the species because the true name of the animal has been treated as taboo. The situation is similar, but less apparent in the name of wolf, *farkas* (literally, one with a tail), and also in the name of bear, *medve*, which is a borrowed word from a Slavic language.

5.1.3 Origin of folk knowledge of mammals

We know from many ethnographical studies that populations with traditional lifestyles have a very detailed knowledge of the various species in their surroundings (Lévi-Strauss 1962). In this specific Hungarian community, the overwhelming majority of the species were known through personal experience, similar to the findings of Carpaneto and Germi (1989), Hunn (1990) and Rea (1998). There are only a few species in the area, mainly rare and/or secretive animals, which are relatively unknown by the people there. Such species are Lesser Mole-rat, European Ground Squirrel, Common Hamster, Eurasian Beaver, Eurasian Lynx, and Mouflon. Many interviewees knew the supposedly extinct hamster and ground squirrel only from other areas. This unfamiliarity may have been the cause of their being regarded as the most harmful pests. Stories about these species were usually realistic or only slightly embellished (as in the stories on Wild Boar attacks) and heard mostly from inhabitants of other villages.

People tended to personally know even the rare animals that are difficult to observe, such as Stoat and Forest Dormouse. This supports the idea that a significant portion of their knowledge originated from personal experiences. The high degree of familiarity with these species may have survived for specific reasons. In the case of dormice, this might have been hunting, and in Stoat, the explanation may be its winter fur, which is of outstanding quality compared to other furred animals.

Only few of our informants regularly visited lakes, rivers and streams. As a consequence, they had less information on species of aquatic species and habitats. We collected the majority of the relevant data from only few people. Lack of knowledge may explain the widespread nature of false information related to otters. It is often called crocodile, which is probably refers to its detrimental voracity. Its secretive and aquatic life style may have provided more space for the spread of false beliefs.

In the case of certain species, the possibility has arisen that a part of their knowledge originates from the media or books (see Frazão-Moreira et al. 2009). The significance of this is definitely the greatest in the case of the Golden jackal. The image of this species is greatly influenced by the legend of Miklós Toldi who was born in Nușfalău. The epic poem by Arany (Toldi, 1846) in which the protagonist fights with 'reed wolves', is part of the general cultural knowledge among contemporary Hungarians. The other example for the effect of media is the brown bear. Our interviewees almost always mentioned the appearance of this species in the urban area of Brașov, which was frequently broadcasted on TV. Nevertheless, we did not detect new information and any significant change in the consideration of the species as a consequence of this. Interestingly one interviewee called the Brown Bear polar bear. This mistaken naming may indicate that people know almost nothing about animals that are absent in the area, and at most heard or read their names in the media or in books. Molnár (2012) obtained similar data in the salt steppe of Hortobágy, where the effect of media and books was negligibly small on the knowledge of wild plants.

5.2 Folk knowledge of invertebrates in the Carpathian Basin

5.2.1 Folk taxa and unknown taxa

The folk knowledge of invertebrates revealed in Szilágyság, Drávaszög and Gömör was extensive and detailed. With certain species or groups of species, the only informants who knew them were those most likely to encounter them because of their profession or as a result of some special activity (such as fishermen using animals as bait, or herders with livestock parasites).

The 208 folk generics and specifics found is greater than the number of known vertebrate folk taxa (Ulicsni et al. 2013; Ulicsni unpubl.).

The differences in the fauna of the three different areas seemed to have little effect on the list of local folk taxa. Based on our data, the folk taxonomies could also be regarded – with negligible differences – as uniform (major differences are shown in the results and discussed below).

The uneven distribution of knowledge may have caused by two possible reasons: 1) the erosion of knowledge (e.g. reductions in hand harvesting mean less familiarity with the Dwarf Velvet Mite *Microtrombidium pusillum*); 2) certain species are linked to particular farming activities, and so are not generally known. A beekeeper, for instance, would have better knowledge of bee pests, a herder would be more familiar with sheep parasites. Such species may be completely unknown to other members of the community.

The reliability of the knowledge was very high. Despite carrying out constant checks using cross-questioning, errors, falsifications and slips of the tongue were only registered in very few cases. It was more likely for respondents to answer that they didn't know information or weren't familiar with species. Due to the general aversion towards the majority of invertebrate species, however, the informants were sometimes prone to exaggeration. A similarly high degree of reliability and low proportion of errors have been experienced in other Central European locations in studies of botanical knowledge (Molnár 2012; Babai et al. 2014). For some species (e.g. Vine Louse, Itch Mite), there was a high proportion of knowledge that was not based on personal experience.

In line with our expectations (*cf*. Hunn and Selam 1991; Hunn 1999), larger species, those occurring more frequently and those with more distinctive morphologies were more widely known. Animal and human parasites were often exceedingly well-known. Compared with knowledge of vertebrates, the majority of invertebrate taxa were less detailed. In contrast, it was surprising to us that so many invertebrate species are known which have, to our knowledge, no economic significance. The reasons for this were not always clear. Human lifestyles have greatly changed, so there is uncertainty concerning how important a given taxon may have been in the past (e.g. the dormouse species', which were once regularly hunted, but which are not used at all today, (Ulicsni et al. 2013)). Yet there were other species that we did not expect to be widely known which proved, during the study, to be significant even today. Examples are species that have appeared recently, such as *Harmonia axyridis*, and species of predatory mites that are particularly small, harmless and can be seen on other insects.

The phenomenon of the less consistency of a species' place in the taxonomy when locals know only their larval form was in compliance with our prior expectations and was also often observed in the Sóvidék region (Romania) by Gub (1996).

Surprisingly informants made no distinction between a significant number of diverse and morphologically easy-to-distinguish lepidopteran species. By comparison, in places where use is made of lepidopteran species (e.g. larvae are eaten in Mexico), up to 67 different species may be known in detail (Ramos-Elorduy et al. 2011). Species of the order Lepidoptera are an important food source in numerous other regions of the world (Malaisse and Latham 2014).

With recently settled invasive species or major local invasions of species with a constant lower-level presence, we found that the media played an enhanced role as a source of information. The degree of knowledge sometimes varied greatly, depending on the extent of the invasion, which resulted in some significant differences between the three areas.

The proportion of covert categories was low compared to their higher prevalence among, for example, the Matses of Peru (Fleck et al. 2002). Where the covert categories are concerned, there is a chance that a few further known folk taxa were not identified during our data collection.

5.2.2 Names – main features and points of interest, unnamed species, modern names

Names could be chopped and changed around even in the case of species that were otherwise clearly separated, such as with locusts, grasshoppers and cicadas; all three of these taxa share the ability to jump, but their size and morphology differ. Almost everybody could distinguish between the three taxa, but the names they used were sometimes swapped around. Berlin et al. (Berlin et al. 1981) also found that people agreed closely on the appropriate names for some species and disagreed markedly on the names of other species.

In some cases, when multiple taxa have identical names in everyday speech (e.g. *Lampyris noctiluca*, *Lamprohiza splendidula* and *Cetonia aurata*) the context would determine whether the folk specific referred to the first two or to the third species, so there was no need for separate names.

The reason for the wide range of diverse names of Firebug (*Pyrrhocoris apterus*) may be its distinctive behaviour, or perhaps the fact that hordes of them together can be witnessed in early spring (this phenomenon often also serves as the basis for folk weather forecasts). This contradicts the earlier observation (Hunn and Selam 1991) that smaller species which cause little or no harm, and which also have no benefit, are often not given names, regardless of how common they are. The proliferation of names also contradicts the observations of Berlin et al. (Fleck et al. 2002), which state, roughly, that the more salient a species is, the more uniform its name will be.

Names and other types of knowledge could, in certain cases, be a hybrid of traditional and scientific knowledge. It is more common for the official Hungarian scientific names to originate from folk names. The influence of schooling could only be felt among a few informants and only for a very limited number of species.

5.2.3 Folk taxonomy, folk nomenclature and salient features

The described 16 prototypic species, were usually the most common species, or could serve as a basis for comparison due to some other feature.

The key attributes for classification an invertebrate taxon as *bogár* (ca. beetle) were the hardness of the integumentary system and the shape of the species. The most common taxa in this group were those with a hard chitinous covering and those belonging to the scientific order Coleoptera.

Berlin et al. (Berlin et al. 1981) argued that biological species differ considerably in their overall distinctiveness from one another, and this differential distinctiveness leads to the formation of folk generic categories of differing degrees of perceptual importance. A significant part of the taxonomic literature, however, is about vertebrates, and the basic principles established in the literature often do not work with invertebrate groups. Among invertebrates, there is greater importance attached, for example, to prototypic species. These play an important role in taxonomic identification (Fleck et al. 2002). Nevertheless, the prototypic species were often given only brief descriptions by our informants. The reason for this may lie in the fact that these prototypic species were used as the basis for comparison. In such cases, the less typical species were the ones requiring more detailed descriptions, because they are being compared with and differentiated from the prototypic species.

In the few cases when folk taxa were far removed from each other according to scientific classification the main reason for this is probably because their physical structures are very distinct and/or very similar with other taxa (like in the case of harvestmen (Opiliones) and cellar spiders (Pholcidae)). In line with previous findings (Berlin 1992), folk taxonomic relations were, to a significant extent, based on the morphological appearance of the taxa.

In the past, this knowledge may have been more widespread here as well. We could not find out how or where this belief originated. It is hard to perceive any axis on the bodies of the bivalves, so it could be that they were not regarded as an animal species in their own right for this reason. When touching the body of the bivalves, the experience is similar to touching the slimy skin of a frog, and furthermore, they live in the same habitat. Several informants could identify tadpoles (one of the common folk names is *kutyahal* – "dogfish"), although they were mostly unaware of their relationship with fully grown frogs. Tadpoles therefore exerted no influence on the supposed link between bivalves and frogs. In Ghimeş (Gyimes, Romania), the tadpoles of the Yellow-bellied Toad (*Bombina variegata*) are used in veterinary medicine. The connection between the spawn (*tojás* - egg), the tadpole (*békapinty,* *frog carp?*) and the mature adult is recognised for all common species of frog occurring there (Babai 2011).

Sometimes species were classified not (only) according to morphological salient features, but (also) ecological and cultural features (e.g. *Geotrupes* spp., *Gryllotalpa gryllotalpa*). In other words, species which are clearly different from each other, even to an untrained eye, could sometimes be placed into the same taxonomical group. In such cases, morphology, the default first priority when making classifications (Berlin 1992), was replaced by ecological differentiation.

In the case of the few animal species which were not universally viewed as animals by the informants the uncertainty may derive from the small size of the creatures, or from the fact that they are hard to observe. The small size of the animals involved may also be the main reason behind the various explanations given for the origin of "cuckoo spit" (meadow froghopper foam nests), *Erwinia* infestations of maize, and gossamer. These three phenomena were regarded as structures created by the most diverse range of species, and in the case of gossamer, several informants described it as a weather phenomenon.

5.2.4 Human uses of invertebrate taxa

The use of invertebrates in our study areas was much less significant, than the role of plants in nutrition and medicine (e.g. Pieroni 2000; Łuczaj et al. 2013; Babai et al. 2014), or the role of insects in nutrition and medicine in other parts of the world (Gómez et al. 2000; Ramos-Elorduy 2006; Brito et al. 2019). Also compared with the tropics [27 medicinal species (Neto et al. 2005); more than 200 edible species (Paoletti et al. 2000)] this is much lower both in diversity and in terms of the body mass of the invertebrates used.

It was a completely new, previously unknown practice in Europe, that people of Szilágyság consumed the honey stomachs of black-coloured carpenter bees (*Xylocopa violacea*, *X. valga*) even during no shortage of alternative foods.

In the last hundred years, the consumption of invertebrates in Europe has traditionally been restricted to just a few species (Łuczaj 2005), and in the areas of our investigation, they were only consumed occasionally. However, most of these rare practices has been vanished just like the consumption of *nádiméz* (honey in the tube of the reed) in Drávaszög due to the gradual replacement of thatching as a roofing material.

Contrary to our expectations, we did not document any current uses for blister beetles or slugs. The use of slugs as a lubricant of cartwheels (Svanberg 2006) was not mentioned in our study areas. Based on other data collections, however, this practice was known in the Carpathian Basin (Molnár unpubl.).

5.2.5 Proverbs and sayings

Some of these were based on observations of animal behaviour or experience of their population cycles, and so do have some genuine basis in fact (e.g. the swarming patterns of *Lytta vesicatoria*). Other folk beliefs, however, were probably closer to old wives' tales (e.g. drawing a cross on the back of a Field Cricket will prevent it from jumping; the presence of *Andricus hungaricus* prevents hens from brooding).

The positive attitude towards the presence of Hog Lice on swine is probably based on the observation that parasites abandon sick or dead livestock. Gub (1996) also found examples of healing involving external animal parasites, a practice that can also be deduced from the same kinds of observation.

In addition to Vallejo and González (2013), Gub (1996) also mentions the use of Head Lice in human medicine, especially in treating jaundice. We did not document any similar instances, although this practice may well be widespread, and with further research there is a high chance of finding more such cases.

5.2.6 Invertebrate species that enjoy folk conservation or state protection

With regard to ladybirds, the tradition of protecting them came from the culture (songs and sayings), but they were also recognised as useful animals. Butterflies were respected for their beauty. Here it should be noted that the state protection enjoyed by certain species of butterfly (e.g. *Iphiclides podalirius*, *Inachis io*) in Hungary is justified more by their beauty than their rarity. Field and house crickets were generally left unharmed, as a result of their pleasant chirruping and their cultural significance.

In the areas under investigation, traditional uses of and attitudes towards invertebrates have not revealed any kind of activity that would cause major damage from a nature conservation point of view. The fundamental factors behind this state of sustainability are small-scale farming, which imposes less strain on the environment, and the fact that resources are mostly used locally. Traditional methods of agriculture do without chemicals, so populations of many invertebrate species only began to decline as intensive farming spread (starting in the 1980s).

With the exception of edible snails and in a few cases certain galls the use of invertebrate taxa had remained local, and was therefore sustainable. In areas where the use has spread beyond the locality, for example in Mexico, with invertebrates living in species of *Agave*

(Ramos-Elorduy 2006), or in areas of the Carpathian Basin where Edible Snails are harvested in big quantity (Bihari-Horváth 2011), a significant reduction in the prevalence of such species has been experienced. The effects of such destruction have tended to be far more significant with regard to vertebrate taxa [7, e.g. predatory mammals and birds].

5.2.7 Folk wisdom related to nature as a whole

Sometimes knowledge pertaining to the taxa could have a more general relevance, and be regarded as folk wisdom concerning the functioning of nature as a whole. The damage caused by the Gypsy Moth (*Lymantria dispar*), for example, was regarded as a minor problem, because – according to many informants – major damage does not occur by itself "in nature", only as a result of human intervention.

Certain instances of "wisdom" appeared not to originate from traditional folk knowledge. The view that "if the bees disappear, then we will disappear too, because there won't be anything to eat" probably springs from the influence of the media.

Folk wisdom in our study areas was fragmentary, probably heavily eroded, and seemed no longer to constitute a unified, systematic worldview, or social conventions that impact on everyday behaviour and thinking, as has been described e.g. in connection with the ontology of Native Indian communities in North America (Nelson 1982; Turner 2008; Berkes 2012).

5.3 The estimated and calculated level of local familiarity for the studied wild animal species

Both zoologists and the linear model inaccurately estimated the level of local familiarity of ca. 30-40% of the species. Unexpectedly, little difference was found between the accuracy of the model (70%) and that of the zoologists (60%). The list of the most over- and underestimated species overlapped by ca. 50%.

A zoologist's perception of wild animal species differs from that of a local farmer. The two groups perceive different things as interesting, beautiful, valuable or harmful. In some cases, zoologists were unaware if a given species was a provider of a certain ecosystem service or a cause of serious damage at a local level. The model, built upon general zoological knowledge, was also unable to consider local cultural and ecological specialities. Over- or underestimation of certain species were, however, often easy to explain with expertise in traditional zoological knowledge.

The most common cause of knowledge underestimation by both zoologists and the model was the undervaluation of or the lack of information on local socio-economic contexts and beliefs. For example, in the case of the Hungarian Gall Wasp (*Andricus hungaricus*), besides its use as tanning material, superstitions might play an important role in it being locally well-known: ”*My mother always compelled me to throw them out* (when as a child I was collecting them. It cannot be kept near the house because) *hens will not brood*.” (Ulicsni et al. 2016).

Abandoned practices also contributed to a higher level of familiarity than expected. Although the use of the Mediterranean Medicinal Leech (*Hirudo verbana*) has considerably declined, knowledge of its former use was passed on effectively. The same is true for the black-colored carpenter bees (*Xylocopa violacea, X. valga*) whose honey bag was widely eaten before the spread of commercial sweets. “*If you take it apart there is a small honey sac in the middle. When we were young, we often caught it to get the honey from them.*” (Ulicsni et al. 2016). The Spanish Fly (*Lytta vesicatoria*) has been used as an aphrodisiac and against rabies: “*When someone was bitten by a rabid dog, he had to eat eight…*”. Many locals still remember this. Today this species is only used as bait for fishing.

Damage caused by a taxon may also affect local people more sensitively than expected, which is why zoologists, who represent another knowledge system and lifestyle, might underestimate familiarity with a species. For example, the damage done to fish caught in a traditional fish trap (called *varsa*) by the Great Silver Water Beetle (*Hydrous piceus*) is very conspicuous. The Chicken Body Louse (*Menacanthus stramineus*) is also a very dangerous parasite killing domestic fowl. Almost everybody can identify it and, suprisingly, precisely distinguish it from mites (Gub 1996). Locals argue that the Eurasian Weasel (*Mustela nivalis*), the Beech Marten (*Martes foina*) and the Grey Wolf (*Canis lupus*) kill more animals than they could take and eat, behave very annoyingly, and cause a lot of damage. There are also many superstitions surrounding them. For example, it is believed that the Eurasian weasel sucks the udder of cows, causing mastitis. “*It bites the udder so it is spoiled.*” Sometimes it was cured with the skin of the weasel (Ulicsni et al. 2013). Level of familiarity was also overestimated if zoologists were unaware of the fact that local people did not associate damage with the pest that caused it. In these cases the species had lower familiarity level than expected (e.g. the Common Fish Louse (*Argulus foliaceus*)). Another possible reason for this latter species to be lesser-known is that the old experienced fishermen have died out and their knowledge is lost (Ulicsni et al. 2016).

One reason for underestimating level of familiarity might be that zoologists considered morphological salience of a species more important than its impact (e.g. use and harm). Namely, they expected the morphologically more salient species to be better known. The Wasp Spider (*Argiope bruennichi*) and the European Praying Mantis (*Mantis religiosa*) are morphologically very striking species but have no actual impact on humans, so they are little-known by locals. Unexpectedly, locals have learnt even the names of these species, mostly in school and from media (Ulicsni et al. 2016).

Size seemed to be an important factor if it was a distingishing feature from other similar (related) species, like for the European Stag Beetle (*Lucanus cervus*) among bugs and the European Hornet (*Vespa crabro*) among smaller wasps.

One reason for overestimation might be that zoologists based their predictions on their knowledge of natural and urban areas rather than rural agricultural landscapes. If a species was abudant in urban areas but rare in rural ones and zoologists did not know that, they overestimated the level of familiarity. A good example is the Oriental Cockroach (*Blatta orientalis*). It does not occur in rural areas in our region, people cannot encounter it, and do not know what it is (Ulicsni et al. 2016).

Some of the locally better known species have only appeared in the recent past in our region. Zoologists did not expect the locals to recognise them, e.g. the Harlequin Ladybird (*Harmonia axyridis*). Suprisingly, locals did know that it appeared 5-7 years ago and they did not mistake it for other ladybird species. Another of this kind of newcomer taxa was the Green Shield Bug/Southern Green Stink Bug taxa (*Palomena prasina*/*Nezara viridula*). Local people put them into the same folk taxon and have already observed that one winter is needed to change color from green to brown (Ulicsni et al. 2016).

In summary, the most common causes of underestimation by both zoologists and the model were undervaluation and an insufficient understanding of local values, beliefs and ecology. Another reason for underestimation was that zoologists considered the morphological salience of a species as more important than its impact (e.g. use or harm). Neither dangerous species nor species of high nature conservation value were consistently over- or underestimated. Unexpectedly, legal protection or endangerment had only minimal impact on the level of familiarity of the species. Biró et al. (2014) also show that many rare, threatened and thus protected plant species are less well known than expected, as these are most frequently small and non-utilized species that are rare also at the local scale.

Knowledge loss has a high impact on the available local traditional knowledge in our region, especially in more industrialized and urbanized areas (Biró et al. 2014). On the other hand, there is still a considerable amount (comparable to many tropical and boreal regions) of actively used traditional ecological knowledge in the economically marginal areas utilized with extensive land-use practices in East-Central Europe (Molnár et al. 2008, Biró et al.

2014). However, this traditional knowledge is fading rapidly, and most of it may be lost in the next decades.

It is a well-known phenomenon that knowledge about a species can be heavily influenced by the needs, practices and worldview of local cultural groups (Alves 2012; Berkes 2012). There are many examples from different cultures around the world of unexpectedly salient species. For example, in the tropics, the larvae of some weevil species play a significant role in human diet as they are the main source of essential tryptophan. As a result, locals know a lot about these species, their habitats, behaviour, etc. (Ramos-Elorduy 2002). In East Africa there is a unique traditional use for whirligig beetles (Gyrinidae) and predaceous diving beetles (Dytiscidae), as a stimulant for breast growth (Kutalek & Kassa 2005). Fruits and roots hoarded for the winter by rodents are exploited for food by several local Siberian communities (Ståhlberg & Svanberg 2010), resulting in these rodent species and their habitat and behaviour being well known and distinguished.

There are several limitations to our study. For the zoologists, the ordinal scale had only four categories, as they argued they could not estimate the level of familiarity more precisely. The accuracy of the model could be increased by using a larger sample size. However, the sample size used was limited by the number of species known to the local communities studied and the number of taxa with sufficient information in our dataset. Data on observed familiarity may not be totally accurate either. Interviewing 57 people about more than 350 species is time-consuming, not to mention tiring for the informants. On the other hand, the unexpectedly large (50%) overlap between the zoologists and the model regarding the most inaccurately estimated species corroborates the robustness of our analysis (50% is far from being a random pattern). We are also aware that in the local community, the level of familiarity does not necessarily correlate with the depth, richness and usefulness of traditional knowledge, and that knowledge erosion might affect depth of knowledge more than the mere recognition of a species (Biró et al. 2014).

5.4 Local knowledge of key features of beavers

Considerable local knowledge about beavers was found in all three study sites (Kászon, Mura, Szigetköz), even though in some places beavers only reappeared 5-10 years ago. Similarly, the Canadian Beaver is also a well-known and salient species all through its natural range even in places where they have just recently appeared (Santo et al. 2017, Schüttler et al. 2011). The time and method of beavers' local reappearance (cf. Čanády et al. 2016, Czabán 2017, information from scientific and conservation experts /SCEs/) were well estimated by both knowledgeable and randomly-selected local informants (KLIs and RLIs) despite the fact that they knew little about the actual reintroduction methods. Local knowledge of the conservation status and hunting status of beavers reflected the differences between Hungarian and Romanian regulations (internet-1). In Romania, regulations allow even protected species to be conditionally shot or trapped (Salvatori et al. 2002).

The species' local distribution was well known and local knowledge was consistent with the scientific literature (Bajomi 2011, Czabán 2017) and the experiences of the SCE group. Scientific literature (Bajomi 2011, Czabán 2017) and information from SCEs confirmed these local perceptions. In Kászon and by the Mura the beaver population is still growing. In the Szigetköz, the population has probably stagnated, but locals still perceive growth. Local knowledge about the biology of beavers was also consistent with the literature and SCE information regarding both distance reached from waterbodies (Haarberg 2007, Stoffyn-Egli and Willison 2011) and predators (Gable et al. 2018).

The use of woody plant species by the beavers was well known to locals as far as species were concerned, but they knew less about the plant parts beavers eat. This is probably because it was much easier to discover cut trees than other evidence of feeding (e.g., small gnawed twigs) (cf. Stoffyn-Egli and Willison 2011, Panait 2012, Juhász et al. 2017, Janiszewski et al. 2017, experience of SCEs). In Kászon, locals have presumed a connection between the arrival of beavers and the decline in the abundance of fish. This might have contributed to the false impression of beavers eating fish. Beaver dams were common in Kászon. That is why many locals could have believed that the purpose of felling the trees was dam building rather than feeding. We conclude that beavers were viewed from different perspectives at the three sites but local knowledge about their legal status, biology and behavior was extensive everywhere.

5.4.1 Impact of beavers on ecosystem services

5.4.1.1 Provisioning services

Consistent with the literature and SCE opinions, both groups at all three sites evaluated damage to cultivated crops realistically (cf. Panait 2012). By the Mura, wild boars were considered to be more harmful than beavers. Damage to crops is rarely reported in literature (e.g. McKinstry and Anderson 1999). The impact of beavers on provisioning services could be related to the human use of the immediate waterfronts. In Kászon the streams are accompanied by trees and hay meadows, by the Mura arable fields extend to the river in a dominantly forested landscape, and in the Szigetköz there are extensive plantations on the riversides. According to Caballero-Serrano et al. (2017), it is typical that the value of damage to provisioning services is estimated by the various local stakeholder groups differently than by biologists and conservationists. Our results indicate that these estimates can even differ from region to region. It was conspicuous that in several cases, negative impacts mentioned were just potential impacts, and the beavers' landscape-forming activity was perceived as negative regardless of its actual economic impact. For example, species (like *Salix* spp.) mentioned as damage to fuel wood are not of high commercial value.

Perception of beavers' impact on fish was contradictory, as reported in the scientific studies (cf. Jones et al. 1997, Collen and Gibbson 2001). Informants mentioned that beaver dams moderate the flow of water and it becomes disadvantageous for some species, like trout (c.f. Rosell et al. 2005). On the other hand, informants also mentioned that this is beneficial for species that prefer slow-flowing water (c.f. Kemp et al. 2012). Similarly, it was mentioned that the trees falling into the water may provide shelter and spawning grounds for several fish species (c.f. Hägglund and Sjöberg 1999). Some of the informants, especially in the Szigetköz, declared that beavers have a negative impact on fish without mentioning any specific reason, most likely because of their general dislike of the animal. We suppose that local opinion was influenced by the number of fish caught (see also Wohl 2015) rather than conservational aspects like fish diversity or abundance of rare fish species.

In the Szigetköz there are extensive poplar plantations right by the river (Czabán 2016) and informants reported considerable damage to them (especially RLIs, because they are less aware of specific aspects of the impacts and usually provided more general answers). Similar damage to timber stock has been reported from North America (Payne and Peterson 1986, McKinstry and Anderson 1999, Wigley and Garner 1987). In the Szigetköz people regularly gather fuelwood from the floodplains, and damage was mentioned by several informants. We could not evaluate the impact on timber and fuel services in Kászon, as everywhere in Romania, there is no timber production along small streams (Panait 2012) and by the Mura River the riverine forests are protected and thus cannot be exploited.

5.4.1.2 Regulating services

Impacts on regulating services were mentioned mostly as negative and provided important arguments for regarding beavers as a 'nuisance' (cf. Wigley and Garner 1987, Panait 2012, Ecke et al. 2017, Puttock et al. 2017). Flood risk as a disservice is a serious beaver impact in the US as well (Wigley and Garner 1987, McKinstry and Anderson 1999, Wohl 2015). In Kászon the impact of beaver dams and impoundments was said to be substantial. Based on SCEs' information, in Romania there were a few occasions when the increased flood levels caused by beaver dams endangered villages. Along the big rivers of Hungary, the actual problem was the burrowing of dykes and embankments. In contrast, damage to the irrigation system, typical in North America (McKinstry and Anderson 1999), has not been mentioned in the investigated areas. The regions around the world where the impact of beavers is studied vary considerably in amount of precipitation, land use, human population and geomorphology. This variability of landscape characteristics may be partly responsible for our limited understanding of how much beavers influence ecological systems (Törnblom et al. 2011).

As for erosion control, the literature clearly indicates positive impacts (Grygoruk and Nowak 2014, Small et al. 2016, Czabán 2016), while locals mostly perceived negative ones. That may be because they were more conspicuous than the mostly indirect positive impacts. Locals may have perceived beavers' influence on water purification as negative because their indicators (like decomposing organic matter, floating bits of trees) were different from those of scientists. Müller-Schwarze (2011), Czabán (2016) and Law et al. (2016) argue that the most important impacts of beaver ponds are that they retain sediment, are sinks for nitrogen, and decrease pH to an optimal level (which are not perceivable by locals).

Informants often assessed the impacts on life-cycle maintenance, habitat and genetic diversity differently from the land user's and from the ecological points of view. Some informants reported undesirable habitat changes related to their own land management problems while others appreciated the creation of new habitats. An unexpectedly high number of informants provided comments with ecological relevance (51%). It is well established that beavers increase the number of species, and contribute to the maintenance and creation of habitats (Jones et al. 1997, Wright et al. 2002, Nummi and Holopainen 2014, Czabán 2016, Stringer and Gaywood 2016, Law et al. 2017).

5.4.1.3 Cultural services

The perception of beavers' impact on cultural ecosystem services has brought up interesting attitudes. Informants in Kászon considered the "*mess*" and "*untidiness*" (cf. Babai and Molnár 2014) generated by beavers as a problem because locals' semi-traditional land-use system makes them partial to the 'tidiness' of the man-made local landscape. While studying brown bears, Kellert (1994) revealed that aesthetic values are important factors affecting attitudes toward wildlife. Land owners in the US benefit from the aesthetic (and thus recreational) value of beaver ponds (Enck et al. 1992, McKinstry and Anderson 1999, Jonker et al. 2006). In post-communist countries people are often suspicious about any kind of change (Panait 2012, Turnock 1993), which might explain the negative perception of beavers' transformation of the landscape. This fear of change and of possible intensification of impacts and damage is probably expressed in the almost unambiguously negative perception of population growth (cf. Turnock 1993). Local communities would prefer the beaver population to stagnate or decrease in other regions of the world as well (McKinstry and Anderson 1999, Jonker et al. 2006).

The informants, who perceived beavers' impact on recreation as negative, referred to the disturbance of fishing and aesthetic points (see also Wohl 2015). Ambivalence was common: several people mentioned that anglers are annoyed because beavers make fishing difficult (primarily by frightening fish away), others said that beavers didn't make any difference. An unexpected finding of our study is that locals considered enjoyment (as an ecosystem service) to be one of the most important positive impacts of beavers. Sometimes this made people more forgiving even if beavers were a 'nuisance' to them. Others also found that beavers can emotionally engage a broad segment of the public (Wigley and Garner 1987, Enck et al. 1992, Meyer 2005, Jonker et al. 2006, Panait 2012, Wohl 2015), but they do not mention the forgiving attitude. This phenomenon might be explained partly by beavers being a cute animal and a skilful builder, and partly by the persistent positive communication of nature conservationists (B. Bakó, personal communication, March 2, 2018).

5.4.2 Overall perception of beavers by locals

Perception of the harmfulness and usefulness of beavers was greatly influenced by their marked impact on provisioning services and various smaller 'nuisances' (e.g. felling of shade trees, or gnawing of garden plants). Törnblom at al. (2011) also point out the contradictory character of the species. While evaluating harms and benefits, both real and potential impacts came up, and informants presumed that beavers influence other people's lives more negatively than their own. On the other hand, benefits and positive impacts were also mentioned (similarly to the US and Switzerland; Wigley and Garner (1987), McKinstry and Anderson (1999), Meyer (2005)). Even though the species was basically considered a 'nuisance,' informants frequently argued that humans, floods and other wild animals (like wild boars, deer, cormorants, and otters) cause more damage than beavers. However, this did not influence the general opinion that beavers are harmful and 'nuisances.' In most cases, there was no considerable difference between the perception of the RLI and KLI group members, and the proportion of informants perceiving the positive impacts of beavers was generally higher in the more knowledgeable KLIs.

Locals did not recognize the conservational benefits of beavers in their personal life. The presence of beavers was considered to be beneficial for outsiders (e.g. nature conservationists, animal rights activists, tourists) rather than themselves. In Kászon, traditional land-use practices are still present; people live relatively close to nature. This may be one of the reasons why people there often find something beneficial in the elements of nature, even in beavers.

5.4.3 Suggestion for better management of an 'adorable nuisance'

In many East-Central European cultural landscapes there are still extensive semi-natural riverine areas with spontaneously evolving habitats where the presence of beavers could be justified. Beavers are able to transform the 'order' of the human-controlled cultural landscape, and that makes them very effective conservational 'tools' (ecosystem engineer species). Locals had deep knowledge about beavers and diverse perceptions of beavers' impacts. Impacts on provisioning and regulating services were perceived mostly as negative, while impacts on cultural ecosystem services were perceived much more positively. Beavers were perceived as a 'loveable nuisance.' The lack of local understanding of priorities and objectives of nature conservation is well illustrated by an informant's remark: "*If beavers are so harmful, why are conservationists spreading them?*"

As the beaver situation changes rapidly and dynamically, it is important that beaver management be adaptive (Enck 1992). Studies based on interviews can effectively assess the knowledge, perception and attitudes of locals, which are strongly determined by local ecological and social contexts. The impacts of management regulations on beavers and locals and their local perception would be also worth monitoring.

We argue that strengthening cooperation between nature conservationists and locals could moderate present and potential future conflicts. Two types of conflicts arose that have to be managed separately: conflict between beavers and locals and conflict between locals and conservationists introducing and protecting beavers. In the study areas, the local traditional communities' 'instinctive concern' for the fate of their local natural resources is still pronounced, and in their scenarios the beaver is a disrupting factor. In our opinion, it is important to take this into account when managing conflicts. Cooperation of locals and conservationists could be based on the positive feelings about beavers like cuteness, curiosity, and building mastery.

5.5. The key findings of the dissertation

With the documentation of folk knowledge on wild mammals and invertebrates we provide a list of folk taxa, and discuss folk biological classification and nomenclature, salient features, uses, related proverbs, sayings, and conservation. The most important findings:

- 208 invertebrate and 42 mammal folk species were identified
- 859 invertebrate and 122 mammal folk name – folk taxon identifications were made
- first description of the folk taxonomy of invertebrates and mammals in Hungarian (Central European) communities
- salient features of invertebrates and mammals were described for all known folk species
- 30 different uses of insects were documented

We studied local knowledge of beavers and the perception of their impact on ecosystem services and local livelihoods, and the perception of their general harmfulness and usefulness in Hungary and Romania in three ecologically distinct, diverse rural landscapes. The most important findings:

- locals had a deep knowledge on beavers' behavior and impact
- the negatively most affected people were more constructive related to the conservation of beavers
- much more people had negative attitude towards beavers than those who were personally affected

We examined whether the expert judgment of academic zoologists or a feature-based linear model is better at predicting the observed level of local familiarity with wild animal species. The most important findings:

- similar accuracy of zoologists' and a feature-based linear model's estimates on local ethnozoological knowledge (ca. only 60%, and 70 %) was identified
- 50% overlap was identified between the species most inaccurately estimated by the zoologists and a feature-based linear model
- neither the overestimated nor the underestimated group of species was significantly different in their traits (tendencies - zoologists' accuracy decreased by undervaluation of local folklore and local usefulness and overvaluation of the importance of striking morphology; the model overemphasized morphology, size and abundance)

6. CONCLUSIONS

Biologists may ask why one should study folk knowledge of animals in a region so often studied by zoologists for centuries. There are several answers to this question. The main goal of science is to describe the world. The disciplines of anthropology and ethnobiology describe the local knowledge of specific groups of people. We argue, that before the dual impact of the modern economy and public education became so powerful, Hungarian rural people might have possessed knowledge as deep as that of, for example, the natives of Amazonia. Ethnographic works from the late 19th and early 20th centuries provide the basis for this argument. In spite of this documentation of folk zoological knowledge in Europe is very limited. Although the names of the most important wild animals have been collected by ethnographers and linguists (in Hungary, e.g. Jolsvay et al. 1977, Lőrinczy 1979-2002), folk zoological knowledge was not documented and published sufficiently due to the limits of theoretical and personal zoological knowledge and, also, due to the varying range of scientific interests.

Locals and conservationists often use different indicators to assess certain ecosystem services and they also view impacts on the local ecosystem services from different perspectives. Their understanding of biodiversity is also different. Communication with knowledgeable locals who are – as our results show - generally more receptive to regulating services could lead to satisfactory compromises and understanding in management. Local traditional ecological knowledge of wild animals is highly relevant to helping us understand the mentality and worldview of local people.

High level of uncertainty among zoologists in estimating local familiarity (30-40%) shows, that it may be unrealistic to expect academic zoologists with limited understanding of traditional zoological knowledge to identify adequate target species for knowledge co-production and thus bridge knowledge systems. It also raises ethical issues, for example, how correct it is to push scientists preparing assessments (e.g. in CBD or IPBES) to do reviews in areas they are not familiar with. It induces unfavorable bias in recognition given to different perspectives, and also imply the negative practice relying solely on external perspectives. This way both the local and external experts are treated unfairly which hinders the possibilities of the effective knowledge co-production.

Cooperative research based on more than one knowledge system can unite the benefits of different ontological and epistemological systems. Cooperative research can eliminate knowledge gaps, which can benefit all stakeholders who are actively involved in the process

(Raymond et al. 2010). We argue that bias and underestimation of local knowledge can hinder these processes, can lead to less efficient cooperation and even waste resources, for example, if communication of conservationists is not adjusted well to the knowledge locals have of target species and species groups.

When selecting teams of authors for e.g. IPBES assessments, increasing attention (although still not enough) is paid to including experts on Indigenous and Local Knowledge in order to bridge knowledge systems. It is our sincere hope that traditional knowledge holders and their knowledge can thus more effectively promote the protection of species and habitats and the sustainable use of biodiversity, and increase awareness of the need for conservation. Inclusive conservation approaches can take into account not only the knowledge of locals but also local economic and socio-cultural aspects (e.g. perceptions based on local values and beliefs). Better recognition of local knowledge could also help the preservation and transmission of local knowledge necessary for the continuation of local – often still sustainable – land-use practices.

We argue that researchers of traditional and local knowledge can function as bridging experts in these activities, aiding zoologists and conservationists who seek target species for knowledge co-production. It is the scholars' responsibility to learn, archive and use the knowledge connected to animals, meanwhile, zoologists would have the opportunity to decolonize their approaches, open up to traditional knowledge, and learn how to work in collaboration with local people. We believe that a more efficient bridging of knowledge systems could increase the chances of success and lead to improved cooperation between conservation practice, academic science, and indigenous and traditional knowledge holders.

7. ACKNOWLEDGEMENT

We gratefully acknowledge all the people who patiently and generously shared their knowledge with us from **Szilágyság**: Erzsébet Ambrus†, Eszter Borbás, Lajos Bordás, András Csíki†, Anna Farnas†, Géza Farnas, Margit Fazekas†, Mihály Fazekas, Sándor Fazekas†, János Kandert†, Lajos László†, Karolina Nemes, Margit Ősz†, Pál Őz, Eszter Posta, Rozália Posta, Lídia Somogyi, István Szabó, Pál Szabó†, Klára Szűcs; **Drávaszög**: János Laczkó, Sándor Kovács, Dezső Kettős, Jolán Kettős, András Pataky†, Ida Kristóf, János Pajrok, Mária Dobszai†, Lajos Lubascsik†, Rózsika Bicó, Gyula Kovács, János Kőgyesi†, József Molnár†, Dezső Tibor, György Vidra, Margareta Csokonai, Sára Kelemen, Pál Borkó, Sándor Hegedűs, Attila Karakas, Irma Szarka, Zoltán Bak, Mária Ferenc, István Micheli, József Micheli, Ferenc Muhi; **Gömör**: Béla Balajti, László Borbély, József Cselényi, Zoltán Fábry, Andor Forgon, Györgyné Forgon, László Kertész, Zoltán Miklós, Dezső Nagy, Ilona Nagy, Kálmánné Tóth, Lászlóné Tóth; **Kászon**: Béla Balázs, Norbert Balázs, Antal Balázsi, Imre Bartha, Magdolna Bodó, András Borbáth, Kató Borbáth, Roland Csűrös, Aranka Gál, Annamária Horváth, id. András Karcsa, Vilma Illyés, István Koszti, János Koszti, Csaba Kotró, Zsuzsanna Kővári, Teréz László, Erzsébet Makó, László Makó, József Mihácz, Sándor Mihály, András Miklós, Albert Okos, László Posztuly, Miklós Posztuly, Mária Ráduly, János Szökő†, András Szűcs, Imre Tamás, András Tódorán; **Mura**: Balázs Andor, Gézáné Bagladi, János Bánfai, Balázs Bekő, Zoltán Bíró, László Faragó, József Fülöp, Richárd Honcz, Attila Horváth, István Horváth, János Káli, Géza János Kertész, István Nagy, Imre Simon, Norbert Simon, Ferenc Soós, József Stropka, János Süle, Imre Szabó, Róbert Tamás, Béla Varga, Imre Varga, Jenő Varga, Zoltán Varga; and **Szigetköz**: Károly Belovitz, Sándor Besser, Sándorné Besser, József Birkás, Ferenc Cina, Dávid Cseh, Sándor Dán, Erzsébet Földes, Zoltánné Földes, Ambrus Fűzfa, István Glaser, ifj Ferenc Cina, Tibor Kaiser, Sándorné Kiss, Angelica Komlódi, Mihály Koncz, Árpád Kovács, Ernőné Lancz, Róbert Légrádi, Elek Lévai, János Majtényi, Jánosné Majtényi, Jenő Molnár, Krisztina Molnár, János Nagy, Bence Németh, Tibor Németh, Zsolt Palotás, László Papp, Gábor Platzer, Miklós Stenczinger, Imre Stenczinger, Márton Stenczinger, Zoltán Strupka, István Takács and other people who required anonymity. Thanks to István Tórizs and his family for their help with the field work, to Tiborné Ulicsni for transcribing our recordings, to Zoltán Varga and the Hungarian Institute for Educational Research and Development for granting us permission to use drawings from the book titled ’Állatismeret’, and to György Szollát for contacting some of the informants.

Our thanks also go out to all the scientific and conservation experts interviewed. Thanks to Steve Kane, Béla Borsos, Brigitta Palotás and Benjamin Jack Schutz for English translation and proofreading of different parts of the text.

8. REFERENCES

Álvares F., Domingues J., Sierra P., Primavera P. 2011. Cultural dimension of wolves in the Iberian Peninsula: implications of ethnozoology in conservation biology. Innovation: The European Journal of Social Science Research 24: 313-331.

Alves RRN, Rosa IL. 2014. Animals in traditional folk medicine. Springer, Heidelberg, New York, Dordrecht, London.

Alves RRN., Silva JS., da Silva Chaves L., Albuquerque UP. 2018. Ethnozoology and animal conservation. In Ethnozoology (pp. 481-496). Academic Press.

Alves RRN., Souto WMS. 2015. Ethnozoology: A Brief Introduction. Ethnobiology and Conservation; 4:1-13.

Alves RRN. 2012. Relationships between fauna and people and the role of ethnozoology in animal conservation. Ethnobiology and Conservation 1:1-69.

Anderson CB., Griffith CR., Rosemond AD., Rozzi R., Dollenz O. 2006. The effects of invasive North American beavers on riparian plant communities in Cape Horn, Chile: do exotic beavers engineer differently in sub-Antarctic ecosystems? Biol Conserv. 128(4): 467-474.

Anderson M. 2000. Sami children and traditional knowledge, In Svanberg I, Tunon H. (eds): Ecological knowledge in the North. Studies in Ethnobiology. Swedish Biodiversity Centre. Uppsala; 55-66.

Asselin H. 2015. Indigenous forest knowledge. in Peh K, Corlett R, Bergeron Y. editors. Routledge Handbook of Forest Ecology. New York: Earthscan, Routledge, pp. 586-596.

Avar Á. 2012. A természet és az állatok a hagyományos mongol gondolkodásban. [Nature and animals in traditional Mongolian thinking.] PhD Thesis, Eötvös Loránd Tudományegyetem Bölcsészettudományi Kar, Budapest.

Babai D., Molnár Á., Molnár Z. 2014. Traditional ecological knowledge and land use in Gyimes (Eastern Carpathians). MTA BTK Néprajztudományi Intézet és MTA Ökológiai Kutatóközpont Botanikai és Ökológiai Intézet, Budapest-Vácrátót.

Babai D., Molnár Z. 2014. Small-scale traditional management of highly species-rich grasslands in the Carpathians. Agr Ecosyst Environ. 182: 123-130.

Babai D. 2011. Hagyományos ökológiai tudás az etnozoológia tükrében – A gerinces állatok népi ismerete Hidegségben (Traditional ecological knowledge in the mirror of ethnozoology – the local knowledge of Vertebrates in the Gyimes region (Eastern Carpathians, Romania)). MSc Thesis, Pécsi Tudományegyetem Bölcsészettudományi Kar Néprajz és Kulturális Antropológia Tanszék, Pécs.

Babai D., Molnár Z. 2009. Népi növényzetismeret Gyimesben I.: növénynevek, népi taxonómia, az egyéni és közösségi növényismeret. Botanikai Közlemények., 96: 117-143.

Bajomi B. 2011. Reintroduction of the Eurasian beaver (Castor fiber). – Hungary. Danube Parks Network of Protected Areas, Directorate of Duna-Dráva National Park, Budapest, Hungary.

Bakó B. 2007. Erdei pele In Bihari Z., Csorba G., Heltai M. (eds.) Magyarország emlőseinek atlasza. Kossuth Kiadó, Budapest., 144-151.

Bartholy J., Bozó L. 2003. Magyarország éghajlati atlasza. Országos Meteorológiai Szolgálat. Budapest.

Beaudreau AH., Levin PS., Norman KC. 2011. Using folk taxonomies to understand stakeholder perceptions for species conservation. Conservation Letters 4:451-463.

Bentley JW., Rodríguez G. 2001. Honduran Folk Entomology. Curr.Anthropol. 42:285-301.

Berkes F., Colding J., Folke C. (eds.) 2008. Navigating social-ecological systems: building resilience for complexity and change. Cambridge University Press.

Berkes F., Colding J., Folke C. 2000. Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications 10:1251-1262.

Berkes F. 2012. Sacred Ecology. Third Edition. Routledge, New York, USA.

Berlin B., Boster JS., O'Neill JP. 1981. The perceptual bases of ethnobiological classification: evidence from Aguaruna Jívaróo ornithology. J. Ethnobiol. 1:95-108.

Berlin B. 1992. Ethnobiological classification. Principles of categorisation of plants and animals in traditional societies. Princeton University Press, Princeton.

Bihari Z. in Bihari Z., Csorba G., Heltai M. 2007. Magyarország emlőseinek atlasza. Kossuth Kiadó, Budapest., 50-51.

Bihari-Horváth L. 2011. Szarvaskő „etnomalakológiája” - Az éti csiga gyűjtögetése és fogyasztása egy Heves megyei lokális közösségben. Az egri Dobó István Vármúzeum Évkönyve, Eger. 47:309-326.

Biró É, Babai D, Bódis J, Molnár Z. 2014. Lack of knowledge or loss of knowledge? Traditional ecological knowledge of population dynamics of threatened plant species in East-Central Europe. Journal for Nature Conservation 22:318-325.

Bodenheimer FS. 1951. Insects as Human Food: A Chapter of the Ecology of Man. Springer, New York. 352 pp.

Bonow M, Svanberg I. 2017. Urban Ponds for Breeding Medicinal Leeches (Hirudo medicinalis Linnaeus, 1758) in Sweden. Meta H: historiskarkeologisk tidskrift, 63-72.

Bonta M. 2010. Ethno-ornithology and biological conservation. In: Tideman S, Gosler A. (eds.) Ethno-ornithology. Birds, indigenous peoples, culture and society. Earthscan, London – Washington. pp. 13-29.

Brehm A. 1989. Az állatok világa. (Life of animals) ÁKV-Maecenas, Budapest.

Brito IDSP., Borges AKM., de Faria Lopes S., Dias TLP., Alves RRN. 2019. Environmental influence on the choice of medicinal animals: a case study from northeastern Brazil. Journal of ethnobiology and ethnomedicine, 15(1), 55.

Broch HB. 2009. Tracks that matter: On space, place and Hare Indian ethnobiology with special reference to the Marten (*Martes americana*). Acta Borealia: A Nordic Journal of Circumpolar Societies 26: 77-95. DOI: 10.1080/08003830902951540.

Brown CH. 1979. Folk zoological life-forms: Their universality and growth. American Anthropologist, New Series 81(4): 719-781.

Brown CH. 1984. Language and living things: Uniformities in folk classification and naming. Rutgers University Press; New Brunswick.

Burchsted D., Daniels M., Thorson R., Vokoun J. 2010. The river discontinuum: applying beaver modifications to baseline conditions for restoration of forested headwaters. BioScience. 60(11): 908-922.

Caballero-Serrano V., Alday JG., Amigo J., Caballero D., Carrasco JC., McLaren B., Onaindia M. 2017. Social Perceptions of Biodiversity and Ecosystem Services in the Ecuadorian Amazon. Hum Ecol. 45(4): 475-486.

Čanády A., Krišovský P., Bajomi B., Huber A., Czabán D., Olekšák M. 2016. Is new spread of the European beaver in Pannonian basin an evidence of the species recovery? Eur J Ecol. 2(2): 44-63.

Carpaneto GM., Germo FP. 1989. The mammals in the zoological culture of the Mbuti Pygmies in north-eastern Zaire. Hystrix, (n.s.) l, 1-83.

Chao JT., Fan YB., Yeh WC., Chen YM. 1993. The" Sacred Butterfly" in Alishan. Chin. J. Entomol. 13:385-389.

Colding J, Folke C. 2001. Social taboos: "invisible" systems of local resource management and biological conservation. Ecological Applications 11:584-600.

Collen G, Gibson RJ. 2001. The general ecology of beavers (Castor spp.) as related to their influence on stream ecosystems and riparian habitats, and the subsequent effects on fish—a review. Reviews in Fish Biology and Fisheries. 10: 439–461.

Costa-Neto EM. 1999. Healing with animals in Feira de Santana city, Bahia, Brazil. Journal of Ethnopharmacology 65:225-230.

Czabán D. 2017. A hód állományának vizsgálata az FHNP működési területén. (Examination of the beaver's population in the FHNP's operational area) Fertő–Hanság Nemzeti Park Igazgatóság, Sarród, Kézirat. 46 p.

Czabán D. 2016. Hódok a Szigetközben. (Beavers in Szigetköz.) – In: Korda, M. (ed.): Az erdőgazdálkodás hatása az erdők biológiai sokféleségére. (Impact of forest management on forest biodiversity.) – Tanulmánygyűjtemény. pp. 403–418.

Danielsen F., Jensen PM., Burgess ND., Coronado I., Holt S., Poulsen MK., Rueda RM., Skielboe T., Enghoff M., Hemmingsen LH., Sørensen M., Pirhofer-Walzl K. 2014. Testing Focus Groups as a Tool for Connecting Indigenous and Local Knowledge on Abundance of Natural resources with Science-Based Land Management Systems. Cons Lett. 7:380-389.

Davidson-Hunt IJ., Berkes F. 2005. Nature and society through the lens of resilience: toward a human-in-ecosystem perspective. In Berkes F, Colding J, Folke, C. (eds.) Navigating social-ecological systems. Building resilience for complexity and change. Cambridge University Press, Cambridge – New York. pp. 53-82.

De Groot RS., Alkemade R., Braat L., Hein L., Willemen L. 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecol Complex. 7(3): 260-272.

de Jong Y., Verbeek M., Michelsen V., de Place Bjørn P., Los W., Steeman F., Bailly N., Basire C., Chylarecki P., Stloukal E., Hagedorn G., Wetzel FT., Glöckler F., Kroupa A., Korb, G., Hoffmann A., Häuser C., Kohlbecker A., Müller A., Güntsch A., Stoev P., Penev L. 2014. Fauna Europaea - all European animal species on the web. Biodiversity Data Journal 2: e4034.

Diamond J., Bishop KD. 1999. Ethno-ornithology of the Ketengban people, Indonesian New Guinea. in Medin D.L, Scott A. editors. Folkbiology. MIT Press, Cambridge, pp. 17-45.

Díaz S., Demissew S., Joly C., Lonsdale W., Ash N., Larigauderie A. 2015. The IPBES Conceptual Framework - connecting nature and people. Current Opinion in Environmental Sustainability 1-16.

Díaz S., Pascual U., Stenseke M., Martín-López B., Watson RT., Molnár Z., Hill R., Chan KMA., Baste IA., Brauman KA., Polasky S., Church A., Lonsdale M., Larigauderie A., Leadley PW., van Oudenhoven APE., van der Plaat F., Schröter M., Lavorel S., Aumeeruddy-Thomas Y., Bukvareva E., Davies K., Demissew S., Erpul G., Failler P., Guerra CA., Hewitt CL., Keune H., Lindley S., Shirayama Y., Polasky, S. 2018. Assessing nature's contributions to people. Science, 359(6373), 270-272.

Dickman AJ. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. Anim Conserv. 13: 458–466.

Dobrosi D. 1999. Az épületekben lakó denevérek országos felmérésének eredményei 1991-97. In: Molnár, V., Molnár, Z., Dobrosi, D. (eds) Az I. Magyar Denevérvédelmi Konferencia (Sarród, 1997. november 29.) kiadványa. Magyar Denevérkutatók Baráti Köre, Budapest, 16-20.

Duenn P., Salpeteur M., Reyes-García V. 2017. Rabari Shepherds and the Mad Tree: The Dynamics of Local Ecological Knowledge in the Context of Prosopis juliflora Invasion in Gujarat, India. J Ethnobiol. 37(3): 561-580.

Duhart F. 2009. Caracoles y sociedades en Europa desde la antigüedad: reflexiones etnozoológicas. Studium: Revista de humanidades. 15:115-139.

Durst PB., Johnson DV., Leslie RN., Shono K. 2010. Forest insects as food: humans bite back. RAP publication, Bangkok.

Ecke F., Levanoni O., Audet J., Carlson P., Eklöf K., Hartman G., McKie B., Ledesma J., Segersten J., Truchy A. 2017. Meta-analysis of environmental effects of beaver in relation to artificial dams. Environ Res Lett. 12(11): 113002.

Edlund A-C. 1992. Språklig tabuering vid säljakt: kring ord för sälar på svenskspråkigt område. In: Edlund L-E (ed.) Tabu, verklighet och språk: tio uppsatser om folkliga tabueringsföreställningar och taxonomier. Carlsson, Stockholm, 54-88.

Ellen R. 2006. The cultural relations of classification: an analysis of Nuaulu animal categories from central Seram (Vol. 91). Cambridge University Press.

Enck JW., Bishop PG., Brown TL., Lamendola JE. 1992. Beaver-related Attitudes, Experiences, and Knowledge of Stakeholders in Wildlife Management Unit 21.

Endes M. 1987. A Gyöngyös-Tarna hordalékkúp-síkság gerincesállatvilága. Folia Historico-naturalia Musei Matraensis 12: 107-117.

Endes M., Balogh P., Szentgyörgyi P., Vizslán T. 2003. A Rakaca patakvidék gerinces faunája. Calandrella 12: 174-181.

Ens EJ., Pert P., Clarke PA., Budden M., Clubb L., Doran B., Douras C., Gaikwad J., Goth B., Leonard S., Locke J., Packer J., Turpin G., Wason S. 2015. Indigenous biocultural knowledge in ecosystem science and management: review and insight from Australia. Biol Conserv. 181:133-149.

Erőss ZP. 2015. A malaco-faunistical study of Salaj county/Szilágyság, Romania with taxonomical notes. Studia Universitatis Vasile Goldis Seria Stiintele Vietii (Life Sciences Series). 25 (3).Estabrook GF. 2008. The significance of sheep in the traditional agriculture of Beira Alta, Portugal. Journal of Ethnobiology 4: 55-68.

Ficowski J. 1986. Cyganie na polskich drogach [Gypsies on the Polish roads – in Polish]. Kraków & Wrocław: Wyd. Literackie.

Fischer A., Young JC. 2007. Understanding mental constructs of biodiversity: implications for biodiversity management and conservation. Biol Conserv. 136(2): 271-282.

Fischer-Kowalski M., Weisz H. 1999. Society as hybrid between material and symbolic realms: Toward a theoretical framework of society-nature interaction. Advances in Human Ecology. 8:215-252.

Fleck DW., Voss RS., Simmons NB. 2002. Underdifferentiated taxa and sublexical categorization: an example from Matses classification of bats. Journal of Ethnobiology 22: 61-102.

FM (Földművelésügyi Minisztérium). 2017. Official website of Hungarian Nature Conservation Authority. FM, Budapest. [Cited 2019 September 9]. Available from: http://www.termeszetvedelem.hu/

Forest Peoples Programme, the International Indigenous Forum on Biodiversity and the Secretariat of the Convention on Biological Diversity. 2016. Local Biodiversity Outlooks. Indigenous Peoples' and Local Communities' Contributions to the Implementation of the Strategic Plan for Biodiversity 2011-2020. A complement to the fourth edition of the Global Biodiversity Outlook. Moreton-in-Marsh, England.

Frazão-Moreira A., Carvalho AM., Martins E. 2009. Local ecological knowledge also 'comes from books': cultural change, landscape transformation and conservation of biodiversity in two protected areas in Portugal. Anthropological Notebooks, 15:1, p. 27-36.

Fridell S., Svanberg I. 2007. Däggdjur i svensk folklig tradition. Dialogos, Stockholm.

Fügedi L., Szentgyörgyi P. 1992. A Borsodi-dombság keleti és középső részének emlős (Mammalia) faunája. Calandrella 6(1): 49-61.

Gable TD., Windels SK., Romanski MC., Rosell F. 2018. The forgotten prey of an iconic predator: a review of interactions between grey wolves Canis lupus and beavers Castor spp. Mammal Rev. 48(2): 123-138.

Gadgil M., Olsson P., Berkes F., Folke C. 2005. Exploring the role of local ecological knowledge in ecosystem management: three case studies. In Berkes F Colding J Folke C. (eds.) Navigating social-ecological systems. Cambridge University Press, Cambridge – New York. pp. 189-209.

Gilchrist G., Mallory M. 2007. Comparing expert-based science with local ecological knowledge: What are we afraid of? Ecology and Society 12(1): r1. [online] URL: http://www.ecologyandsociety.org/vol12/iss1/resp1/

Gilchrist HG., Mallory ML., Merkel F. 2005. Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. Ecology and Society. 10.

Gombkötő P., Estók P. 1999. The status of woodland bats in north-east Hungary. In Cruz M., Kozakiewicz (eds.) Bats & Man. Million Years of Coexistence. Abstracts VIIIth European Bat Research Symposium, 23-27 August 1999, Poland:20.

Gómez B., Castro A., Jungans C., Montoya LR., Villalobos FJ. 2000. Ethnoecology of white grubs (Coleoptera: Melolonthidae) among the Tzeltal Maya of Chiapas. J. Ethnobiol. 20:43-59.

Gomez-Baggethun E., Mingorria S., Reyes-Garcia V., Calvet L., Montes C. 2010. Traditional Ecological Knowledge Trends in the Transition to a Market Economy: Empirical Study in the Donana Natural Areas. Conservation Biology. 24:721–729.

Gorczyca E., Krzemień K., Sobucki M., Jarzyna K. 2018. Can beaver impact promote river renaturalization? The example of the Raba River, southern Poland. Sci Total Environ. 615:1048-1060.

Groesbeck AS., Rowell K., Lepofsky D., Salomon AK. 2014. Ancient clam gardens increased shellfish production: Adaptive strategies from the past can inform food security today. PloS ONE. 9:e91235.

Grygoruk M., Nowak M. 2014. Spatial and temporal variability of channel retention in a lowland temperate forest stream settled by European beaver (Castor fiber). Forests. 5(9):2276-2288.

Gub J. 1996. Erdő-mező állatai a Sóvidéken. Firtos Művelődési Egylet, Korond.

Gulyás S., Sümegi P. 2011. Farming and/or foraging? New environmental data to the life and economic transformation of Late Neolithic tell communities (Tisza Culture) in SE Hungary. Journal of Archaeological Science. 38:3323-3339.

Gunderson LH. 2005. Adaptive dancing: interactions between social resilience and ecological crises. In Berkes F, Colding J, Folke C. (eds.) Navigating social-ecological systems. Building resilience for complexity and change. Cambridge University Press, Cambridge – New York. pp. 33-52.

Gurung AB. 2003. Insects–a mistake in God's creation? Tharu farmers' perception and knowledge of insects: A case study of Gobardiha Village Development Committee, Dang-Deukhuri, Nepal. Agr. Hum. Values. 20:337-370.

Gustawicz B. 1881. "Podania, przesądy, gadki i nazwy ludowe w dziedzinie przyrody." Zbiór wiadomości do antropologii krajowej. Kraków. pp. 102-186.

Haarberg O. 2007. Amit a hódról tudni érdemes. (What should we know about beavers) – WWF füzetek 26. WWF Magyarország, Budapest.

Hägglund Å., Sjöberg G. 1999. Effects of beaver dams on the fish fauna of forest streams. Forest Ecol Manag. 115: 259-266.

Haines-Young R., Potschin M. 2013. Common International Classification of Ecosystem Services (CICES): Consultation on Version 4, August–December 2012. EEA Framework Contract No EEA/IEA/09/003. https://www.nottingham.ac.uk/cem/pdf/CICES%20V43_Revised%20Final_Report_29012013.pdf

Halley DJ., Rosell F. 2003. Population and distribution of European beavers (Castor fiber). Lutra. 46(2):91-101.

Harshberger JW. 1895. "Some new ideas." Philadelphia Evening Telegraph; Philadelphia.

Hegyi I. 1978. A népi erdőkiélés történeti formái. Akadémiai Kiadó, Budapest.

Hemp C. 2001. Ethnozoological research on invertebrates on Mt. Kilimanjaro, Tanzania. Ecotropica. 7:139-149.

Henderson J., Harrington JP. 1914. Ethnozoology of the Tewa indians. Smithsonian Institution Bur. Am. Ethnol. Bull., Washington. 56.

Herjulfsdotter R., Svanberg I. 2005. Noabenämningar för huggorm (*Vipera berus*). Svenska Landsmål och Svenskt Folkliv 128: 135-159.

Herman O. 1914. A magyar pásztorok nyelvkincse: a magyarok nagy ösfoglalkozása. Királyi Magyar Természettudományi Társulat, Budapest.

Herrmann TM., Sandström P., Granqvist K., D'Astous N., Vannar J., Asselin H., Saganash N., Mameamskum J., Guanish G., Loon JB., Cuciurean R. 2014. Effects of mining on reindeer/caribou populations and indigenous livelihoods: community-based monitoring by Sami reindeer herders in Sweden and First Nations in Canada. The Polar Journal 4:28-51.

Hood GA., Larson DG. 2015. Ecological engineering and aquatic connectivity: a new perspective from beaver-modified wetlands. Freshwater Biol. 60(1):198-208.

Hunn ES., Selam J. 1991. Nch'i-wana," the big river": Mid-Columbia Indians and their land. University of Washington Press; Seattle.

Hunn ES. 2011. Ethnozoology. Ethnobiology, Hoboken, New Jersey: John Wiley. 83-96.

Hunn ES. 1982. The utilitarian factor in folkbiological classification. American Anthropologist, New Series. 84(4):830-847.

Hunn ES. 1990. Nch’i-Wána „The Big River” Mid-Columbia indians and their land. Seattle, University of Washington Press.

Hunn ES. 1999. Size as limiting the recognition of biodiversity in folkbiological classifications: One of four factors governing the cultural recognition of biological taxa. In: Medin D. L. and Atran S. (szerk.): Folkbiology. MIT Press, Cambridge, MA, 47-70.

Huntington HP. 2000. Using Traditional Ecological Knowledge in Science: Methods and Applications. Ecological Applications 10:1270-1274.

Idrobo CJ., Berkes F. 2012. Pangnirtung Inuit and the Greenland shark: co-producing knowledge of a little discussed species. Human Ecology 40:405-414.

International Society of Ethnobiology 2006. International Society of Ethnobiology Code of Ethics (with 2008 additions). http://ethnobiology.net/code-of-ethics/

internet-1: [Cited 2020 June 26]. Available from: http://nepszamlalas.adatbank.transindex.ro/?pg=etnikai&id=438.

internet-2: [Cited 2020 June 26]. Available from: http://njt.hu/cgi_bin/njt_doc.cgi?docid=56000.313262.

Ionescu G., Ionescu O., Pasca C., Sirbu G., Jurj R., Popa M. 2010. Castorul in Romania: Monografie. (Beavers in Romania: Monography) Bucharest: Editura Silvica. [In Romanian].

Iturralde J., Bordas MIS., Zabala J. 2003. Etnoentomología de la Vaquita de San Antón o mariquita (Coccinella septem-punctata) en el País Vasco (Coleoptera: Coccinellidae). Boletín de la SEA; 2003;253-269.

Jacqmain H., Bélanger L., Courtois R., Beckley T., Nadeau S., Dussault C., Bouthillier L. 2005. Proposal to combine Cree and scientific knowledge for improved moose habitat management on Waswanipi Eeyou Astchee, northern Québec. Alces 41:147–160.

Janiszewski P., Kolasa S., Strychalski J. 2017. The preferences of the European beaver castor fiber for trees and shrubs in riparian zones. Appl Ecol Env Res. 15(4):313-327.

Johnson JT., Howitt R., Cajete G., Berkes F., Louis RP., Kliskey A. 2016. Weaving Indigenous and sustainability sciences to diversify our methods. Sustainability Science 11:1-11.

Johnson LM., Hunn ES. 2010. Landscape ethnoecology: reflections. in Johnson LM, Hunn ES. editors. Landscape ethnoecology. Concepts of biotic and physical space. New York, NY, USA, Oxford, United Kingdom: Berghahn Books, pp. 279-297.

Jolsvay A., Steinmann H., Szily E. 1977. A magyar állatvilág szótára. Natura Kiadó, Budapest.

Jones CG., Lawton JH., Shachak M. 1997. Positive and negative effects of organisms as physical ecosystem engineers. Ecology. 78(7):1946-1957.

Jonker SA., Muth RM., Organ JF., Zwick RR., Siemer WF. 2006. Experiences with beaver damage and attitudes of Massachusetts residents toward beaver. Wildlife Soc B. 34(4):1009-1021.

Juhász E., Babai D., Biró M., Molnár Z., Ulicsni V. 2017. Az eurázsiai hód (Castor fiber) táplálkozási és fásszárú-használati szokásaival kapcsolatos helyi tudás két évtizeddel a visszatelepítések kezdete után a Kárpát-medencében. (Local ecological knowledge on feeding habits and woody plant species usage of the reintroduced Eurasian beaver (Castor fiber) in the Carpathian Basin two decades after its reintroduction) Természetvédelmi Közlemények. 23:182-200.

Kato D., Gopi GV. 2009. Ethnozoology of Galo tribe with special reference to edible insects in Arunachal Pradesh. Ind J Tradit Knowledge. 8:81-83.

Kellert SR. 1994. Public attitudes toward bears and their conservation. Int C Bear. 9:43-50.

Kemp PS., Worthington TA., Langford TEL., Tree ARJ., Gaywood MJ. 2012. Qualitative and quantitative effects of reintroduced beavers on stream fish. Fish Fish. 13(2):158–181.

Kendrick A., Manseau M. 2008. Representing traditional knowledge: resource management and Inuit knowledge of barren-grond caribou. Society and Natural Resources 21:404–418.

Keszeg V. 2012. Történetek és történetmondás Detrehemtelepen. Erdélyi Múzeum-Egyesület, Kolozsvár.

Kicsi SA. 2015. A fák, a kakukk és a rovarok. Cédrus Művészeti Alapítvány – Napkút Kiadó, Budapest.

Kicsi SA., Magyar LA. 2007. A sün apológiája. In Kicsi S. A., Magyar L. A., A @-tól az egyszarvúig – Zoohistóriai érdekességek. Semmelweis Kiadó, Budapest.

Kimmerer RW. 2002. Weaving traditional ecological knowledge into biological education: a call to action. BioScience 52:432-438.

Kolberg O. 1881. Dzieła wszystkie (Vol. 14). Polskie Towarzystwo Ludoznawcze, Wrocław.

Kovács A. 1987. Járok-kelek gyöngyharmaton... növény- és állatnevek a Felső-Szigetköz tájnyelvében [Local names of flora and fauna in Felső-Szigetköz]. Mosonmagyaróvári Helytört. Füz. 6:1-110.

Krause RJ., Vaccaro I., Aswani S. 2010. Challenges in Building Insect Ethnobiological Classifications in Roviana, Solomon Islands. J. Ethnobiol. 30:308-320.

Kremen C. 2005. Managing ecosystem services: what do we need to know about their ecology? Ecol Lett. 8(5):468-479.

KSH Központi Statisztikai Hivatal 2013. 2011. évi népszámlálás, 3. – Területi adatok, 3.8. Győr-Moson-Sopron megye. Győr. 274 p. [Cited 2020. June 26]. Available from: http://www.ksh.hu/docs/hun/xftp/idoszaki/nepsz2011/nepsz_03_08_2011.pdf

KSH Központi Statisztikai Hivatal. Zala megye statisztikai évkönyve 2014. Győr; 2015. 236 p. [Cited 2020 June 26]. Available from: http://www.ksh.hu/docs/hun/xftp/idoszaki/evkonyv/zala_evk_2014.pdf

Kutalek R., Kassa A. 2005. The use of gyrinids and dytiscids for stimulating breast growth in East Africa. Journal of Ethnobiology 25:115-128.

Kutasi C. 2002. A Bakony rovarvilága. Bakonyi Természettudományi Múzeum.

Law A., Gaywood MJ., Jones KC., Ramsay P., Willby NJ. 2017. Using ecosystem engineers as tools in habitat restoration and rewilding: beaver and wetlands. Sci Total Environ. 605–606:1021–1030. https://doi.org/10.1016/j.scitotenv.2017.06.173

Law A., McLean F., Willby NJ. 2016. Habitat engineering by beaver benefits aquatic biodiversity and ecosystem processes in agricultural streams. Freshwater Biol. 61(4):486–499. https://doi.org/10.1111/fwb.12721

Lelkes A. 2013. Hód előfordulás Zala megyében (Beaver occurrence in Zala county) 2013. WWF Magyarország, Tornyiszentmiklós. p. 8.

Lescureux N., Linnell JD. 2013. The effect of rapid social changes during post-communist transition on perceptions of the human-wolf relationships in Macedonia and Kyrgyzstan. Pastoralism 3:1-20.

Lescureux N., Linnell JDC. 2010. Knowledge and perceptions of Macedonian hunters and herders: The influence of species specific ecology of bears, wolves, and lynx. Human Ecology 38(3):289-299.

Levine J., Muthukrishna M., Chan K., Satterfield T. 2017. Sea otters, social justice, and ecosystem-service perceptions in Clayoquot Sound, Canada. Conserv Biol. 31(2): 343-352.

Lévi-Strauss C. 1962. La pensée sauvage. Plon, Paris. 389 pp.

Lőrinczy É. 1979-2002. Új magyar tájszótár. Akadémiai Kiadó, Budapest.

Łuczaj Ł. 2005. Podręcznik robakożercy czyli jadalne bezkręgowce Środkowej Europy. Wydawnictwo Chemigrafia, Krosno.

Łuczaj Ł. 2010. Plant identification credibility in ethnobotany: a closer look at Polish ethnographic studies. Journal of Ethnobiology and Ethnomedicine. 6(1),36.

Łuczaj Ł., Köhler P., Pirożnikow E., Graniszewska M, Pieroni A, Gervasi T. Wild edible plants of Belarus: from Rostafiński's questionnaire of 1883 to the present. J.Ethnobiol. Ethnomed.; 2013;9:21.

Łuczaj Ł., Szymański WM. 2007. Wild vascular plants gathered for consumption in the Polish countryside: a review. Journal of ethnobiology and ethnomedicine, 3(1):17.

Lundquist CJ., Baldi A., Dieterich M., Gracey K., Kovacs EK., Schleicher J., Skorin T., Sterling E., Jonsson B-G. 2015. Engaging the conservation community in the IPBES process. Conservation Biology 29:1493-1495.

Majnep IS., Bulmer, R. 2007. Animals the Ancestors Hunted: an Account of the Wild Mammals of the Kalam Area, Papua New Guinea. Crawford House, Adeleide.

Malaisse F., Latham P. 2014. Human consumption of Lepidoptera in Africa: an updated chronological list of references (370 quoted!) with their ethnozoological analysis. Geo-Eco-Trop. 38:339-372.

Malkin B. 1962. Seri ethnozoology. Pocatello, ID: Occasional papers of the Idaho State College Museum, 7.

Manikowska-Ślepowrońska B., Szydzik B., Jakubas D. 2016. Determinants of the presence of conflict bird and mammal species at pond fisheries in western Poland. Aquat Ecol. 50(1): 87–95. https://doi.org/10.1007/s10452-015-9554-z

Mapinduzi AL., Oba G., Weladji RB., Colman JE. 2003. Use of indigenous ecological knowledge of the Maasai pastoralists for assessing rangeland biodiversity in Tanzania. African Journal of Ecology. 41:329-336.

Marian SF. 1903. Insectele în limba: credințele, si obiceiurile Românilor. Studiu folkloristic [The insects in the language, beliefs and customs of Romanians. A study in folklore.] Inst. de Arte Grafice" Carol Göbl". 14;595 pp.

Martín-López B., Iniesta-Arandia I., García-Llorente M., Palomo I., Casado-Arzuaga I., Del Amo DG., Gómez-Baggethun E., Oteros-Rozas E., Palacios-Agundez I., Willaarts B., González JA., Santos-Martín F., Onaindia M., López-Santiago C., Montes C. 2012. Uncovering ecosystem service bundles through social preferences. PLoS ONE. 7(6):e38970.

McKinstry MC., Anderson SH. 1999. Attitudes of private-and public-land managers in Wyoming, USA, toward beaver. Environ Manage. 23(1):95-101.

Menzies CR., Butler C. 2006. Introduction: Understanding ecological knowledge. Pages 1–17 in Menzies CR, ed. Traditional Ecological Knowledge and Natural Resource Management. University of Nebraska Press.

Meyer F. 2005. Sympathieträger oder Störenfried?: Akzeptanz und Schutz des Bibers im Spannungsfeld von Naturschutz (Popular or troublemaker?: Acceptance and protection of the beaver - the conflict of nature conservation), Wasserbau, Land-und Forstwirtschaft: Synthesebericht von Diplomarbeit und Workshop. Geographisches Institut der Universität Zürich.

Meyer-Rochow VB. 2013. Ethno-entomological observations from North Korea (officially known as the "Democratic People's Republic of Korea"). J. Ethnobiol. Ethnomed. 9:7.

Molnár Z., Gellény K., Margóczi K., Biró M. 2015. Landscape ethnoecological knowledge base and management of ecosystem services in a Székely-Hungarian pre-capitalistic village system (Transylvania, Romania). Journal of Ethnobiology and Ethnomedicine. 11:3.

Molnár Z. 2012. Traditional ecological knowledge of herders on the flora and vegetation of the Hortobágy. Hortobágy Természetvédelmi Közalapítvány, Debrecen.

Molnár Z., Bartha S., Babai D. 2008. Traditional ecological knowledge as a concept and data source for historical ecology, vegetation science and conservation biology: A Hungarian perspective. in Szabó P, Hedl R. editors. Human Nature. Studies in Historical Ecology and Environmental History. Institute of Botany of the ASCR, Brno, 14-27.

Molnár Z. 2012. Classification of pasture habitats by Hungarian herders in a steppe landscape (Hungary). Journal of Ethnobiology and Ethnomedicine 8:28.

Molnár Z., Babai D. 2009. Népi növényzetismeret Gyimesben I.: növénynevek, népi taxonómia, az egyéni és közösségi növényismeret. Botanikai Közlemények., 96: 117-143.

Morales-Reyes Z., Martín-López B., Moleón M., Mateo-Tomás P., Botella F., Margalida A., Donázar JA., Blanco G., Pérez I., Sánchez-Zapata JA. 2017. Farmer Perceptions of the Ecosystem Services Provided by Scavengers: what, who and to whom. Conservation Letters (early view), DOI: 10.1111/conl.12392

Morris B. 2004. Insects and Human Life. Berg, New York. 320 pp.

Müller-Schwarze D. 2011. The beaver: its life and impact. Cornell University Press.

Nadasdy P. 2005. Hunters and bureaucrats: power, knowledge, and aboriginal-state relations in the southwest Yukon. UBC Press, Victoria.

Nelson RK. 1982. Make prayers to the raven. A Koyukon view of the northern forest. University of Chicago Press.

Neto E. 2006. Bird-spiders (Arachnida, Mygalomorphae) as perceived by the inhabitants of the village of Pedra Branca, Bahia State, Brazil. J Ethnobiol Ethnomed. 2:50.

Neto EMC., Pacheco JM. 2005. Utilização medicinal de insetos no povoado de Pedra Branca, Santa Terezinha, Bahia, Brasil. Biotemas 18:113-133.

Nishida AK., Nordi N., Alves RRDN. 2006. Mollusc gathering in Northeast Brazil: an ethnoecological approach. Human Ecology; 34:133-145.

Nolsøe M. 1997. Trúgv og siðir í sambandi vid útróður í Føroyum. Føroya Fróðskaparfelag, Tórshavn.

Nordi N., Nishida AK., Alves RR. 2009. Effectiveness of two gathering techniques for Ucides cordatus in Northeast Brazil: implications for the sustainability of mangrove ecosystems. Hum. Ecol. 37:121-127.

Nummi P., Holopainen S. 2014. Whole-community facilitation by beaver: ecosystem engineer increases waterbird diversity. Aquat Conserv. 24(5):623–633.

Padmanaba M., Sheil D., Basuki I., Nining L. 2013. Accessing local knowledge to identify where species of conservation concern occur in a tropical forest landscape. Environmental Management 52:348–359.

Panait AC. 1999. Eurasian Beaver (Castor fiber) Former and Proposed Reintroductions in Romania: A Comparative Attitudinal Study. Doctoral dissertation, Department of Life Sciences, Silwood Park, Imperial College London.

Paoletti MG., Buscardo E., Dufour DL. 2000. Edible invertebrates among Amazonian Indians: a critical review of disappearing knowledge. Environment, Development and Sustainability. 2:195-225.

Pascual U., Balvanera P., Díaz S., Pataki G., Roth E., Stenseke M., Watson RT., Dessane EB., Islar M., Kelemen E., Maris V., Quaas M., Subramanian SM., Wittmer H., Adlan A., Ahn SE., SAl-Hafedh Y., Amankwah E., TAsah S., Berry P., Bilgin A., Breslow SJ., Bullock C., Cáceres D., Daly-Hassen H., Figueroa E., Golden CD., Gómez-Baggethun E., González-Jiménez D., Houdet J., Keune H., Kumar R., Ma K., May PH., Mead A., O'Farrell P., Pandit R., Pengue W., Pichis-Madruga R., Popa F., Preston S., Pacheco-Balanza D., Saarikoski H., Strassburg BB. den Belt M., Verma M., Wickson F., Yagi N. 2017. Valuing nature's contributions to people: the IPBES approach. Current Opinion in Environmental Sustainability 26:7-16.

Pawley A. 1994. On the classification of marine animals in Wayan. Science of Pacific Island Peoples. 3:87-107.

Payne NF., Peterson RP. 1986. Trends in complaints of beaver damage in Wisconsin. Wildlife Soc B (1973-2006). 14(3):303-307.

Percino-Daniel N., Buckley D., García-París M. 2013. Pharmacological properties of blister beetles (Coleoptera: Meloidae) promoted their integration into the cultural heritage of native rural Spain as inferred by vernacular names diversity, traditions, and mitochondrial DNA. J. Ethnopharmacol. 147:570-583.

Peršič M., 1998. Dormouse hunting as part of Slovene national identity. Natura Croatica 7(3):199-211.

Petrosillo I., Zurlini G. 2016. The important role of ecological engineers in providing ecosystem services at landscape level. Anim Conserv. 19(6):500-501.

Pieroni A. 2000. Medicinal plants and food medicines in the folk traditions of the upper Lucca Province, Italy. J. Ethnopharmacol. 70:235-273.

Polfus JL., Heinemeyer K., Hebblewhite M. 2014. Comparing traditional ecological knowledge and western science woodland caribou habitat models. Journal of Wildlife Management 78:112–121.

Pollock MM., Wheaton JM., Bouwes N., Volk C., Weber N., Jordan CE. 2012. Working with beaver to restore salmon habitat in the Bridge Creek intensively monitored watershed: Design rationale and hypotheses. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-120. 47 p.

Primack RB. 2006. Essentials of conservation biology (Vol. 23). Sunderland, MA: Sinauer Associates.

Puttock A., Graham HA., Cunliffe AM., Elliott M., Brazier RE. 2017. Eurasian beaver activity increases water storage, attenuates flow and mitigates diffuse pollution from intensively-managed grasslands. Sci Total Environ. 576:430-443.

Răescu CS., Dumbravă-Dodoacă M., Petrovici M. 2011. Macrozoobenthic community structure and dynamics in Cerna River (western Romania). AACL Bioflux. 4:79-87.

Ramos-Elorduy J., Moreno JM., Vázquez AI., Landero I., Oliva-Rivera H., Camacho VH. 2011. Edible Lepidoptera in Mexico: Geographic distribution, ethnicity, economic and nutritional importance for rural people. J. Ethnobiol Ethnomed. 7:1.

Ramos-Elorduy J., Pino-Moreno JM., Morales J. 2002. Análisis químico proximal vitaminas y nutrimentos inorgánicos de insectos consumidos en el Estado de Hidalgo, México. Folia Entomológica Mexicana 41:15-29.

Ramos-Elorduy J. 2006. Threatened edible insects in Hidalgo, Mexico and some measures to preserve them. J. Ethnobiol. Ethnomed. 2:51.

Raymond CM., Fazey I., Reed MS., Stringer LC., Robinson GM., Evely AC. 2010. Integrating local and scientific knowledge for environmental management. Journal of Environmental Management. 91:1766-1777.

Rea AM. 2007. Wings in the desert: a folk ornithology of the Northern Pimans. University of Arizona Press.

Rea AM. 1998. Folk mammalogy of the Northern Pimans. University of Arizona Press, Tucson, AR.

Roba HG., Oba G. 2009. Community participatory landscape classification and biodiversity assessment and monitoring of grazing lands in northern Kenya. Journal of Environmental Management. 90:673-682.

Roba HG., Oba G. 2009. Efficacy of Integrating Herder Knowledge and Ecological Methods for Monitoring Rangeland Degradation in Northern Kenya. Human Ecology. 37:587-612.

Rolland E. 1877-1915. Faune popularie de la France, 15 volumes. Maisonneuve, Paris.

Rosell F., Bozsér O., Collen P., Parker H. 2005. Ecological impact of beavers Castor fiber and Castor canadensis and their ability to modify ecosystems. Mammal Rev. 35(3):248–276.

Salvatori V., Okarma H., Ionescu O., Dovhanych Y., Find'o S., Boitani L. 2002. Hunting legislation in the Carpathian Mountains: implications for the conservation and management of large carnivores. Wildlife Biol. 8(1):3-10.

Santo AR., Guillozet K., Sorice MG., Baird TD., Gray S., Donlan CJ. Anderson CB. 2017. Examining Private Landowners' Knowledge Systems for an Invasive Species. Hum Ecol. 45(4):449–462. https://doi.org/10.1007/s10745-017-9920-7

Schüttler E., Rozzi R., Jax K. 2011. Towards a societal discourse on invasive species management: A case study of public perceptions of mink and beavers in Cape Horn. J Nat Conserv. 19(3):175–184. https://doi.org/10.1016/j.jnc.2010.12.001

Seidel C., Reinhardt K. 2013. Bugging forecast: unknown, disliked, occasionally intimate. Bed bugs in Germany meet unprepared people.PLoS ONE. 8:e51083.

Service CN., Adams MS., Artelle KA., Paquet P., Grant LV., Darimont CT. 2014. Indigenous knowledge and science unite to reveal spatial and temporal dimensions of distributional shift in wildlife of conservation concern. PLoS ONE. 9:e101595.

Silvano RAM., Valbo-Jørgensen J. 2008. Beyond fishermen's tales: contributions of fishers' local ecological knowledge to fish ecology and fisheries management. Environment, Development and Sustainability 10:657.

Small BA., Frey JK., Gard CC. 2016. Livestock grazing limits beaver restoration in northern New Mexico. Restor Ecol. 24(5):646-655.

Smeraldo S., Di Febbraro M., Ćirović D., Bosso L., Trbojević I., Russo D. 2017. Species distribution models as a tool to predict range expansion after reintroduction: A case study on Eurasian beavers (Castor fiber). J Nat Conserv. 37:12-20.

Solís L., Casas A. 2019. Cuicatec ethnozoology: traditional knowledge, use, and management of fauna by people of San Lorenzo Pápalo, Oaxaca, Mexico. Journal of ethnobiology and ethnomedicine, 15(1):58.

Sõukand R., Kalle R., Svanberg I. 2010. Uninvited guests: Traditional insect repellents in Estonia used against the clothes moth *Tineola bisselliella,* human flea *Pulex irritons* and bedbug *Cimex lectularius.* J. Insect Sci. 10:150.

South A., Rushton S., Macdonald D. 2000. Simulating the proposed reintroduction of the European beaver (Castor fiber) to Scotland. Biol Conserv. 93(1):103-116.

Souza SP., Begossi A. 2007. Whales, dolphins or fishes? The ethnotaxonomy of cetaceans in São Sebastião, Brazil. Journal of Ethnobiology and Ethnomedicine 3:9.

Ståhlberg S., Svanberg I. 2010. Gathering food from rodent nests in Siberia. Journal of Ethnobiology 30:184-202.

Stearns REC. 1887. Ethno-conchology: A study of primitive money. Report of the United States National Museum for the year ending June 30, 1887 (Pt. 2 of the Annual Report of the Board of Regents of the Smithsonian Institution for the year ending June 30, 1887.). 297-334.

Stoffyn-Egli P., Willison JHM. 2011. Including wildlife habitat in the definition of riparian areas: The beaver (Castor canadensis) as an umbrella species for riparian obligate animals. Environ Rev. 19:479–493. https://doi.org/10.1139/A11-019.

Strindberg A. 1882. Svenska folket i helg och söcken, i krig och i fred, hemma och ute eller Ett tusen år af svenska bildningens och sedernas historia. 1. Fritze, Stockholm.

Stringer AP., Gaywood MJ. 2016. The impacts of beavers Castor spp. on biodiversity and the ecological basis for their reintroduction to Scotland, UK. Mammal Rev. 46(4):270–283. https://doi.org/10.1111/mam.12068

Svanberg I., Łuczaj Ł., Pardo-de-Santayana M., Pieroni A. 2011. History and current trends of ethnobiological research in Europe. In Anderson EN., Pearsall D., Hunn E., Turner NJ. (eds.) Ethnobiology. Hoboken N.J.: Wiley-Blackwell. pp. 191–214.

Svanberg I. 2006. Black slugs (*Arion ater*) as grease: a case study of technical use of gastropods in pre-industrial Sweden. J. Ethnobiol. 26:299-309.

Svanberg I. 2007. Human usage of mermaid's glove sponge (Isodictya palmata) on the Faroes. J. Mar. Biol. Assoc. UK. 87:1773-1775.

Svanberg I. 2006. Humlehonung, korstroll och ålamask: etnobiologiska essäer om evertebrater i Norden och Estland. Uppsala University, Uppsala. 84 pp.

Svanberg I. 2011. »Hans kött förtäres sannolikt blott av zigenare«: Människan och igelkotten på Balkanhalvön. In: Gildea, C. F. (ed.) El Mago: Vänskrift till Ingmar Söhrman på hans 60-års födelsedag den 9 december 2010. Göteborg.

Swahn J-Ö. 2004. The cultural history of crayfish. Bulletin français de la pêche et de la pisciculture; 372-373:243-251.

Szabó L., Heltai M., Lanszki J., Szűcs E. 2007. An indigenous predator, the golden jackal (Canis aureus L., 1758) spreading like an invasive species in Hungary. Bull USAMV-CN. 63:1-6.

Tálasi I. 1936. A Kiskunság népi állattartása. Néprajzi füzetek.

Tendeng B., Asselin H., Imbeau L. 2016. Moose (Alces americanus) habitat suitability in temperate deciduous forests based on Algonquin traditional knowledge and on a habitat suitability index. Écoscience 23:77-87.

Tengö M., Brondizio ES., Elmqvist T., Malmer P., Spierenburg M. 2014. Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach. Ambio 43:579-591.

Tidemann S., Gosler A. 2010. Ethno-Ornithology: birds, indigenous peoples, culture and society. Earthscan, London.

Törnblom J., Angelstam P., Hartman G., Henrikson L., Sjöberg G. 2011. Toward a research agenda for water policy implementation: Knowledge about beaver (Castor fiber) as a tool for water management with a catchment perspective. Balt For. 7(1):154-161.

Toussaint-Samat M. 1987. Histoire naturelle et morale de la nourriture. BORDAS Paris.

Turner N. 2008. The earth's blanket: traditional teachings for sustainable living. D & M Publishers, Vancouver, Toronto.

Turner NJ. 2014. Ancient Pathways, Ancestral Knowledge: Ethnobotany and Ecological Wisdom of Indigenous Peoples of Northwestern North America, McGill-Queen's University Press, Montreal and Kinsgston.

Turnock D. 1993. Geography in the New Romania. GeoJournal. 29(1):5-8.

Turvey ST., Fernández-Secades C., Nuñez-Miño JM., Hart T., Martinez P., Brocca JL., Young RP. 2014. Is local ecological knowledge a useful conservation tool for small mammals in a Caribbean multicultural landscape? Biological Conservation, 169:189-197.

Ulicsni V. 2012. Vadonélő emlősfajok etnobiológiája Szilágynagyfalun (Folk knowledge of non-domestic animals among ethnic Hungarians in North-Western Romania). BSc Thesis, Szegedi Tudományegyetem Természettudományi és Informatikai Kar Ökológiai Tanszék, Szeged, Hungary [in Hungarian].

Ulicsni V., Svanberg I., Molnár Z. 2013. Folk knowledge of non-domestic mammals among ethnic Hungarians in North-Western Romania. North-Western Journal of Zoology 9:383-398.

Ulicsni V., Svanberg I., Molnár Z. 2016. Folk knowledge of invertebrates in Central Europe-folk taxonomy, nomenclature, medicinal and other uses, folklore, and nature conservation. Journal of Ethnobiology and Ethnomedicine 12:47.

Ulicsni V., Babai D., Vadász C., Vadász-Besnyői V., Báldi A., Molnár Z. 2019. Bridging conservation science and traditional knowledge of wild animals: The need for expert guidance and inclusion of local knowledge holders. Ambio. 48(7):769-778.

Uprety Y., Asselin H., Bergeron Y., Doyon F., Boucher JF. 2012. Contribution of traditional knowledge to ecological restoration: practices and applications. Écoscience 19:225-237.

Vallejo JR., González JA. 2015. The medicinal use of leeches in contemporary Spain: between science and tradition. Acta Medico-Historica Adriatica. 13:131-158.

Vallejo JR., González JA. 2013. The use of the head louse as a remedy for jaundice in Spanish folk medicine: an overview. J Ethnobiol Ethnomed. 9:52.

Varga Z. 1997. Biogeographical outline of the invertebrate fauna of the Aggtelek Karst and surrounding areas. In Research in Aggtelek National Park and Biospherre Reserve. ANP Directorate, Aggtelek, Hungary. 87-94.

Venables WN., Ripley BD. 2002. Modern Applied Statistics with S. Fourth Edition. Springer, New York.

Voorhees H, Sparks R, Huntington HP, Rode KD. 2014. Traditional knowledge about polar bears (Ursus maritimus) in Northwestern Alaska. Arctic. 67:523–536.

Walker DN. 2000. Preliminary bibliography on dogs and wolves stressing their prehistoric and historic occurence, hybridisation and domestication. British Archaeological Reports (BAR) International Series 23:313-343.

Wepukhulu DM. 1992. Bukusu Ethnozoology (Invertebrates) – II. (unpublished manuscript) University of Kenya, Mombasa, Kenya. 17 pp.

Wiggen G. 2008. Zoologisk nomenklatur och folketradisjonelle dyrenemningar: ei påminning om etnozoologi som møtespunkt for natur- og kulturutdanning med døme frå limnofaunaen og andre virvellause dyr. Namn og nemne. 25:11-48.

Wigley TB., Garner ME. 1987. Landowner perceptions of beaver damage and control in Arkansas. – In: Holler, R. N. ed.: Proceedings of the third eastern wildlife damage control conference. Gulf State Park, Alabama, Gulf Shores, US.

Wiklund KB. 1916. Lapska namn på ren-oestriderna och deras larver. Le Monde Oriental. 10:183-191.

Wohl E. 2015. Of wood and rivers: bridging the perception gap. WIRES: Water. 2(3):167-176.

Wright JP., Jones CG., Flecker AS. 2002. An ecosystem engineer, the beaver, increases species richness at the landscape scale. Oecologia. 132(1):96-101.

Zagrobelny M., Dreon AL., Gomiero T., Marcazzan GL., Glaring MA., Møller BL., Paoletti MG. 2009. Toxic moths: sources of a truly safe delicacy. J. Ethnobiol. 29:64-76.

Ziembicki MR., Woinarski JCZ., Mackey B. 2013. Evaluating the status of species using Indigenous knowledge: Novel evidence for major native mammal declines in northern Australia. Biological Conservation 157:78–92.

Зеленин ДК. 1929-30. Табу слов у народов восточной Европы и северной Азии. Сборник музея антропологии и этнографии 8-9.

9. LIST OF PUBLICATIONS

Ulicsni Viktor, Babai Dániel, Juhász Erika, Molnár Zsolt, Biró Marianna 2020. Local knowledge about a newly reintroduced, rapidly spreading species (Eurasian beaver) and perception of its impact on ecosystem services. PLoS ONE, 15(5), e0233506. IF: 2,740

Biró Marianna, Molnár Zsolt, Öllerer Kinga, Lengyel Attila, Ulicsni Viktor, Szabados Klára, Kiš Alen, Perić Ranko, Demeter László, Babai Dániel 2020. Conservation and herding co-benefit from traditional extensive wetland grazing. Agriculture, Ecosystems & Environment, 300, 106983. IF: 4,241

Varga Anna, Demeter László, Ulicsni Viktor, Öllerer Kinga, Biró Marianna, Babai Dániel, Molnár Zsolt 2020. Prohibited, but still present: Local and traditional knowledge about the practice and impact of forest grazing by domestic livestock in Hungary. Journal of Ethnobiology and Ethnomedicine, 16(1), 1-12. IF: 2,264

Ulicsni Viktor, Babai Dániel Folk knowledge of wild animals in the Slovenian-Hungarian borderland. Acta Ethnographica Hungarica. (in press)

Babai Dániel, Szépligeti Mátyás, Tóth Antónia, Ulicsni Viktor Traditional ethnobotanical knowledge and the cultural significance of plants in Hungarian communities of Slovenia. Acta Ethnographica Hungarica. (in press)

Ulicsni Viktor, Molnár Zsolt 2019. Vadon élő állatokhoz kapcsolódó hagyományos tudás a Hortobágyon [Contribution to herders' folk knowledge of wild animals in the Hortobágy region] in Tóth Albert, Tóth Csaba (2019, eds.) A Hortobágyi Természetvédelmi Kutatótábor 45 éve. Alföldkutatásért Alapítvány, Kisújszállás.

Juhász Erika Mária, Biró Marianna, Ulicsni Viktor, Molnár Zsolt 2019. Természetvédők és kutatók ismeretei az eurázsiai hód kapcsán a Kárpát-medencében I.: elterjedés, életnyomok, az együttélés lehetőségei, az elhullás okai. Természetvédelmi Közlemények, 25, 59-79.

Ulicsni Viktor, Babai Dániel, Vadász Csaba, Vadász-Besnyői Vera, Báldi András, Molnár Zsolt 2019. Bridging conservation science and traditional knowledge of wild animals: The need for expert guidance and inclusion of local knowledge holders. Ambio, 1-10. IF: 4,103

Ispán Ágota Lídia, Babai Dániel, Mód László, Ulicsni Viktor, Mészáros Csaba 2018. Complex Ethnographic Research Methods for the Study of Protected Areas and Border Communities at the Slovenian-Hungarian Border1. Acta Ethnographica Hungarica, 63(2), 471-500.

Babai Dániel, Ulicsni Viktor, Avar Ákos 2017. Conflicts of Economic and Cultural Origin Between Farmers and Wild Animal Species in the Carpathian Basin - an Ethnozoological Approach. Acta Ethnographica Hungarica. 62(1), 187-206.

Juhász Erika, Babai Dániel, Biró Marianna, Molnár Zsolt, Ulicsni Viktor 2017. Az eurázsiai hód (*Castor fiber*) táplálkozási és fásszárú-használati szokásaival kapcsolatos helyi tudás két évtizeddel a visszatelepítések kezdete után a Kárpát-medencében [Local ecological knowledge on feeding habits and woody plant species usage of the reintroduced Eurasian beaver (*Castor fiber*) in the Carpathian Basin two decades after its reintroduction]. Természetvédelmi Közlemények. 23, 182-200.

Babai Dániel, Avar Ákos, Ulicsni Viktor 2016. „Veszélyes a varas béka, rossz fajzat!" – Az etnozoológia jelentősége és feladata a 21. Században [”The warty frog is dangerous, maleficent kind" The significance and importance of ethnozoology in the 21st century]. Kovász. 1, 3-29.

Ulicsni Viktor, Svanberg Ingvar, Molnár Zsolt 2016. Folk knowledge of invertebrates in Central Europe-folk taxonomy, nomenclature, medicinal and other uses, folklore, and nature conservation. Journal of Ethnobiology and Ethnomedicine, 12(1), 47. IF: 1,903

Varga Anna, Molnár Zsolt, Biró Marianna, Demeter László, Gellény Krisztina, Miókovics Eszter, Molnár Ábel, Molnár Krisztina, Ujházi Noémi, Ulicsni Viktor, Babai Dániel 2016. Changing year-round habitat use of extensively grazing cattle, sheep and pigs in East-Central Europe between 1940 and 2014: Consequences for conservation and policy. Agriculture, Ecosystems & Environment. 234, 142-153. IF: 4,099

Ulicsni Viktor, Svanberg Ingvar, Molnár Zsolt 2013. Folk knowledge of non-domestic mammals among ethnic Hungarians in North-Western Romania. North-Western Journal of Zoology 9(2), 383-398. IF: 0,7

10. AUTHORS' CONTRIBUTIONS

For ”Folk knowledge of non-domestic mammals in North-Western Romania” (4.1) and ”Folk knowledge of invertebrates in the Carpathian Basin” (4.2) ZsM and UV have prepared the conception and design of the project. UV undertook the data gathering. ZsM, UV, and IS were involved in analysing data as well as drafting and writing the manuscript. For ”Predicting the observed level of local familiarity with wild animal species” (4.3) ZsM, BA, BD and UV have prepared the conception and design of the project. VCs, VB, MZs and UV undertook the data analysis. UV, MZs, BD, BA, VCs and VB were involved in analysing data as well as drafting and writing the manuscript. For ”Local knowledge of some key features of European beavers” (4.4) BM, ZsM, BD and UV have prepared the conception and design of the project. UV, BD, BM undertook the data gathering. BM, UV, BD, MZs, JE and UV undertook the data analysis. UV, BM, MZs, BD and JE were involved in analysing data as well as drafting and writing the manuscript.

11. ÖSSZEFOGLALÓ

A tájjal szoros kapcsolatban élő emberek ökológiai ismereteire vonatkozó kutatások világszerte növekvő figyelmet kapnak (lásd pl. IPBES - Pascual és mtsai 2017, vagy Díaz és mtsai 2018). Nincs ez másként Magyarországon sem, hiszen az ezen a területen végzett kutatások hazánkban is egyre jelentősebbé váltak az elmúlt 10 évben (Molnár et al. 2008). Hagyományosan az etnozoológiai kutatások elsősorban a gerinces fajok népi taxonómiájának alapkutatására és néhány további, az emberek számára különösen fontos, feltűnő taxon vizsgálatára fókuszáltak. Ezen disszertáció e két téma vizsgálata mellett (Ulicsni et al. 2013) a gerinctelenekkel kapcsolatos ismeretek (Ulicsni et al. 2016) és az ökológiai/természetvédelmi kérdések célzottabb tanulmányozását (Ulicsni et al. 2018, 2020) tűzte ki célul. A népi taxonómia leírása mellett célunk volt a helyiek által ismert vadon élő állatfajok morfológiai, ökológiai és kulturális jellegzetességeik alapján történő elkülönítésének leírása, valamint az ökoszisztéma-szolgáltatások és a nem kívánt ökoszisztéma-szolgáltatások (disservice) helyi megítélésének vizsgálata egy visszatelepített és inváziósan terjedő kulcsfaj (az eurázsiai hód) kapcsán. A disszertáció által tárgyalt harmadik fő kérdéskört az akadémiai tudásban a hagyományos tudás helyére, megismerési módjára vonatkozóan jelen lévő tudáshiány (Tengö et al. 2014) csökkentése érdekében végzett kutatások teszik ki.

Az első két vizsgálatban három régióban (egy-egy romániai, szlovákiai és horvátországi) dokumentáltuk a vadon élő gerinctelenekre és egy romániai tájban a vadonélő emlősökre vonatkozó népi ismereteket. Felsoroltuk a népi taxonok listáját, vizsgáljuk a hagyományos ökológiai tudáson alapuló taxonómiát és nómenklatúrát, a legfontosabb tulajdonságokat, felhasználásokat, a kapcsolódó közmondásokat, valamint a természetvédelmi vonatkozásokat. Különös figyelmet szentelünk a települések közelében esetlegesen előforduló gerinctelen fajokra (fajcsoportokra) vonatkozó ismeretek vizsgálatára. Az adatgyűjtés során az egyes taxonok beazonosítására fényképeket használtunk, valamint félig strukturált interjúkat készítettünk, és a helyiekkel képcsoportosítást (pile sorting) végeztettünk.

Vizsgálataink során 42 emlős és 208 gerinctelen népi taxonra vonatkozó ismereteket dokumentáltunk. Ezek közé számos olyan faj is tartozott, amelyek tudomásunk szerint gazdasági jelentőséggel nem bírnak. A tudás megbízhatósága magas volt, bár egyes adatközlők néha hajlamosak voltak a túlzásra. A népi taxonok 93%-ának volt saját egyedi neve, és a taxonok 90%-a a népi taxonómiába jól beágyazódott. A népi taxonómiai csoportok többnyire azonosak voltak a tudományos osztályozás csoportjaival. A fajok 36%-át az adatközlők legalább fele ismerte.

Az ismert népi taxonok tulajdonságai morfológiai, etológiai-ökológiai és kulturális elválóságuk (szálienciájuk) alapján kerültek leírásra. A fizikai megjelenés esetében a prototípus megnevezése, és az ahhoz való viszonyítás volt jellemző jelenség a rendszertani besorolásoknál. Az ökológiai elválóság szempontjából a táplálkozás, a mozgásforma, az élőhely, a szaporodási jellemzők, a hang, az éves és a napi viselkedési minta, valamint a megfigyelhetőség volt fontosabb jellemző. A kulturális elválóság szempontjából az okozott kár és a fajok által szerzett haszon jellemzése volt kiemelkedő. A fajok túlnyomó többségét személyes tapasztalatok alapján ismerték adatközlőink, míg a könyvek és a média hatása elhanyagolható volt.

A gerinctelenek közül 24 faj (taxon) közvetlen felhasználása volt regisztrálható (4 gyógyszerként, 5 táplálékként, 11 horgászcsaliként, 2 játékként). Az irodalomból korábban nem ismert jelenségként leírásra került a fadongófajok (*Xylocopa violacea, X. valga*) mézgyomrának fogyasztása. 30 taxonnal kapcsolatban említettek közmondást, vagy időjárás-előrejelzéshez, illetve a termés mennyiségének és minőségének előrejelzéséhez kapcsolódó megfigyelést. A gerinctelenek tudatos kímélete, védelme csak néhány taxonnál fordult elő, de az adatközlők többsége ennél több faj elpusztításától tartózkodik. Néhány esetben a fajok egyetemes jelentősége is említésre került, ami a természet egészének működését érintő népi bölcsességnek tekinthető. A gerinctelenek túlnyomó többségét viszont alapvetően károsnak tekintették és amikor alkalmuk volt rá, elpusztították vagy legalább elpusztításra érdemesnek tekintették azokat. Nem találtunk azonban bizonyítékot arra, hogy a gerinctelen fajok tudatos pusztítása eredményeként bármely faj populációja érzékelhető csökkenést szenvedett volna el.

Az ismert népi állattaxonok nagy száma (383 népi fajszintű taxon a háziállatok nélkül) és a rájuk vonatkozó részletes ismeretek alapján elmondhatjuk, hogy jelentős mennyiségű tudás van jelen a vizsgált közösségekben. Eredményeink alapján azt valószínűsítjük, hogy hasonló mértékű tudás lehet jelen Közép-Európa más tájegységeiben is, amely felderítésre, további vizsgálatok végzésére érdemes.

A természet- és társadalomtudományok legkülönbözőbb területeiről jövő szakértők sora hívta már fel a figyelmet az akadémiai tudomány, valamint az őslakos- és helyi tudásrendszerek közötti közös tudásalkotás erősítésének jelentőségére. Úgy tűnik, az együttműködés egyik fő akadálya a tudomány oldaláról, hogy a természettudósoknak nincs tapasztalatuk arról, hogy hol érdemes keresni, és hogyan lehet megszerezni a hagyományos ismereteket. Megvizsgáltuk, hogy az egyes taxonok kapcsán zoológusok, vagy egy jelleg-alapú lineáris modell tudja jobban megjósolni a vadon élő állatfajokkal kapcsolatos helyi ismeretek szintjét. Eredményeink alapján sem a modell, sem a zoológusok nem bizonyultak kellően pontosnak a becslést illetően (70%, illetve 60%). A pontatlanság valószínűleg túlnyomó részt a fajok helyi ökológiai és kulturális sajátosságainak elégtelen ismeretéből származik. Összességében elmondható, hogy több helyi ismeret regisztrálható, mint ami a zoológusok várakozása. A közös tudásalkotás során releváns fajok megtalálásának pontosságát javíthatja a helyi ökológiai tudás és kultúra megértése. Ehhez pedig a hagyományos zoológiai ismereteket tanulmányozó szakértők és maguk a helyi tudás birtokosainak hozzájárulása, aktív részvétele szükséges.

Jelentős tudáshiány tapasztalható a visszatelepített őshonos fajoknak helyi közösségek által érzékelt ökoszisztéma-szolgáltatásokra és a helyi közösségek megélhetésére gyakorolt hatásaival kapcsolatban. Két magyarországi és egy romániai, ökológiai jellemzőiben jelentősen eltérő, változatos vidéki tájban vizsgáltuk az eurázsiai hódra vonatkozó helyi ismereteket, a helyi lakosok által érzékelt ökoszisztéma-szolgáltatásokra gyakorolt hatásukat, valamint kárósságuk és hasznosságuk észlelését. Fő vizsgálati módszerünk strukturált interjúk készítése volt a hódokkal kapcsolatban részletesebb ismeretekkel rendelkező és véletlenszerűen kiválasztott helyi adatközlőkkel. A megkérdezettek többsége jól tájékozott volt a hódok védettségével, biológiájával és viselkedésével, valamint a természetre és az ökoszisztéma-szolgáltatásokra gyakorolt különféle hatásaival kapcsolatban. Míg az ellátó (provisioning) szolgáltatásokra vonatkozó helyi percepciók szinte kizárólag negatív hatásokat jelentettek, a szabályozó és kulturális szolgáltatásokkal kapcsolatban negatív és pozitív, illetve ellentmondásos hatások is említésre kerültek. A hódok által okozott tényleges és potenciális károk ellenére a legtöbb megkérdezett esetében jellemző volt egy pozitív attitűd irányukban, amelyet főként a faj „aranyos″ megjelenésével és összetett építményeikkel magyaráztak. Úgy gondoljuk, hogy a természetvédők és a helyiek közötti kommunikációnak figyelembe kellene vennie a helyi percepciók komplexitását, a különböző érdekcsoportok közötti kölcsönös tanulás pedig hozzájárulhat a helyi konfliktusok mérsékléséhez, és az adaptív kezelési stratégiák kidolgozásához.

Felmerülhet a kérdés, hogy miért érdemes tanulmányozni az állatokra vonatkozó hagyományos tudást egy olyan, zoológusok által évszázadok óta kutatott területen, mint a Kárpát-medence. Erre a kérdésre számos válasz adható. A tudomány fő célja a világ jelenségei egészének a leírása. Az kultúrantropológia és az etnobiológia meghatározott embercsoportok helyi ismereteit írják le. Minden jel arra mutat, hogy a modern gazdaság és a közoktatás kettős hatásának erőssé válása előtt a Kárpát-medencében földművelésből és állattenyésztésből élő emberek ugyanolyan részletes ismeretekkel rendelkezhettek természeti környezetükről, mint például Amazónia eldugott vidékeinek őslakosai napjainkban. Ezen érvelés alapját a 19. század végéről és a 20. század elejéről származó néprajzi munkák sora adja. Ennek ellenére a hagyományos zoológiai ismeretek Európában csak nagyon kis arányban kerültek lejegyzésre: noha a legfontosabb állatfajok helyi neveit néprajzkutatók és nyelvészek összegyűjtötték (Magyarországon pl. Jolsvay et al. 1977, Lőrinczy 1979-2002), a helyi ökológiai tudás túlnyomó részét (zoológiai ismereteik korlátossága, és eltérő tudományos érdeklődésük miatt) nem dokumentálták és publikálták kellőképpen.

A helyiek és a természetvédelmi szakemberek gyakran eltérő indikátorokat használnak bizonyos ökoszisztéma-szolgáltatások értékelésére, és eltérő szempontokból szemlélik a helyi ökoszisztéma-szolgáltatásokra gyakorolt hatásokat is. A biodiverzitás jelentőségének értékelése is többnyire eltérő e két csoport esetében. A természetvédelem és a nagy ökológiai tudással bíró (valamint az eredmények alapján a szabályozó ökoszisztéma-szolgáltatások érzékelésére nagyobb fogékonyságot mutató) helyiek között folytatott kommunikáció nagyban növeli a kompromisszumok létrejöttét a tájgazdálkodásban.

A zoológusok körében megfigyelhető magas szintű bizonytalanság a helyi közösségekben fellelhető ökológiai ismeretek becslésében (30–40%) azt mutatja, hogy nem lehet elvárni a korlátozott hagyományos tudással rendelkező akadémiai kutatóktól, hogy azonosítsák a közös tudásalkotáshoz megfelelő célfajokat, és ezáltal hidat építsenek a két tudásrendszer között. Ez a bizonytalanság olyan etikai kérdéseket is felvet, mint például, hogy mennyire helyes a természeti környezetünk állapotáról értékeléseket készítő tudósokat (pl. a CBD-ben vagy az IPBES-ben) arra szorítani, hogy olyan tudományterületeket hozzanak be a döntéshozásba, amelyeket nem ismernek. Ez a tudóstársadalmat érintő kényszer kedvezőtlen hatással van a különböző nézőpontok elismerésére, és magával vonja a kizárólag külsős szempontokra építő negatív gyakorlatot is. Ezáltal sem a helyi, sem a külső szakértők tudását nem kezeli megfelelően a rendszer, ezzel nagyban akadályozva a hatékony közös tudásalkotás lehetőségeit. A tudásrendszerek együttműködése ennek ellenére alapvető jelentőségű, folyamatosan keresni kell a megfelelő módozatait.

Több tudásrendszer együttműködésén alapuló kutatások egyesíthetik a különféle ontológiai és episztemológiai rendszerek előnyeit azáltal, hogy az együttműködésen alapuló kutatás nagyban hozzájárulhat a tudáshiányok kiküszöböléséhez, ami minden, a folyamatban résztvevő érdekelt számára különösen előnyös lehet (Raymond et al. 2010). Kijelenthetjük, hogy a különböző tudásrendszereknek a döntéshozatalban való nem egyenlő részvétele és a helyi ismeretek alulbecslése akadályozhatja ezeket a folyamatokat, kevésbé hatékony együttműködéshez, és akár az erőforrások pazarlásához is vezethet, például olyan esetekben, amikor a természetvédelmi szakemberek kommunikációja nincs összhangban a célfajokra/fajcsoportokra vonatkozó helyi tudással.

Tapasztalataink és széleskörűen alátámasztott eredmények alapján a hagyományos tudás, illetve maguk a hagyományos tudás ismerői nagyban hozzájárulhatnak a fajok és élőhelyek védelméhez, valamint a biológiai sokféleség fenntartható használatához, és nagymértékben növelhetik a természetmegőrzés szükségességének tudatosságát. Ezeken túlmenően az inkluzív természetvédelmi megközelítésnek nemcsak a helyiek tudását, hanem a helyi gazdasági és szociokulturális szempontokat is érdemes figyelembe vennie (például a helyi értékeken és hiedelmeken alapuló percepciókat), ezzel elősegítve a helyi – gyakran még mindig fenntartható – földhasználati gyakorlatok folytatásához szükséges ismeretek megőrzését és továbbadását.

A tudóstársadalom feladata, hogy megismerje, megőrizze és használja az állatokhoz kapcsolódó tudást, ugyanakkor a zoológusok feladata az is, hogy dekolonizálják megközelítésüket, nyissanak a hagyományos ökológiai tudás felé, és megtanulják, hogyan működjenek együtt a helyi közösségekkel. Úgy gondoljuk, hogy a tudásrendszerek hatékonyabb összekapcsolása növelheti e célok megvalósulásának esélyeit, és javíthatja az együttműködést a természetvédelmi gyakorlat, az akadémiai tudomány, valamint a hagyományos és helyi tudás ismerői között.

12. SUMMARY

Research on ecological knowledge of people living in rural areas is receiving increased attention worldwide (see e.g. IPBES – Pascual et al. 2017 or Díaz et al. 2018), and research on this field has also become more significant in Hungary in the last 10 years (Molnár et al. 2008). Traditionally, ethnozoologists were primarily interested in basic research on the folk taxonomy of vertebrate species and more direct examination of some highly salient taxa which have direct relevance to people. In this thesis, in addition to the examination of these two topics (Ulicsni et al. 2013), a more targeted study of invertebrate-related knowledge (Ulicsni et al. 2016) and ecological/conservation issues (Ulicsni et al. 2018, 2020) were targeted. Besides recording folk taxonomy, our aim was to describe the morphological, ecological and cultural salient features of wild animal species, to examine the local perceptions of ecosystem services and disservices related to a reintroduced and invasively spreading keystone species. The last main topic of the thesis has been spranged by the fact that there is a lack of experience among academic scientists regarding where and how traditional knowledge can be found and obtained (Tengö et al. 2014).

In the first two topics we made the documentation of folk knowledge on wild mammals in one (Romanian) and invertebrates in three regions, in Romania, Slovakia and Croatia. We provided a list of folk taxa, and discuss folk biological classification and nomenclature, salient features, uses, related proverbs, sayings, and conservation. We studied "all" invertebrate species (species groups) potentially occurring in the vicinity of the settlements. We used photos, held semi-structured interviews, and conducted picture sorting.

We documented 42 mammal and 208 invertebrate folk taxa. Many species were known which have, to our knowledge, no economic significance. 36% of the species were known to at least half of the informants. Knowledge reliability was high, although informants were sometimes prone to exaggeration. 93% of folk taxa had their own individual names, and 90% of the taxa were embedded in the folk taxonomy. Folk taxonomical groups were mostly identical to the groups of the scientific classification.

The characteristics of the known folk taxa were described according to their morphological, ethological-ecological and cultural salience. In the case of physical appearance, naming of a prototype and comparison to it was typical. In terms of ecological salience feeding habit, characteristics of movement, habitat, breeding habit, bashfulness, voice, annual and daily pattern of behaviour, and observability were the most important characteristics. In terms of cultural salience, characterization of harm caused and benefit gained was unequivocally dominant. The overwhelming majority of the species were known through personal experience. The effect of books and the media was negligible.

Among insects 24 species were of direct use to humans (4 medicinal, 5 consumed, 11 as bait, 2 as playthings). Completely new was the discovery that the honey stomachs of black-coloured carpenter bees (*Xylocopa violacea*, *X. valga*) were consumed. 30 taxa were associated with a proverb or used for weather forecasting, or predicting harvests. Conscious ideas about conserving invertebrates only occurred with a few taxa, but informants would generally refrain from harming some species. We did not find any mythical creatures among invertebrate folk taxa. Almost every invertebrate species was regarded as basically harmful. Where possible, they were destroyed or at least regarded as worth eradicating. However, we could find no evidence to suggest any invertebrate species had suffered population loss as a result of conscious destruction. Sometimes knowledge pertaining to the taxa could have more general relevance, and be regarded as folk wisdom concerning the functioning of nature as a whole.

The high number of known folk taxa suggests that it would be worth conducting further investigations in other areas of Europe.

Many people call for strengthening knowledge co-production between academic science and indigenous and local knowledge systems. A major barrier to cooperation seems to be a lack of experience regarding where and how traditional knowledge can be found and obtained. We examined whether the expert judgment of academic zoologists or a feature-based linear model is better at predicting the observed level of local familiarity with wild animal species. Neither the zoologists nor the model proved sufficiently accurate (60% and 70%, respectively), with the inaccuracy probably resulting from inadequate knowledge of the local ecological and cultural specificities of the species. This indicates that more knowledge is likely to come from local knowledge than zoologists would expect. Accuracy of targeting the relevant species for knowledge co-production could be improved through specific understanding of the local culture, provided by experts who study traditional zoological knowledge and by local knowledge holders themselves.

There is a knowledge gap concerning ecological knowledge and perception of local community members regarding the impact of reintroduced native species on local ecosystem services and livelihoods. We studied local knowledge of beavers and the perception of their impact on ecosystem services and local livelihoods, and the perception of their general harmfulness and usefulness in Hungary and Romania in three ecologically distinct, diverse rural landscapes. Structured interviews were carried out with knowledgeable and randomly selected local informants. We found that locals were knowledgeable about legal status, biology and behavior of beavers and their diverse impact on nature and ecosystem services. Perceptions included mostly negative impacts on provisioning services, while both negative and positive impacts on regulating and cultural services were perceived, including some contradictory impacts of the species. In spite of the actual and anticipated potential future harms caused by beavers, most people appreciated its precise building mastery and 'cute' nature. We argue that communication between nature conservationists and locals should reflect this complexity of perceptions, while reciprocal learning could help to moderate local conflicts and develop adaptive management strategies.

Biologists may ask why one should study folk knowledge of animals in a region so often studied by zoologists for centuries. There are several answers to this question. The main goal of science is to describe the world. The disciplines of anthropology and ethnobiology describe the local knowledge of specific groups of people. We argue, that before the dual impact of the modern economy and public education became so powerful, Hungarian rural people might have possessed knowledge as deep as that of, for example, the natives of Amazonia. Ethnographic works from the late 19th and early 20th centuries provide the basis for this argument. In spite of this documentation of folk zoological knowledge in Europe is very limited. Although the names of the most important wild animals have been collected by ethnographers and linguists (in Hungary, e.g. Jolsvay et al. 1977, Lőrinczy 1979-2002), folk zoological knowledge was not documented and published sufficiently due to the limits of theoretical and personal zoological knowledge and, also, due to the varying range of scientific interests.

Locals and conservationists often use different indicators to assess certain ecosystem services and they also view impacts on the local ecosystem services from different perspectives. Their understanding of biodiversity is also different. Communication with knowledgeable locals who are – as our results show - generally more receptive to regulating services could lead to satisfactory compromises and understanding in management.

High level of uncertainty among zoologists in estimating local familiarity (30-40%) shows, that it may be unrealistic to expect academic zoologists with limited understanding of traditional zoological knowledge to identify adequate target species for knowledge co-production and thus bridge knowledge systems. It also raises ethical issues, for example, how correct it is to push scientists preparing assessments (e.g. in CBD or IPBES) to do reviews in areas they are not familiar with. It induces unfavorable bias in recognition given to different perspectives, and also imply the negative practice relying solely on external perspectives. This way both the local and external experts are treated unfairly which hinders the possibilities of the effective knowledge co-production.

Cooperative research based on more than one knowledge system can unite the benefits of different ontological and epistemological systems. Cooperative research can eliminate knowledge gaps, which can benefit all stakeholders who are actively involved in the process (Raymond et al. 2010). We argue that bias and underestimation of local knowledge can hinder these processes, can lead to less efficient cooperation and even waste resources, for example, if communication of conservationists is not adjusted well to the knowledge locals have of target species and species groups.

It is our sincere hope that traditional knowledge holders and their knowledge can thus more effectively promote the protection of species and habitats and the sustainable use of biodiversity, and increase awareness of the need for conservation. Inclusive conservation approaches can take into account not only the knowledge of locals but also local economic and socio-cultural aspects (e.g. perceptions based on local values and beliefs). Better recognition of local knowledge could also help the preservation and transmission of local knowledge necessary for the continuation of local – often still sustainable – land-use practices.

It is the scholars' responsibility to learn, archive and use the knowledge connected to animals, meanwhile, zoologists would have the opportunity to decolonize their approaches, open up to traditional knowledge, and learn how to work in collaboration with local people. We believe that a more efficient bridging of knowledge systems could increase the chances of success and lead to improved cooperation between conservation practice, academic science, and indigenous and traditional knowledge holders.

13. APPENDIX

Appendix 1 Data base of invertebrate folk knowledge among Hungarians in Szilágyság, Drávaszög and Gömör

Latin equivalent, English scientific name and Hungarian vernacular names of 208 invertebrate taxa with a typical citation for each, main habitat and proportion of informants who knew the taxon. Key places of encounter and habitats are as follows: aquatic, riparian habitat (W); forest (F); grassy, shrubby areas (G); cropland (A); vineyard, orchard (O); surrounding of the house, village, garden (S); on animal/human (P); in the house (H), everywhere (O) Local names which are derived surely from formal education or from the media are marked with "#". Protected species are marked with "*".

	Fig.	**scientific and proper names**	**the most typical local names and their literal English translation**	**saliences**	**key places of encounter and habitats**	**proportion of informants who knew the taxon (%)**
1.	16	*Fasciola hepatica* Common Liver Fluke	*métely*	*It is in the liver of the livestock. It's like a pumpkin seed cut in half. Fluky stock is skinny. / You must not graze it around lakes. Surely some snail spreads it.*	P	64
2.	16	*Toxocara canis* *Echinococcus* spp. Dog Roundworm	*giliszta*	-	P	9
3.	16	*Taenia solium* *Taeniarhynchus saginatus* Pork Tapeworm, Beef Tapeworm	*giliszta*, *galandféreg* (galandworm)	*It can be found in pigs, piglets, the guts, even in man, as big as half a metre long was also taken out.*	P	38
4.	16	*Taenia multiceps* tapeworm species	*keringő* (whirler), *motoszká* (fumbler)	*A fly lays the egg into the nostrils of the sheep and it goes up to the brain. When it is developed there, the sheep would blow it out. If one does not blow it out, it will get the circling disease. / Before, we would operate them.*	P	4
5.	16	Nematoda e.g. *Pseudocapillaria tomentosa* fish roundworm species	*giliszta*	*These worms like the sterlet (Acipenser ruthenus) very much, they get into the stomach. It is thin like a needle.*	P	2
6.	14	*Ditylenchus dipsaci* Stem Nematode	*fireg, kukac*	*Onions get worms as well. Small little worms. Yellowish.*	S	9
7.	16	*Haemonchus contortus* Barber's Pole	*(piros) féreg* (red féreg)	*The cow has that manyplies, it was all full with red worm inside.*	P	2

8.	16	*Hirudo verbana* Mediterranean medicinal leech*	*pióka, vérszípó* (blood sucker), *nadály*	*We would go into the water and it stuck on our legs. It was collected. / We would sprinkle ash on it and parted with the skin. It lives long. There are people who's blood it does not like. / The leech is not a parasite; it was used for medicine centuries long.*	P, W	100
9.	16	Piscicolidae e.g. *Piscicola geometra* leech species on fishes	*pióca*	*They kill the fish; suck their blood, stuck on them.*	P, W	5
10.	16	*Haemopis sanguisuga* Horse-leech	*lópióka* (horse pióka)*, turbók, drótkukac* (wire worm)	*It was dug out from wet earth. / We call it the wire worm. They are this big and hard, dark green. /*	W	80
11.	16	*Lumbricus* spp. e.g. *Lumbricus terrestris* earthworms	*giliszta, földigiliszta* (earth giliszta)	*Selyemkukac* (silkworm) *are in the garden, around the house, under the bricks, after rain, they breathe in the fresh air. It's a soft bodied worm.*	S	100
12.	16	*Eisenia fetida* Redworm	*giliszta, trágyagiliszta* (dung giliszta)	*It is beside the dung. / Reddish. Not so big.*	S	10
13.	16	*Aporrectodea dubiosa* earthworm species	*fekete giliszta* (black giliszta)	*It is on the waterside. Black.*	W	2
14.	17	*Arion, Limax* spp. e.g. *Limax maximus* slug species	*kopaszcsiga* (bald snail), *meztelencsiga* (naked snail), *csupaszcsiga* (nude snail)	*It ate members of the cabbage family. / You could hardly find a plant which would not be damaged by them. / It is usually found such dark cellars. Wherever it goes, leaves this discharge behind. / After the rain. / I draw them from the well.*	A, S	96
15.	17	*Agriolimax agrestis* and similar species smaller field slugs	*meztelencsiga* (naked snail), *kopaszcsiga* (bald snail)	*The white ones come in every four or five years but would then teem frightfully.*	A	4
16.	17	*Arion vulgaris* Spanish Slug	*kopaszcsiga* (bald snail), *spanyol kopaszcsiga* (Spanish bald snail)	*They are visitors here. You would not find them long ago. / It will spread here as well. / It came from Spain with vegetables and are very prolific.*	A	16
17.	17	*Limax maximus* Great Grey Slug	*meztelencsiga* (naked snail), *meztelen erdei csiga* (naked forest snail)	*They would gnaw away mushrooms instantly. / They would eat it, whether edible or poisonous.*	F	5
18.	17	*Bielzia coerulans** Carpathian Blue Slug	*meztelencsigá* (naked snail)	*You can find blue or grey ones.*	F	5
19.	17	*Cepaea* spp. e.g. *Cepaea vindobonensis* land snail species	*csiga, kígyócsiga* (snake snail)	*This was called the snake snail. Where the name does come from I have no idea. / They collect the dew drops.*	A, S	14
20.	17	*Helix* spp. (*) mainly *Helix pomatia*	*csiga, éti csiga* (edible snail)	*This is the strongest animal because it carries its house on the back. / I would not do any harm to them, even though they can*	G, S	100

		edible snails		*make trouble. / I always tread on them. They like to eat my flowers. I would throw them back to the hens. / They are not so harmful.*		
21.	17	*Xerolenta obvia* land snail species	*csiga, paradicsiga*	*These are white little snails on the plants. They would also stick to the grass leaves.*	G, S	55
22.	17	Lymnaeidae e.g. *Lymnaea stagnalis* freshwater snail species	*vízicsiga* (water snail)	*During floods (high water) they climb on boats or a thick branch. Floods are coming when the snail climbs out of the water.*	W	6
23.	17	Planorbidae (excl. *Ferrissia*, *Ancylus*, *Hebetancylus*) e.g. *Planorbis planorbis* ramshorn snails	*csiga, vízicsiga* (water snail)	*When the water was rising, this came up to the surface.*	W	12
24.	17	Bivalvia e.g. *Anodonta cygnea* clams	*békateknő* (frog tub), *kagyló*	*Frog tub. We would pick them when I was a kid. It comes off from the frog. Like the egg from the inside.*	W	83
25.	17	Gastropoda e.g. *Zebrina detrita* snails	*csiga*	*They would gnaw during the night and they drag that mucus behind. / Little snail come out, your house is burning. You'll get milk and butter, it will be left for tomorrow*. (a child song)	F, G	100
26.	19	Julidae e.g. *Megaphyllum unilineatum* millipede species	*ezerlábú* (thousand legged), *drótféreg* (wire worm)	*I have seen this little black insect on the garbage heap. / Who's got the patience to pick up so many of them? They would have swept them, obviously.*	S, G	16
27.	19	*Lithobius* spp. e.g. *Lithobius forficatus* Common Centipedes	*százlábú* (hundred legged)	*It's so reddish. / You can get many of them when you lift the flower pots.*	S, G	44
28.	13	*Ixodes* spp. e.g. *Ixodes ricinus* ticks	*kullancs, csiglanc*	*I think they are not infected here. They are rather on the blades of grass. It is dangerous because it spreads encephalitis. / You would pick at it or you put fat or oil on it and than it would climb out or fall out. / The one living on animals would not get into humans. / You would say to little kids 'you're a tick'. / It was not dangerous before. I think this has become infested due to this many poisons and the atom.*	P, F	94
29.	13	*Dermatophagoides* spp. e.g. Dermatophagoides *pteronyssinus* house dust mites	*poratka* (dust atka)	-	H	2
30.	13	*Sarcoptes scabiei* Itch Mite	*rüh* [it is not seen as an animal]	*It would creep into your skin and little pimples would appear. It would also get wedged in among the fingers. / Something was mixed in pig fat and used as ointment.*	P	35
31.	13	*Haematopinus suis* Hog Louse	*rüh*	*When piglets got the itch, they would be smeared with fat, nowadays with cooking oil.*	P	9
32.	13	*Psoroptes ovis* Sheep Scrab	*rüh*	*The Temoxa, we would dip them in summer and then their wool would not fall out.*	P	7

33.	13	Pseudoscorpiones e.g. *Chelifer cancroides* false scorpions	no name	*This is a little beetle, I can see them some times. They are like the ones in the TV* (scorpions)*, only they are little. It fell from a tree. It has two feelers.*	H	5
34.	12	Araneae e.g. *Tegenaria domestica*spiders spiders	*pók*	A wide spread belief says spiders must not be killed because it brings misfortune.	H	100
35.	12	*Dolomedes fimbriatus** Raft Spider	*vízipók* (water pók)	*The same shape as a spider.*	W	9
36.	12	*Argyroneta aquatica** Diving Bell Spider	*vízipók* (water pók)	*It's got a big bladder* (in fact, a bubble) *with which it goes down.*	W	4
37.	12	*Araneus* spp. e.g. *Araneus diadematus* spider species	*keresztespók* (crossed pók)	*You put it into a white bag and let it out in the morning. You would open the bag and it has written your fortune numbers there. / We were afraid of them because they stung. / It is Greek Catholic because it's got a double cross.*	G	42
38.	12	*Argiope bruennichi* Wasp Spider	*pók*	*This is like a guest spider in these parts. / But it did not eat the common wasp.*	G	5
39.	12	Pholcidae e.g. *Holocnemus pluchei* Opiliones e.g. *Phalangium opilio* cellar spiders and harvestmen	*kaszáspók* (scything pók), *házi pók* (house pók)	*You pick its leg out, it would still work for a while, sawing the air. / You get plenty of them in the villages.*	H	61
40.	12	*Pardosa* spp. e.g. *Pardosa alacris* wolf spiders	*főldipók* (ground pók)	*Ground spider* (that is: not a net weaving species). *It has eggs on the back.*	O	5
41.	12	Thomisidae e.g. *Thomisus onostus* crab spiders	*pók*	*You can get yellow ones as well. Sits on flowers.*	G	4
42.	13	*Dermanyssus gallinae* Poultry Mite	*poloska, pirostetyű* (red louse)	*It's there right away in tiny chicks. / You must roast onions and smear it under their little wings, at the tail and the neck. Or, they are stamped out with smoke.*	P	9
43.	13	*Argas reflexus* Pigeon Tick	*madárkullancs* (bird tick), *vértetű* (blood louse)	*It is very quick. If it spreads in poultry, it would suck their blood, there is plenty of them.*	P	11
44.	12	gossamer	*ökörnyál* (ox saliva)	*There will be no rain because the gossamer is stretching* (i.e. carried by the wind)*. / It usually flies during Indian summer.*	G	16
45.	13	Parasitidae e.g. *Parasitus coleoptratorum* a family of predatory *mites*	*poloska*	*A tiny red bug.*	P	5
46.	13	*Microtrombidium pusillum* Dwarf Velvet Mite	*Istenbárányka* (God's lambkin), *Jézusbárányka* (Jesus' lambkin)	*It's so velvet-like, beautiful, no dresses like it are ever made. /* They sang: *Shine, Sun, shine, Jesus' lambkin freezes to death under the gardens. And then the Sun shone. / You could see it in springtime.*	S	17

47.	13	*Tetranychus urticae* Red Spider Mite	*hamuféreg* (ashféreg)	-	A	4
48.	19	*Astacus astacus*, Astacus leptodactylus** European Crayfish, Danubian Crayfish	*rák, folyami rák* (river rák), *cseri rák* (tanned rák)	*It's on the water bottom, on pebbles. / Once upon a time our canals were so clear, full of crabs.*	W	90
49.	19	*Austropotamobius torrentium* Stone Crayfish	*sebesvízi rák* (rapid waters crab), *rák*	*This is upstream, in mountain creeks. / You can't eat it because it's so tiny.*	W	2
50.	10	*Daphnia* spp. e.g. *Daphnia magna* water fleas	*vízibolha* (water flea)	*Very little, bouncing in water.*	W	2
51.	13	*Argulus foliaceus* Common Fish Louse	*tetű* (louse)	*You can find it in marshy lands. / Fish ponds were limed. This is why this bad kind did not occur.*	W	10
52.	10	Oniscidea e.g. *Armadillidium vulgare* woodlice	*pincebogár* (cellar bogár), *krumplibogár* (potato bogár)	*If you touch it, it will become a ball. / Where there is potato and the soil is wetter, it would winter there.*	H	51
53.	11	*Mantis religiosa** European Praying Mantis	*imádkozó sáska* (praying sáska), *sáska, alázatos manó* (humble imp)	*It's hands are like if it would pray, but it doesn't. / They are usually at the watersides. / It becomes rare. Because of the poisons. Mostly it is encountered on grazing land. / We mostly have these green ones, but you could find some brown ones as well.*	A, O	42
54.	11	*Acrida hungarica** Hungarian Snouted Grasshopper	*sáska*	*It leaps like magic. / They come in different colours.*	G, O	2
55.	11	*Oecanthus pellucens* Italian Tree Cricket	*őszifíreg* (Autumn worm) *őszike* (little in autumn), *haris* (roarer)	*It says 'gather, gather'. / Autumn is here, the autumn worm sounds. / It comes out only in the evening. / It was brought in on flower vases on the leaves.*	O	40
56.	11	*Locusta migratoria** Migratory Locust	*siska, sáska, szöcske* (hopper)	*This does not sing, it grazes. It was here long ago, now is gone. / Hay meadows were stripped barren. We collected them.*	A	11
57.	11	*Tettigonia viridissima* Great Green Bush-cricket	*sáska, kabóca, szöcske* (hopper)	*It grows high. / Flies and jumps as well. / It likes to be in the reeds on sedges, weeds. / Haven't seen it for a few years. / It likes to eat leaves, comes in the house. Causes panic, although it does not bite your head off.*	O	73
58.	11	*Dociostaurus maroccanus* Moroccan Locust	*sáska*	*A bad lot, eats away everything. They fly. / We had them before, in 1951 for the last time.*	O	9
59.	11	*Calliptamus italicus* and similar species Italian Locust	*szöcske* (hopper), *sáska*	*They fly.*	G	7
60.	11	*Chorthippus* spp. e.g. *Chorthippus parallelus* smaller grasshoppers	*szöcske (hopper), sáska, kabóca*	*This tiny thing is on the hay meadow. But I don't know the name. / You get green ones, brown ones.*	G	63

61.	11	*Gryllus campestris* Field Cricket	*tücsök, mezei tücsök* (meadow tücsök)	*Black cricket. It is lured out of the hole with a blade of grass. / It can not jump any more when you crossed it with your finger. As long as it did not return to the ground. Then it would be able to jump again. / It makes music in summer and does not care with the winter. / It has a kind of wing but light. / They would be in the same hole with the dung-beetle* (*Geotrupes* spp.). *I would say it is menial of the other one.*	G	95
62.	11	*Acheta domestica* House Cricket	*tücsök, házi tücsök* (house cricket), *fehér tücsök* (white cricket)	*Brown-reddish. / Sing in the night. / Well, it leaps, giant leaps. / Long ago it was there in bakeries and in old peasant houses in the door case. / It likes to come in the house, crawls to and fro all winter. / Behind the refrigerators, because it is both warm and damp. / It would loose its colour in the house and sometimes will be quite white by the time it comes out in Spring.*	H	33
63.	10	*Gryllotalpa gryllotalpa* and *Gryllotalpa stepposa* European Mole Cricket and Steppe Mole Cricket	*lótetű* (horse louse), *lóhere* (horse drone), *csúr, csikóbogár* (foal beetle), *medve* (bear), *ollós bogár* (scissors beetle)	*It can be found in manure. / Eats worms. And the mole eats them and worms alike. / It would make big troubles in seedling beds. / It is called louse, but it's not so tiny to be a louse. / Flies in the night. / It has millions of tiny eggs in the nest. / Around Losonc it was called a bear. It resembles it.*	S	98
64.	10	*Pyrrhocoris apterus* Firebug	*suszterbogár* (cobbler bug), *csiribabó, verőkőtő, kőverő* (stone beater), *bodobács*	*Nice beetles. The first one to come out in Spring to the sun. / 'They stick together like the csiribabó'* (firebugs). */ 'They sit out like the verőkőtő'. / Usually on rotten trees.*	S	100
65.	10	Notonectidae e.g. *Notonecta glauca* backswimmers (true bugs)	*vízibolha* (water flea)	*This kind of bug is in the water, two legs are long. / If the net was any denser, they would eat up smaller fish in the apex. / Jumps and bites.*	W	10
66.	12	*Gerris* spp. e.g. *Gerris paludum* water striders	*vízipók* (water spider), *vízimolnár* (water miller), *vízibizigli* (paddle boat)	*Collects lesser bugs on the surface of the water. Very quick. Always on the top of the water. Maybe it was called water miller for this reason. / We also called it paddle boat. They run in groups. / They can play on the water very well.*	W	58
67.	10	*Dolycoris baccarum* and similar species Sloe Bug (true bugs)	*büdösbogár* (stink bogár), *büdösbence* (stinking Ben), *poloska, büdösmártin* (stinking Martin), *büdösbanka* (stinky banka), *mezei poloska* (meadow poloska)	*Sometimes you snatch it with raspberries. It's bitter. And very stinky. / Before cold weather comes, they are already between the window panes. They know winter is coming.*	H, O	98

68.	10	*Palomena prasina, Nezara viridula* Green Shield Bug Southern Green Stink Bug	*büdösbogár* (stink bogár), büdösbence (stink Ben), *poloska*	*Do you know, which is green? The one born this year. By next year it will be the same colour. This is like a swan. A young swan is greyish mottled.*	H, O	82
69.	10	*Graphosoma lineatum* Italian Striped-bug	*büdösbogár* (stink bogár)	*Lives on dills. Each stem has 10 or 15. / They suck out moisture up at the seeds. / If you only touch any of them, they are stinky.*	S	15
70.	10	*Eurydema ornatum* Red Cabbage Bug	*káposztabogár* (cabbage bogár), *büdösbogár* (stink bogár)	*The same smell as [Dolycoris baccarum]. / Eats cabbage. / Comes in lots.*	S	14
71.	10	Carabidae e.g. *Zabrus tenebrioides* ground beetles	*bogár*	*They are running about. Here in the greenhouse. / When the grave is dug, you would see such black bugs often in the ground.*	H	42
72.	10	*Geotrupes* spp. e.g. *Geotrupes vernalis* dor beetles	*ganajtúró* (dung grouter)	*Grouts in cow dung. Undemanding beast. / Makes pellets and rolls them. / There were millions. Today only now and then.*	S	53
73.	10	*Melasoma populi* Poplar Leaf Beetle	no name	*It would come on poplars in the woods. Crawls on leaves.*	F	4
74.	10	*Phytodecta rufipes* Brassy Willow Leaf Beetle	*ötpettyes katicabogár* (five spots Kate bogár), *katicabogár* (Kate bogár)	*It is lighter, yellowish-red, five spots. Gnawed sown Trifolium away. / A pest in parcels under lucerne.*	A	4
75.	10	*Leptinotarsa decemlineata* Colorado Potato Beetle	*krumplibogár* (potato bogár), *mandalinka, kolorádóbogár#* (Colorado bogár), *kórórágó* (stalk gnawer), *pizsamás bogár* (pijama bogár)	*This is what we got from America. / You must put nettle in water and leave it for week. It will become stinky and sprays the plant. / You could get paid if you found such bugs. / It was introduced with the potato. / Just now there are not so many. It rained a lot.*	A	100
76.	10	*Chaetocnema* spp. and *Phyllotrema* spp. e.g. Chaetocnema *tibialis* flea beetles	*balha, káposztabolha* (cabbage bolha)	*It jumps. Makes holes in radish, kohlrabi leaves, cabbage. / Tiny black bugs.*	A	61
77.	10	*Chaetocnema* spp. and *Phyllotrema* spp. (+*Erwinia stewartii*) flea beetles and Stewart's Wilt	*balha, bogár*	*Tiny black bugs, leaves long marks on the greenish part of maize. / Sucks the leaves, likes sweet corn best.*	A	4
78.	10	*Epicometis hirta* Hairy Beetle	*szőrös kandalló* (hairy hearth), *bogár*	*Hairy. / Comes on flowers. There are many, in particular on the fields, sunflowers and wheat.*	A	11

79.	10	*Tenebrio molitor* Mealworm Beetle	*drótkukac* (wire worm), *lisztkukac* (flour worm)	*I bought corn meal in the shop and it was full with it. / It also breeds in ground pepper. / You had better screen the flour before use.*	H	14
80.	10	Curculionidae e.g. *Larinus turbinatus* true weevils	*orrúbogár* (nosy bug)	*It has a long trunk. / The wings are hard.*	A	10
81.	10	*Anthonomus pomorum* Apple Blossom Weevil	*bimbólikasztó#* (bud puncher), *bimbólikasztó bogár#* (bud puncher bogár),	*A tiny bug, gets into the buds when it starts to sprout and does harm to cherries, plums.*	O	19
82.	10	*Cleonus punctiventris* Sugar-beet Weevil	*répabogár* (beet bogár)	*Carrot beetle. Gnaws a hole in the carrot. Sucks the sap of tiny carrots and they perish, wither. This is why it was controlled by spraying.*	A	2
83.	10	*Ceuthorrhynchus macula-alba* Poppy Ceutorrhynchid Beetle	*mákbogár* (poppy bogár)	*Punches poppy heads while young. And it would not yield because the worms eat it away from inside.*	A	2
84.	10	*Sitophilus granarius* Wheat Weevil	*zsúzsok, búzazsúzsok* (wheat zsúzsok)	*It is also a bad lot, eats the wheat. / Does harm to fodder inside. / If there is only a little water, it would grow.*	H	22
85.	10	*Bruchus pisi, Acanthoscelides obtectus* Pea Beetle, Bean Beetle	*zsúzsok, paszulyzsúzsok* (bean zsúzsok)	*Comes from inside the peas. / More recently you can find in beans as well. / All beans must be discarded. Eats the cotyledon out.*	H	58
86.	10	*Lytta vesicatoria* Spanish Fly	*kőrisbogár* (ashtree bogár)	*My grandmother would say, rain is coming the ash tree stinks. / Very stinky, in particular on the ash tree.*	F, G	88
87.	10	Cantharidae e.g. *Rhagonycha fulva* soldier beetles	*kőrisbogár* (ashtree bogár)	-	F, G	7
88.	10, 14	*Melolontha melolontha* Cockchafer	*cserebogár, májusi cserebogár* (May cserebogár) , *pajod, csimmaz, pillangó* (butterfly)	*You can get cockchafer in Spring. Not later. / You need three years before it develops. / If there is a lot of cockchafers, you will get high corn yields. / Cockchafer would lay* (give birth to) *that white butterfly.*	O	100
89.	10	*Amphimallon solstitialis* Summer Chafer	*cserebogár, kis cserebogár* (small cserebogár)	*It comes later on, in June, mostly* (as opposed to the ordinary cockchafer). */ This is lesser and yellowish.*	O	5
90.	10	*Cerambyx cerdo* Great Capricorn Beetle*	*cincér, hőscincér* (hero cincér)	*It can weep like hell when you get it. / Got large moustache and long legs. / 'Your moustache is like that of a capricorn beetle.'*	S, F	33
91.	10	*Rosalia alpina** Rosalia Longicorn	*cincér*	-	F	2
92.	10	*Pyrrhidium sanguineum* Welsh Oak Longhorn beetle	*kőrisbogár* (ashtree bogár)	-	S	4

93.	10	*Lucanus cervus** European Stag Beetle	*szarvasbogár* (horn bogár), *csikkantós bogár* (pinching bogár), *bika, tehén* (bull, cow)	*Once you catch it, it would grasp your finger like a pair of scissors. / We would nail it on the wall, the kids just gazed. / This is the bull* (male), *and this is the cow* (female). */ They wrestle. Two bulls. / It comes mostly around oak trees.*	F	98
94.	10	*Oryctes nasicornis** European Rhinoceros Beetle	*orrszarvúbogár* (nose horn bogár), *orrszarvú* (nose horn), *szarvasbogár* (horn bogár)	*You can't get it everywhere. / They like old trees. / A kind of horn beetle.*	F, S	61
95.	10	*Lethrus apterus** Flightless Earth-boring Dung Beetle	*bogár*	*This bores holes in the ground and drags in leaves in reserve gear.*	G	2
96.	10	*Pentodon idiota* beetle species	*bogár*	*This is in springtime. Those big ones on the sidewalk.*	S	4
97.	10	*Coccinella septempunctata* Seven-spot Ladybird	*katicabogár* (Kate bogár), *hétpettyes katicabogár* (seven spots Kate bogár), *petikebogár* (Pete bogár)	*It eats aphids. It seems it likes them. / 'Kate beetle! Where I go to marry?' And then we watched. Blew at it till it flew away. That way we married.*	S, G	100
98.	10	*Adalia bipunctata* Two-spot Ladybird	*katicabogár* (Kate bogár), *petikebogárka* (little Pete bogár)	*Similar to Kate beetle, but has only two spots, unfortunately.*	S, G	12
99.	10	*Psyllobora vigintiduopunctata* 22-spot Ladybird	*katicabogár* (Kate bogár), *sárga katicabogár* (yellow Kate bogár), *11 pettyű katica* (11 spots Kate)	*There are yellow Kate beetles as well.*	S, G	68
100.	10	*Harmonia axyridis* Harlequin Ladybird	*katicabogár* (Kate bogár)	*There was such a Kate beetle invasion last year. They are not the ones I saw when I was a kid. / The Sun shone there in a warm afternoon, there were so many you could grasp them.*	H	71
101.	10	*Meloe* spp. e.g. *Meloe proscarabaeus* (*) oil beetles	*bogár*	*It's got a big belly like this.*	F, A	11
102.	10	*Calosoma sycophanta** forest caterpillar hunter	*bogár*	*Usually it is on the ground as well. When we get home, it sneezes. You are not hit by what it blows out. Maybe only a little air. Protects itself. / Runs away quickly.*	F	7
103.	10	Gyrinidae e.g. *Gyrinus natator* whirligig beetles	*bogár*	-	W	4

104.	10	*Dytiscus* spp. e.g. *Dytiscus marginalis* great diver species	*vízibogár* (water bogár)	-	W	4

105.	10	*Hydrous piceus* Great Silver Water Beetle	*vízibogár* (water bogár), *csíbor* (pincher), *víziböléný* (water buffalo)	*Big and black, likes warm water. / Mostly in lakes. / Sets on the fish, gnaws on it. / They say it bites. / When it ebbed, they flew here to the light.*	W	79
106.	10	*Cetonia aurata* Green Rose Chafer	*szentjánosbogár* (Saint John's bogár), *foszforbogár* (phosphorus bogár), *aranyos virágbogár* (golden flower bogár)	*All say glow worm because it shines as the Sun hits it. But this can not be seen in the night. / Flies with a buzz. Creeps into drying cloth.*	G	82
107.	10	*Lampyris noctiluca, Lamprohiza splendidula* Common Glow-worm, Central European Firefly	*szentjánosbogár* (Saint John's bogár), *foszforbogár* (phosphorus bogár)	*They are tiny and light up. You can see in the night air. / It's only a small worm. I would illuminate when the [Oecanthus pellucens] sounds. The back is lighting.*	G	69
108.	10	*Ips* spp. e.g. *Ips typographus* engraver beetles	*szu, szujétel, faszu* (wood szu)	*It makes very small holes, tiny dense holes. / I would put firewood in tin trays to keep it from the parquet.*	H	100
109.	10	*Agriotes* spp. e.g. *Agriotes sputator* click beetles	*drótkukac* (wire kukac), *drótbogár* (wire bogár), *drótféreg* (wire féreg)	*Likes carrots. Yellowish, hardy.*	H	27
110.	10	*Diabrotica virgifera* Western Corn Rootworm	*kukoricabogár* (corn bogár)	*Can make a lot of harm. Sucks the sap of the leaves.*	A	2
111.	10	*Blaps* spp. e.g. *Blaps lethifera* tenebrionid beetle	*büdösbogár* (stink bogár), *büdösbanka* (stinky banka), *kátránybogár* (tar bogár), *svábbogár* (Swabian bogár)	*Very stinky when you step on it. / Mostly in cellars. Formerly tar paper was put down in dirt floored houses and it was underneath.*	H	33
112.	8	*Xylocopa violacea, Xylocopa valga* black colored carpenter bees	*dongó* (buzzer), *cigánydongó* (Gypsy buzzer)	*Big, black and collects honey also. Bites. Has a loud buzz. / Does not bite. / I've got a barn full of wood. They drill on them like drilling machines. It laid eggs into it.*	S	53
113.	8	*Apis mellifera* European Honey Bee	*méh, méhecske* (little méh), *házi méh* (house méh)	*It was August when there is less flowers and these times bees are more dangerous, attack you easier.*	O	100

114.	8	*Apis mellifera* var. *ligustica* Italian Bee	*vadméh* (wild méh), *erdei méh* (forest méh)	*It was an old house, full of wild bees in the end. They sting, its painful. / We call them forest bee. Once we brought some home with my father. Ants attacked and killed them off. / They make hives in hollows. / The tree brings that wax. And they eat it.*	G, F	31
115.	8	*Osmia adunca* mason bee species	*nádiméh* (reed méh)	*It can nest in a single stem of reed, but can go up to the first node only. / They do not bring in honey, but pollens, and they put a lid on it made of mud, which is gnawed away by the young when they come out of it.*	H	18
116.	8	Andrenidae e.g. *Andrena flavipes* mining bees	*csemelyke, vadméhe* (wild méh)	*It is in the ground. Such brownish in colour. Collects nectar, pollen. Tiny. / Leaves little heaps around with a hole in the middle. It does not have a strong sting but it does sting. It's got a net but not so beautiful which is built by the common wasp.*	G	15
117.	8	*Bombus terrestris* Buff-tailed Bumblebee	*dongó* (buzzer), *csemélyke, földiméh* (ground méh)	*Hairy. They dwell in the ground. Don't do any harm to man. Collect honey as well. / Maybe there is a yellowish stripe in the back on top. / Like my finger – they make little round nests to put honey in it for themselves. Foxes, dogs, mice rake it out and eat.*	G, O	25
118.	8	*Bombus lapidarius* Red-tailed Bumblebee	*dongó* (buzzer)	*It does not die as the other bee which has the sting coming out. This one does not tear its sting off, it merely stings you. / Such a big black with red and yellow head.*	G, O	7
119.	15	*Formica rufa** Red Wood Ant	*vöröshangya* (red hangya), *erdei vöröshangya* (forest red hangya)	*Where there is this big ant, it makes a big ant hill. If you poke it millions come out, but they are all alike.*	F	14
120.	15	ant casts with wings	*szárnyashangya* (winged hangya)	*It drills the ground and then billions fly around in the air. / It comes out from the parquet in the apartment. / We would say if the winged ant comes out, it will rain.*	S	85
121.	15	*Camponotus* spp. e.g. *Camponotus ligniperda* carpenter ants	*tököshangya* (ballsy hangya), *hangya, fekete hangya* (black hangya)	*They gnaw at trees. / We could not stay there under the walnut tree* (sitting, talking) *there were so many. I put salt on their way and later I could see that they move away. Now see, that one came back, just like talking something to the others and they queue up and move out. I say, cunning beasts, they are. That one was the officer, who commanded. / It's ballsy because it carries the eggs between the legs like a big squash. / I brought into the flat with the wood.*	F	42
122.	15	*Lasius flavus, L. umbratus* yellow meadow ant	*sárga hangya* (yellow hangya)	*That one is yellow, bites like hell. / Like the poppy seeds, so tiny they are.*	A	21
123.	15	*Temnothorax* spp. e.g. *Temnothorax affinis* ant species	*hangya*	*Galls grow on oak trees. Some kind of tiny ants are fond of living in them. They make a little hole in it where they can get through. They would thrive on the gall.*	F	2
124.	15	*Tetramorium caespitum* and similar ant species	*hangya, fekete hangya* (black hangya)	*There are so many in the garden it is like a miracle. They climb on our legs but do not bite so hard. Tiny black bits.*	S	100
125.	8	*Sceliphron destillatorium* Mud Dauber Wasp	*darázs, szalmadarázs* (straw darázs)	*Makes nest of mud on the rafter. / It's long and thin.*	S	20

126.	8	Sphecidae e.g. *Ammophila sabulosa* digger wasps	*földidarázs* (ground darázs)	*Drills a hole in the sand. Come and go in it.*	G	2
127.	8	*Vespa crabro* European Hornet	*lódarázs* (horse darázs)	*That one is dangerous. Some 5-6 bite you, you may die. / We say, if nine horse wasps bite the horse, it will perish. / It made a 12 storey nest, hanging on the wall. / You had to pee on the ground and smear the mud over it* (the bite). */ Many are allergic when bitten. It would not die after biting. Goes on, bites again.*	F	100
128.	8	*Vespula vulgaris, Polistes gallicus* paper wasp species	*kecskedarázs* (goat darázs), *darázs, házi darázs* (house darázs)*, padlási darázs* (attic darázs)	*My whole head was swollen. I was a kid, the old women gathered around, some brought sour cream, this or that. I was smeared over, embalmed. Next day I was okay. / Likes mainly the attic. / The mother survives in winter and then there are many in summer. / Aphid appear on the young upper leaves of the peach tree, then the wasp comes but they do not do any harm to the lice I think they eat what the aphid produce.*	S	61
129.	8	*Paravespula germanica* German Wasp	*darázs, földidarázs* (ground darázs)	*They put fire above the nest, they were poured over with hot water, put chemicals on it. / It had a tiny hole like this. They would keep on coming and going there and built a beautiful honeycomb.*	S	100
130.	19	*Cynips quercusfolii* gall wasp species	*cseregolyó* (oak ball), *gubacs*	*This is not the fruit of the tree, it is on the leaves. On oak trees. / There is some bug in this ball as well. Hatches from it.*	F	37
131.	19	*Rhodites rosae* Mossy Rose Gall Wasp	*gubics, hamufíreg* (ash worm), *macskatöki* (cat's bollocks), *csipkelabda* (rose hips ball)	*It's on briars. I saw it on roses. Good for nothing like the balls of a cat.*	G	11
132.	19	*Andricus hungaricus* Hungarian Gall Wasp	*gubacs* (gall), *gubics* (gall)	*My mother made us thrown them away. You must not keep it* (at the house) *because brood will not hatch the eggs.*	F	83
133.	18	*Acherontia atropos** Death's-head Hawk Moth	*ördögpillangó* (devil's pillangó), *boszorkánylepke* (witch lepke), *halállepke* (death lepke), *halálfejes lepke* (death's head lepke)	*Quite big. A pest. / Big and ugly like the devil. / They say it was a witch butterfly, but this is wrong. Some old bitches made it up. / Comes in the evening and flies around here. / It has a big death's head.*	S	77
134.	18	*Macroglossum stellatarum* Hummingbird Hawk-moth	*lepke, kocsisirma* (carman Irma), *kolibri#* (hummingbird)	*Has a long tongue reaching in every flower. / Is like a hummingbird. / Make noises with the wings.*	S	36
135.	18	Lepidoptera e.g. *Melitaea athalia* butterflies	*lepke, pillangó, hernyó*	*Not a real pest. We were glad to see them long ago. They are very nice.*	G	100

136.	18	*Ephestia kuehniella* Mediterranean Flour Moth	*moly*	*A little worm. When you screen the flour, it's like a spider web, woven in. Flour gets the moth when you keep it long, let's say a year.*	H	7
137.	14	*Coccyx turionella* Pine Bud Moth	*rügyfúró#* (bud driller)	*They can make big damage when they are many. Does harm to cherry trees in springtime mostly. This is long like this, has a bill, it punches the plants with.*	O	2
138.	14	*Cydia pomonella, Anarsia lineatella* Codling Moth, Peach Twig Borer	*kukac, hernyó*	*Moth larvae are called worms here. Likes to take a place in quince.*	O	9
139.	18	*Inachis io** European Peacock Butterfly	*pávaszemes lepke* (peackock lepke), *pávaszem* (peackock's eye)	*If you see a red one first in the new year, you will remain healthy and fall in love.*	G	9
140.	18	*Vanessa atalanta** Red Admiral	*lepke*	-	O	2
141.	18	*Vanessa cardui* Painted Lady	*lepke*	*It was like this which came from Africa* (heard on the radio). *And next year I saw two or three but never again. Maybe it would not find food to stay.*	O	2
142.	18	*Gonepteryx rhamni* Common Brimstone	*sárga lepke* (yellow lepke), *sárga pille*	*If you see a yellow butterfly first in spring, you'll fall ill.*	G	7
143.	18	*Pieris brassicae* Large White	*káposztalepke* (cabbage lepke), *lepke, fehér lepke* (white lepke)	*Lays eggs on the cabbage and a little green worm comes out of it. / Its wings are white and there are plenty. Cockchafer*s *lay its worm. You say when there are many cockchafers , there is plenty of worms on the trees.*	A	86
144.	18	*Polyommatus* spp. e.g. *Polyommatus icarus* blues (butterfly species)	*lepke, pillangó, kék pillangó* (blue pillangó)	*After the rain these white butterflies are in the edges of puddles. As many can get to it. / Bluish grey. It was small.*	G	31
145.	18	*Mamestra brassicae* Cabbage Moth	*bagolylepke* (owl lepke), *éjjeli pille* (nocturnal pille)	*Eats cabbage, cauliflowers, broccoli. When you see plenty of butterflies, soon the worms will come. / It comes through the window when it is open.*	A	11
146.	18	*Tineola biselliella* Common Clothes Moth	*moly, molylepke*	*Eats your clothing. / The little moth worms.*	H	96
147.	18	*Ostrinia nubilalis* European Corn Borer	*málépillangó* (maize pillangó), *molylepke*	*If you are careless and leave old corn in the silo and put the new one on top, that one will be two years old and definitely infested with it. / Doesn't eat the corn, just the germ. / When corn is over, half a handful of dust is left. It is butterfly droppings.*	S	70
148.	18	*Catocala elocata* French Red Underwing	*bagolylepke* (owl lepke)	*The one with the red back wings.*	A	2
149.	18	*Helicoverpa armigera* Cotton Bollworm	*bagolylepke* (owl lepke), *paszuly-molypillangó* (beans molypillangó)	*It goes into the geranium buds and eats them from inside. / Likes to attach to trees. And to the walls, frequently comes in. / When it comes out of the bean, a hole is left behind. A little white worm.*	A	23

150.	18	*Cossus cossus* Goat Moth	*szúlepke* (engraver beetle lepke)	*Big brown butterfly. Puts eggs into the bark. It gets into timber laid a long time raw with the bark on. They are almost as big as a grub. Gnaw out passages like a pencil.*	S	5
151.	18	*Saturnia pyri** Giant Peacock Moth	*boszorkánypille* (witch pille), *halállepke* (death lepke), *szemeslepke* (eyed lepke)	*They are big, appear late in the evening when you put the lights on. / Superstitious folks would nail it above the door.*	O	16
152.	18	*Iphiclides podalirius** Scarce Swallowtail	*fecskefarkú lepke* (swallow tail lepke), *fecskeszárnyú pillangó* (swallow winged pillangó)	*The same* (as *Papilio machaon*), *only with a different colour and patterns. / The wings have forked ends.*	G	14
153.	18	*Papilio machaon** Common Swallowtail	*fecskefarkú lepke* (swallow tail lepke), *fecskeszárnyú pillangó* (swallow winged pillangó)	See above	G	14
154.	18	*Lymantria dispar* Gypsy Moth	*gyapjaspillangó* (woolly pillangó), *gyapjaslepke* (woolly lepke)	*Worm, eats away the leaves of a tree. One year it grazed off all leaves by the first of July. Within less than one and half months it was green again because what nature can spoil, can make it right again.*	F	56
155.	18	*Bombyx mori* Domesticated Silkmoth	*selyemhernyó* (silk hernyó), *selyemlepke* (silk lepke)	*They had to go each day, picked the mulberry tree leaves for them.*	H	4
156.	19	*Aedes* spp. e.g. *Aedes vexans* mosquito species	*szúnyog, baglinc*	*Can cause inconvenience. / Has the impertinence to enter the house. / Little, thin, but if sucks itself full of blood, the bite would itch, you can't help it. / When it's rainy, there is plenty, and evenings in marshy places. / I got the malaria once from a mosquito bite. I was a little girl.*	H	100
157.	10	Ceratopogonidae e.g. *Culicoides imicola* biting midges	*báglinc, muslinca*	*Tiny beasts, like a bigger poppy seed. / It was black, but it is also bad. / There was plenty on the meadow in floods. / Harder and smaller than the mosquito. / If you smear it over with vinegar, itching will go away.*	F	14
158.	18	Psychodidae e.g. *Clogmia albipunctata* moth flies	no name	*There is a million in the bath. Both summer and winter.*	H	13
159.	10	*Drosophila* spp. e.g. *Drosophila melanogaster* fruit flies	*muslica, muska, baglinc*	*There are millions. When the wine works. / Doesn't go into the must.*	H	100

160.	19	*Tipula* spp. e.g. *Tipula maxima* crane flies	*szúnyog, szúnyogkirály* (king szúnyog), *árvaszúnyog* (orphan szúnyog), *apatini szúnyog, óriásszúnyog* (giant szúnyog)	*It does not bite, only flies around in the house. / The long legged one does not creep on you. / We stroke the mosquito king to death, there will be no mosquitoes now – this is how we said.*	H	60
161.	9	*Tabanus bovinus* Pale Giant Horse-fly	*bögöly, pécsik*	*It's got streaked eyes. / Bites you as well, but cows get them in lots! / When you sweat, it will attack you.*	P	11
162.	9	*Oestrus ovis* Sheep Bot Fly	*bogár*	*A fly lays eggs in the nostril of the sheep. When developed, the sheep would blow it out. We would always see two or three in the fodder trough.*	P	4
163.	9	*Gastrophilus intestinatus* Horse Bot Fly	*lóbögöly* (horse bögöly)	-	P	2
164.	9	*Haematopota* spp. e.g. *Haematopota pluvialis* clegs (horsefly species)	*pécsik, pécsiklégy, bögöly, lólégy* (horse légy), *bogaraztató légy* (make-jump légy)	*It bites the cows in summer. Horses even more. Greyish. Bite more before rain. / From beginning, mid-July up to mid-August is the season when they attack livestock in big numbers.*	P	83
165.	9	*Hypoderma bovis* Warble Fly	*iméj, böge, dongólégy* (buzzing légy), *zigarzóbogár*	*Winters under the skin of wild game. Long ago they were there under the skin of the cattle, livestock. / We would press them out from the back of the cows. / When it started to buzz, it rounded up livestock like a dog.*	P	77
166.	9	*Lucilia* spp. e.g. *Lucilia caesar* blow flies	*döglégy* (carcass légy), *beköpőlégy* (spiting légy)	*Shiny, mostly on droppings. / You must not have meat left exposed because flies would have spat on it.*	S	73
167.	9	*Calliphora vicina* Bluebottle Blowfly	*döglégy* (carcass légy), *köpőlégy* (spiting légy)	*Spit on meat* (=lays eggs on meat). */ Bluish ones are bigger than the green ones.*	S	21
168.	9	*Fannia canicularis* Lesser House Fly	*légy, kutyalégy* (dog légy), *istállólégy* (stable légy)	*Little black. Not so noisy like an ordinary fly. And keeps on flying around the lamp.*	H	15
169.	9	*Musca domestica* Housefly	*légy, házi légy* (house légy), *pusztuljka* (little perish)	*It's not so dangerous which is in the house. / When flies bite, it will rain, they say.*	H	100
170.	9	*Stomoxys calcitrans* Stable Fly	*légy*	*Smaller with a pointed nose. They would bite my leg.*	S	2
171.	9	*Haematobia irritans* Horn Fly	*óli légy* (pen légy), *légy*	*That one is longer nosed, but smaller, bites so hard that you jump.*	S	7

172.	9	*Sarcophaga carnaria* Common Flesh Fly	*nyűszaró* (maggot shit), *dongólégy* (buzzing légy), *köpőlégy* (spiting légy)	*Big blacks also spat on the meat. And then the maggots gnawed out the meat. / Big and humming, flies quickly. / Maybe this lays most because it is directly full with those tiny worms. You can see it when you squash it.*	S	66
173.	9	*Simulium* spp. e.g. *Simulium colombaschense* black flies	*kolombácsi#* (originated from Kolumbács)	*This attacks the livestock, cows intensively. They say, it may happen that the cow will perish when bitten. / This fly was here in 1938 and it was drummed out that everybody should take care and not go to the meadows too frequently, because you will get bitten. / We put* (dry) *manure in a pot and walked around the grandma so she could hoe and this fly did not hurt her. We made smoke of it.*	S	25
174.	13	*Melophagus ovinus* Sheep Ked	*juhkullancs* (sheep kullancs), *kullancs*	*Stays in sheep. Flat. / Gnawed the wool.*	P	4
175.	9	*Hippobosca longipennis* Dog Fly	*kutyalégy* (dog légy)	*Sticks on the dog, you can hardly get rid of it.*	P	2
176.	14	*Rhagoletis cerasi* s.l. Cherry Fruit Fly	*kukac*	*My mother would say we should not look for it, because the tiny worm was created in it. Well, it was, because it was put in it during blossoming.*	O	94
177.	14	*Rhagoletis pomonella* Apple Maggot	*almalégy* (apple légy)	*In fact not all are the same, this one gnaws at the apples only.*	O	10
178.	14	*Psila rosae* Carrot Fly	*fireg, murokfireg* (carrot worm)	*Little soft white worm.*	S	6
179.	14	*Delia radicum* Cabbage Fly	*káposztaféreg* (cabbage féreg)	*Gnaws on cabbage leaves, but what it will become, we do not know.*	A	12
180.	13	*Braula coeca* Bee Louse	*méhkullancs* (bee kullancs)	*A tiny animal. / You get them on bees, this red one. It kills the bees. / When you neglect their management, it's when it comes.*	P	6
181.	13	Aphididae (green) e.g. *Aphis pomi* green colored aphid species	*levéltetű* (leaf tetű), *tetű, ződtetyű* (green tetű)	*That one is green. It does not hatch* (does not lay eggs)*, it litters* (gives birth)*. The ladybird eats them. The dropping is sweet. Ants would climb the tree to feed on it. / It is under the leaves. It sucks and the leaf goes dry. If there are many on the peach tree, wasps would also gather.*	O	100
182.	13	*Myzus cerasi* Black Cherry Aphid	*fekete levéltetű* (black leaf tetű), *levéltetű* (leaftetű)	*The black leaf louse likes cherries better. / The edges of the leaf curl up because it sucks on it.*	O	16
183.	13	*Dysaphis plantaginea* Rosy Apple Aphid	*szürketetű* (grey tetű)*, tetű*	*Tiny and grey. Water with bordeaux mixture, it will be killed off. A little weak something. The leaf would curl up.*	O	21
184.	13	*Planococcus citri* Citrus Mealybug	*gyapjastetű* (woolly tetű)	*This one is like if it was mouldy. It is mostly at the stem of leaves. This does not fly, where does it generate, where does it come from, I do not know.*	O	4
185.	13	Aleyrodina e.g. *Aleyrodes proletella* whiteflies	*hamufireg* (ash fireg), *tetű, pillangó*	*The twig would go entirely white. / Those whites are the butterflies. It does harm to the grapevine. Gnaws at it when in blossom.*	A	20

186.	13	*Pulex irritans* Human Flea	*bolha*	*Jumps, tiny and black. / We would put walnut tree leaves in the neck to the shirt, so they did not hurt us.*	P	100
187.	13	*Ctenocephalides canis* Dog Flea	*bolha, rókabolha* (fox bolha)	*There are many fleas in the dog which also attacks man. / That one would bite you as well, but it does not stay, does not like it so much.*	P	6
188.	13	*Viteus vitifolii* Vine Louse	*filoxera#*	-	O	2
189.	13	Coccoidea e.g. *Quadraspidiotus perniciosus* scale insect	*pajzstetű* (shield tetű)	*We did not have it when I was a child. / It's like an armour on the back. Eats away the leaves but the stems even more. / That one is here on the plum tree. Sometimes it's not any more only the house. It has left it.*	O	7
190.	13	*Eriosoma lanigerum* Woolly Apple Aphid	*vértetű* (blood tetű)	-	O	4
191.	13	*Pediculus humanus capitis* Head Louse	*tetű, fejtetű* (head tetű), *hajtetű* (hair tetű), *serke*	*Climbs on you, on your head. / It's not a shame to get it, only to keep it. / It was healed at the house. We mixed oil, spirit and petrol and smeared with it. We still have it. It's because untidiness.*	P	100
192.	13	*Menacanthus stramineus* Chicken Body Louse	*tyúktetű* (hen tetű), *tetű*	*It does not stick to man. / It was controlled by onion oil. You must roast onions and smear it. / Pig fat, small red peppers were put in it, and [Sambucus ebulus] in the pen.*	P	91
193.	13	*Haematopinus suis* Hog Louse	*tetű, disznótetű* (pig tetű), *sörte*	*It's greater than the other lice, but does not live of man.*	P	29
194.	13	*Bovicola bovis* Red Louse	*tetyű*	*Cattle would be smeared over with tobacco juice. There is none any more.*	P	20
195.	13	*Pediculus humanus humanus* Body Louse	*ruhatetű* (cloth tetű), *tetű*	*Which lives in the cloth, would not go on your head. / That one is white.*	P	91
196.	13	*Pthirus pubis* Crab Louse	*lapostetű* (flat tetű)	*They say it's on your loin only. Nowhere else.*	P	8
197.	13	*Cimex lectularius* Bed Bug	*poloska*	*You had to sleep with the lights on because in the dark the plant bug would come out. / They occurred only during the war.*	P	27
198.	10	*Blatta orientalis* Oriental Cockroach	*csótány, svábogár* (Swabian bogár)	*In the blocks of flats. Totally black beetle, a larger one. / They creep under the cupboards. / If you put on the light, it will disappear.*	H	23
199.	10	*Blattella germanica* German Cockroach	*csótány, svábogár* (Swabian bogár)	*They like to stay in neglected, abandoned kitchens.*	H	12
200.	10	Dermaptera e.g. *Forficula auricularia* earwigs	*fülbemászó* (ear crawler)	*Climbs in your ear and drills it. A bad lot. It has a little dart. / Some went deaf. / Runs away quickly, thin and long. / Cloth, coat was left hung on the tree, this would enter there.*	O	92
201.	11	Cicadinae (except *Cicada orni*) e.g. *Cicadella viridis* cicadas	*sáska, szöcske* (hopper)	*A little bouncing bug.*	G	7

202.	11	*Cicada orni** bigger cicada species	*őszike* (little autumn), *trücsök*	*It is able to sound for hours* (vocalisation). *Starts to buzz at harvest time. It is able to howl for 10 minutes, for 20 minutes the same tone. / It's rare in our region, but there are many of them at the sea* (Adriatic).	O	7
203.	19	Cercopidae e.g. *Philaenus spumarius* froghoppers (cicad species)	*hab* (foam)	*It might be a kind of saliva. / There are little ash worms in it, that's why.*	G	74
204.	10	Myrmeleontidae e.g. *Myrmeleon formicarius* antlions	*porvaatka* (dust mite), *bogár*	*There is a lot of dust under the barn, where it is dry, it makes that nest. But it turns around with such a speed it would scatter dust on both sides. / Sparrows pick them out all.*	S	12
205.	18	*Chrysopa* spp. e.g. *Chrysopa perla* lacewings	*szitakötő* (sieve weaver) , *aranyszemű fátyolka*# (gold eyed veil), *lepke*	*Flutters its wings. / Comes in to the light. / Very stinky when you catch it. / Its wings are like a sieve. There is plenty of them in Fall.*	H	29
206.	19	*Palingenia longicauda** Tisa Mayfly	*tiszavirág*# (Tisza flower), *kérész*	*Short lived. One day and it's over.*	W	18
207.	19	Odonata e.g. *Sympetrum sanguineum* red dragonflies	*szitakötő* (sieve weaver), *vízipillangó* (water pillangó), *víziszita* (water sieve)	*It's got a wing like a sieve. / Flies above the water and feeds on mosquitoes. Flies quickly, stops suddenly and hovers.*	W	21
208.	19	Odonata e.g. *Anax imperator* blue dragonflies	*szitakötő* (sieve weaver), *vízipillangó* (water pillangó), *víziszita* (water sieve)	See above.	W	100

Appendix 2 The 10 features used to parametrize the model

Size: the absolute size of the species was used: 1) just visible by eye; 2) smaller than 3 cm; 3) 3-15 cm (largest insects and smaller vertebrates); 4) 15-50 cm (smaller vertebrates); 5) larger than 50 cm (ungulates, meso- and larger predators).

Morphological salience: species were categorized by colour, body form (unique, extraordinary, bizarre or different from the simplest rounded form): 1) rounded body with no conspicuous parts (e.g. Red Louse (*Bovicola bovis*)); 3) moderately conspicuous (e.g. European Honey Bee (*Apis mellifera*)); 5) striking colour and special morphology (e.g. Fire Salamander (*Salamandra salamandra*)).

Ethological character: species were categorized by sound, scent, mobility, conspicuous behaviour: 1) slow movement, and inconspicuous behaviour (e.g. Lake Limpet (*Acroloxus lacustris*)); 3) moderately conspicuous (e.g. Great Silver Water Beetle (*Hydrous piceus*)); 5) moves conspicuously, noisy (e.g. black carpenter bees (*Xylocopa violacea*, *X. valga)*).

Abundance: abundance in the Carpathian Basin was used. If distribution is fragmented, gradient-like or patchy, the average population density was used: 1) rare species living either only in a few localities, or rare everywhere (e.g. Eurasian Beaver (*Castor fiber*)); 3) moderately abundant (e.g. Common Dormouse (*Muscardinus avellanarius*)); 5) widespread and frequent/abundant almost everywhere in the Carpathian Basin (e.g. bats (Chiroptera)).

Habitat: the probability and frequency of human encounters was estimated: 1) very rarely seen by non-professionals or farmers because the species is reclusive and nocturnal, or lives under rocks in uncultivated areas (e.g. Forest Dormouse (*Dryomys nitedula*), European Copper Skink (*Ablepharus kitaibelii*)); 3) there is a medium chance of encounters (e.g. whirligig beetles (Gyrinidae)); 5) frequent around humans, and easily observed (e.g. Housefly (*Musca domestica*)).

Danger to humans: anything ranging from minor to unbearable nuisances, or even to deadly attacks: 0) not dangerous to humans, causes no inconvenience (e.g. false scorpions (Pseudoscorpiones)); 3) moderately inconvenient, potentially dangerous (e.g. European Honey Bee (*Apis mellifera*)); 5) very dangerous or even deadly to humans (e.g. European Hornet (*Vespa crabro*)).

Harmfulness refers expressly to harm done to livestock, crops or other human property: 0) no harm (e.g. Sand Lizard (*Lacerta agilis*)); 3) moderate harm (e.g. Brown Hare (*Lepus europaeus*)); 5) regular, substantial harm (e.g. Colorado Potato Beetle (*Leptinotarsa decemlineata*)).

Usefulness refers to how much a species directly serves the well-being of humans, livestock, crops or other human property (edible flesh or good fur, kills/eats parasites, important pollinator): 0) not directly useful, and of little indirect use (e.g. European Tree Frog (*Hyla arborea*)); 3) moderately useful (e.g. Hungarian Gall Wasp (*Andricus hungaricus*)); 5. significantly and directly useful (e.g. European Honey Bee (*Apis mellifera*)).

Subjective relation of humans with the given species, and their diverse occurrence in different folklore genres: 0) neutral relationship, the species does not appear in folklore (e.g. a family of predatory mites (Parasitidae)); 1) there is no widely known narrative element related to the species, but it is present in the spiritual and oral culture; 3) narratives are widely known, the species appears in folklore genres (e.g. Eurasian Weasel (*Mustela nivalis*)); 5) the species is represented in numerous narrative text corpuses and diverse folklore genres, with strong emotional attachment or aversion (e.g. Red Deer (*Cervus elaphus*)).

Nature conservation value was based on legally protected status and status of threat: 0) alien and native pest species; 1) native species, sometimes harmful, not protected, not endangered; 2) species that are not (or not significantly) endangered, not harmful, and cannot be hunted; 3) species protected or of special attention because of their value as game animal; 4) vulnerable, threatened species, officially protected in Hungary; 5) species highly and critically endangered in the Carpathian Basin.

Appendix 3 Values of features and observed, calculated and expected familiarity values

No.	scientific name	common name	size	morphological salience	ethological saliance	abundance	habitat	usefulness	harmfulness	danger to human	richness of national folklore	nature conservational value	observed familiarity (%)	calculated familiarity (model) (%)	expected familiarity (zoologists) (scores)
1	***Rhagoletis pomonella***	**Cherry Fruit Fly**	1	1	1	4	5	0	3	0	0	1	10	62	1.2
2	**Pseudoscorpiones**	**false scorpions**	1	5	1	2	4	0	0	0	0	1	5	25	0.4
3	***Calosoma sycophanta***	**Forest Caterpillar Hunter**	3	5	3	3	2	2	0	0	0	3	7	51	0.8
4	***Cetonia aurata***	**Green Rose Chafer**	2	5	4	3	3	0	0	0	0	1	82	27	1.5
5	***Canis aureus***	**Golden Jackal**	5	4	4	3	2	0	3	2	1	2	36	59	1.4
6	**Andrenidae**	**mining bees**	2	1	1	2	1	1	0	1	0	2	15	19	0.7
7	***Ursus arctos***	**Brown Bear**	5	3	5	1	3	1	4	5	4	5	29	35	2.0
8	**Parasitidae**	**a family of predatory mites**	1	4	4	5	3	0	0	0	0	1	5	35	0.3
9	***Leptinotarsa decemlineata***	**Colorado Potato Beetle**	2	5	1	5	5	0	5	0	0	0	100	65	3.0
10	***Graphosoma lineatum***	**Italian Striped-bug**	2	4	3	4	5	0	1	0	0	1	15	46	1.2
11	***Argiope bruennichi***	**Wasp Spider**	2	5	2	3	3	1	0	1	1	1	5	38	1.7
12	**Chiroptera**	**bats**	3	5	5	5	5	0	1	2	4	4	100	112	2.2
13	***Lucilia* spp.**	**blow flies**	2	5	3	4	4	0	1	3	0	1	73	47	2.4
14	***Drosophila melanogaster***	**Vinegar Fly**	1	1	5	5	5	0	0	0	0	1	100	73	2.5
15	***Pulex irritans***	**Human Flea**	1	1	5	3	5	0	0	4	2	1	100	74	2.8
16	***Dryomys nitedula***	**Forest Dormouse**	3	4	2	1	1	0	1	0	0	5	6	8	0.9
17	***Castor fiber***	**Eurasian Beaver**	5	4	5	2	3	0	3	0	2	4	9	53	1.5
18	***Mustela nivalis***	**Eurasian Weasel**	4	3	3	3	4	0	2	0	2	2	93	62	1.8
19	***Meles meles***	**Eurasian Badger**	5	5	4	4	3	0	3	1	0	1	87	65	2.6
20	***Cohlicopa* spp.**	**a pulmonate gastropod genus**	1	2	1	3	1	0	0	0	0	1	0	20	0.3
21	***Salamandra salamandra***	**Fire Salamander**	3	5	1	1	1	0	0	1	2	4	34	33	1.6
22	**Dermaptera**	**earwigs**	2	4	3	4	4	0	0	1	2	1	92	53	2.0
23	***Lacerta agilis, Podarcis taurica***	**Sand Lizard, Balkan Wall Lizard**	3	3	4	5	4	0	0	0	1	3	100	75	2.2
24	***Cervus elaphus***	**Red Deer**	5	5	4	4	3	4	3	2	5	1	88	114	2.8
25	***Mus spicilegus***	**Steppe Mouse**	3	2	3	3	3	0	2	1	0	1	31	54	1.7
26	***Sceliphron destillatorium***	**Mud Dauber Wasp**	2	3	3	3	4	0	0	2	0	1	20	23	0.9
27	***Lymantria dispar***	**Gypsy Moth**	3	2	3	4	3	0	4	0	0	0	56	60	1.9

28	**Myrmeleontidae**	**antlions**	1	1	5	3	5	0	0	0	0	1	12	55	1.0
29	**Notonectidae**	**backswimmers (true bugs)**	2	4	4	3	3	0	1	2	0	1	10	20	1.3
30	***Harmonia axyridis***	**Harlequin Ladybird**	2	5	5	5	4	0	2	1	2	0	71	72	0.9
31	***Mus musculus***	**House Mouse**	3	3	4	5	5	0	4	3	4	0	91	96	2.9
32	***Musca domestica***	**Housefly**	2	1	5	5	5	0	1	1	2	1	100	92	2.8
33	***Apis mellifera***	**European Honey Bee**	2	3	4	5	5	5	0	3	5	2	100	99	3.0
34	***Mustela erminea***	**Stoat**	4	4	2	2	2	0	1	0	2	4	15	46	1.5
35	***Menacanthus stramineus***	**Chicken Body Louse**	1	1	2	3	5	0	3	1	0	1	91	55	1.8
36	***Mantis religiosa***	**European Praying Mantis**	3	5	4	4	4	1	0	0	2	3	42	86	2.2
37	***Macroglossum stellatarum***	**Hummingbird Hawk-moth**	2	3	5	4	5	0	0	0	0	1	36	39	1.3
38	***Xylocopa violacea, Xylocopa valga***	**black coloured carpenter bees**	3	4	5	3	3	0	2	3	0	1	53	46	1.7
39	***Vipera berus***	**Adder**	4	3	3	1	2	0	2	5	3	5	24	28	1.9
40	***Blatta orientalis***	**Oriental Cockroach**	2	3	3	3	5	0	1	4	3	0	23	53	2.1
41	***Lytta vesicatoria***	**Spanish Fly**	3	5	4	2	2	1	1	2	0	1	88	44	1.3
42	***Gyrinus natator***	**Whirligig Beetle**	1	1	5	2	3	0	0	0	0	1	4	24	0.5
43	***Hydrous piceus***	**Great Silver Water Beetle**	3	3	3	3	2	0	2	1	0	1	79	37	1.5
44	***Lutra lutra***	**Eurasian Otter**	5	4	3	3	3	0	4	0	1	5	68	58	2.4
45	***Ostrinia nubilalis***	**European Corn Borer**	2	1	2	4	5	0	4	0	0	1	70	64	2.4
46	***Anguis fragilis* s.l.**	**slow worm species**	3	3	3	3	2	0	0	0	0	4	77	35	1.1
47	***Cepaea* spp.**	**land snail species**	2	4	1	3	3	0	1	0	0	1	14	18	1.0
48	**Aleyrodina**	**whiteflies**	1	4	3	3	3	0	4	0	0	1	20	16	1.2
49	***Vespa crabro***	**European Hornet**	3	3	5	4	4	0	3	5	0	1	100	58	2.6
50	***Haemopis sanguisuga***	**Horse-leech**	3	1	4	3	1	0	0	0	0	1	80	55	1.7
51	***Fasciola hepatica***	**Common Liver-fluke**	2	2	3	2	4	0	3	2	0	1	64	30	2.0
52	***Melolontha melolontha***	**Cockchafer**	3	4	5	5	4	0	5	0	2	1	100	89	3.0
53	***Bovicola bovis***	**Red Louse**	1	1	2	2	5	0	1	0	0	1	20	44	1.8
54	***Acroloxus lacustris***	**Lake Limpet**	1	2	1	3	1	0	0	0	0	1	0	20	0.5
55	***Emys orbicularis***	**European Pond Turtle**	4	5	2	2	3	0	0	0	1	4	40	50	2.3
56	***Muscardinus avellanarius***	**Common Dormouse**	3	3	2	3	1	0	1	0	0	4	20	30	1.3
57	***Mustela eversmanni***	**Steppe Polecat**	4	3	2	2	2	0	2	0	0	4	2	23	1.2
58	***Ovis aries***	**Mouflon**	5	5	3	2	3	1	3	0	0	0	39	46	1.8
59	***Cerambyx cerdo***	**Great Capricorn Beetle**	3	5	4	2	3	0	1	0	0	3	33	41	1.6
60	***Andricus hungaricus***	**Hungarian Gall Wasp**	3	4	1	3	3	3	0	0	3	2	83	62	1.2
61	***Glis glis***	**Edible Dormouse**	4	3	3	3	2	0	3	0	2	4	42	50	1.4
62	***Lucanus cervus***	**European Stag Beetle**	3	5	4	3	3	0	1	1	2	3	98	69	2.6
63	***Martes foina***	**Beech Marten**	4	4	4	4	5	1	4	0	0	1	98	70	2.3
64	**Curculionidae**	**true weevils**	2	4	1	3	3	0	4	0	0	1	10	18	1.5
65	***Oryctes nasicornis***	**European Rhinoceros**	3	5	1	2	2	0	0	0	0	3	61	41	1.5

		Beetle													
66	***Argulus foliaceus***	**Common Fish Louse**	1	2	4	3	2	0	2	0	0	1	10	26	1.5
67	***Haematopota* spp.**	**clegs (horsefly species)**	3	2	4	3	4	0	2	3	1	1	83	76	2.5
68	***Tineola bisselliella***	**Common Clothes Moth**	2	2	3	5	5	0	5	0	0	1	96	67	2.8
69	***Pediculus humanus humanus***	**Body Louse**	1	1	2	1	5	0	0	2	0	1	91	27	2.2
70	***Ips* spp.**	**engraver beetles**	1	1	2	4	5	0	5	0	0	1	100	62	2.3
71	***Canis lupus***	**Gray Wolf**	5	4	4	1	1	2	4	5	5	5	82	63	2.0
72	***Triturus cristatus* s.l.**	**crested newt species**	3	4	1	3	1	0	0	0	0	4	31	36	1.5
73	***Oryctolagus cuniculus***	**European Rabbit**	4	4	5	2	4	1	1	0	2	0	26	57	2.0
74	***Sus scrofa***	**Wild Boar**	5	5	4	5	3	4	4	5	4	1	100	98	2.9
75	***Felis silvestris***	**Wildcat**	5	4	2	2	1	0	1	1	0	5	93	32	1.8
76	***Pyrrhocoris apterus***	**Firebug**	2	4	5	5	5	0	2	0	1	1	100	67	2.7
77	***Sciurus vulgaris***	**Eurasian Red Squirrel**	4	5	5	4	3	0	1	0	4	3	78	77	25
78	***Bombina bombina***	**European Fire-bellied Toad**	3	4	4	4	3	1	0	1	0	3	23	51	1.9
79	***Palomena prasina/ Nezara viridula***	**Green Shield Bug Southern Green Stink Bug**	2	2	5	4	5	0	3	0	0	1	82	56	1.7
80	***Hyla arborea***	**European Tree Frog**	3	4	3	5	3	1	0	0	4	3	98	80	2.5
81	***Bufotes viridis***	**European Green Toad**	3	4	2	4	5	1	0	1	2	3	93	88	2.4

Appendix 4 Values of features, observed and calculated familiarity values for species used in the model but not used in the questionnaire

No.	scientific name	common name	size	morphological salience	ethological saliance	abundance	habitat	usefulness	harmfulness	danger to human	richness of national folklore	nature conservational value	observed familiarity (%)	calculated familiarity (model) (%)
1	***Vulpes vulpes***	**Red Fox**	5	5	3	5	4	3	5	2	4	0	100	100
2	***Capreolus capreolus***	**European Roe Deer**	5	5	5	5	4	4	3	1	3	1	100	100
3	***Talpa europaea***	**Common Mole**	4	5	5	5	5	0	4	0	3	3	98	100
4	***Rattus norvegicus***	**Brown Rat**	4	3	4	5	5	0	5	4	3	0	100	96
5	***Lepus europaeus***	**Brown Hare**	4	5	4	4	4	3	3	0	4	3	100	87
6	***Erinaceus roumanicus***	**Northern White-breasted Hedgehog**	4	5	4	5	5	2	0	1	3	3	100	100
7	***Coccinella septempunctata***	**Seven-spot Ladybird**	2	5	3	5	4	5	0	0	5	2	100	100
8	***Paravespula germanica***	**German Wasp**	2	5	5	5	5	0	2	4	2	1	100	86
9	***Vespula vulgaris, Polistes gallicus***	**paper wasp species**	2	5	5	5	5	0	2	4	2	1	61	86
10	***Helix spp.***	**edible snails**	3	5	4	4	4	2	3	0	4	2	100	89
11	***Spermophilus citellus***	**European Ground Squirrel**	4	4	5	3	4	0	1	1	2	5	53	70
12	***Araneus* spp.**	**spider species**	2	5	5	5	5	1	0	1	4	1	42	86
13	***Sarcophaga carnaria***	**Common Flesh Fly**	2	4	5	5	5	0	4	3	0	1	66	59
14	***Dama dama***	**Fallow Deer**	5	5	4	2	3	5	3	1	0	0	46	46
15	***Alces alces***	**Elk**	5	5	3	1	1	3	3	3	1	2	3	33
16	***Bombus terrestris***	**Buff-tailed Bumblebee**	2	4	4	5	4	4	0	1	1	2	25	57
17	***Cricetus cricetus***	**Common Hamster**	4	4	3	2	3	1	3	1	1	3	65	41
18	***Mustela putorius***	**European Polecat**	4	4	3	3	4	1	4	0	2	1	91	69
19	***Natrix natrix***	**Grass Snake**	4	4	4	4	4	0	0	0	2	3	96	75
20	***Pelophylax lessonae P. kl. esculenta P. ridibundus***	**Pool Frog, Edible Frog, Marsh Frog**	3	3	5	4	3	1	0	0	3	3	67	62
21	***Hirudo verbana***	**Mediterranean Medicinal Leech**	3	4	3	4	3	1	0	4	1	3	100	63
22	***Lacerta viridis***	**European Green Lizard**	3	4	5	3	4	1	0	1	1	3	55	64
23	***Palingenia longicauda***	**Tisa Mayfly**	3	4	5	2	3	2	0	0	2	3	18	49

24	***Apis mellifera* var. *ligustica***	**Italian Bee**	2	2	4	4	4	4	0	3	1	1	31	58
25	***Taenia solium Taeniarhynchus saginatus***	**Pork Tapeworm, Beef Tapeworm**	4	3	1	2	5	0	4	5	0	1	38	49
26	***Gryllotalpa gryllotalpa***	**European Mole Cricket**	3	4	3	5	5	0	4	0	1	1	98	93
27	***Lumbricus* spp.**	**earthworms**	3	4	3	5	5	3	0	0	1	1	100	93
28	***Arion vulgaris***	**Spanish Slug**	3	4	4	4	5	0	5	0	0	0	16	71
29	***Lampyris noctiluca***	**Common Glowworm, Central European Firefly**	2	4	5	5	4	0	0	0	3	1	69	66
30	***Harmonia axyridis***	**Harlequin Ladybird**	2	5	5	5	4	0	2	1	2	0	71	72
31	***Ixodes* spp.**	**ticks**	1	2	3	4	5	0	3	5	2	1	94	74
32	***Geotrupes* spp.**	**dor beetles**	2	3	5	4	4	3	0	0	1	1	53	39
33	***Microtus arvalis***	**Common Vole**	3	2	2	5	4	0	4	1	0	1	42	83
34	***Hypoderma bovis***	**Warble Fly**	2	4	4	3	4	0	2	3	0	1	77	30
35	***Blaps* spp.**	**tenebrionid beetle**	3	4	4	5	5	0	0	1	0	1	33	83
36	***Diabrotica virgifera***	**Western Corn Rootworm**	2	4	4	4	4	0	5	0	0	0	2	35
37	***Lynx lynx***	**Eurasian Lynx**	5	4	1	1	1	0	1	1	1	5	29	23
38	***Astacus astacus***	**European Crayfish**	3	5	3	2	1	2	0	1	1	4	90	46
39	***Meloe* spp.**	**oil beetles**	3	4	3	3	3	0	2	0	2	3	11	59
40	***Tettigonia viridissima***	**Great Green Bush-cricket**	3	5	3	5	4	0	1	0	0	1	73	82
41	***Psyllobora vigintiduopunctata***	**22-spot Ladybird**	2	5	2	5	3	4	0	0	0	1	68	46
42	***Coronella austriaca***	**Smooth Snake**	4	3	3	2	2	0	0	1	1	4	2	34
43	***Hydrous piceus***	**Great Silver Water Beetle**	3	3	3	3	2	0	2	1	0	1	79	37
44	***Sorex, Crocidura* spp.**	**shrews**	3	4	2	4	3	1	0	0	0	3	54	50
45	**Thomisidae**	**crab spiders**	2	5	3	5	3	1	0	0	1	1	4	56
46	**Aphididae**	**green colored aphid species**	1	2	4	5	5	0	3	0	0	1	100	65
47	**Julidae**	**millipede species**	2	4	2	5	5	1	0	1	0	1	16	58
48	***Gerris* spp.**	**water striders**	2	4	5	5	4	0	0	0	0	1	58	47
49	***Argyroneta aquatica***	**Diving Bell Spider**	2	2	5	4	1	0	0	2	1	3	0	40
50	***Rana dalmatina, Rana temporaria***	**Agile Frog, Common Frog**	3	3	2	3	3	1	0	0	1	3	20	46
51	***Polyommatus* spp.**	**blues (butterfly species)**	2	5	3	4	4	0	0	0	0	2	31	44
52	**Chaetocnema**	**flea beetles**	1	1	4	5	4	0	4	0	0	1	61	63

53	**_Lithobius_ spp.**	**common centipedes**	2	4	4	5	4	0	0	0	0	1	44	47
54	**_Bruchus pisi Acanthoscelides obtectus_**	**Pea Beetle, Bean Beetle**	1	1	1	5	5	0	5	0	0	1	58	73
55	**_Cossus cossus_**	**Goat Moth**	3	3	3	3	4	0	4	0	0	1	5	47
56	**Bivalvia**	**clams**	3	4	1	4	3	1	0	2	0	1	83	53
57	**_Tipula_ spp.**	**crane flies**	3	4	2	5	4	0	0	0	0	1	60	73
58	**_Nyctereutes procyonoides_**	**Racoon Dog**	5	4	2	1	1	1	1	3	0	0	0	13
59	**_Martes martes_**	**European Pine Marten**	4	4	2	1	1	0	1	0	0	4	16	6
60	**_Acheta domestica_**	**House Cricket**	2	1	3	3	5	0	0	0	0	1	33	57
61	**_Pediculus humanus capitis_**	**Head Louse**	1	1	1	3	5	0	0	5	1	1	100	68
62	**_Rhagoletis cerasi_ s. l.**	**Cherry Fruit Fly**	1	1	1	5	5	0	4	0	0	1	94	73
63	**_Oecanthus pellucens_**	**Italian Tree Cricket**	2	3	4	4	3	0	1	0	0	1	40	18
64	**_Agriotes_ spp.**	**click beetles**	2	3	3	4	4	0	1	0	0	1	27	29
65	**_Microtrombidium pusillum_**	**Dwarf Velvet Mite**	1	3	2	5	4	0	0	2	0	1	17	40
66	**Thysanura**	**silverfish species**	2	3	2	5	5	0	0	0	0	1	0	50
67	**Psychodidae**	**moth flies**	2	3	4	3	5	0	0	0	0	1	13	32
68	**Cercopidae**	**froghoppers (cicad species)**	2	5	1	5	4	0	0	0	0	1	74	56
69	**_Eisenia fetida_**	**Redworm**	3	4	1	4	4	1	0	0	0	1	10	61
70	**_Apodemus agrarius_**	**Striped Field Mouse**	3	4	3	4	2	0	0	0	0	1	54	50
71	**_Osmia adunca_**	**mason bee species**	2	2	4	1	3	2	0	1	1	1	18	10
72	**_Sitophilus granarius_**	**Wheat Weevil**	1	1	1	4	4	0	5	0	0	1	22	52
73	**_Braula coeca_**	**Bee Louse**	1	3	1	4	2	0	4	0	0	1	6	16
74	**_Pthirus pubis_**	**Crab Louse**	1	1	2	1	5	0	0	5	0	1	8	29
75	**_Cimex lectularius_**	**Bed Bug**	1	1	1	1	4	0	0	5	2	1	27	35
76	**_Myzus cerasi_**	**Black Cherry Aphid**	1	1	2	4	4	0	3	0	0	1	16	52
77	**_Fannia canicularis_**	**Lesser House Fly**	2	1	2	3	5	0	1	1	0	1	15	57
78	**_Chrysopa_ spp.**	**lacewings**	2	2	3	4	4	0	0	0	0	1	29	46
79	**_Gonepteryx rhamni_**	**Common Brimstone**	2	5	3	3	3	0	0	0	0	1	7	27
80	**_Ablepharus kitaibelii_**	**European Copper Skink**	3	2	2	1	1	0	0	0	0	5	0	18
81	**_Bielzia coerulans_**	**Carpathian Blue Slug**	3	5	1	1	1	0	0	0	0	3	5	16
82	**_Natrix tesellata_**	**Dice Snake**	4	1	1	1	1	0	0	0	1	3	2	34
83	**_Taenia multiceps_**	**tapeworm species**	1	1	1	1	3	0	3	0	0	1	9	5
84	**_Haematopinus suis_**	**Hog Louse**	1	1	2	1	3	0	1	0	0	1	29	5
85	**_Simulium_ spp.**	**black flies**	2	1	1	2	1	0	2	1	0	1	25	20

Appendix 5 Questions (data sheet)

Questions – the data sheet used for the interviews:

Name of the informant, profession, place, date of birth, date of interview

What does a beaver look like?

What is the size of beavers?

What do they eat?

Which tree species are used by beavers?

Which parts of the tree are eaten by beavers?

How far do beavers go from water bodies?

Are beavers useful or harmful?

What kind of benefits could you mention?

What kind of harms could you mention?

Are there any natural predators of beavers?

Are they dangerous or not to humans?

Is it legal to hunt beavers?

Are they protected or not?

How can you deduce the presence of beavers if you cannot actually see them?

What kind of tree species are used for dams?

Why do beavers build dams?

Which year have the beavers appeared in your neighborhood?

How did they arrive?

Do you know of any concrete release events?

Where do beavers live in your neighborhood?

What is your estimate of local population size?

Is the local population increasing, decreasing or stagnant?

Is this population trend good or bad in your opinion?

What impact do the beavers have on local nature?

What impact do the beavers have on water bodies?

What impact do the beavers have on fish populations?

What impact do the beavers have on riparian woodlands?

What impact do the beavers have on arable fields?

What impact do the beavers have on hay meadows next to the water?

What impact do the beavers have on your life?

What impact do the beavers have on other inhabitants of your village?

Why is it good that the beavers are here?

Who benefits from the beavers being here?

Appendix 6 Some typical examples of the diverse perceptions of beavers related to regulating and cultural services (memes)

REGULATING: Water regulation

they regulate the water flow of streams, and somehow balance water regime
during droughts the level of ground water is raised
they make reservoirs
they raise water levels nicely
they're good because meadows are flooded, the stream recovers its original bed; bad because marshlands came back
water level is raised by their dams which is good for the agriculture [counterbalance drainage]
they don't build dams, don't make any difference in waters
they're not harmful, just obstructs the water flow
they clog the stream and the water spreads
the trees felled into the water course catch a lot of debris, and because of that the stream creates a new bed for itself

REGULATING: Erosion control

they stop riverside erosion [by felling trees and steering water away from the banks]
good because they moderate the flow of water, so it doesn't erode; bad because they chop off trees which would protect the banks
the water flow is slower, the banks collapse
they hinder the natural flow of the stream, when water level is high, it cuts in on the sides, and makes wider floodplain
it has taken a part of our garden [2 m]
they burrow the banks, make dens; water can cut in more easily and deeply, the current gets it
the stream have become wider and deeper, and the banks higher

Well, it's just that if they build a series of dams, lakes are created. Trout doesn't like slow water. I can't tell if fish leave or not, but it's beneficial for smaller fish, that's for sure. But as a matter of fact it might be good for trout either, because of the roots, they can hide there.
It's native. They belong here.
Well, the impoundments probably help the breeding of fish and that is good for humans. They [beavers] *provide spawning ground, which is also good from the environmental point of view.*
they help nature to nurse fish by building dams [so that they can breed and be eaten]
They are good for fish because of the dams. Dams provide shelter. And it's also positive that new plant and animal species appear.
God has created beavers with a purpose
More fish and frogs, and so more storks. They are good for wild boars. Boars can wallow in the ponds where the water is not moving, just impounded.
they create nesting place for other animals
maybe nature needs them as well
grey heron, black stork, and mallards have reappeared
When water is higher, there are more fish. And they can spawn. They must have a place and function in the food chain.
the felled trees provide habitat for insects
it's a living creature, let it be
they create habitat for other species like fungi
they are good for biodiversity
they are beneficial from the ecological point of view and that is good for everyone
they provide food for fish: carps eat buds, breams and chub eat the insects from the trees
the number of fish doesn't change but they may just help some other animals
the composition of the forests changes: maples advance
fish and mallards leave [to avoid beavers]
They are useless animals and disturb fish. Every creature has a place in nature, but these are simply needless.
they are bad, because litter is accumulated, and that poisons fish
trout prefer fast moving waters and beavers stop the rapid flow

REGULATING: Flood protection

they moderate floods

rivers shouldn't be allowed to run wider

they wash the banks away, this is the damage they cause

REGULATING: Water purification and water quality regulation

water remains pure

dams filter out litter

the felled trees collect debris

they purify water

dams gather debris and sediment

Water is impounded which means that the amount of sediment increases. That's surely not good for the water.

they stir up mud and silt

they befoul water, slow the flow of water

CULTURAL: Aesthetic values

they clean [gnaw] *the edges of hay meadows* [the informants consider that as tidiness]

it's good that they clean the banks of the stream

beautiful, a curiosity

no lush weeds remain [good, beavers gnaw plants off]

they clean the groves along the stream, they gnaw off weed trees

[good to have them] *because of the beauty of nature*

they have no impact, but awful to see

there is quite a chaos on the floodplain

it takes the filth to the meadows

stream banks are very ugly

they fell trees, the landscape becomes ugly

there is marsh and filth everywhere

CULTURAL: Enjoyment provided by wild species

their presence is good for animal lovers, nature conservationists

Well, they are good for children. They love beavers. They have such cute faces. You just can't dislike them. They are adorable and beautiful animals.

they are nice animals, I like them, they have a cute face, I disapprove of hurting them

one more curiosity, now I greet them as friends

They don't bother me. I like watching their lodge, what a complex building, and how it raises the water level. They are expert builders, I love their activity. Locals went to admire the lodge: how beautiful, how proficient.

They build expertly. Even the most proficient lumberjack wouldn't be able to fell the trees to the same spot.

They are nice to see, beautiful. They are good because of aesthetic reasons.

There is a very beautiful tree with signs of gnawing. It's wonderful.

Children have enjoyed finding it. The first dams were very much admired. It was a fairy tale, a wonder, magical, …so good. It is a pleasure to see what these little creatures can build.

They give me half a day of extra work each year, but that's all. I can live with that… I'm an animal lover, I enjoy having them here.

it is wonderful how they defend their territories, they are boxing with each other

I am glad that beavers are here

I move carefully so that I could observe them better

sometimes I watch them when I'm in my boat, and I don't move, I stop

it could be a Hungarian specialty

I don't like them, I am afraid of them

nobody is happy about them, dams are nice, but it's not good that we maintain their habitat

CULTURAL: Educational values, information and knowledge

they are good for researchers who study them and also for children

it's good to see them for real

camps could be organized to show them to children

there is a beaver-tour in Iklódbördőce [a trail is blazed]

unconventional biology classes should be organized to 7-8 grade students

CULTURAL: Recreation and ecoturism

they block the water flow, so tourists, children and animals can bath

It created a lake. Children could skate in winter.

nature reserves should be designated

paddling trips are organized to see the beavers' lodges and signs of gnawing on the banks of Mura

tourism can be based on beavers like in the north, visitors can hunt them, it's extra profit

it think they wouldn't attract tourists

we come here to relax but then sometimes we get upset about them

it should be perceived as a special attraction, but a station to observe beavers shouldn't be built

they have felled the ash tree near my fishing site, they disturb fishing

they have even gnawed the boats

the puddles detained after floods are swarming with mosquitos

one can't fish for 10-15 minutes, half an hour, not until the water calms down after their movement

We could bath in the past. Now children are hardly let go [because beavers make the stream dirty].

Appendix 7 Estimated values of coefficients of explanatory variables and calculated familiarity for the 81 species

No.	scientific name	common name	size	morphological salience	ethological saliance	abundance	habitat	usefulness	harmfulness	danger to human	richness of national folklore	nature conservational value	calculated familiarity (model) (%)
1	***Rhagoletis pomonella***	**Cherry Fruit Fly**	0	0	0	34	27	0	0	0	0	1	62
2	**Pseudoscorpiones**	**false scorpions**	0	-9	0	16	17	0	0	0	0	1	25
3	***Calosoma sycophanta***	**Forest Caterpillar Hunter**	28	-9	0	27	6	0	0	0	0	0	51
4	***Cetonia aurata***	**Green Rose Chafer**	2	-9	0	27	6	0	0	0	0	1	27
5	***Canis aureus***	**Golden Jackal**	32	-18	0	27	6	0	0	2	10	0	59
6	**Andrenidae**	**mining bees**	2	0	0	16	0	0	0	1	0	0	19
7	***Ursus arctos***	**Brown Bear**	32	-25	0	-2	6	0	0	3	19	1	35
8	**Parasitidae**	**a family of predatory mites**	0	-18	0	45	6	0	0	0	0	1	35
9	***Leptinotarsa decemlineata***	**Colorado Potato Beetle**	2	-9	0	45	27	0	0	0	0	0	65
10	***Graphosoma lineatum***	**Italian Striped-bug**	2	-18	0	34	27	0	0	0	0	1	46
11	***Argiope bruennichi***	**Wasp Spider**	2	-9	0	27	6	0	0	1	10	1	38
12	**Chiroptera**	**bats**	28	-9	0	45	27	0	0	2	19	0	112
13	***Lucilia* spp.**	**blow flies**	2	-9	0	34	17	0	0	2	0	1	47
14	***Drosophila melanogaster***	**Vinegar Fly**	0	0	0	45	27	0	0	0	0	1	73
15	***Pulex irritans***	**Human Flea**	0	0	0	27	27	0	0	3	16	1	74
16	***Dryomys nitedula***	**Forest Dormouse**	28	-18	0	-2	0	0	0	0	0	1	8
17	***Castor fiber***	**Eurasian Beaver**	32	-18	0	16	6	0	0	0	16	0	53
18	***Mustela nivalis***	**Eurasian Weasel**	26	-25	0	27	17	0	0	0	16	0	62
19	***Meles meles***	**Eurasian Badger**	32	-9	0	34	6	0	0	1	0	1	65
20	***Cohlicopa* spp.**	**a pulmonate gastropod genus**	0	-8	0	27	0	0	0	0	0	1	20
21	***Salamandra salamandra***	**Fire Salamander**	28	-9	0	-2	0	0	0	1	16	0	33

22	**Dermaptera**	**earwigs**	2	-18	0	34	17	0	0	1	16	1	53

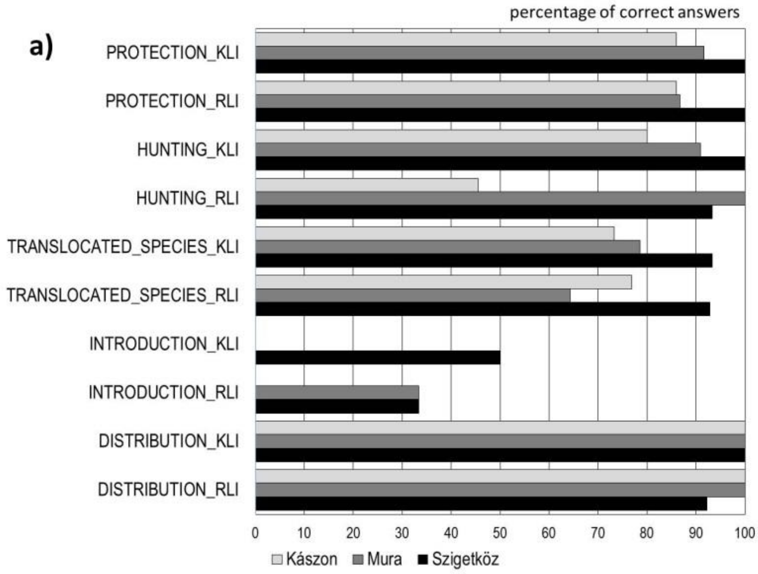
23	***Lacerta agilis, Podarcis taurica***	**Sand Lizard, Balkan Wall Lizard**	28	-25	0	45	17	0	0	0	10	0	75
24	***Cervus elaphus***	**Red Deer**	32	-9	0	34	6	0	0	2	47	1	114
25	***Mus spicilegus***	**Steppe Mouse**	28	-8	0	27	6	0	0	1	0	1	54
26	***Sceliphron destillatorium***	**Mud Dauber Wasp**	2	-25	0	27	17	0	0	2	0	1	23
27	***Lymantria dispar***	**Gypsy Moth**	28	-8	0	34	6	0	0	0	0	0	60
28	**Myrmeleontidae**	**antlions**	0	0	0	27	27	0	0	0	0	1	55
29	**Notonectidae**	**backswimmers (true bugs)**	2	-18	0	27	6	0	0	2	0	1	20
30	***Harmonia axyridis***	**Harlequin Ladybird**	2	-9	0	45	17	0	0	1	16	0	72
31	***Mus musculus***	**House Mouse**	28	-25	0	45	27	0	0	2	19	0	96
32	***Musca domestica***	**Housefly**	2	0	0	45	27	0	0	1	16	1	92
33	***Apis mellifera***	**European Honey Bee**	2	-25	0	45	27	0	0	2	47	0	99
34	***Mustela erminea***	**Stoat**	26	-18	0	16	6	0	0	0	16	0	46
35	***Menacanthus stramineus***	**Chicken Body Louse**	0	0	0	27	27	0	0	1	0	1	55
36	***Mantis religiosa***	**European Praying Mantis**	28	-9	0	34	17	0	0	0	16	0	86
37	***Macroglossum stellatarum***	**Hummingbird Hawk-moth**	2	-25	0	34	27	0	0	0	0	1	39
38	***Xylocopa violacea, Xylocopa valga***	**black coloured carpenter bees**	28	-18	0	27	6	0	0	2	0	1	46
39	***Vipera berus***	**Adder**	26	-25	0	-2	6	0	0	3	19	1	28
40	***Blatta orientalis***	**Oriental Cockroach**	2	-25	0	27	27	0	0	3	19	0	53
41	***Lytta vesicatoria***	**Spanish Fly**	28	-9	0	16	6	0	0	2	0	1	44
42	***Gyrinus natator***	**Whirligig Beetle**	0	0	0	16	6	0	0	0	0	1	24
43	***Hydrous piceus***	**Great Silver Water Beetle**	28	-25	0	27	6	0	0	1	0	1	37
44	***Lutra lutra***	**Eurasian Otter**	32	-18	0	27	6	0	0	0	10	1	58
45	***Ostrinia nubilalis***	**European Corn Borer**	2	0	0	34	27	0	0	0	0	1	64
46	***Anguis fragilis* s.l.**	**slow worm species**	28	-25	0	27	6	0	0	0	0	0	35
47	***Cepaea* spp.**	**land snail species**	2	-18	0	27	6	0	0	0	0	1	18
48	**Aleyrodina**	**whiteflies**	0	-18	0	27	6	0	0	0	0	1	16
49	***Vespa crabro***	**European Hornet**	28	-25	0	34	17	0	0	3	0	1	58
50	***Haemopis***	**Horse-leech**	28	0	0	27	0	0	0	0	0	1	55

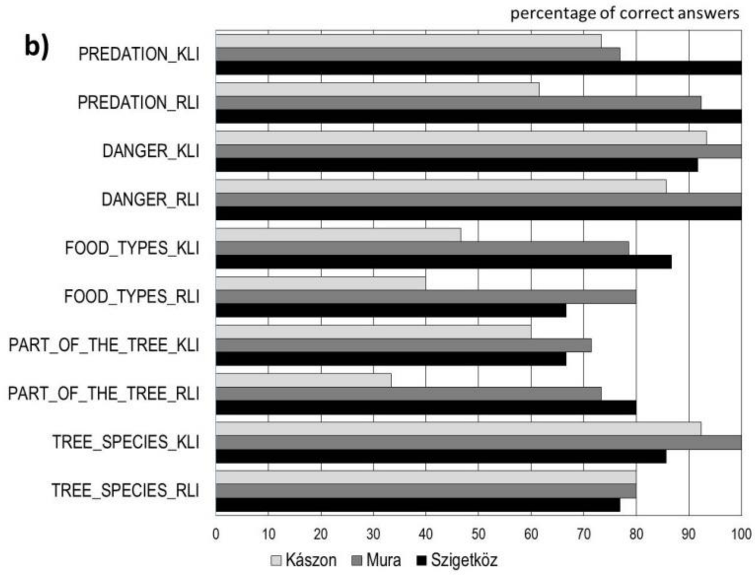
	sanguisuga												

51	***Fasciola hepatica***	**Common Liver-fluke**	2	-8	0	16	17	0	0	2	0	1	30
52	***Melolontha melolontha***	**Cockchafer**	28	-18	0	45	17	0	0	0	16	1	89
53	***Bovicola bovis***	**Red Louse**	0	0	0	16	27	0	0	0	0	1	44
54	***Acroloxus lacustris***	**Lake Limpet**	0	-8	0	27	0	0	0	0	0	1	20
55	***Emys orbicularis***	**European Pond Turtle**	26	-9	0	16	6	0	0	0	10	0	50
56	***Muscardinus avellanarius***	**Common Dormouse**	28	-25	0	27	0	0	0	0	0	0	30
57	***Mustela eversmanni***	**Steppe Polecat**	26	-25	0	16	6	0	0	0	0	0	23
58	***Ovis aries***	**Mouflon**	32	-9	0	16	6	0	0	0	0	0	46
59	***Cerambyx cerdo***	**Great Capricorn Beetle**	28	-9	0	16	6	0	0	0	0	0	41
60	***Andricus hungaricus***	**Hungarian Gall Wasp**	28	-18	0	27	6	0	0	0	19	0	62
61	***Glis glis***	**Edible Dormouse**	26	-25	0	27	6	0	0	0	16	0	50
62	***Lucanus cervus***	**European Stag Beetle**	28	-9	0	27	6	0	0	1	16	0	69
63	***Martes foina***	**Beech Marten**	26	-18	0	34	27	0	0	0	0	1	70
64	**Curculionidae**	**true weevils**	2	-18	0	27	6	0	0	0	0	1	18
65	***Oryctes nasicornis***	**European Rhinoceros Beetle**	28	-9	0	16	6	0	0	0	0	0	41
66	***Argulus foliaceus***	**Common Fish Louse**	0	-8	0	27	6	0	0	0	0	1	26
67	***Haematopota* spp.**	**clegs (horsefly species)**	28	-8	0	27	17	0	0	2	10	1	76
68	***Tineola bisselliella***	**Common Clothes Moth**	2	-8	0	45	27	0	0	0	0	1	67
69	***Pediculus humanus humanus***	**Body Louse**	0	0	0	-2	27	0	0	2	0	1	27
70	***Ips* spp.**	**engraver beetles**	0	0	0	34	27	0	0	0	0	1	62
71	***Canis lupus***	**Gray Wolf**	32	-18	0	-2	0	0	0	3	47	1	63
72	***Triturus cristatus* s.l.**	**crested newt species**	28	-18	0	27	0	0	0	0	0	0	36
73	***Oryctolagus cuniculus***	**European Rabbit**	26	-18	0	16	17	0	0	0	16	0	57
74	***Sus scrofa***	**Wild Boar**	32	-9	0	45	6	0	0	3	19	1	98

75	***Felis silvestris***	**Wildcat**	32	-18	0	16	0	0	0	1	0	1	32
76	***Pyrrhocoris apterus***	**Firebug**	2	-18	0	45	27	0	0	0	10	1	67
77	***Sciurus vulgaris***	**Eurasian Red Squirrel**	26	-9	0	34	6	0	0	0	19	0	77
78	***Bombina bombina***	**European Fire-bellied Toad**	28	-18	0	34	6	0	0	1	0	0	51
79	***Palomena prasina, Nezara viridula***	**Green Shield Bug, Southern Green Stink Bug**	2	-8	0	34	27	0	0	0	0	1	56
80	***Hyla arborea***	**European Tree Frog**	28	-18	0	45	6	0	0	0	19	0	80
81	***Bufotes viridis***	**European Green Toad**	28	-18	0	34	27	0	0	1	16	0	88

Appendix 8 Percentage of correct answers related to the key features of beavers

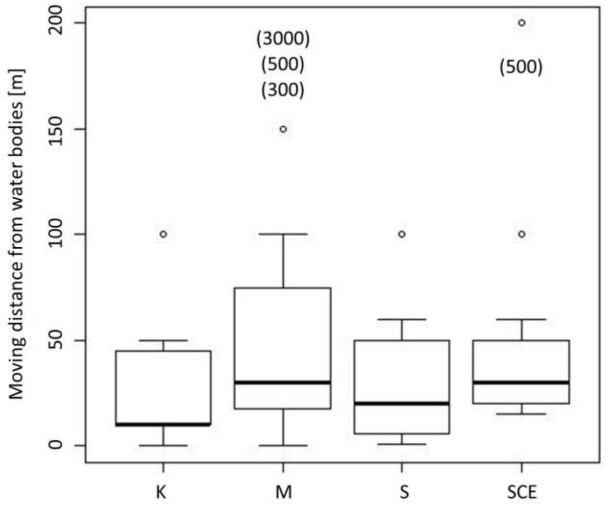




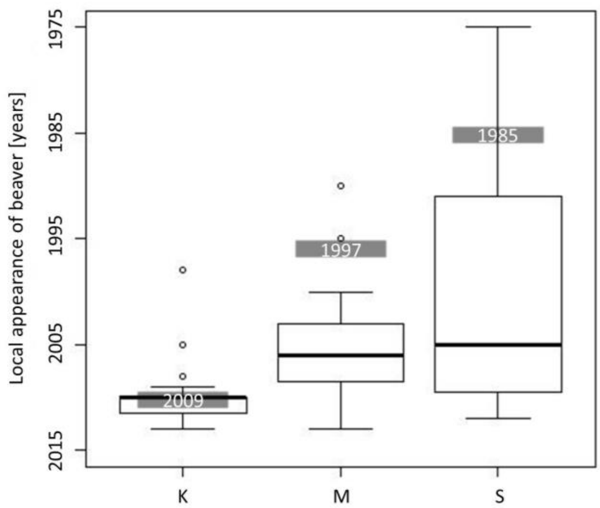
Appendix 8 Percentage of correct answers related to the key features of beavers (RLI: randomly-selected informants, KLI: local knowledgeable informants). **a)** PROTECTION: are they protected or not?; HUNTING: is it legal to hunt beavers?; TRANSLOCATED SPECIES: how did they arrive?; INTRODUCTION: do you know of any concrete release event?; DISTRIBUTION: where do beavers live in your neighbourhood? **b)** PREDATION: are there any natural predators of beavers?; DANGER: are they dangerous or not to humans?; FOOD TYPES: what do they eat?; PART OF THE TREE: which parts of the tree are eaten by beavers?; TREE SPECIES: which tree species are used by beavers?

Appendix 9 The moving distance of beavers from bodies of water and the time of beavers' local reappearance in years, as perceived by the local informants

a)



b)



Appendix 9 a) The moving distance of beavers from bodies of water as perceived by the local informants (K - Kászon, M - Mura, S - Szigetköz, SCE: values of scientific and conservational experts). **b)** The time of beavers' local reappearance in years, as perceived by the local informants (three regions: K: Kászon, M: Mura, S: Szigetköz). Numbers indicate the year of reappearance according to the scientific and conservation experts and literature.