

The status and population changes of the Little Owl (*Athene noctua*) in the south of Békés county (Hungary)*

László Bozó^{1*} & András István Csathó²

Received: November 27, 2017 – Accepted: December 20, 2017



Bozó, L. & Csathó, A. I. 2017. The status and population changes of the Little Owl (*Athene noctua*) in the south of Békés county (Hungary). – Ornis Hungarica 25(2): 23–33. DOI: 10.1515/orhu-2017-0013

*Presented at 1st Hungarian Owl Research Conference held in Pécs on 8th September 2017.

Abstract Between 1995 and 2017 we carried out surveys on the Little Owl (*Athene noctua*) in Battonya town and Kevermes village in southern Békés county. In 2007 and 2017 we have surveyed nesting sites in the village and the outer areas of Kevermes. The population of the species was estimated at the beginning of the breeding season and in early summer with field observations. Between 1995 and 2017 we collected road-kill data within the entire administrative area of Battonya. We registered each found road-killed Little Owl. We found 64 road-kills in Battonya. The number of casualties of the species has increased unambiguously over the studied 23 years. Most of the road-killed Little Owls (53 individuals, 82.81% of the total) were found in summer (June–August). 51 road-killed individuals (79.69%) were noted in the outer areas of Battonya, and 13 specimens (20.31%) in the town. Our results highlight that vehicle traffic is an important mortality factor for the population. The Little Owl has a large population in this landscape, and the population size has increased over the last decade. In the background of this increase is most likely the rise in the number of abandoned houses because of the unfavourable economic and social situation in the region. The local pairs nested only on attics and roof structures in Kevermes, often in residential buildings. The buildings of modern agriculture do not meet the needs of the species. A large part of the population breeds in the village, because with the disappearance of the farms the breeding pairs of the outer areas of Kevermes have disappeared. However, in Battonya the species regularly breeds in the outer areas of the town. Finally, we also collected some ethnoecological data on how local people relate to the species.

Keywords: road-kill, road mortality, population surveys, agricultural landscape, farmland bird, Strigiformes, ethnoecology

Összefoglalás 1995 és 2017 között a Békés megyei Battonya és Kevermes kúvik- (*Athene noctua*) állományát vizsgáltuk. Munkánk során 2007-ben és 2017-ben kül- és belterületi fészkelőhelyeket mértünk fel Kevermesen. A faj állományát a költési idő kezdetén és kora nyáron történő terepi megfigyelésekkel becsültük. 1995 és 2017 között Battonya város teljes közigazgatási határára kiterjedő elütöttállat-felmérést végeztünk, amely során minden megtalált kúviktetem adatait feljegyeztük. Összesen 64 elgázolt kúvikot találtunk a vizsgálat 23 éve alatt. Az elütések száma jelentős emelkedést mutatott az évek során. A kúvikok túlnyomó többségét a nyári hónapokban (június–augusztus) ütötték el (53 példány, az összes elütés 82,81%-a). 51 elgázolt példány (79,69%) a város külterületén került elő, míg a belterületen 13 példány (20,31%). Az adatok arra utalnak, hogy a közúti gépjárműforgalom a faj esetében jelentős veszélyeztető tényezőnek számít. Eredményeink alapján megállapítható, hogy a faj jelentős állománnyal rendelkezik a vizsgált területen, sőt a populáció mérete növekedést mutatott az elmúlt évtizedben. Ennek hátterében elsődlegesen az elhagyott épületek számának növekedése állhat, amely a régió kedvezőtlen gazdasági és társadalmi helyzetével áll kapcsolatban. A kúvikpárok felméréseink szerint kizárólag padlásokon és tetőszerkezeteken költenek Kevermesen, gyakran még jelenleg is lakott épületekben. A modern mezőgazdaság kiszolgáló épületei már kevésbé felelnek meg a faj igényeinek. Az állomány jelentős része a belterületen költ, a tanyavilág megszűnésével Kevermesen a külterületi fészkelőhelyek eltűntek, ugyanakkor Battonyán még viszonylag nagy számban él külterületi mezőgazdasági épületekben is. Adatokat gyűjtöttünk továbbá arról is, hogy a helyi lakosok hogyan viszonyulnak a kúvikhoz.

Kulcsszavak: közúti elutések, állományfelmérés, agrártáj, bagolyalakúak, etnoökológia

¹Department of Systematic Zoology and Ecology, Eötvös Loránd University, 1117 Budapest, Pázmány Péter sétány 1/C., Hungary, e-mail: bozolaszlo91@gmail.com

²Körös-Maros National Park Directorate, 5540 Szarvas, Anna-liget 1., Hungary

*corresponding author

Introduction

The Little Owl – *Athene noctua* (Scopoli, 1769) – has a trans-Palearctic distribution (Voous 1960), and related mostly to the agricultural landscape. In Europe, Little Owls originally have colonized a wide range of habitats with the exception of uplands (>300 m) and woodlands (Exo 1992). Permanent grasslands which have short vegetation throughout the year, in particular pastures flanked by lines of pollarded trees and parkland with large number of hedgerow trees and old orchards, affording ample nest-holes, provide optimal habitats (Exo 1992). However, in the past decades there were changes in landscape structures, accompanied by the removal of hedgerows and vegetation patches, land drainage, and removal of old trees, as well as changes in agricultural management, including an increase in soil fertilization and a switch from spring to autumn sowing. In Central Europe a drastic reduction in pastures has occurred, with a majority of grasslands drained and overloaded with nitrogen inputs, as well as sown with competitive nitrogen-responsive grass species. These large-scale habitat changes associated with the intensification and mechanization of agriculture have in turn caused a reduction in prey and nest-site availability for the Little Owl (Tucker & Heath 1994). As a result, the distribution of the species has become fragmented and isolated in many areas and countries and the populations are declining (Schönn 1986, Juillard 1989, Exo 1992, Tucker & Heath 1994, Šálek & Schröpfer 2008, Van Nieuwenhuyse *et al.* 2008, Grzywaczewski 2009, Žmihorski *et al.* 2009).

The Little Owl is a strictly protected species in Hungary. Traditionally it breeds in the lowlands, but for the above mentioned reasons nowadays it breeds mainly in anthropogenic environments, like on the loft of farmland houses, agricultural buildings and abandoned old houses (Hámori 2016, 2017). Because of the lack of studies, the size of the Hungarian population is not exactly known (Šálek *et al.* 2013), but it is likely to be higher than the data reported in the literature (Magyar *et al.* 1998, Schmidt 1998, Hadarics & Zalai 2008). A large part of the population lives on the Great Hungarian Plain, therefore it is very important to collect appropriate data from this area for the effective protection of the species.

The aim of this study was to find out the tendency of the population of the species in Békés county, and to compare two different survey methods.

Material and methods

We investigated the population changes of Little Owl with two different methods in Kevermes village (46° 25' 12" N, 21° 10' 48" E) and Battonya town (46° 16' 60" N, 21° 00' 60" E)

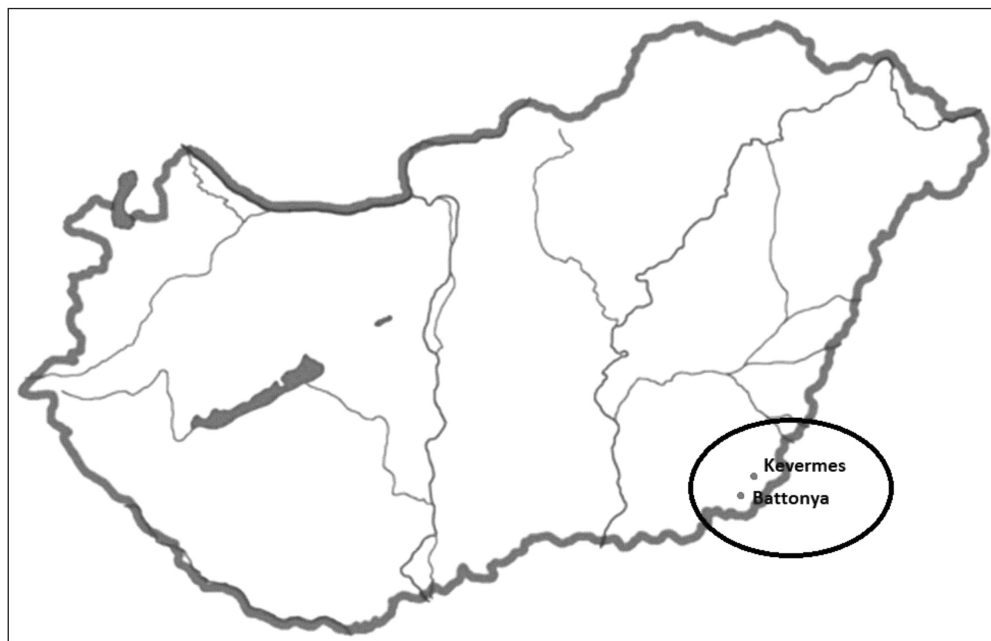


Figure 1. Location of Battonya and Kevermes in Hungary
1. ábra Battonya és Kevermes elhelyezkedése Magyarországon

in Southeastern Hungary (Csanádi-hát region, Békés county) (*Figure 1*). The distance between these two settlements is 20 km.

Population surveys in Kevermes

For estimation of the population size in Kevermes village within the 4,300 hectares administrative area we collected data three times in spring and early summer in 2007 and 2017. The size of the population was estimated with field observations of the individuals, because searching for nests were not possible as the buildings were privately owned. We considered a place as nesting place if we saw and heard the birds on each observation day. These places were shown on a map. We also noted the most likely place of the nest and the type of buildings the species favoured in Kevermes. The estimated territory sizes were calculated in two ways. First, the size of the total area of Kevermes (both the settlement and the outer areas) was divided by the supposed number of nesting pairs. Second, this calculation was also done for the settlement area without the outer areas.

Road-kill surveys in Battonya

Between 1995 and 2017 we carried out road-kill surveys in the entire administrative area of Battonya town (14,577 hectares). The surveys were carried out by bicycle in most cases once a month during the whole year. There are four busy roads in the outer areas of

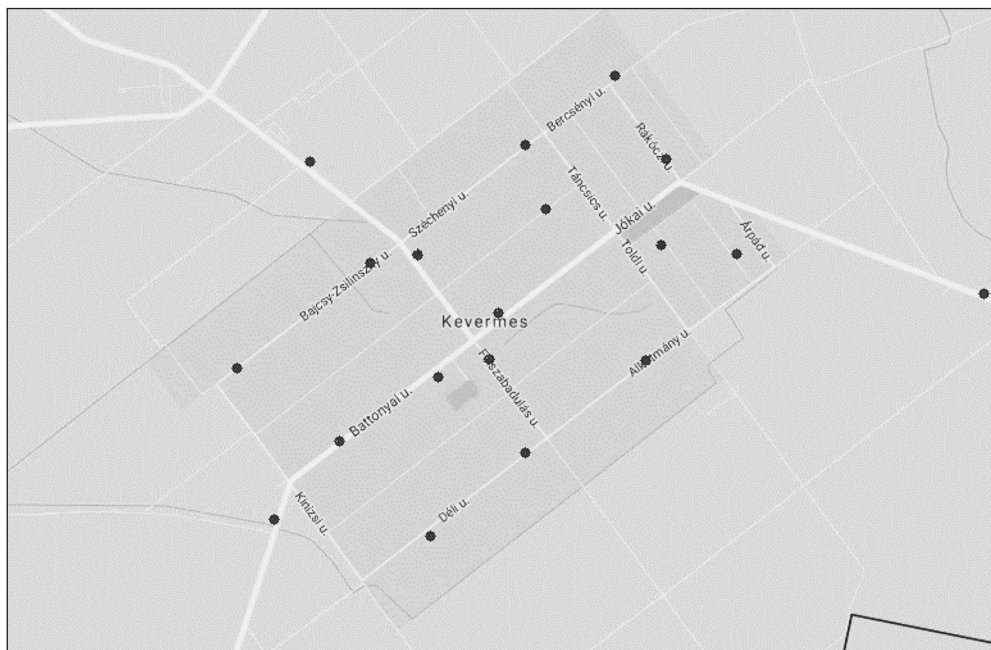


Figure 2. Map of the breeding pairs of Little Owl in Kevermes in 2007

2. ábra A Kevermesen fészkelő kuvikpárok térképe 2007-ben

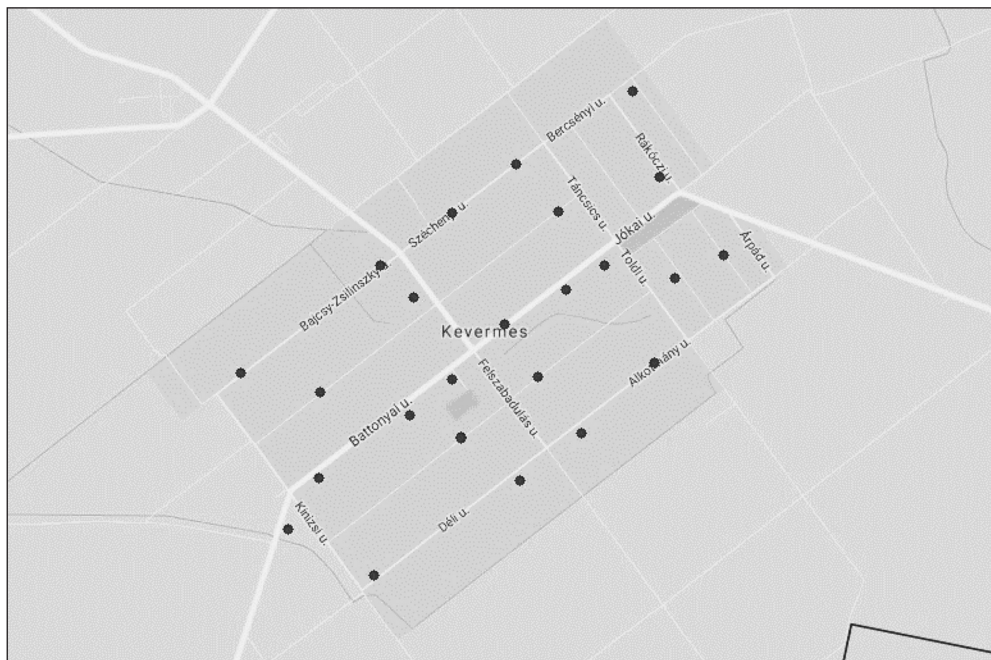


Figure 3. Map of the breeding pairs of Little Owl in Kevermes in 2017

3. ábra A Kevermesen fészkelő kuvikpárok térképe 2017-ben

Battonya: Kovácsházi road (length: 8.4 km), Dombegyházi road (4.3 km), Tornyai road (5.0 km) and Mezőhegyesi road (3.4 km) (Csathó & Csathó 2009a). All of the Little Owls found road-killed were recorded. Estimated date of the collision together with its location along the road was noted for each individual. In most cases photos were also taken of the road-killed Little Owls (we have digital photos of 54 specimens, 84.38% of the total). To create the database and the figures we used Microsoft Excel 2016.

Local people and the Little Owls

We also collected some ethnoecological data. During our fieldwork in Kevermes and Battonya when we met with people we asked them how do they relate to the Little Owl and what is their opinion about the species. We also noted any problems that people told us about the species.

Results

Population surveys in Kevermes

According to our surveys, in Kevermes 19 pairs nested in 2007, while at least 24 pairs in 2017 (*Figure 2-3*). Some of the nesting moved to another site, or disappeared or new ones appeared between the two survey years. These changes were probably due to the fact that many of the buildings that were suitable for nesting in 2007 have collapsed by 2017. The former nesting sites in the outskirts of the village disappeared by 2017, therefore all pairs were located within the area of the village. If we take into consideration the entire administrative area, the average territory size was 226 hectares/pair in 2007, while it was 179 hectares/pair in 2017. However, the estimated territory size calculated for the settlement area only was 26.3 hectares in 2007 and 20.8 hectares in 2017.

Based on our observations and numerous information from local people, the pairs are nesting only on attics and roof structures, often in residential buildings.

Road-kill surveys in Battonya

Between 1995 and 2017 we have collected data on 64 road-kills of Little Owl in the administrative area of Battonya. The number of road-kills showed a clear increase. Only 6 road-killed Little Owls (9.38% of the total) were found between 1995 and 2009 (Csathó & Csathó 2009a), whilst this number increased to 58 (90.63%) between 2010 and 2017 (*Figure 4*).

The number of road-killed individuals showed remarkable variation within the year. 53 birds (82.81% of the total) were found in summer (from June to August), 6 (9.38%) in spring (from March to May), 4 (6.25%) in autumn (from September to November) and only 1 (1.56%) record in winter (from December to February) (*Figure 5*).

On Kovácsházi road 20 road-killed Little Owls were found (31.25% of the total), on Dombegyházi road 11 individuals (17.19%), on Tornyai road 13 (20.31%) and on Mezőhegyesi road

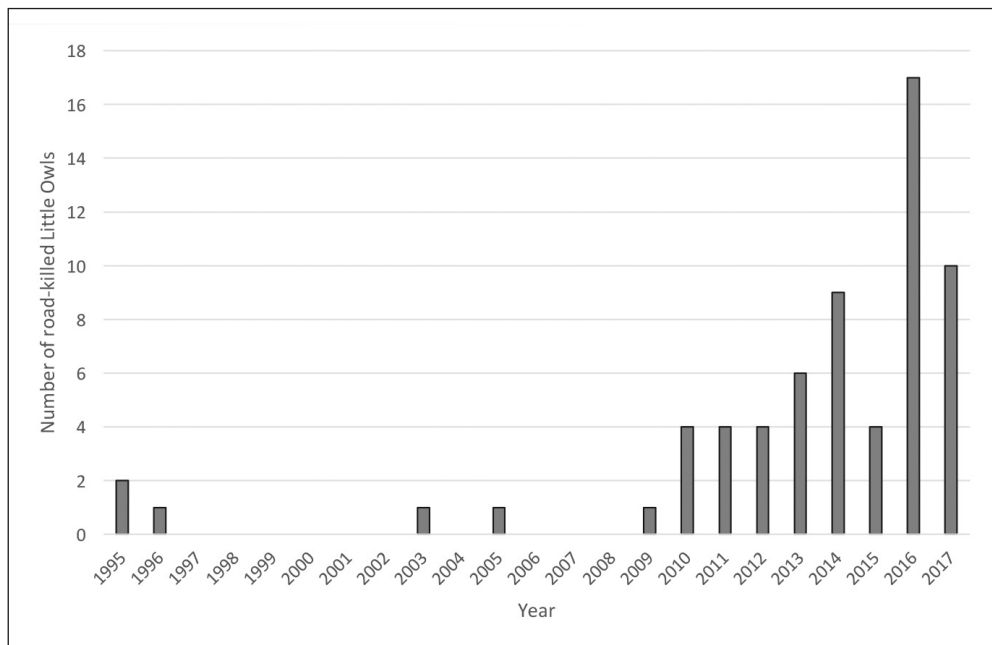


Figure 4. Number of road-killed Little Owls between 1995 and 2017 in Battonya

4. ábra Az elütött kuvikok száma Battonyán 1995 és 2017 között

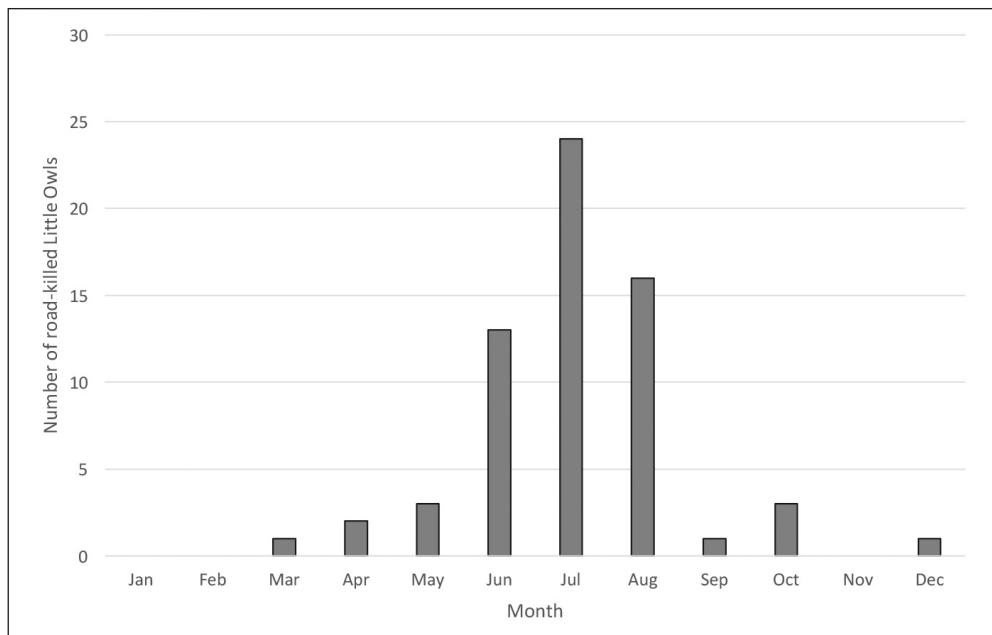


Figure 5. Monthly distribution of the road-killed Little Owls (Battonya, 1995–2017)

5. ábra A kuvik-elütések éven belüli eloszlása, havonkénti bontásban (Battonya, 1995–2017)

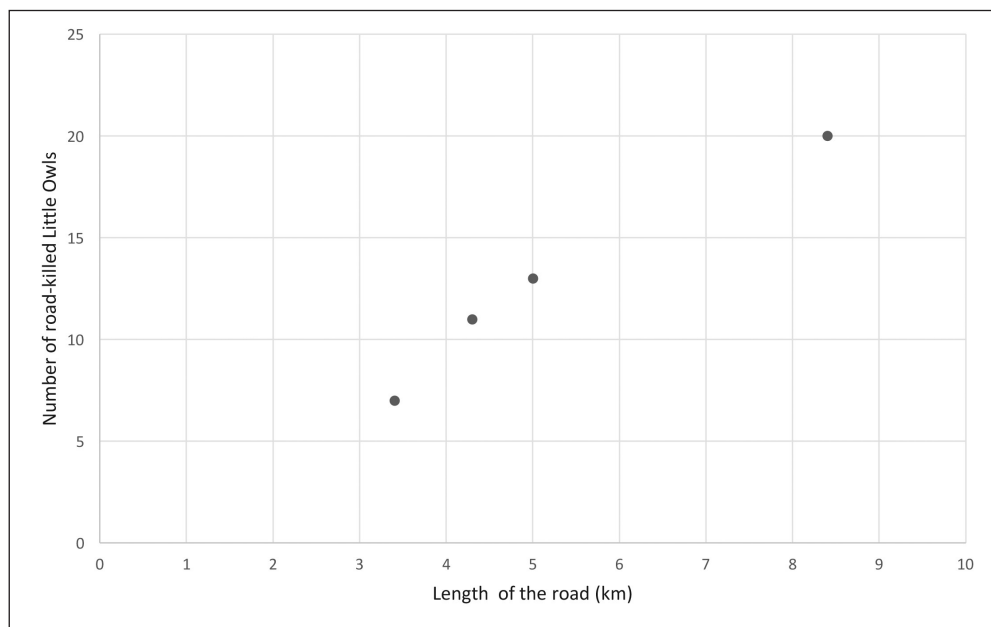


Figure 6. Relationship between the length of the roads of the outer areas and the number of road-killed Little Owls (Battonya, 1995–2017)

6. ábra Az egyes külterületi útszakaszok hosszának és az adott útszakaszokon előkerült kuvik-elütések számának összefüggése (Battonya, 1995–2017)

7 birds (10.94%). So 51 road-kills were in the outer area of Battonya (79.69%). We have noted data on 13 road-kills of Little Owl in the town (20.31%). The length of the roads of the outer areas and the number of road-killed Little Owls shows linear relationship (Figure 6).

Local people and the Little Owls

Based on our ethnoecological experience, the Little Owl is one of the least favoured bird species among the local people in the region. The reason is that the birds are extremely loud at the beginning and end of the breeding season, which has generated many conflicts. Humans are disturbed by this loudness and many are unable to sleep, therefore we expect that many nests are destroyed and several birds are caught and killed. We have no information about shooting. Poisoning (which might be secondary poisoning) occurred only once in Kevermes. The people do not recognize the species correctly, they often think these birds are Tawny Owls (*Strix aluco*).

Discussion

In the southern part of Békés county, on the Csanádi-hát region the landscape was originally dominated by loess steppes and forest-steppes (Csathó 2009, Csathó & Csathó 2009b,

Jakab 2012), but nowadays they have almost disappeared, and agricultural lands predominate. Starting from the 1950s the transformation of the landscape has become more intense: the old tree lines and the remaining forests were cut down gradually, and agricultural production has also changed significantly. The significant decline in animal husbandry, including domestic livestock farming, has only taken place since the 1990s, but now only a small part of the former livestock has remained (Bozó 2017). All of these factors together had negative effect on the population of many bird species in the area, however – thanks to its excellent adaptability (Žmihorski *et al.* 2009, Hámori 2017) – the population of the Little Owl was not affected.

There are no historical data on the species, despite the fact that Bozó (subm.) processed the written sources available from the region from the 18th century until the middle of the 20th century. However, recognizing the breeding habits of the species (Schmidt 1998), the former extensive animal husbandry and extensive farming could have created suitable conditions for the Little Owl. There is only one mention (István Szabó – pers. com.) in Battonya from the middle of the 20th century, however, the reference to the fact that the species nested in white mulberry tree (*Morus alba*) holes at that time indicate that not only the feeding but the traditional nesting conditions were also provided. These have now disappeared, but according to our study, since the mid-1990s, the population of the species increased in the area.

There are some studies dealing with population surveys (Finck 1990, Tomé *et al.* 2008, Thorup *et al.* 2010, Šálek & Lövy 2012, Šálek *et al.* 2013), breeding habits and feeding analyses of Little Owls (Angelici *et al.* 1997, Obuch & Kristín 2004, Lanszki 2006, Hámori 2014, Šálek *et al.* 2016, Hámori *et al.* 2017), however, only Hernandez (1988) dealt specifically with collecting and analysing species-related road-kill data. During his studies in Spain, he got similar results in the distribution of the collisions within a year, that is, the largest number of road-killed individuals occur in August and July after the fledging of juveniles, while the figures are lower in the rest of the year. In Battonya we also found the most road-kills of Little Owls in the same two months, July and August (Figure 5). In our view, similarly to Hernandez (1998), one of the most dangerous threats of anthropogenic environments in small towns and villages is the collision with vehicles. However, as Hernandez (1998) pointed out, the number of deaths can be confounded by the fact that the corpses of dead birds are much easier to notice on a road than the corpses of e.g. deliberately shot or poisoned birds. We think that the number of birds killed in other ways is much lower, since people do not have time to deal with this, and no one poisons the rodents at the abandoned houses that are the main breeding places for the Little Owls. According to Bankovics and Vadász (2009) 10.5% of recoveries is due to the vehicle collisions, although the sample size is rather small. It is interesting to note that while the nearby road network is an ecological trap for the species (Zabala *et al.* 2006), the breeding sites of the Little Owls are usually close to busy roads (Robertson & Hutto 2006). This can be related primarily to feeding habits because illuminated roads concentrate more insects and mammals in the night. Based on the results of Hámori (2014), this owl species has a high tolerance spectrum relative to the disturbing factors of asphalted roads and despite the risk factors in the area, they prefer their proximity because of the food.

Despite that the number of nesting sites is higher in the town, the 79.68% of the found road-killed Little Owls were in the outer areas of Battonya, probably because the vehicles are traveling at higher speeds in the outer areas than in the town (the maximum speed limit 90 km/h in the outer areas and 50 km/h in the town in Hungary).

During the population surveys in Kevermes in 2007 and 2017, not only the increase of the population, but also the change of nesting location of pairs, and disappearance and new development of nesting sites were observed. Our results highlighted that not the food source, but the availability of breeding sites will be the limiting factors for the local population in the future (see also Hámori *et al.* 2017). Compared with the data from 2007, many houses and outbuildings used for nesting formerly collapsed and became unsuitable for nesting by 2017. Adverse demographic changes of the human population (ageing society, moving of young people to the cities or foreign countries, depopulation in the region due to the unfavourable economic situation) have a positive impact on the population of Little Owl, since more properties become abandoned, creating an outstanding opportunity for this species. At present, they can colonise recently abandoned buildings, however, according to our experience, the buildings of the modern agriculture and the new houses are not suitable for the species, so it is possible that there will be a significant decrease in their population in the future.

Based on the literature, this species has wide food spectrum (Angelici *et al.* 1997, Hámori 2014), and sometimes eats plants as well (Lanszki 2006), so it is not surprising that even the decline in the number of livestock did not cause population declines for Little Owls. However, it should be noted that collapsed, abandoned houses are a good habitat for rodents, so this actually replaces the amount of rodents that are falling due to less animal husbandry. It is also interesting, that in the village there are growing areas of arable lands in the place of abandoned properties, which are very similar to the former farmlands. Sparsely populated streets are likely to be an excellent feeding sites for the Little Owl, and it may well have contributed to the increase in population.

The size of the territories varies seasonally according to Finck (1990), with the largest area (28.1 ha) in March–April and the smallest (1.6 ha) in July–August, in the fledging periods of the juveniles. Grzywaczewski (2009) had similar results in Poland (9 ha is the smallest, and 27.5 ha is the largest territory). The estimated size of the territories in our study was similar, but we did not have the opportunity to investigate seasonal changes in territory size.

According to our field experiences the Little Owl has large populations not only in Battonya and Kevermes but also in other settlements in the region – e.g. Dombegyház (Csathó – pers. obs.), Kisdombegyház (Csathó – pers. obs.), Kunágota (Bozó – pers. obs.), Lőkösháza (Bozó – pers. obs.), Nagykamarás (Bozó – pers. obs.), Mezőhegyes (Csathó – pers. obs.), Tótkomlós (Gábor Balogh – pers. com.), Pítvaros (Csathó – pers. obs.) and Csanádalberti (Balogh – pers. com.).

The social judgement of the species is getting worse in the area due to the growth of the population. The background of this is not the ‘halálmadár’ (it means ‘death bird’) superstition, but the extraordinary loudness of the species at the beginning and end of the breeding season, which has generated a number of conflicts over the last decade. Unfortunately, it is difficult to avoid such conflicts since the attitude of people is changing very slowly.

Acknowledgement

The authors express their gratitude to András János Csathó and András Jánosné Csathó for their work on road-kill surveys in Battonya. We are grateful to János Rozgonyi, Erna Bozóné Borbáth and Máté Frank for their help in the population surveys, and for two anonymous reviewers, who had many useful comments on the manuscript.

References

- Angelici, F. M., Latella, L., Luiselli, L. & Riga, F. 1997. The summer diet of the Little Owl (*Athene noctua*) on the Island of Astipalaia (Dodecanese, Greece). – *Journal of Raptor Research* 3: 280–282.
- Bankovics, A. & Vadász, Cs. 2009. Kuvik, *Athene noctua* (Scopoli, 1769) [Little Owl]. – In: Csörgő, T., Karcza, Zs., Halmos, G., Magyar, G., Gyurácz, J., Szép, T., Bankovics, A., Schmidt, A. & Schmidt, E. (eds.) Magyar madárvonulási atlasz [Bird Migration Atlas of Hungary]. – Kossuth Kiadó, Budapest, pp. 361–362. (in Hungarian with English Summary)
- Bozó, L. (subm.) Történelmi madártani adatok a Maros-Körös köze délkeleti feléről [Historical bird data from the southeastern part of Maros-Körös köze]. – *Aquila*
- Bozó, L. 2017. Kevermes madárvilága [Birds of Kevermes]. – Dél-békési Természetvédelmi és Madártani Egyesület, Kevermes (in Hungarian)
- Csathó, A. I. 2009. A mezsgyék természetvédelmi jelentősége és védelmük időszzerűsége [Significance and timeliness for nature conservation of the verge]. – *Természetvédelmi Közlemények* 15: 171–181. (in Hungarian with English Summary)
- Csathó, A. I. & Csathó, A. J. 2009a Elütött állatok Battonyán [Roadkills and the dynamics of the faunal casualties in Battonya (SE Hungary)]. – CSEMETE Természet- és Környezetvédelmi Egyesület, Battonya – Szeged (in Hungarian with English Summary)
- Csathó, A. J. & Csathó, A. I. 2009b A battonya-tompapusztai Külső-gulya flóralistája [The florist of the Külső-gulya meadow of Battonya-Tompapuszta (SE Hungary)]. – *Crisicum* 5: 51–70. (in Hungarian with English Summary)
- Exo, K. M. 1992. Population ecology of Little Owls *Athene noctua* in Central Europe: a review. – In: Galbraith, C. A., Taylor, I. R. & Percival, S. (eds.) *The Ecology and Conservation of European Owls*. – Joint Nature Conservation Committee, UK Nature Conservation, No. 5. Peterborough, pp. 64–75.
- Finck, P. 1990. Seasonal variation of territory size with the Little Owl (*Athene noctua*). – *Oecologia* 83(1): 68–75.
- Grzywaczewski, G. 2009. Home range size and habitat use of the Little Owl *Athene noctua* in East Poland. – *Ardea* 97(4): 541–545. DOI: 10.5253/078.097.0420
- Hadarics, T. & Zalai, T. (eds.) 2008. Magyarország madarainak névjegyzéke – Nomenclator avium Hungariae – An annotated list of the birds of Hungary. – Magyar Madártani és Természetvédelmi Egyesület, Budapest, p. 148. (in Hungarian and English)
- Hámori, D. 2014. A kuvik [*Athene noctua* (Scopoli, 1769)] táplálkozásának vizsgálata a Kiskunságban [The diet of Little Owls [*Athene noctua* (Scopoli, 1769)] in Kiskunság]. – *Magyar Ápróvad Közlemények* 12: 193–202. (in Hungarian with English Summary) DOI: 10.17243/mavk.2014.193
- Hámori, D. 2016. Antropogén fészkelő-helyekre kényszerült kuvik *Athene noctua* (Scopoli, 1769) konzervációbiológiai lehetőségei a Felső-Kiskunságban [Conservation biological aspects of the Little Owl (*Athene noctua*, Scopoli, 1769) adapted to anthropogenic nesting environment, Upper-Kiskunság, Hungary]. – *Erdészettudományi Közlemények* 6(2): 175–187. (in Hungarian with English Summary). DOI: 10.17164/EK.2016.014
- Hámori, D. 2017. Kuvikvédelem egy közép-magyarországi mezőgazdasági területen: költési adatok és a mesterséges fészkelőhelyek paramétereinek összefüggései [Little Owl conservation in farmland areas of Central-Hungary: relationships between the nesting data and nestbox parameters]. – *Magyar Ápróvad Közlemények* 13: 187–199. DOI: 10.17243/mavk.2017.187 (in Hungarian with English Summary)
- Hámori, D., Vadász, Cs. & Winkler, D. 2017. Demographic data on the Little Owl (*Athene noctua*) in Upper-Kiskunság. – *Ornis Hungarica* 25(2): 11–22. DOI: 10.1515/orhu-2017-0012
- Hernandez, M. 1988. Road mortality of Little Owl (*Athene noctua*) in Spain. – *Raptor Research* 22(3): 81–84.
- Jakab, G. (ed.) 2012. A Körös-Maros Nemzeti Park növényvilága [The flora of Körös-Maros National Park].

- A Körös-Maros Nemzeti Park természeti értékei I. – Körös-Maros Nemzeti Park Igazgatóság, Szarvas (in Hungarian)
- Juillard, M. 1989. The decline of the Little Owl *Athene noctua* in Switzerland. – Raptors in the modern world WWGBP, pp. 435–439.
- Lanszki, J. 2006. A kuvik (*Athene noctua*) táplálékösszetétele egy Somogy megyei külvárosi élőhelyen [Seasonal diet composition of Little Owl (*Athene noctua*) in a suburban habitat, Somogy county]. – Natura Somogyensis 9: 315–324. (in Hungarian with English Summary)
- Magyar, G., Hadarics, T., Waliczky, Z., Schmidt, A., Nagy, T. & Bankovics, A. 1998. Magyarország madarainak névjegyzéke. Nomenclator avium Hungariae. An annotated list of the birds of Hungary. – KTM Természetvédelmi Hivatal Madártani Intézete, MME, Winter Fair, Budapest – Szeged, p. 86. (in Hungarian and English)
- Obuch, J. & Kristín, A. 2004. Prey composition of the Little Owl *Athene noctua* in an arid zone (Egypt, Syria, Iran). – Folia Zoologica 53(1): 65–79.
- Robertson, B. A. & Hutto, R. L. 2006. A framework for understanding ecological traps and an evaluation of existing evidence. – Ecology 87: 1075–1095. DOI: 10.1890/0012-9658(2006)87[1075:AFFUET]2.0.CO;2
- Šálek, M., Chrenková, M. & Kipson, M. 2013. High population density of Little Owl (*Athene noctua*) in Hortobágy National Park, Hungary, Central Europe. – Polish Journal of Ecology 61: 165–169.
- Šálek, M., Chrenková, M., Dobrý, M., Kipson, M., Grill, S. & Václav, R. 2016. Scale-dependent habitat associations of a rapidly declining farmland predator, the Little Owl *Athene noctua*, in contrasting agricultural landscapes. – Agriculture, Ecosystems and Environment 224: 56–66. DOI: 10.1016/j.agee.2016.03.031
- Šálek, M. & Lövy, M. 2012. Spatial ecology and habitat selection of Little Owl *Athene noctua* during the breeding season in Central European farmland. – Bird Conservation International 22(3): 328–338. DOI: 10.1017/S0959270911000268
- Šálek, M. & Schröpfer, L. 2008. Population decline of the Little Owl (*Athene noctua* Scop.) in the Czech Republic. – Polish Journal of Ecology 56(3): 527–534.
- Schmidt, E. 1998. Kuvik [Little Owl]. – In: Haraszthy, L. (ed.) Magyarország madarai [Birds of Hungary]. – Mezőgazda Kiadó, Budapest, pp. 218–219. (in Hungarian)
- Schönn, S. 1986. Zur Status, Biologie, Ökologie und Schutz des Steinkauzes (*Athene noctua*) in der D.D.R. [Status, biology, ecology and protection of Little Owl (*Athene noctua*) in the D.D.R.]. – Acta Ornithoecologia 1: 103–133. (in German with English Summary)
- Thorup, K., Sunde, P., Jacobsen, L. B. & Rahbek, C. 2010. Breeding season food limitation drives population decline of the Little Owl *Athene noctua* in Denmark. – Ibis 152(4): 803–814. DOI: 10.1111/j.1474-919X.2010.01046.x
- Tomé, R., Catry, P., Bloise, C. & Korpimäki, E. 2008. Breeding density and success, and diet composition of Little Owls *Athene noctua* in steppe-like habitats in Portugal. – Ornis Fennica 85(1): 22–32.
- Tucker, G. M. & Heath, M. F. (eds.) 1994. Birds in Europe: their conservation status. – BirdLife International, Cambridge
- Van Nieuwenhuyse, D., Génot, J. C. & Johnson, D. H. 2008. The Little Owl: Conservation, Ecology and Behavior of *Athene noctua*. – Cambridge University Press, Cambridge
- Voous, K. H. 1960. Die Vogelwelt Europas und ihre Verbreitung [Birdlife of Europe and its distribution]. – Hamburg, Parey
- Zabala, J., Zuberogoitia, I., Martínez-Climent, J. A., Martínez, J. E., Azkona, A., Hidalgo, S. & Iraeta, A. 2006. Occupancy and abundance of Little Owl (*Athene noctua*) in an intensively managed forest area in Biscay. – Ornis Fennica 83(3): 97–107.
- Žmihorski, M., Romanowski, J. & Osojca, G. 2009. Habitat preferences of a declining population of the little owl, *Athene noctua* in Central Poland. – Folia Zoologica 58(2): 207–215.