

Chapter

Qualitative and Quantitative Changes in a Guild of Forest Owls: Eurasian Pygmy Owl (*Glaucidium passerinum*), Ural Owl (*Strix uralensis*), Tawny Owl (*Strix aluco*), Boreal Owl (*Aegolius funereus*) at Kamenný Hrb – Bankov Site in Volovské Mountains Near Košice Town, Eastern Slovakia, between Years 1989 and 2021

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Abstract

A guild of forest owls was evaluated in 1989 – 2021 in a 5.2 km² site in Slovakian Volovské mountains in Western Carpathians. Only the Eurasian Pygmy Owl (*Glaucidium passerinum*) declined in this near 30 year period from 8 to 5 territories and that local decline is referred to the increased presence of Tawny Owl (*Strix aluco*). Clear decline of calling activity of Eurasian Pygmy Owl in sympatric areas with Tawny Owls was also noted. Tawny Owl almost doubled its population from 3 to 5 territories occupied in 2017–2021 and the Boreal Owl (*Aegolius funereus*) was almost absent during 1989–1994 but occupied 8 breeding territories in years 2017–2021. Tawny Owl has a tendency of spreading to higher elevations, while Boreal Owl has an opposite tendency. Boreal Owl seeks suitable breeding habitats in old fir-beech forests with fir and oak stands and Black Woodpecker (*Dryocopus martius*) holes in old beeches as low as below 500 m a.s.l. Due to good populations of small mammals, Ural Owl (*Strix uralensis*) has been able to maintain stable populations with ca. 8 pairs in the study area between years 1989–2021. Good food situation also attracted some Boreal Owls to lowest known elevation limit of the species in Slovakia. Further research is needed, on a larger scale, to support the population trends documented in this paper.

Keywords: Eurasian pygmy owl, boreal owl, tawny owl, Ural owl, densities, trends, Western Carpathians, Slovakia

1. Introduction

The site Kamenný hrb – Bankov is situated near the town Košice, in Volovské mountains, in Eastern Slovakia, in elevation 420–550 m. Volovské mountain range belongs to W Carpathians. The study site can be characterised as a hilly, forested area, overgrown with most forests over 80 years of age (nowadays already over 100 years old). The size study area is approx. 5.2 km². Composition of forests is formed by naturally grown oak (*Quercus petraea*), horbeam (*Carpinus betulus*), beech (*Fagus sylvatica*), fir (*Abies alba*) and lime (*Tilia crdata*) stands, with sycamore (*Acer pseudo-platanus*) in higher elevations and with planted stands of spruce (*Picea abies*) of the same age, as other trees. Coniferous and mixed forests (spruce and fir-beach) dominate the ridge and its northern slope and oak and horbeam forests dominate southern expositions and the lowest elevations, but even oak and fir stand to grow side-by-side naturally, and the site is one of the lowest areas with naturally growing fir in Slovakia. The forest is not homogenous, it is interrupted by smaller and middle-sized meadows, clear-cuts and forest nurseries. The forest is harvested in a moderate, sustainable way, mainly due to its proximity to the town and also due to its main function – to serve as a recreation area for people from the town, with a number of forest tracks. Guild of forest owls at the site consists of 4 species: Eurasian Pygmy Owl (*Glaucidium passerinum*), Ural Owl (*Strix uralensis*), Tawny Owl (*Strix aluco*), Boreal Owl (*Aegolius funereus*), while the last species is a newcomer at the site because in period 1989–1994, only a few data of the species were found and no territorial males. Eurasian Pygmy Owl and Boreal Owl is in Slovakia traditionally associated with coniferous and mixed forests in higher mountains from 400 m a.s.l. up to forest limit in 1500 m a.s.l. [1–5], while Ural Owl and Tawny Owl is associated mostly with mountains and beech or oak forests, rarely broad-leaved lowland floodplain forests [1, 6], even if in some areas they occupy also mixed or even coniferous stands in mountains [7]. Populations of owls are regularly monitored at the site. First ornithological data on the occurrence of Eurasian Pygmy Owl and Ural Owl in the area come from the 1970s years by Mošanský (1982) [8], Danko (1988) [9], Pačenovský (1981) [10] and of the Tawny Owl from 1980s years by Mošanský (1982) [8], Takáč (1982) [11] and occurrence of the Boreal Owl from the site was previously not known. The site is one of the lowest areas in Volovské mountains with distribution of Eurasian Pygmy Owl, where two nests situated in 520 and 470 m elevation found and checked in years 1989, 1990, 1991, 1994, 1997 and 2009 were regarded as the lowest known nest sites of the species for Slovakia [5]; as well as one of the lowest known areas with distribution of the Boreal Owl. Thirty-year-long observation of the site prepared a possibility to follow population trends of 4 owl species occupying the site and most of them have shown rather steep population changes within those periods.

2. Qualitative and quantitative changes in a guild of forest owls Eurasian pygmy owl, ural owl, tawny owl, boreal owl at kamenný hrb – bankov site

Population of Eurasian Pygmy Owl (thereafter only Pygmy Owl) at the site Kamenný hrb – Bankov has been continually monitored from 1989 till present time, till year 2021

[5, 6, 12–16] but the most intensively in years 1989–1991. As an example of intensity of its monitoring in that period, we can mention years 1989–1994, when the site was visited 189 times (in 1989 realised 109 site visits/99 records), with a result of 161 records of the species at the area, even if over a half of site-visits was done in order to observe activity of owls at two occupied nest-sites. Local population of the Ural Owl was during the same period also under regular control, during years 1989–1991 by both authors, and from the 1980-ies till present time by local ornithologist Jozef Mihók, who placed a number of nest-boxes in the area, to support the breeding of the species. A low number [3–5] of nest-boxes was placed in the area in year 1991 also for the Pygmy Owl and for the Boreal Owl by first author of the paper, but these nest-boxes were not occupied by these species. In Slovakia breeding of the Pygmy Owl in a nest-box is very unusual, so far only one case was found [5, 9] and all other occupied nests in the country were found in holes excavated by Great-spotted Woodpecker (*Dendrocopos major*) or, especially in higher elevations also by the Eurasian Three-toed Woodpecker (*Picoides tridactylus*) and just very exceptionally breeds also in natural cavities – just 2 known cases so far [5]. On the other hand, breeding of the Boreal Owl in nest-boxes is quite common, as well as breeding of Tawny and Ural owl [1], but at study area, Kamenný hrb-Bankov nest-boxes were utilised only by Ural Owls, besides of natural raptor nests. Breeding of two pairs of Pygmy Owl was documented in Kamenný hrb area during years 1989–1994 [5, 7, 12–14] and in one territory breeding was documented also later on, in years 1997 and 2009 [5]. Also, food consumption, breeding biology and notes from ethology were evaluated from nests found in Volovské mountains [12], as well as course of autumn mating of the species was evaluated [16]. Curiosity of these breeding records is, that 5 subsequent breeding attempts were found in the same owl territory marked „B1“: in years 1990, 1991, 1994, 1997 and 2009, while during years 1990–1997 the owls used for breeding the same oak tree, even if not in every year they utilised the same woodpecker cavity. It is almost sure, that during these years (1990–1997) more than 1 male used that territory – that presumption is likely because of short life-span of the species and it was proved, that in years 1990 and 1991 another female took part in the breeding because in both years breeding female birds were captured and ringed and the female breeding in 1991 in the same tree as in previous year had no ring. Distribution of the 8 identified breeding territories of Pygmy Owls in Kamenný hrb site during years 1989–1994 is shown at **Figure 1**. Examples of scetches describing site-visits with recorded observations of Pygmy Owls are shown at **Figures 2** and **3**. Distribution of Pygmy Owl territories at Kamenný hrb site in years 2017–2021 shows a very different picture (**Figure 4**). Despite a quite intense search after the species, especially during autumn 2020 and winter 2020–2021 only 4 occupied territories were located and effectiveness of locating of the species was very low: only 4 positive occurrences of the species despite 16 site-visits devoted to an intensive search for the species, including imitations of advertising calls. Lower density of Pygmy Owl at the site could be best explained by the already described phenomenon [17, 18] of increased competition with Tawny Owl – see **Figures 5** and **6**, that caused e.g. local extinctions of Pygmy Owl in parts of W Germany after distribution of Tawny Owl to higher elevations, what almost happened also here, at Kamenný hrb site. Very low vocal activity of the species in years 2020–2021 is probably as well a result of competition with Tawny Owl, the species remains secretive even during autumn mating and winter season, only in late autumn (XI, XII) and early spring (II) was detected some territorial activity. Only 23% of site visits were effective to locate calls of the species in years 2020–2021 in comparison to 90.8% of positive site visits in 1989 and 83% of positive visits in years 1989–1994. On the other hand, occurrence of the Tawny Owl increased at Kamenný hrb site from 4 occurrences annually (females only) in 1989 to 7–10 registrations/year (regular territorial

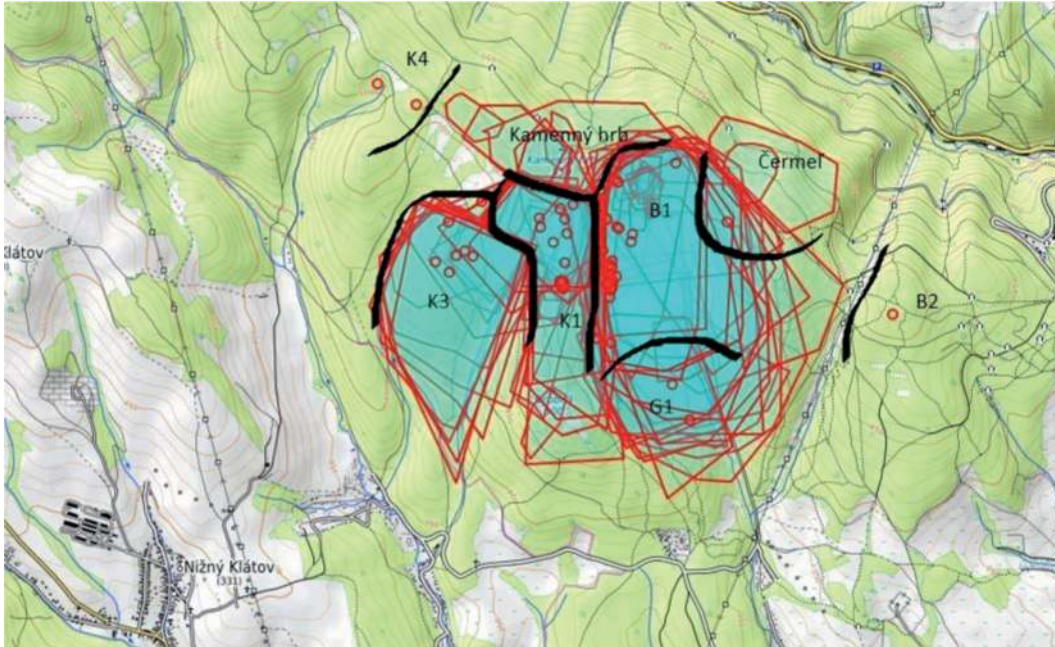


Figure 1. Distribution of 8 identified breeding territories of Eurasian pygmy owl (*Glaucidium passerinum*) in years 1989–1994 at the site Kamenný hrb – Bankov near Košice. Data were excerpted from online databasis Aves-symfony of SOS/BirdLife Slovakia – 161 data. Names and symbols of identified territories of *G. passerinum*: B1, K1, K3, K4, G1, Kamenný hrb, Čermel, B2. Known limits between individual territories are marked with black solid lines. In 2 of the territories even breeding nest cavities were found: in territory K1 nest site was known in years 1989 and 1990; in territory B1 nest sites was found in years 1990, 1991, and 1994.

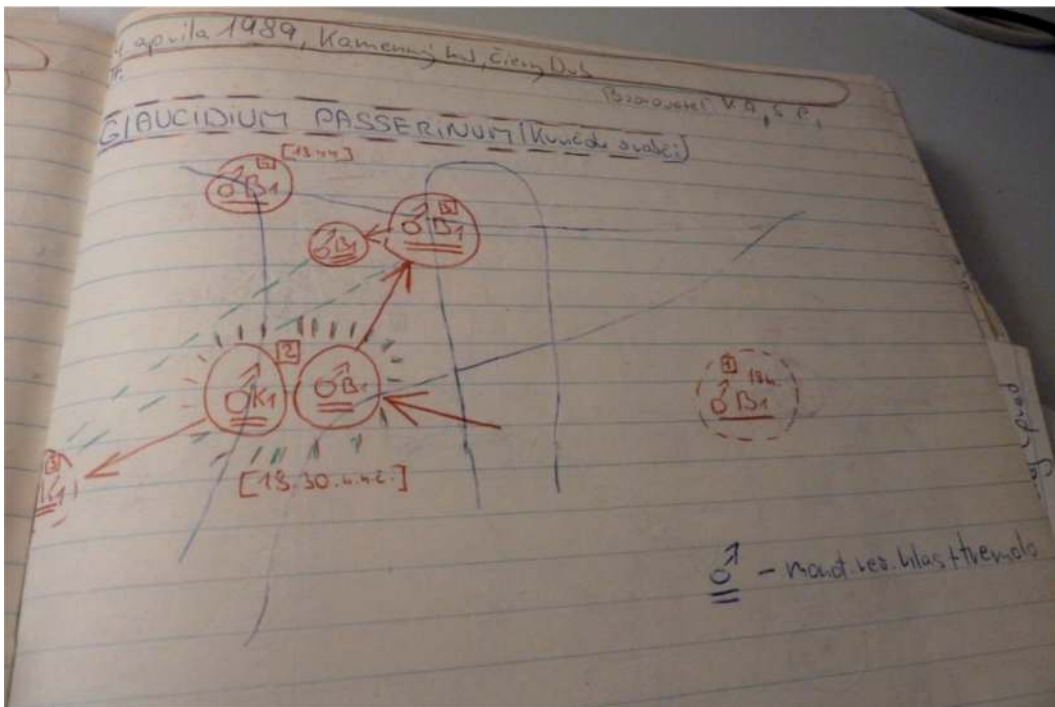


Figure 2. Example of original field note from year 1989, describing a detailed evening observation of activity of 2 calling males of Eurasian pygmy owl (B1 and K1) at border-line of the two territories (A. Kúřthy).

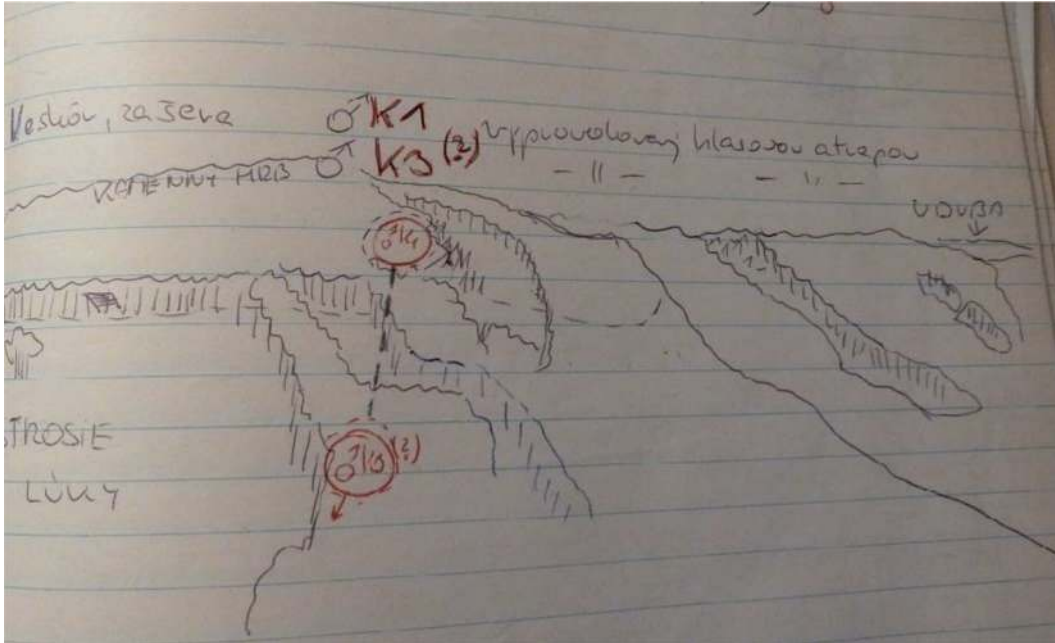


Figure 3.
A “three dimensional” note of observation at a border of 2 Eurasian Pygmy Owl territories, possibly K1 and K3, in March 1989. (A. Kürthy).

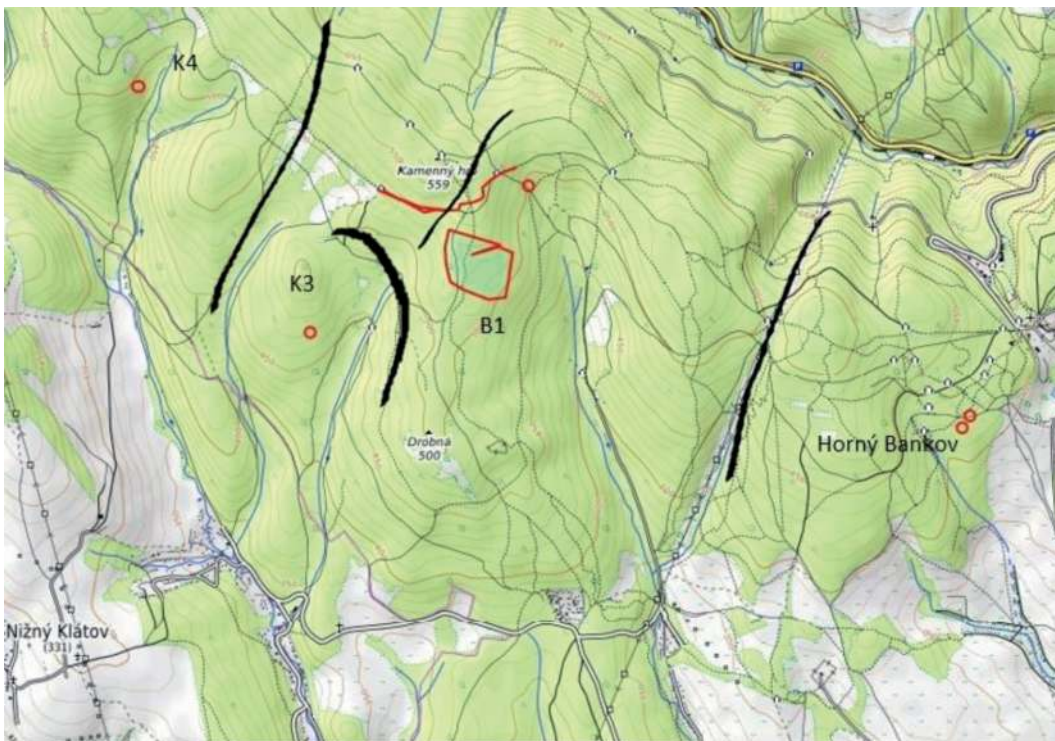


Figure 4.
Distribution of 4 identified breeding territories of Eurasian pygmy owl (*Glaucidium passerinum*) in years 2017–2021 at the site Kamenný hrb – Bankov near Košice town. Data were excerpted from online databasis Aves-symphony of SOS/BirdLife Slovakia – 8 records. Names/codes of known territories and years, when corresponding occupied territory was checked: B1 (2017, 2020, 2021), K3 (2020), K4 (2020), Horný Bankov (2019, 2020). Known, or supposed borders between individual territories are marked with black solid lines.

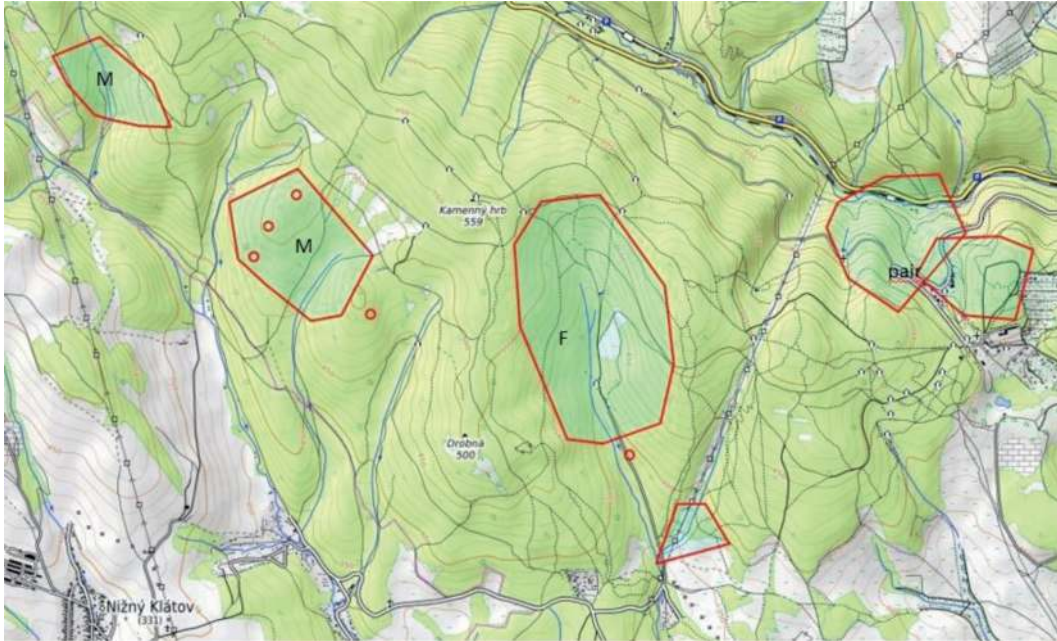


Figure 5. Known distribution of occupied territories of the tawny owl (*Strix aluco*) in years 1989–1994 at the site Kamenný hrb – Bankov near town Košice. Data were excerpted from online databasis *Aves-symfony* of SOS/BirdLife Slovakia – 14 data. With symbol „M” were marked breeding territories occupied by territorial males; with symbol „F” is marked an area where only occurrence of a female bird was found; with a symbol „pair” is marked a territory occupied by a pair with detected nest site.

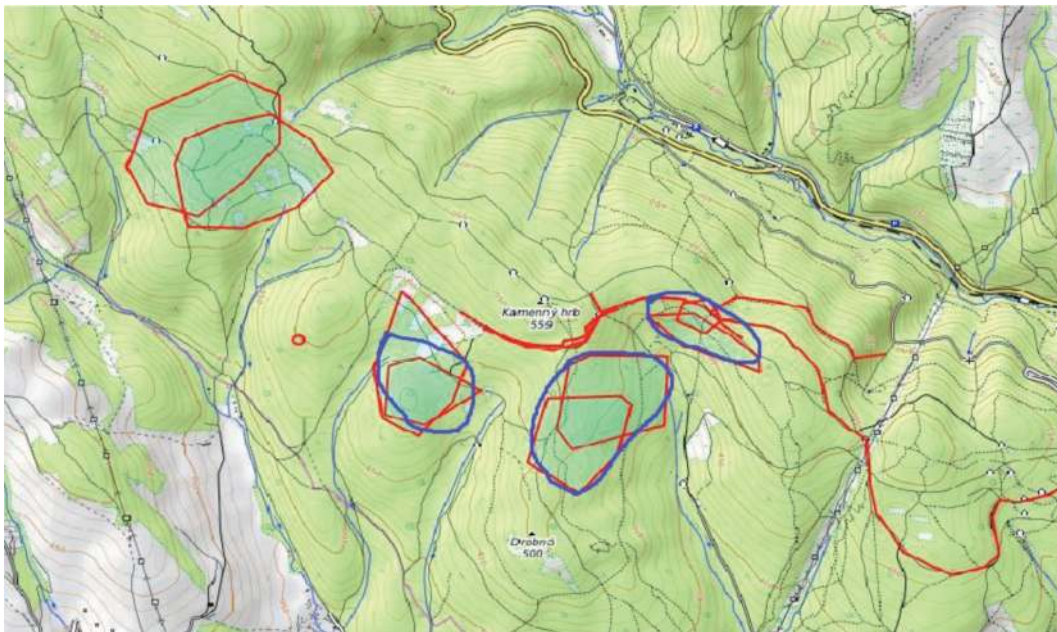


Figure 6. Known distribution of occupied territories of the tawny owl (*Strix aluco*) in years 2017–2021 at the site Kamenný hrb – Bankov near town Košice. Data were excerpted from online databasis *Aves-symfony* of SOS/BirdLife Slovakia – 17 data. Number of occupied territories after 30 years moderately increased, present number of supposed breeding pairs occupying the area is 5 according to known territories defended by territorial males. Main difference is against situation from years 1989–1994 is presence of at least 2 territories of males at the main ridge to east from altitude quote “Kamenný hrb”; as well as at the side-ridge Kamenný hrb – Drobná and a following hill to the W – All 3 marked with blue circles; where in the previous period 1989–1994 about 30 years earlier territorial occurrence of the species was unknown.

males) in years 2017–2021 and that increase of territorial activity of Tawny Owls was the most intense in 5 territories of Pygmy Owls marked in 1989 as „B1“, „K1“, „K4“, „Kamenný hrb“ and „Čermel“ (Figure 1), where territorial presence of the Tawny Owl was in years 1989–1994 almost unknown, irregular and very rare (see Figure 4 with distribution of Tawny Owl for years 2017–2021). Also, occurrence of the Pygmy Owl at Horný Bankov – the easternmost territory occupied in 2017–2021 (Figure 2) is a good example of redistribution of the species to suboptimal, highly unusual habitat for the species: 80 years old oak-horbeam forest with almost no conifers, but with a lack of Tawny Owls (but occupied by Ural Owls). Another Pygmy Owl, the westernmost at the site, at Figure 1 shown as territory „K4“ sought a „shelter“ from a neighbouring Tawny Owl and has literally stitched on between 2 Ural Owl territories (see Figures 4 and 8), in order to get protection against its Tawny Owl neighbour, moving its territory inside two territories of Ural Owls. Even if Ural Owl is able to predate Eurasian Pygmy Owls [17] and even in one of nest sites of Pygmy Owl observed at Kamenný hrb, in territory „K1“ was almost sure, that one of the 5 fledglings was predated by Ural Owl [6], that risk is apparently lower for the Pygmy Owl, as close neighbourhood of the more dangerous Tawny Owl [6], which is known to be a foraging generalist and a frequent predator of birds [19]. Even if Boreal Owl does not mean direct threat to Pygmy Owl, their main prey items can overlap (small forest mammals – mice, voles, shrews), thus steep population growth of the Boreal Owl at Kamenný hrb after the year 2000 could also possibly contribute to worsening of local conditions for Pygmy Owl. Distribution and densities of the corresponding 4 owl species: Pygmy Owl, Ural Owl, Tawny Owl and Boreal Owl at Kamenný hrb – Bankov site during last 30 years are shown at Table 1.

Distribution of territories, nor overall density of Ural Owls, as the most dominant of the 4 observed owl species at Kamenný hrb site did not change substantially during previous 30 years – see Figures 7 and 8. Most of Ural Owl territories remained at the same sites as previously and density of the species also remained the same. The Boreal Owl at Kamenný hrb site went through an expressive transition from an irregular non-breeding visitor (Figure 9) in years 1989–1994 to a regularly occurring population of 7–8 all-year-round present territorial males (possibly pairs) in years 2017–2021 (Figure 10). That change is contradictory to planet-warming process, because these owls were forced to lower elevations of the mountain range apparently from higher elevations. But if we address that phenomenon from a broader regional scale of all Volovské mountains range (140,000 ha), where the Bankov-Kamenný hrb site belongs, the explanation is simple: most of spruce forests in elevations over 1000 m in central and western part of Volovské mountains with viable populations of

Owl species	territories 1989–1994	density/km ² 1989–1991	No of records	territories 2017–2021	density/km ² 2017–2021	No of records	trend
<i>Glaucidium passerinum</i>	8	1.5	161	4	0.74	8	–2
<i>Strix uralensis</i>	8	1.5	69	8	1.5	41	stable
<i>Strix aluco</i>	3	0.56	14	5	0.93	17	(+2)
<i>Aegolius funereus</i>	0	0	6	8	1.5	36	(+2)

Table 1. Number of occupied territories and densities of Ural owls, tawny owls, Eurasian pygmy owls and boreal owls at Kamenný hrb – Bankov between years 1989 and 2021.

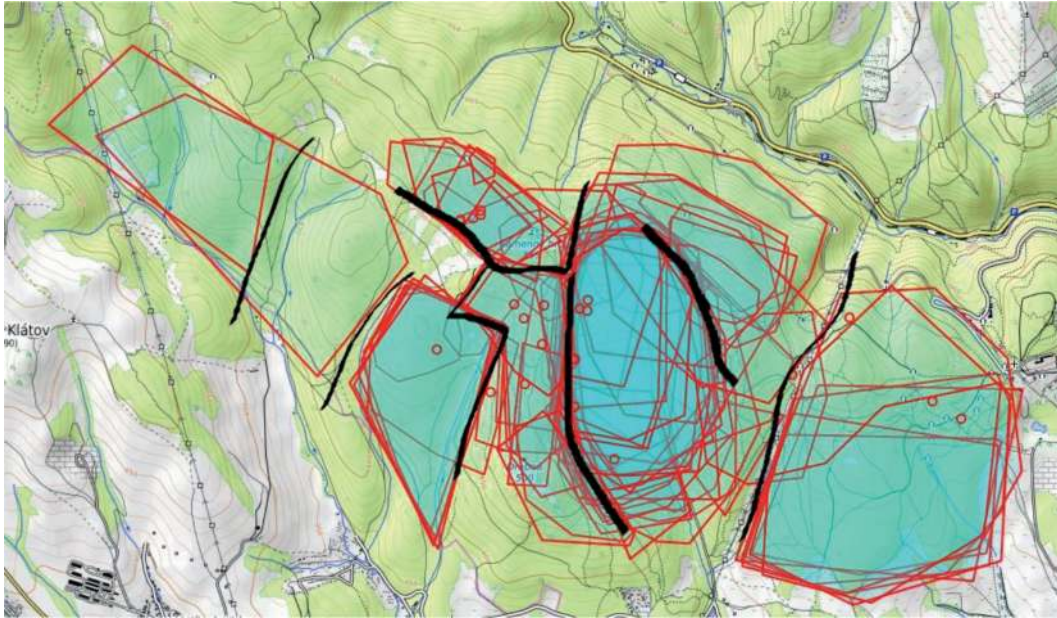


Figure 7. Known distribution of occupied territories of the Ural owl (*Strix uralensis*) in years 1989–1994 at the site Kamenný hrb – Bankov near town Košice. Data were excerpted from online databasis Aves-symfony of SOS/ BirdLife Slovakia – 69 data. Even if specific nest sites were not identified, it is very likely that minimally around 8 pairs has bred at the site in that period. Known or supposed borders between individual breeding territories are marked with black lines.

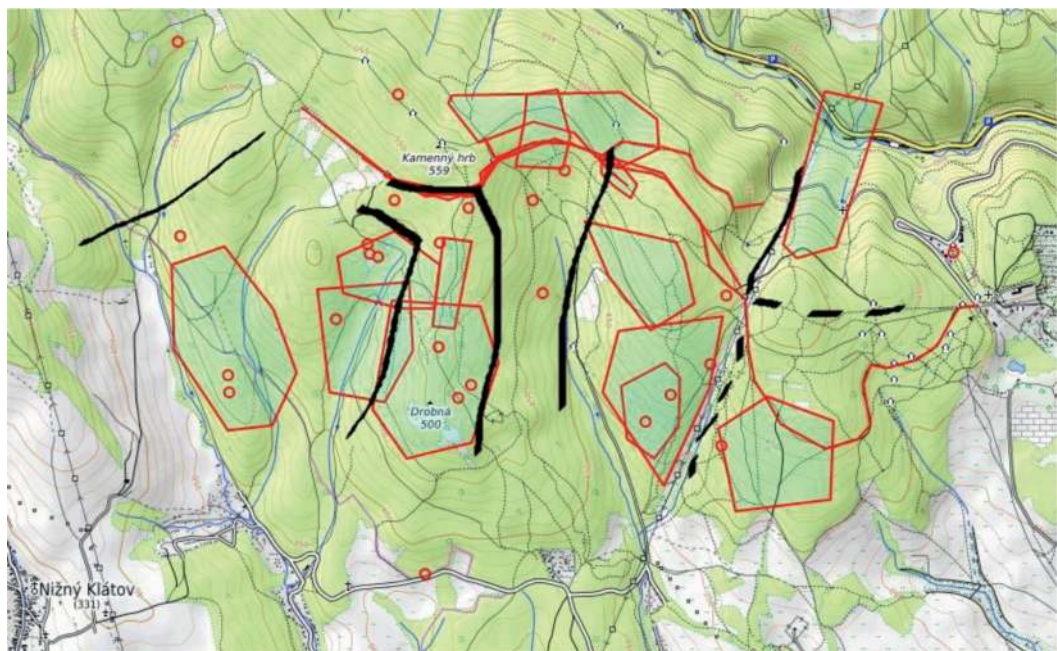


Figure 8. Distribution of occupied territories of the Ural owl (*Strix uralensis*) in years 2017–2021 at the site Kamenný hrb – Bankov near town Košice. 27 distribution data are displayed at detailed DFS map. The population consists of minimally 8 occupied territories of breeding pairs. In some territories even occupied nest-boxes are known. Distribution of individual territories is almost identical as in period 1989–1994.



Figure 9. Sites with sporadic occurrence of the boreal owl (*Aegolius funereus*) at the same site Kamenný hrb – Bankov, between town Košice in the east and village Nižný Klátov in the south; during period 1989–1994. Data were excerpted from online databasis Aves-symfony of SOS/BirdLife Slovakia – 6 data. None of determined birds was a territorial male.

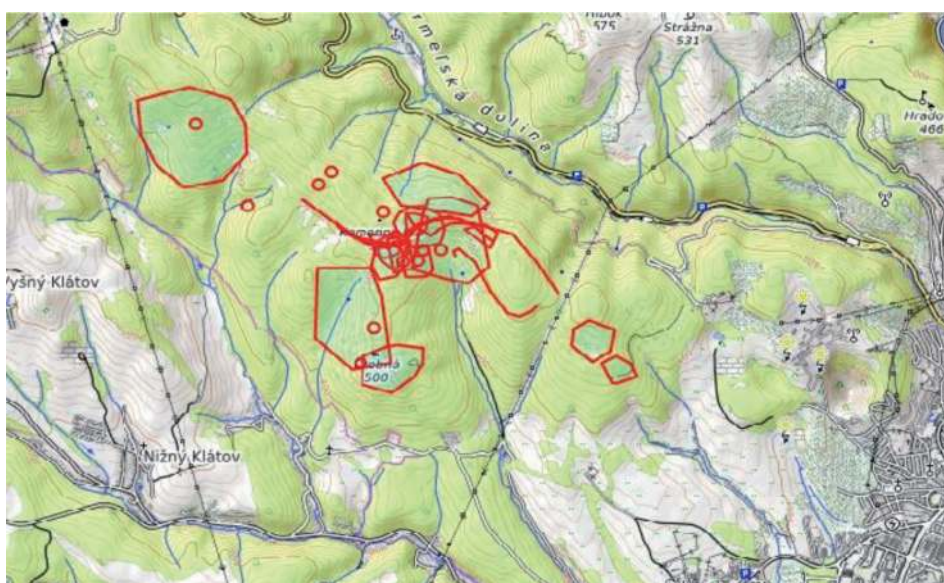


Figure 10. Sites with occurrence of the boreal owl (*Aegolius funereus*) at Kamenný hrb – Bankov, between town Košice in the east and village Nižný Klátov in the south; during period 2017–2021. Data were excerpted from online databasis Aves-symfony of SOS/BirdLife Slovakia – 36 data. Data include 36 occurrences and approx. 8 territorial males. The species is now year-round present in the area as a territorial bird with supposed breeding, number of occurrences increased after 30 years (between 2017 and 2021 in comparison with period 1989–1994) from 6 to 36 and number of occupied territories from 0 to 8.

Boreal Owls were in large extent destroyed and removed, between years 2000–2010 approx [14], thus occurrence of that owl species in elevations as low, as 400–600 m at Kamenný hrb site only reflects the tendency of the species looking for new habitats,

instead of the destroyed habitats in higher elevations of the same mountain range. Possibly good local populations of small forest mammals, such as rodents and shrews at Kamenný hrb, able to maintain a good population of Ural Owls for the last 30 years (see **Figures 5 and 6**), as their main food source; as well as numerous Black Woodpecker (*Dryocopus martius*) cavities in old beech stands at Kamenný hrb site could attract Boreal Owls even to these quite unique – for the species unusually low elevations – at least from a Central-European perspective.

3. Broader regional ties of the observed sites to Volovské mountains

The Kamenný hrb – Bankov site belongs to a broader mountain range of Volovské mountains, of area 1240 km², reaching elevations 1322 m (**Figures 11–13**). In the whole range, Ural and Tawny Owls still survive with a stable trend, despite forest logging, but



Figure 11. Nest site of the Eurasian pygmy owl at Suchý vrch in Starovodská valley in year 2013, 830 m elevation. Photo S. Pačenovský.

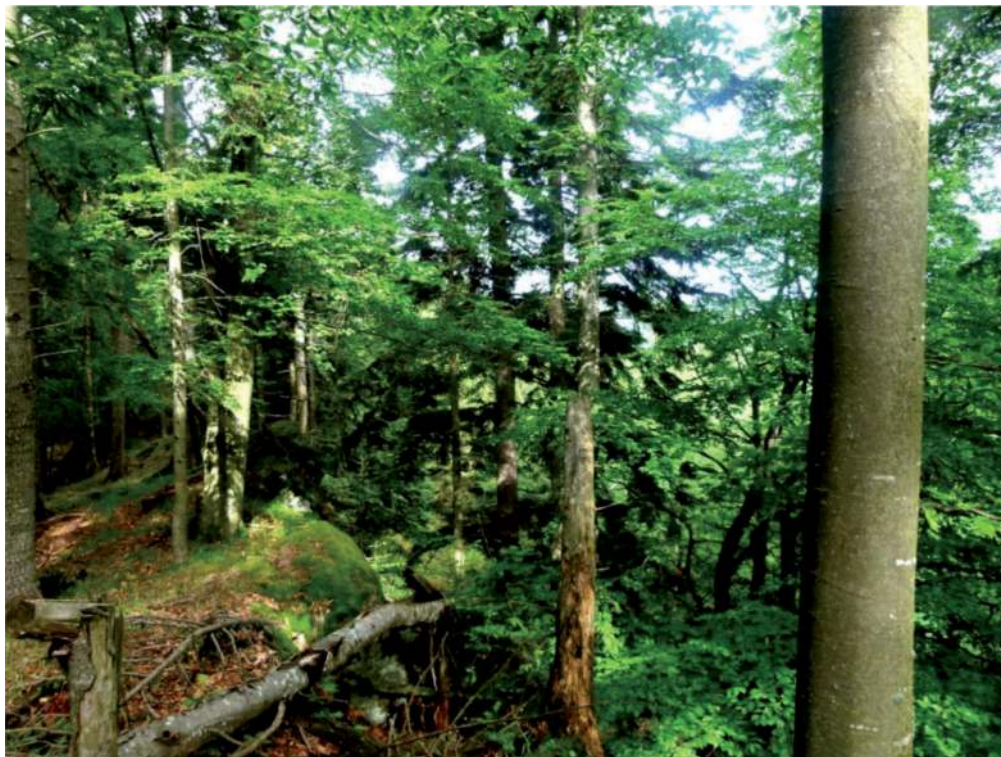


Figure 12.
Breeding territory of Eurasian pygmy owl at Suchý vrch in Starovodská valley in central part of Volovské mountains, fir-beech forest in 830 m elevation, June 2013. Photo S. Pačenovský.



Figure 13.
Starovodská valley in central part of Volovské mountains, July 2013. At opposite slope over 100 years old, natural, mixed forests are visible, as well as other parts of the ridge, denuded after removal of dying spruce forests, 800–1300 m a.s.l. Photo: S. Pačenovský.

Boreal Owls and also probably Pygmy Owls show a moderate long-term decline due to loss of spruce forests above 1000 m elevation as a consequence of climate change and bark-beetle infestations. As profound population decline of Pygmy Owl, as we observed at Kamenný hrb – Bankov site in other, higher elevations of the range was not found even during last decade (2010–2021), with exception of highest areas in central and western part of the range, where vast habitat degradation was observed in spruce forests. Other populations of all 4 owl species in fir-beech forests are still stable. Latest population estimates for whole Volovské mountains range were 130–155 pairs for the Pygmy Owl (locally –1 popul. trend), for the Ural Owl 130–190 pairs (stable popul. trend), for the Boreal Owl 130–180 pairs (–1 popul. trend) and for the Tawny Owl was not stated a precise population estimate [14].

4. Discussion

Food items of Pygmy Owl, collected in years 2010–2014, including three nests from Volovské mountains, from elevations 840–1040 m a.s.l. (Kojšovská hoľa, Tupý vrch, Starovodská valley) were evaluated [20]. Food items from these 3 nests contained remains of 43 specimens of 6 mammal species and 97 specimens of 22 bird species (**Annex 1**). Surroundings of the nest in Starovodská valley are shown in **Figures 11–13**. Food analysis from 2 nests of Pygmy Owl was earlier realised also exactly at the site Bankov – Kamenný hrb from years 1989–1993 [13] and food supply contained several species of small forest mammals and Passerines. These data support an assumption, that local decline of the Pygmy Owl at observed study site Bankov-Kamenný hrb was not caused by food shortage. Even habitat quality did not change considerably during that 30 year period, apart from the fact, that the forest gained 30 years of its mature age. On the other hand, good populations of small mammals in the forest and open habitats (meadows, clear-cuts), able to maintain good and stable populations of Ural Owls could possibly attract some Boreal Owls to as low areas as that site, to lowest known elevation limit of the species in Slovakia.

Density estimates of owls for Volovské mountains are actually being evaluated and an extensive monitoring scheme was realised in year 2021 to get population data for all 4 species from different sites of the range in its highest elevations over 700 m (700–1300 m a.s.l.); the results will soon be published. Could be assumed, that if Boreal Owls tend to move from highly degraded spruce forests at the ridge of Volovské mountains to lower elevations (e.g., Kamenný hrb area in 400–600 m elevation), some Pygmy Owl populations will also follow this trend. Occurrence of the species and even temporary breeding attempts in the Aggtelek Karst in Hungary with first breeding record of Pygmy Owl for Hungary [21] could be an example of that kind of process because Aggtelek karst is situated only 13 km from Southern edge of Volovské mountains and both ranges are interconnected through forested plateaus of the Slovak karst with patches of conifers (and with occurrence of Pygmy Owls in these patches of conifers).

5. Conclusions

Only the Pygmy Owl declined after a near 30 year period (steep decline by –2 from 8 to 5 territories); its local decline is referred to increased presence of Tawny Owl at the site. Only 23% of site visits were effective to locate calls of the species in

years 2020–2021 in comparison to 90.8% of positive site visits in 1989 and 83% of positive visits in years 1989–1994. This fact was probably caused by decline of calling activity of Pygmy Owl in sympatric areas with Tawny Owls. Two other species showed steep population increase +2: the Tawny Owl almost doubled its population at the site, from 3 territories (mostly females only) in 1989–1994 to 5 territories occupied in 2017–2021 and the Boreal Owl was almost absent during 1989–1994 and appeared as regularly occurring territorial species with 8 occupied breeding territories in years 2017–2021. In case of Tawny Owl, there is a tendency of spreading to higher elevations and in the case of Boreal Owl an opposite tendency, looking for suitable breeding habitats in old fir-beech forests with fir and oak stands and Black Woodpecker holes in old beeches as low as below 500 m a.s.l., presumably due to profound habitat loss going on recently in higher, central and W parts of the same mountain range, in elevations about 1000 m a.s.l., where optimal conditions for the species were worsened after year 2000 due to large-scale drying up and destruction of spruce forests. One species, the Ural Owl remained stable at the site between years 1989–2021 with a continual total population of about 8 pairs. Wider regional comparison of the site at the scale of whole Volovské mountains range was given in chapter 3.

Earlier published studies of diet of Pygmy Owl [20] in years 2012–2015, including data from 3 nests located in higher elevations of Volovské mountains revealed an existing wide food supply for the species, including at least 6 mammal and 22 bird species found in diet of these 3 Pygmy Owl pairs. These data support an assumption, that local decline of the Pygmy Owl at observed study site Bankov-Kamenný hrb was not caused by food shortage. On the other hand, good populations of small mammals in the forest and open habitats (meadows, clear-cuts), able to maintain good and stable populations of Ural Owls could possibly attract some Boreal Owls to as low areas as that site, to lowest known elevation limit of the species in Slovakia. It has been concluded that some of quite recent, new, already published data on occurrence of Pygmy Owl in its lower distribution limit, e.g., as those on first documented breeding of the species in Aggtelek karst in N Hungary from 2011 [21] could be explained by a partial population decline and large-scale habitat loss going on in some areas of Volovské mountains, located only 13 km to N from edge of the Aggtelek karst area in Hungary. Still, the study area of 5.2 km² is quite small, so wider conclusions on population trends of these 4 owl species should be taken carefully and further research is needed, on a larger scale.

Acknowledgements

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Annex 1

Annex 1 Food items of pygmy owl, collected in years 2010–2014, at three nests from Volovské mountains, from elevations 830–1040 m a.s.l. (Kojšovská hoľa, Tupý vrch, Starovodská valley). After: Šotnár et al. [20].

Samples (Prey taxon)	1	2	3	Σ
Common shrew (<i>Sorex araneus</i>)	1			1
Eurasian pygmy shrew (<i>Sorex minutus</i>)	1			1
Hazel dormouse (<i>Muscardinus avelanarius</i>)		1		1
Northern birch mouse <i>Sicista betulina</i>		1		1
Yellow-necked mouse (<i>Apodemus flavicollis</i>)	4	9	3	16
Bank vole (<i>Myodes glareolus</i>)	5	14	4	23
Mammals (Mammalia)	11	25	7	43
White wagtail (<i>Motacilla alba</i>)		3		3
Dunnock (<i>Prunella modularis</i>)			1	1
Common whitethroat (<i>Sylvia communis</i>)		1		1
Blackcap (<i>Sylvia atricapilla</i>)			2	2
Common chiffchaff (<i>Phylloscopus collybita</i>)		3	1	4
Goldcrest od Firecrest (<i>Regulus sp.</i>)	1	3	3	7
Common redstart (<i>Phoenicurus phoenicurus</i>)		1	1	2
European robin (<i>Erithacus rubecula</i>)	1	3	2	6
Long-tailed tit (<i>Aegithalos caudatus</i>)		4		4
Great tit (<i>Parus major</i>)		3	3	6
Coal tit (<i>Periparus ater</i>)		13		13
Blue tit (<i>Cyanistes caeruleus</i>)	1	1	5	7
Crested tit (<i>Lophophanes cristatus</i>)		1		1
Marsh tit (<i>Poecile palustris</i>)		2	1	3
Willow tit (<i>Poecile montanus</i>)		1	4	5
Eurasian nuthatch (<i>Sitta europaea</i>)	2	4		6
Eurasian treecreeper (<i>Certhia familiaris</i>)		5		5
Northern wren (<i>Troglodytes troglodytes</i>)		6		6
Yellowhammer (<i>Emberiza citrinella</i>)		1	1	2
Common chaffinch (<i>Fringilla coelebs</i>)	1	5	3	9
Common linnet (<i>Linaria cannabina</i>)	1			1
Eurasian bullfinch (<i>Pyrrhula pyrrhula</i>)	1			1
Passerine (<i>Passeriformes</i>) indet.		2		2
birds/Aves	8	59	27	97
Σ	19	87	34	110

Samples – date of collection: 1 – Kojšovská hoľa, Volovské vrchy Mts, 26 June 2011 + 10 July 2011 (1040 m a.s.l.), 2 – Tupý vrch, Volovské vrchy Mts 18 June 2010 + 3 July 2010 + 12 June 2011 + 20 June 2011 + 26 June 2011 (1020 m a.s.l.), 3 – Stará Voda, Volovské vrchy Mts, 21 July 2013 + 11 June 2014 + 27 June 2014 (830 m a.s.l.).

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