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DIET OF WINTERING LONG-EARED OWL *Asio otus* IN ŽUPANJSKA POSAVINA

Ishrana zimujućih malih ušara Asio otus u Županjskoj Posavini

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ABSTRACT

The study presents the diet of the Long-eared Owl at wintering roosts in rural areas of Strošinci, Drenovci, Bošnjaci and Županja in Županjska Posavina. The total of 1,073 pellets were collected during the winter of 2014/2015; they contained remains of 2,473 specimens belonging to 13 species of small mammals and two bird species. The average number of prey per pellet was 2.36. The majority of small mammal species belonged to the Arvicolinae and Murinae subfamilies, with Common Vole *Microtus arvalis* being the most dominant species represented in the diet (76.1%). The food niche of the Long-eared Owl measured by standardised Levin's index of niche breadth was the widest (0.07) in Strošinci, and the narrowest (0.02) in Bošnjaci. The Shannon–Wiener's measure of diet niche breadth varied between 1.12 (Strošinci) and 0.58 (Bošnjaci). According to the Bray–Curtis index, the highest percentage overlap of prey composition (86.56%) was between Županja and Bošnjaci. Županjska Posavina was hit with catastrophic floods during the summer of 2014. A comparison among flooded and not flooded areas showed no statistically significant difference in the prey composition of the wintering Long-eared Owl in studied areas.

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INTRODUCTION

The Long-eared Owl *Asio otus* is a medium-sized owl belonging to the family of typical owls (Strigiformes) with Holarctic distribution (Mikkola 1983; Cramp 1998). On the IUCN Red List of Threatened Species, the Long-eared Owl is classified as Least Concern (LC) (Birdlife International 2015). It has the same status on the Croatian Red List of Birds (Tutiš *et al.* 2013), and it is a strictly protected species pursuant to the Nature Protection Act (Official Gazette 80/13). Croatian breeding population is estimated from 10,000 to 15,000 breeding pairs (Kralj *et al*. 2013). They are regularly breeding in the lowland continental and mountainous areas, while in Dalmatia they are rare as breeders. Their main wintering sites are in the lowland continental areas and along the Adriatic in the Primorje and Dalmatia regions (Kralj 1997).

In general, the Long-eared Owl feed upon small mammals, mainly voles and mice (Cramp 1998), but their diet can also include other small vertebrates, e.g. squirrels or bats, as well as amphibians and birds (Bertolino *et al*. 2001, Birrer 2009). The Long-eared Owl diet based on pellet analysis was studied extensively throughout Europe and North America, while fewer studies were done in Africa and Asia (Birrer 2009). Contrary to that, very few studies deal with the Long-eared Owl diet from Croatia. Winter diet based on pellet analysis was studied in continental Croatia (Merdić & Merdić 1995) and north Croatia (Dolenec & Kiš Novak 2010). The diet of Long-eared Owls was studied during both breeding and wintering period in Baranja (Mikuska 1979), as well as in Slavonia and Baranja (Nović 1995).

The diet of the Long-eared Owl from Lower Posavina region was not covered by previous studies. This study presents the diet of the Long-eared Owl on roosting sites in Županjska Posavina during the winter of 2014/2015. The study determined prey composition, the width of the food niche at roosting sites, and compared prey composition in relation to the catastrophic flood event during summer 2014.

MATERIAL AND METHODS

Study area

The study area is situated in the northeast part of Croatia along the Sava River, and extends from Županja in the west to Strošinci in the east. This area, known as Županjska Posavina, covering 705.93 km^2, is characterised with one of the largest complex of alluvial oak forest (Spačva forests) in Europe, and agricultural habitats surrounding the villages along Sava (Premuž – Štajcer 2002). Climate is typical continental with four distinctive seasons, cold winters and hot summers. The winter of 2014/2015 was warmer than the average, with temperatures in December, January and February higher than the long-term average (1961-1990).

However, at the end of December and the beginning of January, one cold spell caused a decrease in temperature, thus the minimal temperature of -20°C below zero lasted for a few days. Precipitation during the study winter was above the long-term average (Vršnak Plačko *et al*. 2015).

During the winter of 2014/2015, the Long-eared Owls were wintering in the centre of Županja on birch trees (*Betula pendula* Rhot.). In Bošnjaci, the Long-eared Owls started to winter on birch trees, yet during January, they changed the roosting location to the alley of the weeping willow (*Salix babylonica* L.). In Drenovci, the Long-eared Owls used thuja (*Thuja sp.*) trees as roosting site, while in Strošinci, they roosted on spruce trees (*Picea abies* L.).

In May 2014, the eastern part of the study area suffered from catastrophic floods. Heavy precipitation in the upper watershed caused flesh floods of the Bosna and Drina tributaries and an increase in the Sava River discharge. Due to the collapse of the flood protection dike at Rajevo Selo, situated at the Sava River east from Drenovci, the entire area between Rajevo Selo and Strošinci was flooded for several months. By the end of fall, water receded back to the river course, but the surface area was covered by sediment and sludge. While Županja and Bošnjaci in the western part of the study area were spared of floods, Drenovci and Strošinci were partly flooded.

Owl pellets analysis

The diet of wintering Long-eared Owl was studied using the pellet analysis method (Schmidt 1967, Mikuska *et al.* 1979, Horváth 2007), and the determination of bone remains (skulls, lower mandibles and teeth). Pellets were collected from October 2014 to February 2015 at four roosting places in Županjska Posavina: at Strošinci (44°55'1.43"N, 19°03'47.36"E), Drenovci (44°55'18.08"N, 18°54'54.49"E), Bošnjaci (45°03'5.38"N, 18°45'0.38"E) and Županja (45°04'20.27"N, 18°41'41.45"E). Pellets were collected once per week and only whole pellets were taken. Collected pellets were stored at plastic bags labelled with a date and locality note, and frozen at -20^{0}C. The breakdown of pellets was done using dry technique (Scmidt 1967, Mikuska *et al.* 1979). Before the separation of bones and hairs, pellets were unfrozen at room temperature for one hour; afterwards, individual pellets were broken down with hands. The identification of small mammals was done with stereomicroscope (Leica MZ6) based on skeletal parameters (März 1972, Schmidt 1967, Kryštufek 1991, Kryštufek & Janžekovič 1999). For the identification of species belonging to the subgenus *Sylvaemus*, the method by Tvrtković (1979) was followed. Determination between the Eastern House Mouse *Mus musculus* and the Steppe Mouse *M. spicilegus* was based on the identification key by Macholán (1996). Specimens belonging to the *Mus*, *Rattus* or *Apodemus* genera that were not possible to be identified down to the species level are listed as *Mus* sp., *Rattus* sp. or *Apodemus* sp., respectively. Additional iden-

tification and confirmation of certain problematic samples of small rodents and birds was provided by Prof. Jenő J. Purger and Prof. Gyozo Horvat from the Department of Ecology, Institute of Biology, Faculty of Sciences, University of Pécs, respectively. Scientific and English names of the species were used in accordance with the nomenclature of IUCN (2015).

Statistical methods

In the statistical analysis, only prey items that were identified at species level were used. All birds items were grouped in one item (*Aves sp*.). To define the dietary niche breadth of the Long-eared Owl in each roosting place, the standardized Levins' and Shannon–Wiener measures were used. According to Krebs (2014) the Shannon–Wiener measure gives relatively more weight to the rare resources used by a species, while the Levins' measure gives more weight to the abundant resources used. In order to standardise the food niche breadth and express in the scale from 0 to 1.0 Levins' measure was standardised according the Hurlbert's suggestion (Hurlbert 1978 in Krebs 2014). The food niche breadth among different roosting places based on Shannon–Wiener and standardised Levins' measures was calculated for each month and site separately and tested by one-way ANOVA. The Bray–Curtis index was calculated using PRIMER 5 software to compare the percentage overlap in the owls' diet at four roosting places. The unweighted pair-group average method (UPGA) and Euclidean Distance were used for cluster analysis (Krebs 2014). A possible impact of floods on prey composition was tested by the Mann-Whitney test. For that purpose, results of prey composition of the flooded (Drenovci and Stošinci) and un-flooded sites (Županja and Bošnjaci) were grouped together.

RESULTS

In total, 1073 pellets were collected on four roosting places at Županjska Posavina from October 2014 to February 2015 (Table 1).

Collected pellets contained 2,476 skeletal remains, with 2.36 prey/pellet in average. Out of this number, 2,335 skeletal remains were identified at species level, representing 13 species of small mammals and two bird species (Table 2). In total, 140 mammalian prey remains were not identified to the species level; they belonged to *Apodemus* sp. (73 pieces), *Mus* sp. (63 pieces), *Rattus* sp. (2 pieces) and *Microtus* sp. (2 pieces), respectively.

Common Vole *Microtus arvalis* was the most numerous item of prey with a 76.1% share in the diet across the study area. The highest proportion (84.6%) of this species was recorded at Bošnjaci roost, while the lowest (65.1%) was present in Strošinci. Striped Field Mouse *Apodemus agrarius* was the second most abundant prey in the diet, with 7.8 % share (ranging from 15.5 % at Strošinci to 3.0 %

Table 1. Number of collected pellets at four roosting places in Županjska Posavina during the study period.

Tablica 1*.Broj prikupljenih gvalica na četiri zimovališta u Županjskoj Posavini tijekom perioda istraživanja.*

Roosting place	October 2014	November 2014	December 2014	January 2015	February 2015	Σ
Županja	47	132	41	55	38	313
Bošnjaci	20	109	62	50	62	303
Drenovci	38	43	53	38	47	219
Strošinci	39	42	55	50	52	238
Σ	144	326	211	193	199	1073

Table 2. Prey composition in the diet of the Long-eared Owl in the study area during 2014/2015 winter.

Tablica 2. *Sastav plijena u ishrani male ušare na području istraživanja tijekom zime 2014/2015.*

	Bošnjaci		**Drenovci**		**Strošinci**		**Županja**		Σ	%
Prey	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	
Common Vole *Microtus arvalis* (Pallas, 1778)	611	84.6%	347	70.4%	340	65.1%	584	79.1%	1882	76.1%
Striped Field Mouse *Apodemus agrarius* (Pallas, 1771)	22	3.0%	43	8.7%	81	15.5%	47	6.4%	193	7.8%
Apodemus sp.	16	2.2%	17	3.4%	17	3.3%	23	3.1%	73	3.0%
Wood Mouse *Apodemus sylvaticus* Linnaeus, 1758	19	2.6%	14	2.8%	6	1.1%	24	3.3%	63	2.5%
Mus sp.	16	2.2%	17	3.4%	15	2.9%	15	2.0%	63	2.5%
Harvest Mouse *Micromys minutus* (Pallas, 1771)	9	1.2%	14	2.8%	8	1.5%	9	1.2%	40	1.6%
Field Vole *Microtus agrestis* Linnaeus, 1761	1	0.1%	16	3.2%	11	2.1%	3	0.4%	31	1.3%

	Bošnjaci		**Dre-novci**		**Strošinci**		**Županja**		Σ	%
Bank Vole *Myodes glareolus* (Schreber, 1780),	5	0.7%	3	0.6%	9	1.7%	10	1.4%	27	1.1%
Steppe Mouse *Mus spicilegus* Petényi, 1882	6	0.8%	3	0.6%	7	1.3%	4	0.5%	20	0.8%
Yellow-necked Field Mouse *Apodemus flavicollis* (Melchior, 1834)	4	0.6%	1	0.2%	8	1.5%	6	0.8%	19	0.8%
House Mouse *Mus musculus* Linnaeus, 1758	3	0.4%	1	0.2%	14	2.7%	0	0.0%	18	0.7%
European Pine Vole *Microtus subterraneus* (de Selys-Longchamps, 1836)	1	0.1%	10	2.0%	1	0.2%	2	0.3%	14	0.6%
Pygmy Field Mouse *Apodemus uralensis* (Pallas, 1811)	2	0.3%	1	0.2%	1	0.2%	7	0.9%	11	0.4%
Passer sp.	3	0.4%	3	0.6%	1	0.2%	0	0.0%	5	0.2%
Aves sp.	1	0.1%	1	0.2%	2	0.4%	0	0.0%	4	0.2%
Lesser Shrew *Crocidura suaveolens* (Pallas, 1811)	1	0.1%	0	0.0%	0	0.0%	1	0.1%	2	0.1%
Brown Rat *Rattus norvegicus* (Berkenhout, 1769)	0	0.0%	1	0.2%	0	0.0%	1	0.1%	2	0.1%
Rattus sp.	0	0.0%	1	0.2%	0	0.0%	1	0.1%	2	0.1%
Microtus sp.	2	0.3%	0	0.0%	0	0.0%	0	0.0%	2	0.1%
European Greenfinch *Chloris chloris* Linnaeus, 1758	0	0.0%	0	0.0%	0	0.0%	1	0.1%	1	0.04%
Eurasian Siskin *Spinus spinus* Linnaeus, 1758	0	0.0%	0	0.0%	1	0.2%	0	0.0%	1	0.04%
Σ	722	100.0%	493	100.0%	522	100.0%	738	100.0%	2473	100.0%

Table 3. Percentage of diet overlap among the four studied sites based on the Bray-Curtis index.

Tablica 3. *Postotak preklapanja ishrane malih ušara na četiri istraživana lokaliteta prema Bray-Curtis indeksu.*

Roosting site	Županja	Bošnjaci	Drenovci
Bošnjaci	86.56	-	
Drenovci	81.28	81.20	-
Strošinci	80.58	84.78	82.70

at Bošnjaci), followed by Wood Mouse *Apodemus sylvaticus* with 2.5 % share (in range from 3.3 % at Županja to 1.1 % at Strošinci). The presence of all other species was below 2 % in average for the whole study area (Table 2).

According to standardised Levins' measure, the dietary niche breadth is the highest in the Strošinci village (0.07), followed by Drenovci (0.05), Županja (0.03) and Bošnjaci as the lowest (0.02). According to the Shannon-Wiener measure, the dietary niche breadth is the highest in Strošinci (1.12), followed by Drenovci (1.00), Županja (0.75), and Bošnjaci as the lowest (0.58). The standardised Levins' measure and the Shannon-Wiener measure values are higher in the Strošinci and Drenovci villages, sites less urbanised, and surrounded by a large forest complex, than in Županja and Bošnjaci. One-way ANOVA analysis showed no significant statistical differences in the dietary niche breadth among the roosting sites, both for the standardised Levins' ($F = 2.486$; $p = 0.09$) and the Shannon-Wiener measure ($F = 2.722$; $p = 0.448$). Percentages of diet overlap among four roosting sites are presented in Table 3 and Figure 1.

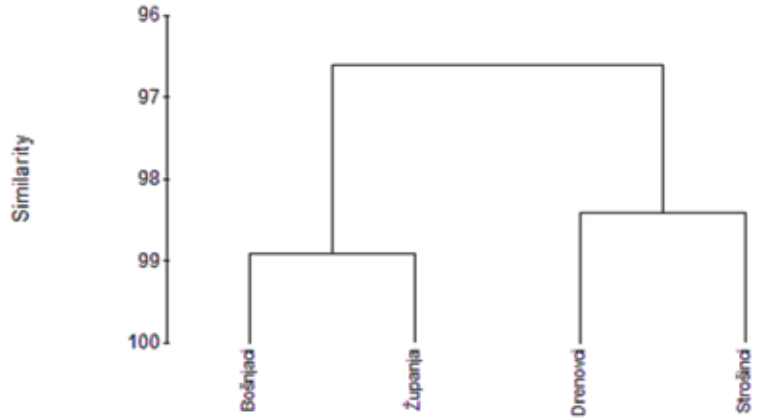

Figure 1. UPGA cluster analysis of diet overlap among four studied sites.

Slika 1. *UPGA klaster analiza postotka prelapanja ishrane malih ušara na četiri istraživana lokaliteta.*

The highest diet overlap was recorded between the neighbouring Županja and Bošnjaci (86.56%), and the lowest diet overlap was recorded between Županja and Stošinci (80.58%). There were no statistically significant differences in the composition of prey of overwintering Long-eared Owls in studied areas with respect to the flooding of the habitat during the summer and fall of 2014. This was confirmed by results of the Man-Whitney test ($U = 36$, $p = 0.29$) among the flooded sites (Drenovci and Strošinci) and sites that were not exposed to flooding (Županja and Bošnjaci).

DISCUSSION

The study of the diet of wintering Long-eared Owl in Županjska Posavina during 2014/2015 confirmed the high percentage of small mammals (99.5%) in the diet. Prior studies of the Long-eared Owl in Croatia have also proved high percentage of small mammals in the winter diet, e.g., 89.3% in Baranya region (Mikuska 1979), 98.5% in Slavonia and Baranya (Nović 1995) or 97.9% in northern Croatia (Dolenec & Kiš Novak 2010). A possible reason for such a high proportion of small mammals in the diet in wintertime might partly be related to a higher abundance of small mammals compared to the abundance of birds or insects (Purger & Krsmanović 1989).

The average number of prey items per pellet was 2.36, which is in accordance with previous investigations of winter diet of the Long-eared Owls in continental Croatia, where 2.56 prey/pellet was recorded (Merdić & Merdić 1995), but higher than in north Croatia, where 1.75 prey/pellet were documented (Dolenec & Kiš Novak 2010). Furthermore, the average number of prey per pellets in Vojvodina (northern Serbia) was 2.31 (Purger & Krsmanović 1989).

Out of 13 identified species of small mammals, twelve species belong to the order Rodentia, with four species from Cricetidae family and eight species of Muridae family. However, the Cricetidae family represents 86.7% of the diet, with Common Vole as the most dominant prey item. Only one species belonged to the order Eulipotypha, with one species from the shrew family Soricidae. The Long-eared Owl is specialized for smaller mammals, such as voles (Romanowski & Zmihorski 2008, Marti 1976). It is interesting to compare the study of the Barn Owl diet at Drenovci, when 16 species of small mammals were identified (Nović 1995), while in the Long-eared Owl diet, only 13 species were present. The key reason is a broader food niche of Barn Owl compared to the Long-eared Owl (Merdić & Merdić 1995), as well as a possible difference in the abundance and availability of prey between two seasons, which is related to small mammal population development (Birrer 2009). Diversity of prey species in the Long-eared Owl diet depends on many factors, such as habitat diversity on hunting grounds, climate (Marti 1976), and seasonal changes (Rubolini *et al*. 2003). Small mammals prey availability further depends on the vegetation cover, since the

Long-eared Owl is specialised for hunting over open areas (Aschwanden *et al.* 2005). Diversity of prey items would depend on the situations when owls hunt prior or after harvest, or on the percentage of forest cover in hunting grounds (Birrer 2009).

Results of prey diversity in the diet from this study are comparable with previous studies on neighbouring areas with similar habitats. For example, in the continental part of Croatia, 11 species were determined out of 242 pellets (Merdić & Merdić 1995), while in north Croatia, 10 species were recorded in 113 pellets (Dolenec & Kiš Novak 2010). Near Danube in the Vojvodina province (Opovo), 14 species were determined out of 372 pellets (Grbić 2000), while in Doroslovo (Vojvodina), 9 species were recorded in 569 pellets (Purger & Krsmanović 1989).

Common Vole was eudominant species in prey composition on all four sites. According to Schmidt (1973), the proportion of Common Vole in prey composition of the Long-eared Owl in Pannonian plain was 51.4%, while in Slavonia and Baranya, it amounted to 95.8% (Nović 1995). In Slovenia, Common Vole was also the most frequent prey species, with the annual proportion in the diet ranging 17-85 % (Tome 2009, 2003). According to Birrer (2009), Common Vole was the most common prey species of the Long-eared Owl in Central Europe in 81.6% prey lists. Common Vole dominates on open habitats, such as meadows, pastures and along agricultural fields, where it digs burrows with food storage (Amori *et al.* 2015). These types of habitats are also favourable for the Long-eared Owl. During fall, harvested fields without tall vegetation make Common Vole even more accessible for owls. Furthermore, Common Vole is less aggressive and comparatively slower than small mammals from the mice (Muridae) family are, and they are active during the night (Mikkola 1983). Apart from the Common Vole, Field Vole *Microtus agrestis* (1.3%), Bank Vole *Myodes glareolus* (1.1%) and European Pine Vole *Microtus subterraneus* (0.6%) were found in the Long-eared Owl diet in Županjska Posavina; that was in accordance with previous studies in Slavonia and Baranya (Nović 1995), the continental parts of Croatia (Merdić & Merdić 1995), as well as Vojvodina province in Serbia (Purger 1989).

Except voles, the diet of the Long-eared Owl in the study area consisted of species from the Muridae family (15.7%). A smaller percentage of mice in the owl's diet are in agreement with other studies of feeding habits for this species (Birrer 2009). Among the Muridae family, the domination of one species is not as pronounced as among the voles. Stripped Field Mouse was the most abundant as prey among the Muridae family (7.8%). This species is active both days and nights, inhabiting fields and forest edges (Kaneko *et al.* 2015). In Strošinci, the Stripped Field Mouse share in the owl's diet increased to 15.5%. Moreover, the share of Yellow-necked Field Mouse *Apodemus flavicollis* was the highest (1.5%) at this village. Yellow-necked Field Mouse is typical for forested habitats (Mitchell-Jones *et al*. 1999, Vukićević-Radić *et al.* 2006) and Strošinci village had – com-

paratively – the highest percentage of forest cover among all the studied sites. Wood Mouse was represented in the diet of the Long-eared Owl with 2.5% in average. This is expected for this primarily forest dwelling species; its participation in the diet can be explained by foraging of the Long-eared Owl along the forest/open habitats edge (Trbović 2008). Low presence of shrews (Soricidae) in the Long-eared Owl diet, with Lesser Shrew *Crocidura suaveolens* as species (0.1%), is consistent with previous studies in Europe (Birrer 2009) and continental Croatia (Nović 1995). The Long-eared Owl usually catches prey bellow 100 g of weight; thus, larger species as rat, dormouse and water vole, are rare in their diet (Mikkola 1983). The presence of only two individuals of Brown Rat *Rattus norvegicus* confirms this, despite the fact that Brown Rat is widely distributed in the study area.

Out of 11 prey items belonging to birds (Aves), only two species were determined to species level – European Greenfinch *Chloris chloris* and Eurasian Siskin *Spinus spinus*, while the others belonged to sparrows *Passer* spp. Sparrows and finches are common prey items in the Long-eared Owl's diet, present in small percentages, except in situations where these species dominate near the winter roost. In such cases, the proportion of birds in the Long-eared Owl's diet can be as high as 59.3% (Shándor & Kiss 2008).

Studies based on pellet analysis are interesting not only from the ornithological point of view, but they can also produce important information on the distribution and abundance of prey species (Horváth *et al.* 2007, Purger 1989). Our study revealed three important contributions to the distribution of small mammal fauna in Croatia. The presence of Harvest Mouse *Micromys minutus* in all four studies sites with the average share of 1.6 % is important, because both the distribution and the abundance of this species in Croatia are largely unknown (Tvrtković 2006). Harvest Mouse has a Near Threatened status on the Croatian Red List of mammals (Tvrtković 2006), while in some parts of Europe, its populations are under decline (Aplin *et al.* 2015). This species is hard to catch with regular traps (Haberl & Kryštufek 2003); thus data from owl pellets are important for the confirmation of his presence in the studied area. Another Near Threatened species in Croatia and the world (Tvrtković 2006, Coroiu *et al.* 2015) that was found in the pellets was Steppe Mouse *Mus spicilegus*. Steppe Mouse is present on natural lowland meadows and along the edges of agricultural fields. According to Tvrtković 2006, Steppe Mouse is distributed in the Slavonia and Baranya region, and along the Sava river from Slavonski Brod to the Babina Greda village. Our study confirms its presence in all four study sites (with the average share of 0.8% of the diet) and extends our knowledge of its distribution for another 40 kilometres eastward until the Croatian-Serbian border. European population of Steppe Mouse are declining due to intensive agriculture and pesticide use (Coroiu *et al*. 2015). Our study documented the presence of a rare spe-

cies in Croatia – Pygmy Field Mouse *Apodemus uralensis*, known from published records in the Tenja (Mikuska *et al.* 1986) and Vođinci villages in Slavonia (Nović 1995). Pygmy Field Mouse is typical steppe habitat species, and its western distribution ends in Eastern Slavonia (Kryštufek *et al.* 2008). Since appropriate steppe habitats are very rare in Croatia due to reclamation and conversion into agricultural field (Topić & Vukelić 2009), the status of Pygmy Field Mouse in Croatia is currently listed as uncertain (Tvrtković 2006).

Diet niche breadth of the Long-eared Owl among the studied sites was relatively similar across the whole study area, which suggest that the Long-eared Owl had comparable diet during the winter 2014/2015. The Shannon-Wiener index, which is more sensitive to the presence of rare species, exhibited a broader width at Drenovci and Strošinci than in the eastern part of the studied area. Both villages are situated in less urbanised areas surrounded by forests and less intensive agriculture. Dietary niche overlap calculated by the Bray-Curtis index showed similar site across the studied area, without any statistically significant difference among the studied sites. Nevertheless, prey composition overlap displayed a distinction between sites located in the western part of the studied area (Županja and Bošnjaci) and the ones located in the eastern part thereof (Drenovci and Strošinci).

Floods negatively affect the populations of small mammals, since they cause a high mortality rate due to drowning in the floodwaters, while the remaining survivors stay alive on higher grounds that were not flooded or in the crowns of large trees (Wijnhoven *et al.* 2005, Pachinger & Haferkorn 1998). However, our study showed no statistically significant difference in prey composition and abundance between the sites that suffered catastrophic floods during summer 2015. This may be explained in two ways: either the population of small mammals recovered very fast after the floods or the Long-eared Owl switched to new hunting grounds despite keeping their traditional roosts.

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SAŽETAK

U radu su predstavljeni rezultati istraživanja ishrane male ušare na zimovalištima u selima Strošinci, Drenovci i Bošnjaci i gradu Županji u Županjskoj Posavini. Tijekom zime 2014/2015. godine prikupljene su 1073 gvalice koje su sadržavale 2473 osteološka ostatka 13 vrsta sisavaca i dvije vrste ptica. Prosječan broj plijena po gvalici iznosio je 2.36. Većina vrsta sitnih sisavaca pripadala je potporodicama Arvicolinae i Murinae. Poljska voluharica *Microtus arvalis,* je bila najzastupljenija u ishrani male ušare s 76.1 %. Ekološka niša ishrane male ušare prema standardiziranoj Levinovoj mjeri najširа je u Strošincima (0.07) a najuža u Bošnjacima (0.02). Prema Shannon–Wienerovoj mjeri, također je najširа u Strošincima (1.12), a najuža u Bošnjacima (0.58). Najveće postotno preklapanje širine ekološke niše prema Bray – Curtisovom indeksu je je kod malih ušara koje zimuju u Bošnjacima i Županji (86.56%). Nije bilo statistički značajne razlike u sastavu plijena zimujućih malih ušara na istraživanim lokalitetima obzirom na poplavljenost staništa tijekom ljeta i jeseni 2014. godine.