

## *Implication upon Herpetofauna of a Road and its Reconstruction in Carei Plain Natural Protected Area (Romania)*

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**Abstract.** In autumn 2011 we monitored a 5 km long road, paved with cobblestone, situated in Carei Plain Natural Protected Area, a road that is due to be modernized and continued across the border into Hungary. Dead bodies from eight different animal groups were observed on the road, amphibians presenting the greatest amount. The most frequent were the *Triturus dobrogicus* corps, a species with conservation importance. The amphibians were affected in the areas where the road is neighboring the wetlands, while on the opposite pole sits the area with acacia plantations. The high number of mortalities recorded on the road, despite the low traffic speed, is alarming. It is likely that the modernization of the road that will surely increase its traffic and the speed of the vehicles, will make the situation even worse. However, the rebuilding could contribute to the reduction in the impact on amphibians, if certain measures are considered while planning the action. Thus, in the areas near the wetlands, there should be undercrossings, fences and speed limits. In this way, the modernization would at least represent an experiment regarding the diminution of the road's impact on amphibians.

**Key words:** road mortality, amphibians, protected area, conservative measures, Romania

### **Introduction**

The negative impact of roads and traffic on biodiversity is generally acknowledged (e.g. RIFFELL, 1999; KUITUNEN *et al.* 2003; CIESIOŁKIEWICZ *et al.* 2006; ROE *et al.* 2006; RAO & GIRISH, 2007; HARTEL *et al.* 2009; GEORGE *et al.* 2011; KAMBOUROVA-IVANOVA *et al.* 2012). The development of road networks put a lot of pressure on biodiversity, identifying and conserving areas without or with very few roads becoming extremely important (see in: SELVA *et al.* 2011). This fact is even more crucial in protected areas, which should be situated in areas without roads or localities (see in: RAYN & SUTHERLAND, 2011). The network of protected areas expanded

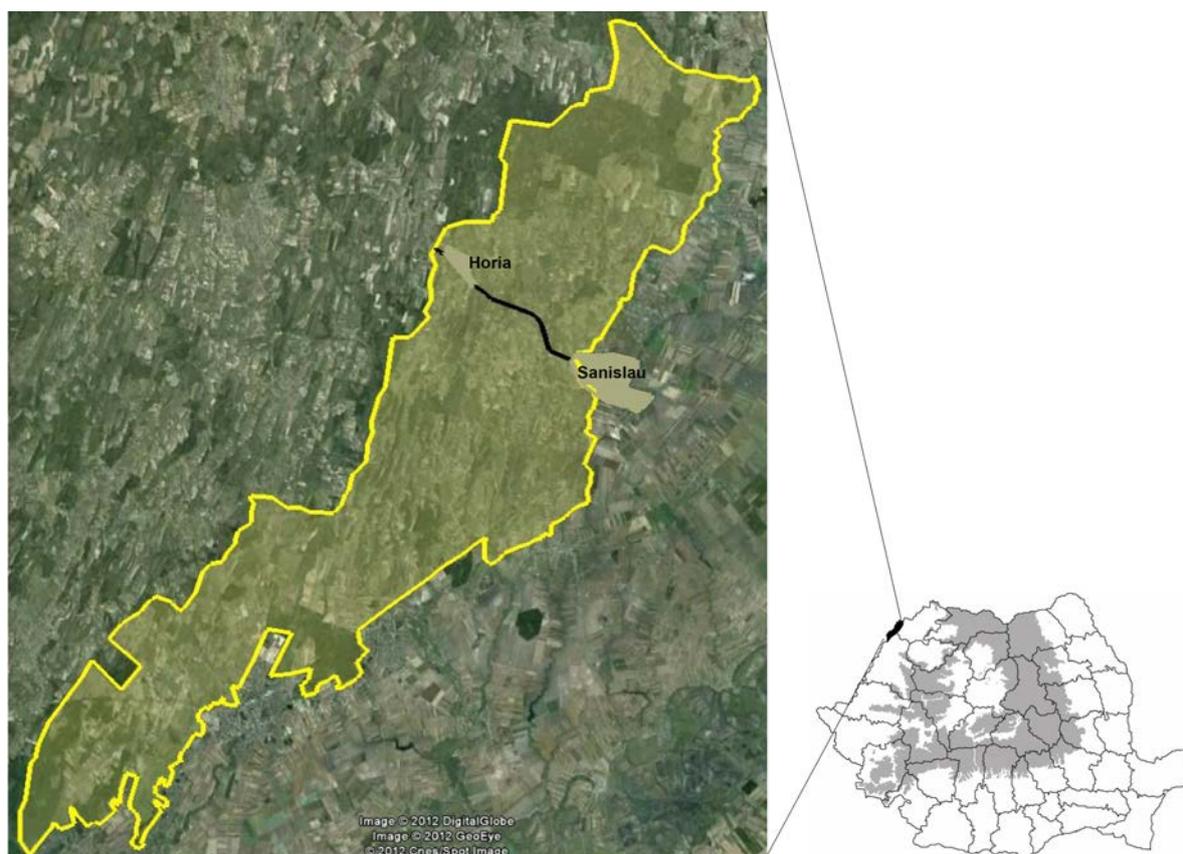
greatly in Romania in recent years (e.g. IOJĂ *et al.* 2010), but many areas were assigned without taking into consideration the reality in the field. As such they comprise in both natural and affected areas and encompass some human localities which ultimately only make the anthropogenic pressure grow constantly. Although some authors consider that there are no major contradictions between economic growth and biodiversity (FUENTES, 2011), economic development, expressed also through the expansion and modernization of the road networks does affect protected areas, Romanian being a part of this trend. In this situation we find the Carei Plain Natural Protected Area which, being on the border between

Romania and Hungary, fully feels the pressure of building roads between the two countries. Thus, our study was started by the authorities' wish of modernizing a road inside the protected area. The aim of the study was to quantify the impact of the road on the herpetofauna during the fall of 2011, by establishing the affected species, the exposed sectors and the potential measures for conservation.

### **Material and Methods**

The analyzed road is situated in the northern part of the Carei Plain Natura 2000's Habitats Directive Site (Campia Careiului - ROSCI0020) (Fig. 1). The area is located in north-western Romania, representing a stretch of approximately 10km wide and 50 km long situated between the border with Hungary and the Oradea - Satu-Mare rail road. The road is perpendicular with the area and the border,

linking the Sanislau and Horea villages, from where it is continued until the border. Nowadays the road, of about 5 km in length, is paved with cobblestone from Sanislau to Horea and then, its last 500m until the border; it's paved with simple quarry stone. The cobblestone sector is degraded, the travelling speed being very low (about 30 km/h) and the traffic is very low. Our research took place in autumn 2011, consisting in more field trips in September and October. The methods were similar to those used in other studies (e.g. CIESIOŁKIEWICZ *et al.* 2006; ELZANOWSKI *et al.* 2009). We used the direct observation of the dead bodies from the road, counting them and making notes on their location and the aspect of the surrounding areas. The road was covered by foot, in order to accurately spot all the bodies. There were three observers that walked in parallel, two on the sides of the road and on the middle.



**Fig. 1.** Map showing the geographical position of the Carei Plain Habitat Directive Site (ROSCI0020) and the studied road between the localities Horia and Sanislau (after GoogleEarth).

## Results

Not all the dead bodies identified on the road from the Carei Plain Natural Protected Area were amphibians. We identified dead bodies belonging to eight different groups of animals, both vertebrates (amphibians, reptiles, birds and mammals) and invertebrates (Diplopoda, Odonata, Coleoptera and Lepidoptera). Amphibians represented the majority of the bodies identified on the road between Sanislau and Horea, both as number of individuals and as number of species. All amphibian bodies were determined to a species level. Thus, we came across 64 dead bodies belonging to 5 species (*Triturus dobrogicus*, *Bombina bombina*, *Pelobates fuscus*, *Bufo bufo*, *Pelophylax esculentus*) (Fig. 2). From the reptiles we only identified bodies of snakes belonging to *Natrix natrix*. Due to the slow speed of the vehicles, birds and mammals had low amounts. On the other side, amphibians - slow animals - were the most frequent victims.

The magnitude of the road killings all along the entire length is variable. There are

sections where one can count more than one dead body on a meter long stretch of the road, but also areas where they occur several tens of meters apart. Generally, amphibian bodies were recorded in three main areas, all with vast wetlands next to the road. The magnitude of amphibian road killings is increased by the fact that the road is right next to all three swamps. Aside for amphibians, only dragonflies and damselflies present a distribution tied to wetlands. All the other groups (which have very low amounts from the total number of dead bodies) are spread relatively uniformly along the road. The areas least affected by road kills are the sections near the acacia plantations.

The amphibians that are affected by the road have a high conservative value (Table 1 also see Council Directive 92/43/EEC, O.U.G. 57/2007). *T. dobrogicus* is a species with high conservative value, which is rare in Romania and is distributed in the southern and western lowlands of the country (e.g. COGĂLNICEANU *et al.* 2000; IFTIME, 2005).

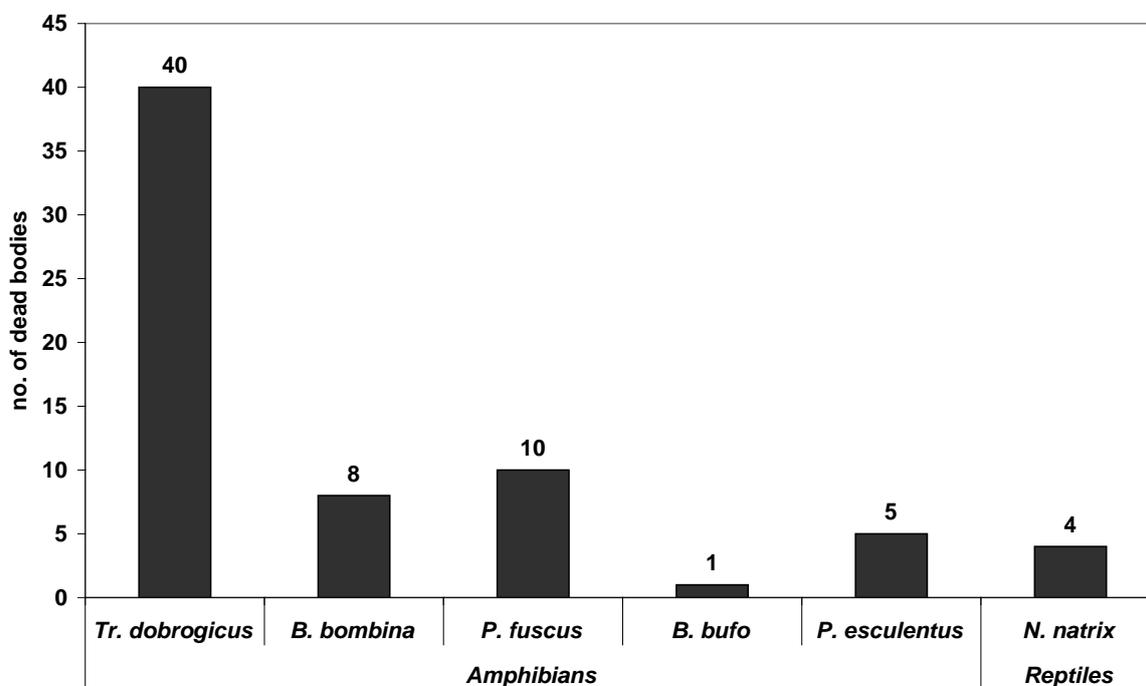


Fig. 2. The number of amphibian and reptile mortalities along the studied road.

**Table 1.** The road mortality affected amphibian and reptile species Natura 2000's status at the European and Romanian level. Legend: N2K=Natura 2000 status; SpCA=species needed special conservation areas; CI-SP=species with community interest – strictly protected; NI-SP= species with nationally interest – strictly protected; CI-M= species with community interest with exploitation management.

Species	N2K status	
	Council Directive 92/43/EEC	O.U.G. nr. 57 / 2007
<i>Triturus dobrogicus</i>	SpCA	SpCA
<i>Bombina bombina</i>	SpCA, CI-SP	SpCA, CI-SP
<i>Pelobates fuscus</i>	CI-SP	SpCA, CI-SP
<i>Bufo bufo</i>	-	NI-SP
<i>Pelophylax esculentus</i>	CI-M	CI-M
<i>Natrix natrix</i>	-	-

### Discussion

The negative impact of the road is great even nowadays, fact proven not so much by the number of dead bodies but by their taxonomic diversity. Thus, even in its current form, it is necessary to take measures to limit the effect of the road on the wildlife in the protected area. The presence of localities and roads which lead to them in the area are realities that can't be changed, but their impact should be limited. The analyzed road is perpendicular on the protected area, basically dividing it. Consequently as the number of roads will increase or will be upgraded, the fragmentation of the area will be higher.

The high frequency of *T. dobrogicus* mortalities is probably a consequence of the distribution of the species in the region and the season. Thus, in the Carei Plain the species's populations seems to be abundant (COVACIU-MARCOV *et al.* 2008 a, b, 2009), which increases the probability of mortalities of some specimens on the roads. Also, during this season there is increased road mortality with this species, as shown in other cases the newts, which became victims of traffic more often in the autumn (GRYZ & KRAUZE, 2008). Probably in the days prior to the study the newts began to withdraw from terrestrial habitats into the water for hibernation. This fact is substantiated by the identification of a live specimen that passed the road to get to the wetland. The negative effect on the newts was probably amplified

by their slow movement in the terrestrial environment.

Road mortality indicates that *T. dobrogicus* uses a vast terrestrial habitat, some bodies being found 500 m away from the swamp. The newts cross the road and hunt even in affected areas like the acacia plantations, crossing the road twice. This underline the necessity of conserving the terrestrial habitat neighboring the aquatic habitat used by amphibians (e.g. DODD JR. & CADE, 1998; POREJ *et al.* 2004). Also, it seems that the territory used by this species during its terrestrial phase is bigger than that of other crested newts, which after reproduction stay near the aquatic habitat (e.g. JEHLE & ARNTZEN, 2000; MULLNER, 2001). This may be a consequence of *T. dobrogicus'* adaptation to the large wetland areas (NECAS *et al.* 1997; IFTIMIE, 2005), as in Carei Plain, where the traveling between habitats is made through favorable wet areas, while for other crested newts the aquatic habitat can be surrounded by hostile terrestrial areas. As well as *T. dobrogicus*, the other amphibian mortalities were also found near the wetlands

On the road, among reptiles we only identified *Natrix natrix*. Snakes become victims of road traffic frequently (e.g. CIESIOLKIEWICZ *et al.* 2006; SANTOS & LLORENTE, 2009; TOK *et al.* 2011). The small number of observed specimens was probably a consequence of the reduced speed of the vehicles, which will likely

increase once the road is modernized. Although they are faster than amphibians, snakes are disadvantaged by their length. Lizards have not been recorded dead on this road, although in other cases, they are frequent victims of the road traffic (e.g. BOGDAN *et al.* 2011; TOK *et al.* 2011). There are *Podacris tauricus* individuals found at the road's edges, a species important in this area (COVACIU-MARCOV *et al.* 2009), however, they don't fall victim to the traffic, due to their faster mobility.

The road mortality for amphibians is concentrated in the area of the three wetlands that are crossed by the road. Generally, for reptiles, the phenomenon reaches high values in the regions where the roads are situated at less than 100 m from the wet areas (LANGREN *et al.* 2009). The least affected by road mortality are the acacia plantations. The areas where the road adjoins agricultural fields are without high road impact and conservative value. These data confirm the fact that the frequency in road mortality is influenced by the type of roadside habitats (GLISTA *et al.* 2007). The most important wetland is located in the neighboring area of Sanislau, as demonstrated by the large number of mortalities in its vicinity.

Our results show a negative effect of road on the amphibians from the natural area of Carei Plain and argue against its modernization. The degradation of the road will require repairs, but these should be made on a small scale and the road shouldn't be continued to Hungary. Upgrading and connecting the road to Hungary will increase a lot the impact of the road, whereas in the protected areas the constructions of roads and settlements should be avoided (RAYN & SUTHERLAND, 2011). If the construction of new roads is inevitable, they should be built in a manner that they won't reduce the conservation value of the habitats (UNDERHILL & ANGOLD, 1999). Based on our results we suggest the following conservation measures in the area, some undercrossings and fences on the side of the road should be made which could reduce, at least in the mortality of newts. Undercrossings should

ensure the movement of the fauna on both sides of the road, and fences should stop the access of the amphibians and reptiles to the road. Such measures have proved to be useful for most species of amphibians, helping to reduce road mortality (DODD JR. *et al.* 2004). In the wetland areas the speed limit should be set to a maximum of 40 km/h, as up to these speeds the butterflies and dragonflies are not affected (RAO & GIRISH, 2007). The above measures will hopefully reduce the impact of the road on the wetlands' wildlife. However, these measures are not efficient for some species like *Hyla arborea* or for some larger snakes which can climb the barriers.

If the reconstruction of the road is done according to these recommendations, as it was shown in previous studies (see in: DODD JR. *et al.* 2004), it should reduce its impact on the herpetofauna. However as to our knowledge, in Romania there are no roads built that take into consideration the conservation imperative. Thus, the effect of the measures will be checked after time. In conclusion, it remains to be seen if the measures meant to protect the herpetofauna will globally reduce the pressure of the road on all the wildlife of the protected area from the Carei Plain. Last but not least we hope that this will be at least an experiment, which will be useful in other case studies.

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