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Herpetofauna of the Podkielecki Landscape Protection Area

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Abstract
The study was conducted in 2016-2017 in the Podkielecki Landscape Protection Area (area 26,485 ha). It was focused on the occurrence and distribution of amphibians and reptiles, the biology of the selected species and the existing threats.
Established in 1995, the Podkielecki Landscape Protection Area surrounds the city of Kielce from the north, east and south-east, and adjoins several other protected areas. It covers the western part of the Świętokrzyskie Mountains (part of the Klonowskie and Masłowskie ranges) and the southern part of the Suchedniów Plateau. The studied area is mostly covered by forest and thicket communities (48.1%) and farmlands (39.9%), followed by built-up areas (7.8%), industrial areas (0.5%), roads and railways (2.7%), and surface water bodies (1%).
The protected area is developed mainly on Palaeozoic rocks, including Cambrian and Ordovician sandstones, Silurian and Carboniferous shales, and Devonian marls. Podzolic soils predominate among soils. The largest rivers include Lubrzanka, Czarna Nida, Bobrza and Belnianka. There are no natural lakes within the PLPA limits, and the largest artificial reservoirs include the Cedzyna Reservoir, Morawica Reservoir, Suków Sandpit and two sedimentation reservoirs of the Kielce Power Plant. The area includes 2 nature reserves: Barcza and Sufraganiec.
The following amphibian species were recognised during the investigations within the borders of the studied area: alpine newt *Ichthyosaura alpestris* Laur., great crested newt *Triturus cristatus* Laur., smooth newt *Lissotriton vulgaris* L., European fire-bellied toad *Bombina bombina* L., common spadefoot toad *Pelobates fuscus* Laur., common toad *Bufo bufo* L., natterjack toad *Epidalea calamita* Laur., European green toad *Bufotes viridis* Laur., European tree frog *Hyla arborea* L., pool frog *Pelophylax lessonae* Cam., edible frog *Pelophylax esculentus* L., marsh frog *Pelophylax ridibundus* Pall., moor frog *Rana arvalis* Nilss., and common frog *Rana temporaria* L. The reptiles were represented by sand lizard *Lacerta agilis* L., viviparous lizard *Zootoca vivipara* Jacquin, slow worm *Anguis fragilis* L., grass snake *Natrix natrix* L. and common European adder *Vipera berus* L. The study also included the phenology and breeding biology of the common toad and common frog.
The most crucial herpetofauna conservation problems identified here include amphibians killed on roads by vehicles. The study area is intersected by very busy roads, in particular: European route no. E77, national roads nos. 73, 74 and S74, and regional roads nos. 745, 750 and 764. For this reason, future road reconstruction projects should consider the assembly of various crossing roads for wildlife, particularly on the 600 m long section of national road no. 74 near Cedzyna Reservoir. Other threats include illegal waste dumping, pollution of surface waters, fire setting, overgrowing and desiccation of small water bodies.

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1. INTRODUCTION

Landscape protection areas (LPA) belong to the most poorly known and least valuable forms of nature protection in Poland. They usually do not reach the natural values of landscape parks, all the more national parks, nature reserves and Natura 2000 areas; however, they play an important role in many ways. First of all, they cover large areas, comprising about 2/3 of the surface of protected nature in Poland. LPAs represent areas used for recreation and leisure, replacing more valuable regions and saving them from threats caused by excessive touristic activities. However, the most important role of LPAs is their function as ecological corridors, which ensure faunal migration between hub areas, that is, national and landscape parks,

and nature reserves. Therefore, LPAs prevent genetic isolation of particular populations, becoming the main elements of the ecological network.

Despite the common unfavourable opinion, some LPAs have relatively high natural values, because such large areas are habitats for a larger number of species compared to small nature reserves. A good example is the Podkielecki Landscape Protection Area (PLPA), containing diverse natural habitats and numerous other forms of spatial, individual and specific natural protection. Due to the fact that the PLPA has never been assessed with regard to the occurrence of amphibians and reptiles, this study is focused on determining the composition and distribution of herpetofauna in PLPA, including threats and protection measures. Additionally, the phenology of two most common amphibians was observed – common toad *Bufo bufo* L. and common frog *Rana temporaria* L.

2. STUDY AREA

Situated in the central part of the Świętokrzyskie Voivodeship, the Podkielecki Landscape Protection Area (area 26,485 ha) was established in 2005 by the resolution of the Świętokrzyskie Voivodeship Assembly. Its coordinates are 50°44'–51°0'N and 20°26'–20°50'E. The PLPA covers the western part of the Świętokrzyskie Mountains and the southern part of the Suchedniów Plateau. Parallel hill ranges, that is, the western part of the Klonowskie Range and the Masłowskie Range, occur in the northern part of PLPA. In the southern part, numerous elevations surround the Lubrzanka river valley. According to the geographic subdivision, PLPA is situated in the Świętokrzyskie Mountains, Suchedniów Plateau, Szydłowskie Hills and Łopuszańskie Hills mesoregions [Kondracki, 2011]. With regard to administrative sub-divisions, it belongs to the Kielce district (Bieliny, Daleszyce, Górno, Łagów, Pierzchnica and Raków communes) and the Skarżysko district (Łączna and Suchedniów communes). PLPA is mostly overgrown by forest and thicket communities (48.1%) and farmlands (39.9%); it also comprises built-up areas (7.8%), industrial areas (0.5%), roads and railways (2.7%), and surface water bodies (1%) [Sidło et al., 2000].

The most valuable objects within the limits of PLPA are two nature reserves – the forest reserve Sufraganiec (17.31 ha) and the inanimate nature reserve Barcza (14.57 ha). PLPA also contains six Natura 2000 areas (all belonging to the special habitat protection areas) – Barcza Habitat PLH260025, Wierzejska Habitat PLH260035, Lubrzanka Gorge PLH260037, Warkocz Valley PLH260021, Czarna Nida Valley PLH260016 and Cisów-Orłowiny Forests PLH260040. Their nearest neighbourhood also includes protected areas, because PLPA borders with the Radomice Nature Reserve, Chęciny-Kielce Landscape Park and six Landscape Protection Areas: Kielecki LPA, Suchedniowsko-Oblęgorski LPA, Sieradowicki LPA, Świętokrzyski LPA, Cisowsko-Orłowiński LPA and Chmielnicko-Szydłowski LPA.

The analysed protected area is built mainly of Palaeozoic (representing all Palaeozoic systems with the exception of the Permian) and Cenozoic rocks (Palaeogene and Neogene). Podzolic soils predominate among soils; brown soils, peat, mulch soils, alluvial muds, and rendzina soils are also present. The PLPA is under the influence of East Małopolska climate, characterised by a small number of days with a moderately warm weather [Woś, 1993].

The largest rivers of PLPA include Lubrzanka, Belnianka, Czarna Nida and Bobrza. There are no large natural water bodies, and the largest artificial reservoirs include the Cedzyna Reservoir (56.2 ha), Morawica Reservoir (7.2 ha), Suków Sandpit (35.7 ha) and two settling tanks of the Kielce Power Plant (8.9 ha and 8.4 ha).

The largest part of the PLPA is covered by forest communities, representing mainly the *Vaccinio-Piceetea* class with the prevalence of coniferous tree species. The poorest and driest soils are overgrown by the Central European lichen pine forests *Cladonio-Pinetum*, whereas looser and more fertile soils are covered by the subcontinental fresh pine forests *Peucedano-Pinetum*. Deeper and more humid soils are overgrown by the sub-oceanic fresh pine forests *Leucobryo-Pinetum*, whereas sand substrates with high groundwater levels – by the Central European humid pine forests *Molinio-Pinetum*. Mixed forests are represented by the continental mixed forests *Quercoroboris-Pinetum*. Acidic, oligotrophic, marsh-peat soils are inhabited by pine bog woodlands *Vaccinio uliginosi-Pinetum* and red grass bog woodlands *Calamagrostio villosae-Pinetum*. The *Piceion abietis* assemblage is represented by montane fir mixed forests *Abietetum polonicum*. Deciduous forests cover much smaller areas of the PLPA. They include ash-alder riparian forests *Fraxino-Alnetum*, oak-hornbeam forests *Tiliocordatae-Carpinetum betuli*, acidophilic lowland beech forests *Luzulo pilosae-Fagetum*, fertile Carpathian beech forests *Dentario glandulosae-Fagetum* and the rarest forest community in the PLPA – thermophilic oak forests *Potentillo albae-Quercetum* [Matuszkiewicz, 2008].

The occurrence of 1,071 species of vascular plants has been determined in the PLPA, which comprises about 43% of Polish flora [Bróż and Maciejczak, 1991; Bróż et al., 1990; Bróż and Przemyski, 2009; Maciejczak and Bróż, 1987; Przemyski, 1998; M. Zając and A. Zając, 2003].

3. METHODS

The studies were performed in 2016-2017 in the entire area of PLPA. Herpetofauna was observed in a number of selected sites (Fig. 1). In the case of amphibians, the localities comprised breeding sites (water reservoirs), and in the case of reptiles – areas of high abundance. The observations were made at various times of the day, from early morning hours till the late evening. The sites were controlled at least 3 times a month between March and May, and 2 to 3 times a month between June and September. Part of the individuals was trapped for specific determination, and then released at the trapping site. The presence of tailless amphibian males was noted sporadically (mainly in the evenings) by surveying their mating calls. Following the need of non-invasive surveys,

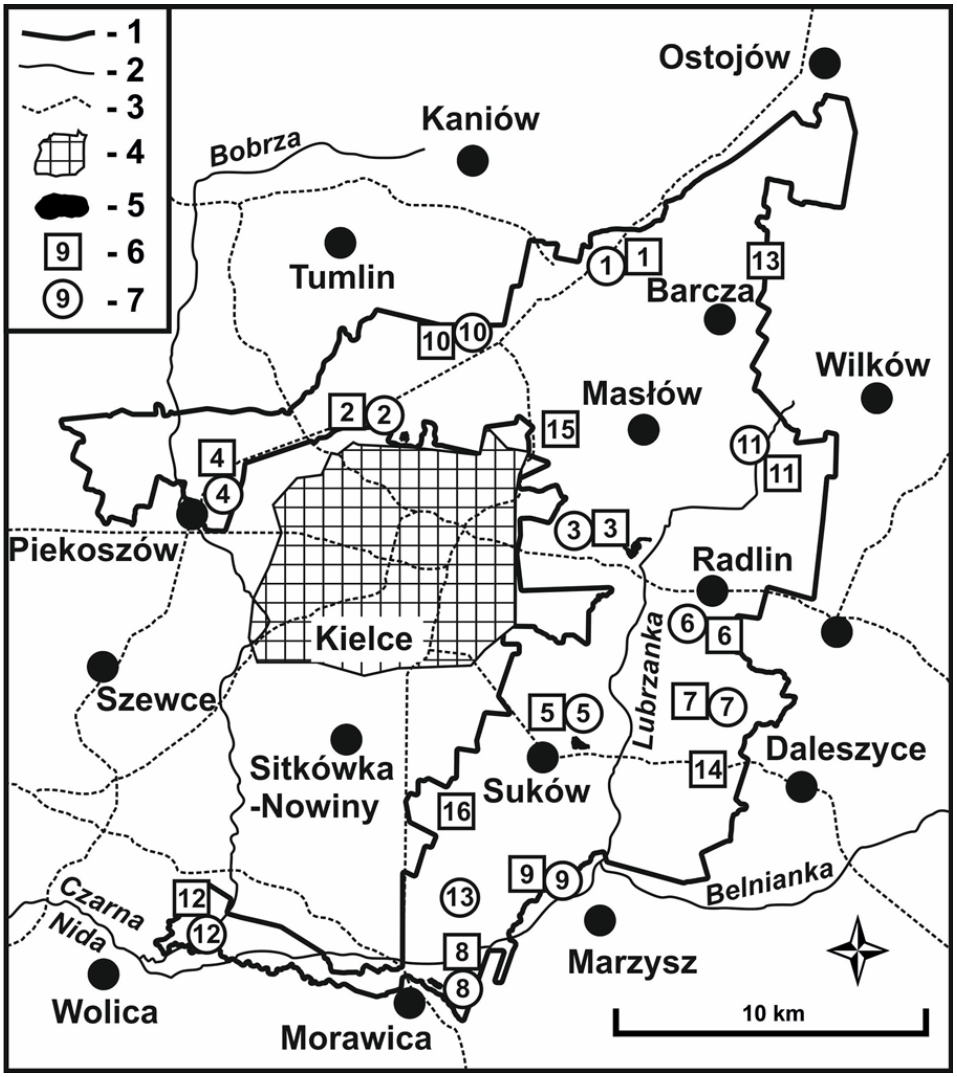

Figure 1. Distribution of amphibians and reptiles in the Podkielecki Landscape Protection Area: 1 – PLPA limits, 2 – rivers, 3 – roads, 4 – city of Kielce, 5 – water reservoirs, 6 – amphibian sites, 7 – reptile sites

only the approximate abundance of amphibians was determined. This was the maximal number of individuals observed in a site during a single inspection.

Two most abundant species were selected for phenological analysis (common toad and common frog), because this guaranteed full observation of particular stages of the breeding cycle. The following stages were determined: amplexus, presence of spawn, presence of larvae, and metamorphosis, with record of atmospheric and water temperatures (at the depth of 30 cm) during each inspection.

Factors threatening the herpetofauna were assessed during the survey. To achieve this, for example, the 600 m stretch of regional road no. 74 was controlled in the vicinity of Cedzyna Reservoir to check the number of run-over amphibians. The dead individuals were removed from the road to ensure single counting. These observations were made in March and April 2016.

4. RESULTS

4.1. Batrachofauna

Batrachofauna was observed in the following 13 sites: 1) Barcza (flooded quarries in the nature reserve, ponds near Lekomin and Lubrzanka pools); 2) Sufraganiec (settling tanks of Kielce Power Plant, Sufraganiec pools and ponds near Kostomłoty and Stara Wieś); 3) Cedzyna (Cedzyna Reservoir and ponds and pools in Zajączkowa Struga valley); 4) Szczukowskie Górki (pond in Borek and Bobrza pools); 5) Suków (Suków Sandpit and ponds near Lubrzanka); 6) Górno (Warkocz pools); 7) Niestachów (Warkocz ponds and pools); 8) Morawica (Morawica Reservoir and ponds near Czarna Nida); 9) Marzysz (Czarna Nida former riverbed); 10) Wiśniówka (flooded quarry); 11) Ameliówka (Lubrzanka pool); 12) Ostrów (Czarna Nida ponds and pools); 13) Zastawie (ponds) (Fig. 1, Table 1).

Table 1. Amphibian sites in the Podkielecki Landscape Protection Area

Species	Sites (numbers according to Fig. 1)												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Ichthyosaura alpestris	++	++	+	–	++	–	++	–	–	+	++	–	–
Lissotriton vulgaris	++	+	+	–	++	–	++	++	–	+	++	–	+
Triturus cristatus	++	+	–	–	+	–	–	–	–	+	–	–	+
Bombina bombina	++	–	–	–	–	–	–	–	–	–	++	–	–
Pelobates fuscus	–	–	–	–	+	–	–	+	–	+	–	–	–
Bufo bufo	+++	+++	++	++	+++	–	+++	+++	++	+++	+++	++	+++
Epidalea calamita	–	–	–	–	+	–	–	–	–	+	–	–	–
Bufotes viridis	+	++	+	–	++	–	–	+	–	++	+	–	+
Hyla arborea	+	+	–	–	–	–	–	–	–	+	+	–	–
Pelophylax esculentus	+	++	++	+	+++	–	++	+++	+	+++	+	–	++
Pelophylax lessonae	++	+	++	–	++	–	+	++	–	++	–	–	+
Pelophylax ridibundus	–	+	+	–	+	–	–	+	–	+	–	–	+
Rana arvalis	++	++	+	–	++	–	–	++	–	+++	++	–	+
Rana temporaria	+++	+++	+++	++	+++	++	+++	+++	++	+++	+++	++	+++

(+ scarce individuals, ++ prolific abundance, +++ very large amounts of individuals)

A total of 14 amphibian species was observed in the study area. The observed species of batrachofauna included: alpine newt *Ichthyosaura alpestris* Laur., smooth newt *Lissotriton vulgaris* L., great crested newt *Triturus cristatus* Laur., European fire-bellied toad *Bombina bombina* L., common spadefoot toad *Pelobates fuscus* Laur., common toad *Bufo bufo* L., natterjack toad *Epidalea calamita* Laur., European green toad *Bufotes viridis* Laur., European tree frog *Hyla arborea* L., pool frog *Pelophylax lessonae* Cam., edible frog *Pelophylax esculentus* L., marsh frog *Pelophylax ridibundus* Pall., moor frog *Rana arvalis* Nilss., and common frog *Rana temporaria* L. (Figure 2, Table 1).

Alpine newt was observed in 7 sites, with several to several tens of individuals noted during each inspection. The species was not present only in the southern part of the PLPA. Smooth newt was equally common, being noted in 9 sites. Both species usually inhabited small reservoirs that were devoid of predatory fish. Great crested newt occurred less frequently (5 sites) and was almost always less abundant compared to the other newts. It was completely absent from the smallest reservoirs. European fire-bellied toad occurred at 2 sites but was relatively abundant there – up to several tens of individuals were observed during single inspections. The number of males and females was almost the same. Common spadefoot toad was rarely observed; usually its calls were depicted only. It was noted in 3 sites but distributed in different parts of the PLPA. Common toad occurred commonly and abundantly, mass mating included even several hundreds of individuals. It was present in all the sites. Natterjack toad inhabited reservoirs in 2 sites. It was moderately abundant there; slightly over ten individuals were noted there in each site during a single inspection. European green toad was noted at 8 mating sites. The most abundant sites, particularly sites number 2, 5 and 10, included over 100 individuals mating at the same time. European tree frog was observed often beyond the reservoirs (mainly in thickets), rarely in the breeding sites. All 4 mating sites were not very abundant, with slightly over ten individuals observed during a single inspection. Pool frog belonged to the most abundant and most commonly occurring amphibians. Hundreds of individuals were noted during inspections in the Sukowa and Wiśniówki reservoirs (sites 2 and 4, respectively). Edible frog was equally common (8 sites), but much more frequent in smaller reservoirs compared to pool frog. Marsh frog was slightly rarer (6 sites) and it restricted its occurrence to larger reservoirs. It was also much less frequent compared to the other 'green frogs' (maximally up to several tens of individuals observed). Moor frog was relatively common but usually not very frequent; over 100 mating individuals were observed very rarely. Common frog mated in all 13 sites. Its frequency was also the highest – even several thousand individuals were noted during a single inspection. It was commonly observed in diverse settings, from forests and meadows, to farmlands and urbanised areas with dispersed infrastructure (Fig. 2, Table 1).

In 2016, breeding biology and phenology were studied in two most prolific amphibian species within the studied area: common toad and common frog. In common toad, individuals in amplexus were observed from 30.03 (atmospheric temp. 10°C, water temp. 6°C) till 13.04, spawn in 7.04-18.04, tadpoles in 13.04-3.07, and metamorphosis

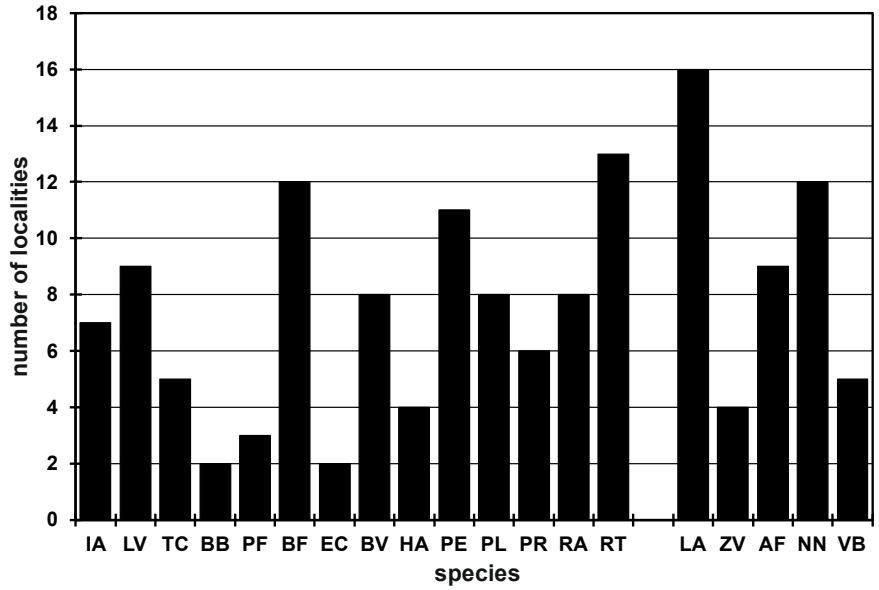

Figure 2. Number of amphibian and reptile sites in the Podkielecki Landscape Protection Area. Amphibia: IA – *Ichthyosaura alpestris*, LV – *Lissotriton vulgaris*,TC – *Triturus cristatus*, BB – *Bombina bombina*, PF – *Pelobates fuscus*, BF – *Bufo bufo*, EC – *Epidalea calamita*, BV – *Bufotes viridis*, HA – *Hyla arborea*, PE – *Pelophylax esculentus*, PL – *Pelophylax lessonae*, PR – *Pelophylax ridibundus*, RA – *Rana arvalis*, RT – *Rana temporaria*. Reptilia: LA – *Lacerta agilis*, ZV – *Zootoca vivipara*, AF – *Anguis fragilis*, NN – *Natrix natrix*, VB – *Vipera berus*.

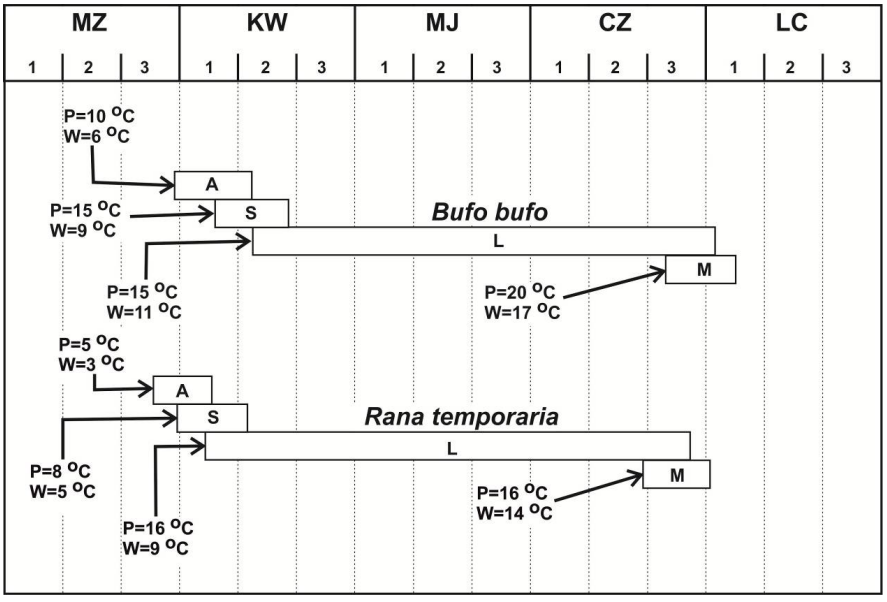

Figure 3. Breeding phenology of common toad and common frog in the Podkielecki Landscape Protection Area in 2016 MZ – March, KW – April, MJ – May, CZ – June, LC – July, 1-3 – decades, A – amplexus, S – spawn, L – larvae (tadpoles), M – metamorphosis, P – atmospheric temperature, W – water temperature.

in 23.06-6.07 (Fig. 3). In common frog (Fig. 4), the stages of breeding phenology were as follows: amplexus from 26.03 (atmospheric temp. 5°C, water temp. 3°C) till 6.04, spawn in 31.03-12.04, tadpoles in 4.04-27.06, and metamorphosis in 19.06-1.07 (Fig. 3).

4.2. Reptiliofauna

Observations of reptiliofauna were performed in 16 sites: 1) Barcza (nature reserve and neighbouring forests and meadows); 2) Sufraganiec (nature reserve and forests to

Table 2. Reptile sites in the Podkielecki Landscape Protection Area

Species	Sites (numbers according to Fig. 1)															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Lacerta agilis	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Zootoca vivipara	+	+	–	–	–	–	–	–	–	–	+	–	+	–	–	–
Anguis fragilis	+	–	–	–	–	–	+	–	+	+	+	+	+	+	–	+
Natrix natrix	+	+	+	–	+	–	+	+	+	+	+	+	–	+	–	+
Vipera berus	–	–	–	–	–	–	+	–	+	–	+	–	+	+	–	–

Figure 4. Common frog (Phot. Dariusz Wojdan)

the north and east of Gruchawka); 3) Cedzyna (forests and meadows around Cedzyna Reservoir); 4) Szczukowskie Górki (forests around Kamienna Droga); 5) Suków (meadows and forests at Lubrzanka, and on Kamienna Góra and Góra Mojecka hills); 6) Górno (meadows at Warkocz); 7) Niestachów (forests of Brzechowskie Range); 8) Morawica (meadows, fields and forests at Morawka and Czarna Nida); 9) Marzysz (forests and meadows at Chodcza); 10) Wiśniówka (forests of Żydowska Góra and Góra Wierzejska hills); 11) Ameliówka (forests and meadows of the Lubrzanka gorge); 12) Nowa Wieś (forests and meadows of Kozłowe Góry, Góra Wieprzowa and Jatkowej Góra hills); 13) Klonów (forests of Klonowskie Range, mainly Cząstkowa Góra, Góra Goła, Wasińskiego Górka, Jończykowa Górka and Białe Górki hills); 14) Kranów (forests to the west of Kranów); 15) Dąbrowa (forests of Domaniówka and Biała Góra hills); 16) Jaworznia (forests at Chodcza and on Babia Góra hill) (Fig. 1, Table 2).

Five reptile species were observed within the PLPA limits, including: sand lizard *Lacerta agilis* L., viviparous lizard *Zootoca vivipara* Jacquin, slow worm *Anguis fragilis* L., grass snake *Natrix natrix* L. and common European adder *Vipera berus* L. (Fig. 2, Table 2).

Sand lizard occurred in all the analysed sites. It was the only reptile that was common and abundant not only in forest areas but also in meadows. From a few to several dozens of individuals were noted during each inspection; males were slightly more numerous compared to females. Viviparous lizard was present in 4 sites, exclusively in forests and most commonly in waterlogged areas (peatlands and margins of watercourses and reservoirs). Single to a few individuals of this species were noted during each inspection. Slow worm was noted in 9 sites, with only 1-2 individuals in a single site. Grass snake was common (12 sites) and abundant (up to several tens of individuals observed). It was most common in reservoirs and their vicinity, but was observed also at a certain distance (even 3 km) from the reservoirs. Common European adder was noted in 5 sites. Only single, exceptionally two, (brown or grey) individuals were observed during each inspection. The species was observed more frequently in forests, particularly in poorly penetrated localities, situated at some distance from villages and often waterlogged (Fig. 2, Table 2).

The observed threats for herpetofauna included human penetration into these animals' habitats, grass burning, littering of forests (e.g., illegal dumping sites) and reservoirs, meadow burning, and expansion of dispersed infrastructure. Dangerous threats include desiccation of small reservoirs and water pollution. The largest danger is posed, however, by killing of amphibians on roads by vehicles. On the 600 m long section of road no. 74 near Cedzyna Reservoir controlled in March and April 2016, a total of 64 run-over individuals of common toad, 27 run-over individuals of common frog and 2 run-over individuals of moor frog were noted. During sporadic observations, run-over amphibians were also noted on roads nos. E77, 73, S74, 745, 750 and 764.

5. DISCUSSION

There are no older reports on PLPA herpetofauna, therefore, it is not possible to compare its present state with earlier years. It may be, however, related to the nearest protected areas, such as the Świętokrzyski National Park and 4 landscape parks (LP): Chęcińsko-Kielecki LP, Suchedniowsko-Oblęgorski LP, Sieradowicki LP and Cisowsko-Orłowiński LP. With regard to amphibians,

the same 14 species as in the PLPA have been observed in almost all the protected areas [Wojdan, 2007b, 2013, 2016; Bąk et al., 2010; Wojdan and Stankowska, 2007; Wojdan and Zielińska, 2010; Ichniowska-Korpula, 2014]. The only exception is Sieradowicki LP, in which 13 species were noted, the natterjack toad being lacking [Wojdan and Dudek, 2010; Wojdan, 2013].

Six reptile species were noted previously in the Świętokrzyski NP, Chęcińsko-Kielecki LP and Cisowsko-Orłowiński LP [Wojdan, 2007a, 2016; Wojdan and Stankowska, 2007]. In addition to the species observed during the current studies was the occurrence of the smooth snake *Coronella austraca* Laur. In turn, five species of reptiliofauna were noted in the Suchedniowsko-Oblęgorski LP and the Sieradowicki LP [Wojdan and Dudek, 2010; Wojdan and Zielińska, 2010]. Smooth snake was not observed in the latter two landscape parks, therefore, the composition of their reptiliofauna is the same as in the PLPA. If PLPA area is compared with the indigenous herpetofauna of Poland [Głowaciński & Sura, 2018], it turns out that 74% and 50% of the national species of amphibians and reptiles are found here, respectively.

Phenology of common toad and common frog was in accordance with the observations conducted in the previous years in the neighbouring areas [Wojdan, 2013]. In 2016, the breeding cycle of both analysed species was accelerated averagely by a decade. This was caused by earlier warming and fast disappearance of the snow over. As a result, common frog and common toad began their mating in the second half of March. Such (or even much earlier) time limits are quite common both in the Świętokrzyskie Mountains [Wojdan, 2013] and in other parts of Poland [Juszczyk, 1987].

Threats observed in the PLPA were typical of farmlands. The most important ones included habitat fragmentation, urbanisation, desiccation of small reservoirs, pollution and eutrophication of reservoirs, forest littering, and particularly grass burning in spring. All these problems are commonly known and frequently described from different parts of the country. In the PLPA, a particularly dangerous threat is that caused by car traffic. The area is intersected by important routes, that is, European route no. E77, national roads nos. 73, 74 and S74, and regional roads nos. 745, 750 and 764. Run-over amphibians were observed on each of these roads. The highest hazard is posed by traffic routes that intersect cyclic amphibian migration routes. This refers particularly to a 600 m stretch of national road no. 74 near Cedzyna Reservoir, to which amphibians such as common toad migrate each spring. Therefore, during the planned road, reconstruction within the limit of the PLPA, it is indispensable to locate special crossing places for amphibians equipped in inducing barriers.

Killings of batrachofauna on roads during spring (mating) or autumn (to wintering areas) migrations is a long discussed but still timely issue, as shown by the new data from different parts of the world [Carr and Fahrig, 2001; Hels and Buchwald, 2001; Mazerolle, 2004; Gibbs and Shriver, 2005; Puky, 2006; Andrews et al., 2008; Eigenbrod et al., 2008; Glista et al., 2008; Woltz et al., 2008; Hartel et al., 2009]. Poland is still very much delayed in the construction of crossings for animals, resulting in alarming publications on the run-over migrating amphibians in different parts of the country [Orłowski, 2007; Gryz and Krauze, 2008; Orłowski et al., 2008; Elżanowski et al., 2009; Brzeziński, 2012], including the Świętokrzyskie Voivodeship [Wojdan, 2010a, 2010b].

6. SUMMARY

The presented studies point to the high diversity of herpetofauna in the Podkielecki Landscape Protection Area. This refers to amphibians and reptiles – in both cases, the number of species inhabiting the PLPA is similar as in areas with higher natural values, such as the Świętokrzyski National Park and 4 landscape parks. It should be stressed that PLPA acts very well as a protected area, even more than as an ecological corridor as commonly considered. The good state of herpetofauna probably results from the large percentage of forested areas and large number of water reservoirs. All forests (including commercial forests) are habitats very close to natural and with least influence of anthropopression, and the dense network of various types of reservoirs facilitates breeding of amphibians. The number of threats is relatively low, because there are no large towns and industrial areas within the PLPA limits. A crucial problem is the dense network of roads, traditional influence of farming (fertilisers, sewage, melioration, etc.) and human presence in the entire area, including both nature reserves.

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