

IMPACT OF VEHICLE TRAFFIC ON AMPHIBIAN MIGRATIONS IN THE PROTECTION ZONE OF THE ŚWIĘTOKRZYSKI NATIONAL PARK

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Summary. The research aimed at localization of areas in the vicinity of the Świętokrzyski National Park where a high rate of mortality of migrating amphibians took place. The highest mortality was observed in the road sections between villages Mąhocice and Ciekoty (the Lubrzanka River gap), and in villages Wzorki and Baszowice (the protection zone of the Park). Notable differences were found between spring migration (to breeding wetlands) and autumn migration (to wintering sites). In the first case the migration corridor was narrow – ca. 200 m, in the second, however, it was as much as 3 km.

Key words: amphibians, animal migration, roads, Świętokrzyski National Park, protection zone

INTRODUCTION

Fauna migrations are subjects of thorough research as a result of an urgent need to protect animals that are numerous killed on roads [Treweek *et al.* 1993, Forman and Alexander 1995, Yanes *et al.* 1995, Hlaváč and Anděl 2002, Forman *et al.* 2003]. The most endangered are species that take seasonal migrations [Spellerberg 1998, Trombulak and Frissell 2000], like amphibians [Fahring *et al.* 1995]. This problem refers especially to areas of high natural values, with a dense network of roads and a small number of wildlife passes [Müller and Berthoud 1994, Underhill and Angold 2000, Iuell *et al.* 2003, Seiler and Helldin 2006]. The central part of the Świętokrzyskie Mountains belongs to such areas.

The aim of the survey was to identify the most dangerous areas for migrating amphibians on roads in the vicinity of the Świętokrzyski National Park and to recognise their mortality rate in different seasons of the year.

METHODS

The road-kill survey was carried out in the central part of the Świętokrzyskie Mountains in the years 2008 and 2009 along the following roads: road No. 74 (national status), roads Nos. 751, 752, 753 and 756 (regional status) and a road between the villages Mąchocice and Ciekoty (not numbered, road under local county office management). The survey sections included road sides with small water courses and pools. The total length of the road sections covered by the research was 52 km (Fig. 1). A preliminary survey was carried out in 2008 in order to identify the migration corridors of batrachofauna. Then, potential road-kill survey sections were chosen for sampling in the following season. In the next year (2009) a detailed road-kill survey was carried out along the road sections chosen. Road parameters were as follows: road classes – G and Z, road width – 6–6.5 m, traffic flow – 2000–3000 vehicles per day. They were divided into sections of 100 m each. Every section was surveyed three times per week. All dead amphibians were identified and counted. Dead individuals were removed after each count.

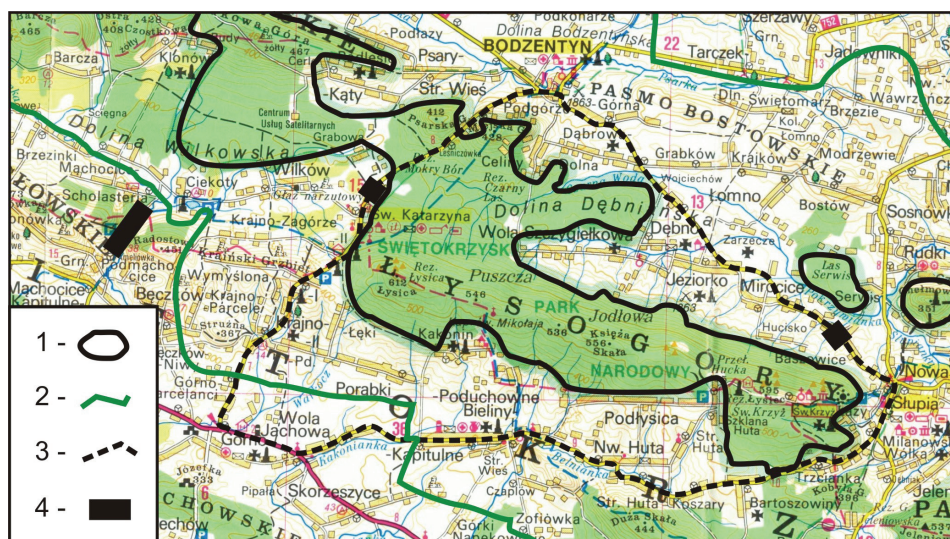


Fig. 1. Survey area: 1 – borders of the Świętokrzyski National Park, 2 – borders of the protection zone, 3 – ring road under reconstruction, 4 – surveyed road sections (to be reconstructed)

The chosen roads run across farmlands (fields and meadows), forests and villages in the protection zone of the Świętokrzyski National Park. The survey was also carried out in the Lubrzanka River gap neighbouring the Park.

RESULTS

In total 14 species of amphibians were found in the Świętokrzyski National Park, that migrated to breeding wetlands in spring. Additionally, a part of them migrated also to wintering sites in autumn. Some populations were very sparse and they were not found directly on roads, but only in their vicinities. These were: *Triturus cristatus* Laur., *Bombina bombina* L., *Pelobates fuscus* Laur., *Pseudepidalea viridis* Laur., *Epidalea calamita* Laur., *Hyla arborea* L., *Pelophylax lessonae* Laur. and *Pelophylax ridibundus* Pall. There were counted some dead individuals of *Lissotriton vulgaris* L., *Mesotriton alpestris* Laur., *Pelophylax* kl. *esculentus* L. and *Rana arvalis* Nilss. Two species with the largest populations represented the most significant road-kill rate: *Bufo bufo* L. and *Rana temporaria* L.

The highest mortality was discovered during autumn migrations, i.e. in September and October 2009, along the road section between the villages Mąchocice and Ciekoty (the Lubrzanka river gap, nearly 3 km long) (Fig. 2). The total number of dead amphibians was 3681, of which 3465 were identified – mostly *Rana temporaria* (3440 individuals). The Lubrzanka River is separated from forests of the Masłowskie Mountain Range, where the amphibians migrated from, by a small road.

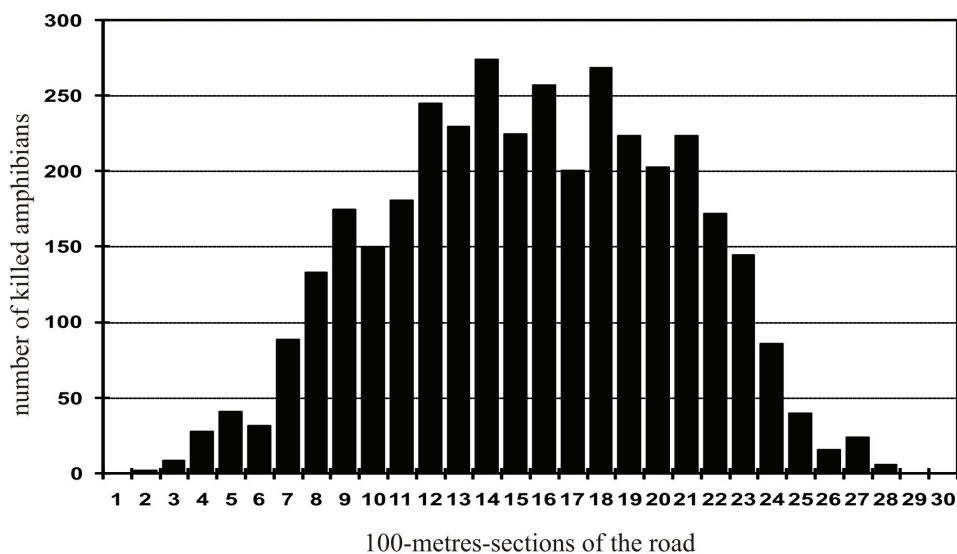


Fig. 2. Mortality of amphibians along the road section between Mąchocice and Ciekoty in September and October 2009

In the protection zone of the Świętokrzyski National Park the highest mortality was observed during spring migration, mostly in April and May 2009. In the Wzorki village (n. Święta Katarzyna village) the number of dead amphibians was 193 individuals along the 130-meter-section (Fig. 3). In the Baszowice village

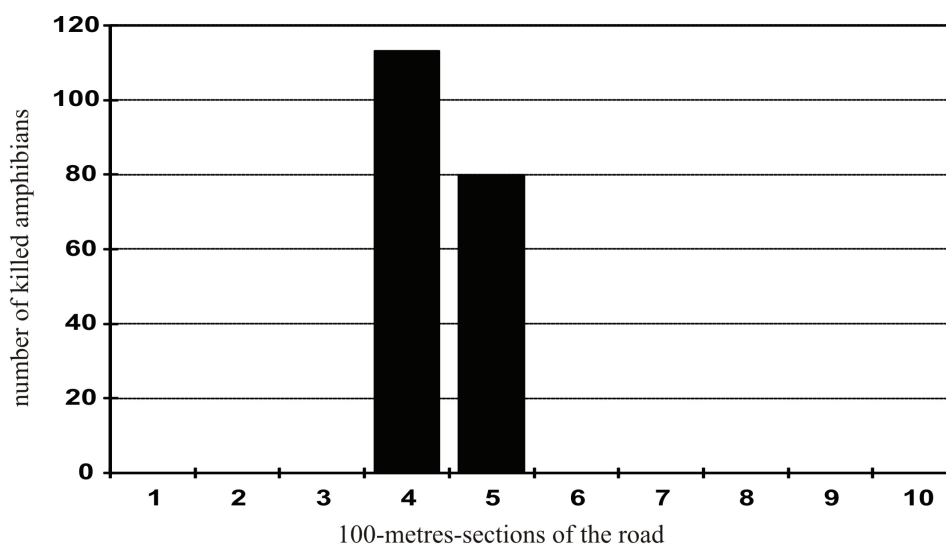


Fig. 3. Mortality of amphibians along the regional road No. 752 in Wzorki in April and May 2009

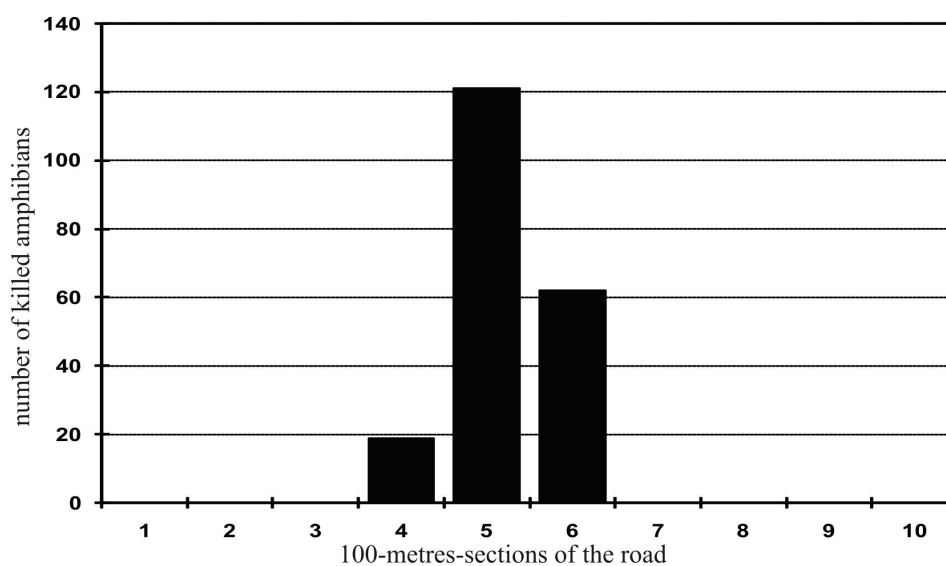


Fig. 4. Mortality of amphibians along the regional road No. 751 in Baszowice in April and May 2009

the number of dead amphibians was 208 individuals along the 220-meter-section of road No. 751 (regional road) (Fig. 4). Some dead amphibian species were observed in small numbers in the vicinity of bridges over river Belnianska in the Huta Koszary village, Czarna Woda river in the Dąbrowa village and over Pokrzywianka river in the village Jeziorko. Moreover, dead individuals were

found on roads in the vicinity of seasonal wetlands, e.g. the Czarna Woda river valley in the Świętokrzyski National Park. In other survey sections the number of dead amphibians was insignificant, with higher number near culverts.

DISCUSSION AND CONCLUSIONS

Presently a lot of attention is paid to spring migrations of amphibians (to breeding wetlands). Autumn migrations are usually not considered (to wintering sites) [Fahring *et al.* 1995, Elzanowski *et al.* 2009]. The research revealed that differences between spring and autumn migrations refer not only to different seasons when they take place. Most observed species hibernated in terrestrial burrows in the nearest localities, thus they did not take long migration routes. The only amphibian that hibernated in water was *Rana temporaria* and this species took long autumn migrations that resulted in a high mortality rate on roads.

The next difference between spring and autumn migrations resulted from the type of breeding wetland. In spring amphibians usually migrated along narrow corridors [Russel *et al.* 2005, Gryz and Krauze 2008, Woltz *et al.* 2008], which was also confirmed by this survey (Fig. 3–4). It resulted from small size of breeding wetlands (pond) and favourable migration routes (along water courses that feed the wetlands). The other reason was phylopathy – amphibians migrate to a parent water body that guarantees breeding success [Pechmann *et al.* 2001, Russel *et al.* 2005, Elzanowski *et al.* 2009].

In the case of autumn migrations the corridor was very wide (Fig. 2) as amphibians hibernated in water courses along their full length. Migrating amphibians did not have to keep a strictly specified direction as there was no difference where they enter water. It usually happens where habitats occupied by amphibians (e.g. *Rana temporaria*) are in a direct vicinity of water courses. A serious threat usually appears when amphibians have to cross a road on the way to a water course.

It is necessary to design passes for amphibians for the purpose of road modernisation within the project called The Small Road Loop (pl. Mała Pętla Świętokrzyska), especially in villages Wzorki and Baszowice. This project, unfortunately, did not cover the Lubrzanka river gap, where amphibians were killed by vehicles in large numbers during the autumn migration.

At all the road sections surveyed (Fig. 1) it would be necessary to design wildlife passes for amphibians. Such a task could be easy to implement only in the case of presently reconstructed ring road, including surveyed sections in the villages Baszowice and Wzorki.

The reconstruction works of The Small Road Loop are being implemented, and legal procedures require environmental impact assessment (EIA) for the special area of conservation „Łysogóry” PLH2600002 (The Świętokrzyski National Park). Such EIA should also include localisation of wildlife passes for amphibians. The width of a spring migration corridor is narrow and animal

passes can be built along both sections (Fig. 3–4) in the number of 35, every 50 m each pass, connected with barriers [Iulell *et al.* 2003]. The section along the Lubrzanka river is much more difficult to protect. It is not a part of the ring road around the Świętokrzyski National Park and in the forthcoming years the section will not be reconstructed.

The autumn migration corridor is wider and requires minimum 40 amphibian passes located every 50 m and connected with barriers. It is doubtful, however, if an investor will agree to the additional high expenditure, especially as this road section is located quite far from the Natura 2000 site, and the only species that is killed in high numbers is *Rana temporaria*.

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WPLYW KOMUNIKACJI SAMOCHODOWEJ NA MIGRACJE PŁAZÓW W OTULINIE ŚWIĘTOKRZYSKIEGO PARKU NARODOWEGO

Streszczenie. Badania miały na celu lokalizację miejsc rozjeżdżania migrujących płazów na drogach w sąsiedztwie Świętokrzyskiego Parku Narodowego. Największą śmiertelność zaobserwowano na odcinkach drogi Mąchocice–Ciekoty (Przełom Lubrzanki) oraz w miejscowościach Wzorki i Baszowice (otulina ŚPN). Wyraźne różnice stwierdzono pomiędzy wędrówkami wiosennymi (godowymi) oraz jesiennymi (na zimowiska). W pierwszym przypadku szlak migracyjny płazów był wąski (około 200 m), a w drugim szeroki (prawie 3 km).

Słowa kluczowe: płazy, migracje fauny, drogi, Świętokrzyski Park Narodowy, otulina