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Abundance and distribution patterns of owls in Pieniny National Park, Southern Poland

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Abstract. Species composition, abundance and distribution of owls *Strigiformes* in the Pieniny National Park were studied during the years 2001-2002. The research area covered 23.25 km^2. Seven owl species were recorded. A total of 30-38 territories (16-17 Tawny Owl territories, six Eagle Owl territories, four Long-eared Owl territories, 2-4 Tengmalm's Owl territories, 2-3 Ural Owl territories, three Pygmy Owl territories and one Little Owl territory) were found, giving a density of 12.9-16.3 territories per 10 km^2. The numbers and density of species in the Pieniny National Park differ from those of other mountainous regions in Poland. The density of the Tawny Owl is significantly higher than other figures given for mountainous areas. The density recorded for the Eagle Owl is the highest in Poland and one of the highest known for this species. A low density is seen for the Ural Owl, indicating a density gradient in the Carpathian Mountains. The Little Owl found here are the only ones presently known in this part of the Polish Carpathians.

Key words: Owls, Strigiformes, Pieniny National Park, distribution pattern.

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I. INTRODUCTION

Scarce, historical data concerning the occurrence of owls in the Pieniny area can be found in the papers of SITOWSKI (1916) and BOCHEŃSKI (1960b). Data about the Eagle Owl were also published by SITOWSKI (1923), FERENS (1953), BOCHEŃSKI (1960a, 1966) and STROJNY (1965). The information found in these publications was not collected according to research methods for owls which are acceptable today and therefore must be treated cautiously. Only the data about the occurrence of the Eagle Owl, probably obtained by interviewing local people who knew nest locations and removed eggs and young from them, are more precise. Up until the second half of the 20th century it was popular to eradicate Eagle Owls and to use them while hunting birds of prey (FERENS 1953). The recent papers include only fragmentary information about the bird fauna of the Pieniny frequently drawn from historical publications (RUPRECHT & SZWAGRZAK 1988, WALASZ & MIELCZAREK 1992, TOMIAŁOJĆ 1990, GŁOWACIŃSKI 1992, 2001). During the mid-1990s an attempt to carry out research primarily in the eastern part of the Pieniny National Park was made (G. CIERLIK, B. KOZIK – unpublished data). The scarce data are also included in the protection plan of the park (PROFUS 2001b). All of the above references give only an overall picture of owl fauna living in the Pieniny. It

does not enable one to trace changes in owl fauna which are possibly occurring. The aim of the following research was to determine the species composition, abundanceand distribution pattern of owls found in the Pieniny National Park.

A c k n o w l e d g e m e n t s. I wish to express my gratitude to the members of the Ornithological Section of the Foresters' Scientific Club of the Faculty of Forestry of the Agriculture University in Kraków for their help with the field work. I want to thank Bogusław KOZIK for his help as well as Włodzimierz CICHOCKI, Grzegorz GRZYWACZEWSKI, Grzegorz JAMROZY and Teresa TOMEK for their comments about the first version of this paper.

II. RESEARCH AREA

The Pieniny range, located in the western Carpathian Mountains, runs along a parallel of latitude, and is 10 km long and 4 km wide. The mountains are relatively low, with an elevation change of 557 m (the highest peak – Mt Trzy Korony – 982 m above sea level). Geographically it is an exceptionally varied mosaic with steep, open, jagged peaks, rock walls and shelves, as well as gentle hill tops and crests covered with forests and fields. The sculpture of the Pieniny Mts is unusually asymmetrical. The northern slopes, crossed by a thick network of valleys, gently fall into the Krośnica Stream Valley. From the main ridge on the southern side, buttresses extend which end in steep peaks, usually with perpendicular walls, falling straight into the Dunajec River Valley (NIEMIROWSKI 1982). The Pieniny National Park (PPN) covers 2346 ha and includes most of the Pieniny Mountains (Fig. 1.). Protected since 1932, it is one of the oldest national parks in Poland, and one of the smallest of its kind in the country. The research area included the entire PPN except for a historical area (the castle in Czorsztyn), a tourist attraction (raft ride in Kąty) and the buildings of the administration of PPN. These objects covered a total of approximately 20 ha. The research area where density was calculated covered 2325 ha.

Most of the Pieniny forests belong to the *Querco-Fagetea* class and are found in the lower montane zone. The forest layer and the entire flora of this region are rich and extremely varied (ZARZYCKI 1982). On the northern slopes, carpathian beech forests *Dentario glandulosae-Fagetum* dominate, although there are significant amounts of mountain sycamore maple forests *Phillitido-Aceretum*. On the southern slopes there are primarily thermophilus fir-beech forests *Carici-Fagetum* (PANCER-KOTEJOWA 1973). Forests cover approximately 71% of the PPN with a domination of fir *Abies alba*, beech *Fagus sylvatica* and spruce *Picea abies*. They create treestands of both single species as well as mixed species. The remaining part of the PPN is mainly covered with small, scattered fields and pastures. There is a clear difference between the eastern part of the PPN with its rich variety of species and treestands of extremely different ages and structure, and the western part where spruce treestands have been planted and there is little variety. The Pieniny National Park also encloses a mosaic of open landscape in which fields and pastures dominate, together with villages and the Dunajec River Valley.

The Pieniny Mountains are characterized by a definitely milder climate than the surrounding Beskidy Mountain ranges. They have a higher mean annual temperature, less annual rainfall, shorter snow cover, and more days of sunshine. There is also a difference between the cooler, more humid climate of the northern slopes and the warmer, drier southern slopes (KOSTRAKIEWICZ 1982).

III. METHODS

Research was carried out by adapting the combined version of the mapping method (TOMIAŁOJĆ 1980) to count owls (DOMASZEWICZ et al. 1984). Observations were made in the spring (March-May) and autumn (October-November) 2001 and in the spring (February-May) 2002. A total of 30 nighttime controls which covered all or part of the research area were made. The date of the controls

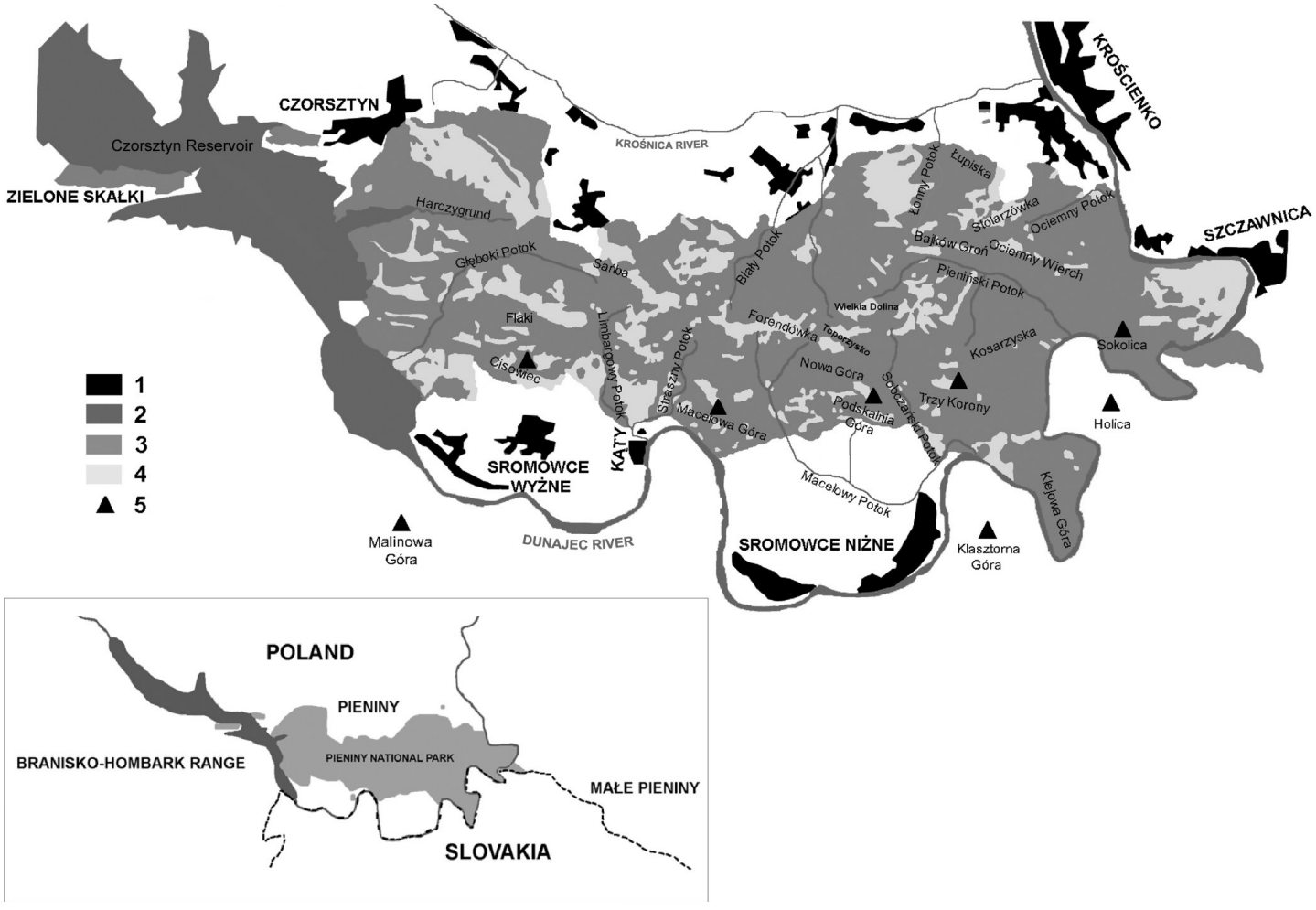

Fig. 1. Location and topography of the Pieniny National Park.1 – buldings; 2 – water reservoir and rivers; 3 – forests; 4 – meadows; 5 – peaks.

was strictly determined by atmospheric conditions. High-pressure periods without wind or precipitation were chosen. Work was done in groups of 2-3 people. When the birds were particularly active several groups of observers were used, making it possible to penetrate a larger area during one night. Observations were made along marked trails penetrating the entire Park. Observers' routes and densities were determined by the type of terrain. Vocal stimulation and listening were done as the groups moved along tourist trails, roads, and paths. About every 200-300 meters, owl call recordings were played or an exact imitation of individual species was made. After three minutes of stimulation there was a waiting period of 5-10 minutes for the birds to react. In order to differentiate from neighboring territories, additional monitoring was done between possibly occupied territories.

About 40 days were devoted to looking for and recording the potential places where individual species might be found. This included looking for trees with hollows, nests of birds of prey, and signs of the owl presence: pellets, feathers, remains of prey, trees trunk or rocks whitened with excrements. Since the Pygmy Owl is active during the day, it was also vocally stimulated during the daylight exploration of the terrain. During the spring there was no direct observation of areas where Eagle Owl nests might possibly have been (steep mountain-sides, rock walls and shelves). Instead, using binoculars or spotting-scopes, opposite slopes were searched for any signs of birds. All indications of the presence and activity of birds were recorded on a field map at a scale of 1:25000.

A territory was considered to be occupied if birds were recorded in it at least three times. A territory was considered to be probably occupied if owls were seen three times but it could not be proven that the owls were not from neighboring territories, or if owls were not seen three times but during nesting period the presence of a territorial male in the appropriate biotope was noted. Occupied territories were used to determine the lower limit of the number of territories as well as density, the upper limit was determine by probably occupied territories. To determine the domination of particular species the upper limits were used.

Unpublished observations, most of which were made in the 1990s, were also used. Some of them were observation cards found in the files of the Pieniny National Park. Others were collected directly from the observers. The Pygmy Owl observations were accepted by the Avifaunistic Commission of the Ornithological Section of the Polish Zoological Society.

In order to picture the distribution pattern of individual species, territories were circled on maps. A territorial size for Tawny Owls was accepted as 35 ha, for the Ural Owl – 80 ha for the Pygmy Owl – 100 ha while for the Tengmalm's Owl – 10 ha (DOMASZEWICZ et al. 1984). Based on field data, an Eagle Owl territory had a radius of 1 km, which is about 315 ha.

IV. RESULTS

During the present study seven owl species were recorded in the Pieniny National Park.

Eagle Owl *Bubo bubo* (LINNAEUS, 1758)

In the Pieniny National Park six occupied territories were recorded (Fig. 2.). They were located:

1. Near the mouth of the Pieniński Potok (stream) and the Holica massif. The territory lies partially on the Slovakian side, outside the Park borders.
2. Near Mt Klejowa Góra. The territory lies partially on the Slovakian side, outside the Park borders.
3. Near Mt Trzy Korony and Mt Podskalnia Góra.
4. Southeastern slope of Mt Macelowa Góra.
5. Mt Cisowiec and Mt Malinowa Góra. Birds were recorded on both the Polish and Slovakian sides.
6. Zielone Skałki. A rocky enclave of the Park with old treestands bordering agricultural land and the Czorsztyn water reservoir.

Fig. 2. Distribution of the Eagle Owl *Bubo bubo* and the Ural Owl *Strix uralensis* breeding territories in the Pieniny National Park (numbers refer to the text). 1 – border of the Pieniny National Park; 2 – occupied Eagle Owl breeding territory; 3 – occupied Ural Owl breeding territory; 4 – probably occupied territories.

Birds were not recorded near the Ociemny Potok where the old nest location was known and where many observations were made in the past by people penetrating the Park (J. BODZIARCZYK, G. CIERLIK, B. KOZIK, J. SZWAGRZYK – unpublished data). An occupied nest was last seen here in 1999 (B. KOZIK – oral communication). No observations have been made since then. It is assumed that the territory was deserted.

The location of the territories was closely associated with the inaccessible, steep mountain-sides of the Pieniny Mts. Their location was covered with walls and protruding rocks, which (except for territories 1 and 2) directly bordered farmland in the Dunajec River valley.

The population density of the Eagle Owl in the PPN was 2.6 territories/10 km^2. The mean distance between the central parts of neighboring territories was approximately 2200 m (1700 m – 2400 m). The Pieniny Eagle Owl probably has a large hunting terrain outside the Park. Evidence of this may be the observations of birds which after the evening calling activity (preceding flight for hunting) were seen flying in the direction of farmland near Sromowce Niżne.

Tawny Owl *Strix aluco* LINNAEUS, 1758

The most numerous owl species found in the Pieniny National Park. Sixteen occupied and one probably occupied territories were recorded (density 6.9-7.3 territories/10 km^2). While they were distributed throughout the entire Park, they were clearly more numerous in the eastern part (Fig. 3.). In three territories there was direct proof of nesting. The presence of 1-2 flying young (2 territories) and 3 fledgelings (1 territory) were recorded.

The territories of the Tawny Owl were located on steep sides of stream valleys as well as the upper part of hills in varied treestands – deciduous, mixed and coniferous. They were found near fields as well as old beech or fir treestands (in the southeastern part of the Park).

Ural Owl *Strix uralensis* PALLAS, 1771

This species was first seen in the Pieniny Mountains during the mid-1990s when the following observations were made: March 8, 1995 a male was heard near Wielka Dolina, April 1, 1998 one bird was seen near Łupiska, August 22, 1998 a calling male and February 6, 2000 two birds were recorded near Bajków Groń (G. CIERLIK, B. KOZIK, J. KUPIS, G. VONČINA – unpublished data).

Fig. 3. Distribution of the Tawny Owl *Strix aluco* breeding territories in the Pieniny National Park. 1 – border of the Pieniny National Park; 2 – occupied breeding territory; 3 – records of young birds in the territory; 4 – probably occupied territories.

During the present study two occupied and one probably occupied territories were recorded (Fig. 2.). They were:

1. Near the Głęboki Potok valley and the upper part of the Harczygrund valley where spruce-fir treestands dominated.
2. The upper part of the Pieniński Potok valley where beech and fir-beech treestands dominated.
3. A probably occupied territory in the upper part of the Biały Potok valley where beech-fir treestands dominated.

The density of the Ural Owl in the Pieniny National Park was 0.9-1.3 territories/10 km^2. The territories lay around the upper parts of stream valleys, neighboring expansive field complexes. All of the locations were in the northern part of the Pieniny range.

Pygmy Owl *Glaucidium passerinum* (LINNAEUS, 1758)

During the 1980s and 1990s this species was seen several times: December 20, 1988 a dead male was found on Macelowa Góra, November 3, 1991 a Pygmy Owl was observed in the valley of Ociemny Potok, March 1, 1997 in the Kosarzyska glade, March 26, 1997 a calling male near Wielka Dolina and Bajków Groń, April 27, 1997 a calling male near the Hudziary field and March 18, 1999 a calling male near Bajków Groń. Furthermore in 2000, the presence of the Pygmy Owl was recorded outside the research area close to „Zielone Skałki", where pellets of this species and remains of prey were found in a nest-box (J. BODZIARCZYK, G. CIERLIK, A. F. FELGER, B. KOZIK, T. OLEŚ, A. POŁTOWICZ – unpublished data).

During the present study within the borders of the Pieniny National Park three nesting territories were recorded (Fig. 4.). They were:

1. Near the Limbargowy Potok valley where spruce-fir treestands dominated, bordering extensive fields.
2. Near the Wielka Dolina where fir-beech treestands dominated, bordering numerous fields.
3. The eastern side of Trzy Korony massif where fir treestands growing on steep mountain-sides falling into the Dunajec River Valley dominated.

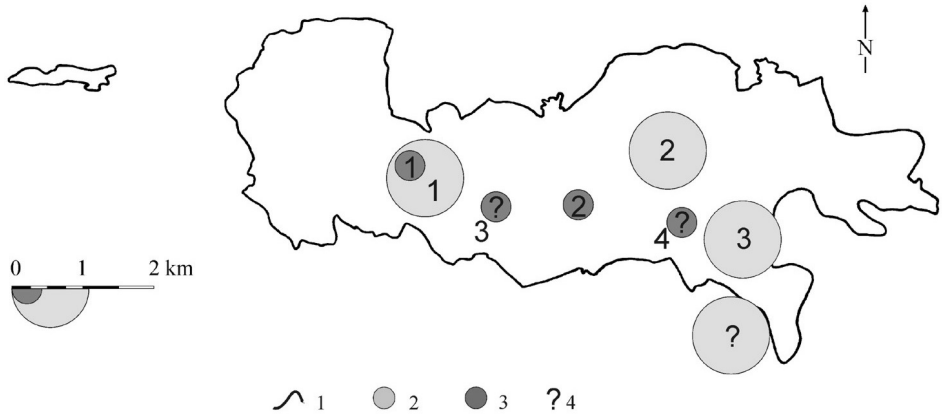

Fig. 4. Distribution of the Pygmy Owl *Glaucidium passerinum* and the Tengmalm's Owl *Aegolius funereus* breeding territories in the Pieniny National Park (numbers refer to the text). 1 – border of the Pieniny National Park; 2 – occupied Pygmy Owl breeding territory; 3 – occupied Tengmalm's Owl breeding territory; 4 – probably occupied territories.

The density of Pygmy Owl was 1.3 territories/10 km^2. Furthermore there was a probably occupied territory of this species on the Slovakian side, bordering the research area on the northeastern side of Mt Klasztorna Góra, where a singing male was heard March 29, 2002.

Little Owl *Athene noctua* (SCOPOLI, 1769)

This species probably nests in Sromowce Wyżne and from there flies into the Park area. It was seen two times: March 1, 2002 a calling bird was heard from a building and March 28, 2002 it was observed flying near the rocks of Mt Cisowiec in the direction of the village.

Tengmalm`s Owl *Aegolius funereus* (LINNAEUS, 1758)

Since the middle of the 1990s this species has been recorded several times: October 12, 1995 a male was heard in the Głęboki Potok valley, April 17 and 18, 1996 a male was heard in the Sopczański Potok valley, March 26, 2000 one bird was heard near the fields of Forendówka (G. CIERLIK, B. KOZIK, G. VONČINA – unpublished data).

During the present study two occupied and two probably occupied territories were recorded (Fig. 4.). They were:

1. In the vicinity of the northern slopes of Flaki as well as the region of the source of Głęboki Potok.
2. In the vicinity of the Macelowy Potok valley.
3. A probably occupied territory in the Straszny Potok valley.
4. A probably occupied territory on the southwestern slopes of Mt Trzy Korony.

Territories were located in fir and spruce-fir treestands growing on the southern slopes, bordering fields. The density of Tengmalm's Owl in the Pieniny National Park was 0.9-1.7 territories/10 km^2.

Long-eared Owl *Asio otus* (LINNAEUS, 1758)

Calling males were heard April 18, 1996 in the vicinity of Mt Nowa Góra as well as in the fields of Stolarzówka (G. CIERLIK, B. KOZIK). In 2002 four locations were recorded. During the period March 1 – May 1, 2002 single records of singing males were made in three places (near the Harczygrund valley, near the Sańba pass and the southeastern slopes of Mt Nowa Góra), as well as two

times in the vicinity of Flaki. Density was 1.7 territories/10 km^2. Territories were located in fir and spruce-fir treestands bordering field complexes. In 2001, this species was not recorded in the Park.

Seven owl species were recorded in the Pieniny National Park. An area covering 23.25 km^2 was occupied by a total of 30-38 territories. This gave a total mean of 12.9-16.3 territories per 10 km^2. The percent of individual species in owl community is shown in Table 1. Tawny Owl definitely was a dominant in the Pieniny National Park. It made up almost 45% of the community. At the same time the Ural Owl made up a relatively low percent. The high number of Eagle Owls was surprising. In the owl community they were subdominant. However the percent of Pygmy Owl and Tengmalm's Owl – boreal-mountain species, associated with coniferous forests, was relatively low. In 2002, the percent of Long-eared Owl was almost ten percent. Little Owl made up a marginal percent in the community.

Table I

Number of breeding territories, density and dominance of owls in the Pieniny National Park in the years 2001-2002. To estimate the dominance of each species maximum numbers of breeding territories was used

Species	Number of territories/23.25 km^2	Density territories/10 km^2	Dominance %
Strix aluco	16-17	6.9 - 7.3	44.8
Bubo bubo	6	2.6	15.8
Asio otus	0-4	1.7	10.5
Aegolius funereus	2-4	0.9-1.7	10.5
Strix uralensis	2-3	0.9-1.3	7.9
Glaucidium passerinum	3	1.3	7.9
Athene noctua	1	+	2.6
Total	30-38	12.9-16.3	100

V. DISCUSSION

The numbers and density of individual species in owl community in the Pieniny National Park differed from other Polish mountainous areas.

It is estimated that in Poland there are 250-270 Eagle Owl pairs, with 40 of these being in the Carpathians (PROFUS 2001a). The density of this species in the Pieniny National Park is the highest in Poland and one of the highest known for the species (MIKKOLA 1983). However this number should be treated cautiously due to the comparatively small size of the research area, its „island" nature and the fact that some parts of the territories covered neighboring areas. High Eagle Owl density was also noted in isolated forest complexes in the Kotlina Biebrzańska, NE Poland and also in the Stołowe Mountains, SW Poland (PUGACEWICZ 1995, MIKUSEK 1996). But the average distance between neighboring territories in PPN was significantly lower than in the Stołowe Mountains and Kotlina Biebrzańska (PUGACEWICZ 1995, MIKUSEK 1996). Under appropriate conditions the distance between occupied nests can be in extreme instances only several hundred meters (CHOUSSY

1971 after MIKKOLA 1983). The high density of the Eagle Owl population in the Pieniny National Park is probably influenced by the abundance of suitable nesting places. Scandinavian data shows that 80% of the nests of this species are on rock shelves (MIKKOLA 1983). Possibly the large numbers of Eagle Owls can also be explained by the accessibility of food (the Dunajec River Valley is urbanized and agricultural). MIKKOLA (1983) consider this to be the main factor influencing the size of territories.

Historical data about Eagle Owls in the Pieniny Mts are probably reliable. SITOWSKI (1916, 1923) mentioned annual nests in areas around Ociemny Mt and Łupiska but he did not refer to nests on southern slopes. In the 1950s in the Pieniny Mts there were five Eagle Owl nesting areas (FERENS 1953). BOCHEŃSKI (1960b) estimated that there were 5-7 pairs. This estimation was based on information concerning known localizations of nests. During the 1980s PROFUS (1992) estimated that the population was made up of three pairs, and twenty years later as 4-5 pairs (PROFUS 2001a). The same author (2001b) wrote: "In 1988 Eagle Owls were recorded in seven places in the Pieniny Mts but nowadays this number probably does not exceed 3 pairs". This data difficult to interpret shows the lack of precise knowledge of the number of Eagle Owls in the 1990s in one of the largest local populations in Poland. The lack of such data also applies to the population of this species in the Slovakian part of the Pieniny. Slovakian atlases show that this species can only be found in the area (ŠŤASTNÝ et al. 1987, DANKO et al. 2002).

The most numerous owl species in the Pieniny National Park was the Tawny Owl. Its mean density in forests areas of Central Europe is 5-10 pairs/10 km^2 (GLUTZ & BAUER 1980). In mountainous areas of Poland this value was significantly lower. The highest density was found in the Sanocko-Turczańskie Mountains as well as the Stołowe Mountains where it reached almost 3 pairs/10 km^2 (ĆWIKOWSKI 1995, MIKUSEK 1996). Significantly lower values were recorded in the Gorce Mountains – 1.1 pairs/10 km^2 and in the Magurski National Park – 0.7 pairs/10 km^2 (NATURSKI 2001, SOBOL 2002). In light of this the results obtained in the PPN are surprisingly high, reaching density levels close to or even higher than of those in the Polish plains (FRONCZAK & DOMBROWSKI 1991, KUSIAK 1991, TOMIAŁOJĆ & STAWARCZYK 2003, OSOJCA 2004). The large numbers of Tawny Owls in the Pieniny National Park may be a result of the mosaic environment (forests and numerous fields). Other factor which presumably influences the territory size and high density is the availability of food determined by the rich fertility of biotopes and mild climate. It is also thought that the low numbers of Ural Owls – a species that is seen to be antagonistic – also presumably influences the high density of Tawny Owls (MIKKOLA 1983).

Historical data about the Tawny Owl in the Pieniny Mts are very general. SITOWSKI (1916) stated that this species, together with the Eagle Owl are the most numerous owls. But he did not give any basis for his evaluation. BOCHEŃSKI (1960b, 1966) recorded the Tawny Owl remains in the Eagle Owl diet in the valley of Łonny Potok. He also showed that it was present in three places neighboring the Pieniny and suggested that around the Pieniny this species may be more numerous than in the mountains themselves. The first quantitative data included only part of the PPN were collected in the mid-1990s. At that time 10 Tawny Owl territories were recorded (G. CIERLIK, B. KOZIK – unpublished material). Of those recorded at that time, eight covered the same territories as today while the next two occupied neighboring areas. Even though the research was limited primarily to the eastern part of PPN it can be assumed that since the 1990s the number of nesting pairs in the area was stable.

The Ural Owl can be found in the Świętokrzyskie Mountains, in the Carpathian Plateau, as well as in the Carpathians themselves where in some places it is the most numerous owl species (TOMIAŁOJĆ & STAWARCZYK 2003). The densities in the Sanocko-Turczańskie Mountains, in the Gorce Mountains (3.3 pairs/10 km^2) and especially in the Bieszczady Mountains and Magurski National Park (5.8 pairs/10 km^2) are significantly higher than the results obtained in Pieniny National Park (ĆWIKOWSKI 1995, 1996, NATURSKI 2001, SOBOL 2002). They are also more numerous in the Niepołomicka Forest and around Tarnów (CZUCHNOWSKI 1993, WÓJCIK et al. 2000). In the mountains Ural Owls prefer high beech forests where they reach the highest density (NATURSKI 2001). In

Pieniny National Park there was only a small percent of optimal habitat which could be the reason for the low density. The territories of this species were found in mixed and coniferous forests. Probably the presence of the Eagle Owl in Pieniny National Park also had a competitive influence on the Ural Owl. Data obtained in the PPN indicate that the territories of these two species do not intersect (Fig. 2.).

The results from Pieniny National Park and other researched areas indicate that in the curve of the Carpathians as one moves west there is a gradual decrease in the density of the Ural Owl (GŁOWACIŃSKI 1991, ĆWIKOWSKI 1996, NATURSKI 2001, SOBOL 2002). The highest density was noted in the Bieszczady and the Beski Niski Mountains, decreasing towards the west. The most western records were found on Mt Babia Góra and in the Tatra Mountains (ŁANOCHA 2001, CICHOCKI et al. 2004). In Slovakia the Ural Owl is found in almost the entire Carpathian curve. In some places of the eastern part of the country it is the most numerous owl species (DANKO et al. 1994, DANKO et al. 2002).

The density of Pygmy Owl in the Pieniny National Park is significantly lower than in other mountainous areas of Poland. High density was recorded in spruce forests of Mt Babia Góra (6.5 pairs/10 km^2) and in the Stołowe Mountains (ŁANOCHA 2001, MIKUSEK 2001b). The density in PPN was similar to that seen in the Gorce Mountains (1.1 pairs/10 km^2) and was higher than the density recorded in Magurski National Park (0.23 pairs/10 km^2) (NATURSKI 2001, SOBOL 2002). The density recorded on the lowland in the Białowieża Primaeval Forest is also higher than that found in PPN (DOMASZEWICZ 1997). The Pygmy Owl is a boreal-mountain species, associated with coniferous forests (MIKKOLA 1983, CRAMP 1985). Until recently this species was considered to be closely associated with spruce. But it has been shown that they also nest in pine, fir and mixed forests (MIKUSEK 2001a). In PPN the Pygmy Owl was also found in spruce-fir treestands as well as fir-beech mixed forests which may indicate the adaptive abilities of this species.

The information about the occurrence of Pygmy Owl in the Pieniny which BOCHEŃSKI (1960b) gave and which was later cited by RUPRECHT & SZWAGRZAK (1988), has been established as being uncertain (TOMIAŁOJĆ 1990). Information about probable nesting in the Pieniny was given by WALASZ & MIELCZAREK (1992). Furthermore DYRCZ (1992) wrote about specimens and calling bird but without giving details of dates and places. The first detailed data about Pygmy Owl in this area was given by PROFUS (2001b). Two of these dealt with Pieniny National Park and involved the observation of single birds (December 27, 1991 – Toporzysko near Łupiska and January 1992 – Ociemny Potok). Above sources show that the first records of Pygmy Owl made in the Pieniny come from the end of the 1980s. At that time the Pygmy Owl was probably already a nesting species in the area. Some of these observations were made in the regions of territories recorded in the present paper. This may indicate that they occupied the area for many years. But the possible expansion and population changes of Pygmy Owl in the Pieniny remain still unclear.

In mountains Little Owl live at elevations up to 600-900 m above sea level where usually they are scarce (TOMIAŁOJĆ & STAWARCZYK 2003). The nesting area in Sromowce Wyżne is the only one presently known in this part of the Carpathians. There is no current data concerning this species in the neighboring Pieniny. The closest nesting areas known for Little Owl were near Limanowa and Nowy Sącz (WALASZ & MIELCZAREK 1992). According to SITOWSKI (1916) the Little Owl was not a rare species in the Pieniny region, but this author did not give any detail data about their nesting areas. BOCHEŃSKI (1960b) and OLEŚ (1961) added two reports from the vicinity of Krościenko which is near the research area. In addition, the remains of Little Owl were found in the diet of Eagle Owl near Łonny Potok (BOCHEŃSKI 1966).

The density of Tengmalm's Owl recorded in Pieniny National Park is lower than the values given for spruce forests of Babia Góra (4.7 pairs/10 km^2) and Stołowe Mountains (MIKUSEK 1996, ŁANOCHA 2001). The densities found were similar to those in Gorce (2.2 pairs/10 km^2) and in lowland forests of northwestern Poland (DOMASZEWICZ 1993, SOBOL 2001, OSOJCA 2004), but are higher than density given for Magurski National Park – 0.23 pairs/10 km^2 (NATURSKI 2001). Like Pygmy Owl, Tengmalm's Owl is a boreal-mountain species, associated with coniferous forests

(MIKKOLA 1983, CRAMP 1985). The upper montane zone with coniferous forests is the optimal habitat for Tengmalm's Owl where it reaches the highest frequency (CICHOCKI et al. 2004). Densities found in the lower montane zone (Gorce, Bieszczady, Pieniny) show that this habitat is less than optimal or is occupied sporadically (Beskid Niski). All Tengmalm's Owl territories in the Pieniny National Park were found in spruce-fir treestands bordering fields. The significant percent of deciduous and mixed forests apparently does not encourage large numbers of this species.

Until recently data about the occurrence of Tengmalm's Owl in the Pieniny were limited. SITOWSKI (1916) reported a spring sighting of this species near Bajków Groń. A second observation was made in June 1959 in the Kosarzyska glade (BOCHEŃSKI 1960b).

Long-eared Owl is a common nesting species in the lowlands and plateaus where in some places it has high density (DOMBROWSKI et al. 1991, KOWALSKI et al. 1991, WALASZ & MIELCZAREK 1992, TOMIAŁOJĆ & STAWARCZYK 2003). The mean density of Long-eared Owl in Central Europe is estimated to be 1.0-1.2 pairs/10 km^2 (GLUTZ & BAUER 1980). In mountains it is a less numerous species, however it is found above the timberline in subalpine montane zone or similar biotopes (LOCH 1997, TOMIAŁOJĆ & STAWARCZYK 2003, CICHOCKI et al. 2004). The density recorded in 2002 in Pieniny National Park is relatively high for a mountain area and is similar to values found in Mazowsze (DOMBROWSKI et al. 1991). It is significantly higher than that found in Magurski National Park – 0.23 pairs/10 km^2 (NATURSKI 2001) and in the Stołowe Mountains (MIKUSEK 1996). The reason of comparatively high density of Long-eared Owl in PPN may be the presence of mosaic of forests and fields preferred by this species.

Historical data about the occurrence of Long-eared Owl in the Pieniny mts are very generalized. SITOWSKI (1916) recorded that a dead Long-eared Owl was found in the northeastern part of today's Park. In 1964 the remains of a Long-eared Owl were found in the diet of Eagle Owl in the vicinity of Łonny Potok (BOCHEŃSKI 1966). From Kąty Krościeńskie, neighboring the Pieniny National Park there is information about two birds shot there (BOCHEŃSKI 1960b). The above mentioned historical observations were cited by RUPRECHT & SZWAGRZAK (1988) and are some of the very few from the Carpathians and Carpathian plateau.

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