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The Dice Snake in the Czech Republic (1)

In 2009, numbers 2, 3, and 4 of the Zooreport journal featured a three-part series of articles about our rarest and most endangered snake species – the Aesculapian snake *(Zamenis longissimus)*. This text starts a series of a similar extent focusing on another critically endangered species of our herpetofauna – the dice snake.

The dice snake *Photo by Radka Musilová*

How to recognize it?

The dice snake *Natrix tessellata* (Laurenti, 1768) lives nearly exclusively in an aquatic environment, mainly in medium and large rivers and their environs (Ložek 1988). It ranks among medium-sized snakes, usually reaching a length of 60–80 cm. Very occasionally, females can grow longer than 100 cm. The scales have a keel-like shape, and the body colouring can vary. The dorsum can be greyish-brown, or reddish-brown to olive grey, with numerous dark square spots arranged in a checkerboard pattern. (From this comes the Latin generic name: The expression *tessella*, used by Pliny the Elder in the 1st century A.D., means a "small cube", and Gaius Suetonius Tranquillus used the adjective *tessellates*, meaning "paved with sets"). It can often have light stripes on its sides. The belly can be yellowish to orange with dark spots. As a defence, it gives a clearly audible hissing, spreads a very bad-smelling secretion from its cloaca, or plays dead (thanatosis).

The natural range

The natural range of the dice snake is very broad. It extends from Europe eastward through Asia Minor, the Caucasus Mountains and Transcaucasia to Kazakhstan, and from Central Asia to China and Mongolia (Rehák 1992). The continuous area in Europe includes the Italian Peninsula, the Balkans, and the Peloponnese. The western border of the natural range covers North Italy, Switzerland, and Germany. In Central Europe, the natural range is more or less continuous from the southern parts of Switzerland through Austria, the southern part of Slovakia, and North and Central Bohemia (Rehák 1992, Kreiner 2007). In Germany, there are four isolated populations of this species: in the river valleys of the Nahe, the Mosel, the Lahn, and the Elbe near Meissen. The last-mentioned population probably died out in the period between the World Wars, even though some unconfirmed reports described it as late as the 1950s (Obst 1976). The population currently living near Meissen has been reintroduced, as we will mention towards the end of this article. Another isolated population used to live in Vorarlberg, the westernmost land in Austria (Grillitsch et Cabela 1992, Rehák 1992). Although it was considered extinct there for fifty years, it is now possible to find sighting reports on the Internet about this species in this area http://derstandard.at/2487111). In Switzerland there are, besides the original habitats in the southern parts of the Alps, also several introduced isolated populations which are mentioned below.

The European part of the natural range of the dice snake (Kreiner 2007)

The Czech Republic is outside the continuous area of the dice snake, and its habitats are not connected. It can be found along medium and large rivers (e.g., the Moldau, the Berounka, the Sázava, the Ploučnice, the Ohře, the Svratka, the Jihlava, the Oslava, the Rokytná, and the Dyje rivers); or in dams on these rivers (e.g., the Brno dam on the Svratka, the Vranov nad Dyjí reservoir, the Moldau sequence of hydroelectric stations, and the Nechranická dam) which were built in places where permanent populations existed before the construction of the dams. Besides these permanent populations, there have been numerous sightings not satisfactorily explained that are usually considered to be introduced or migrating animals (summary in: Mikátová et. al. 2001). Our current knowledge of this species has advanced to the point at which we understand that its behaviour can be very surprising and that there are still many questions to be answered. The dice snake has, for example, been recently found in the Hamerský Brook – a tributary of the Nežárka River (Fabián,

The belly of the dice snake
Photo by Radka Musilová

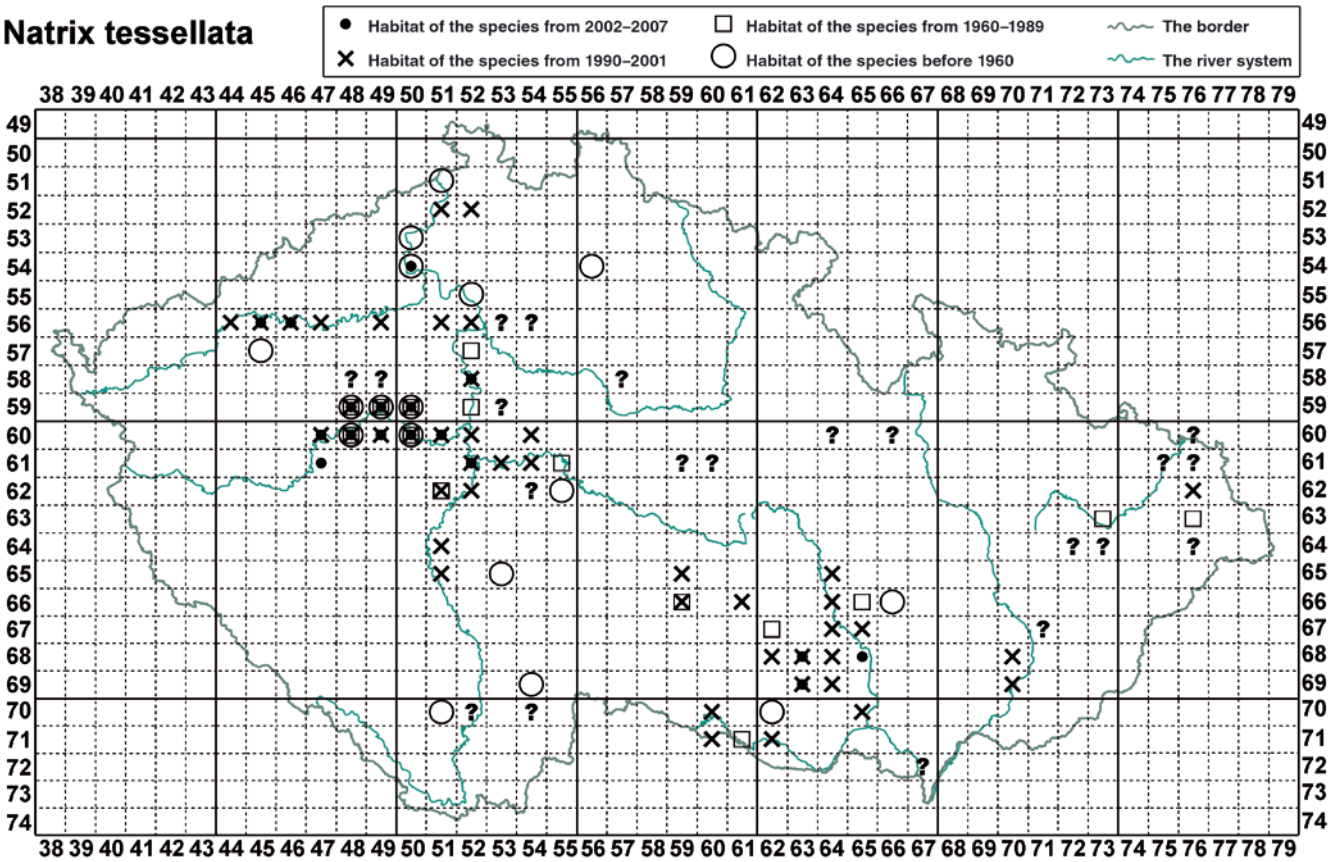
A dice snake while fishing
Photo by Libor Jabůrek

Medek et Hesoun in litt.). Towards the end of the 1990s, a sighting report was published mentioning two dice snakes in Silesia not far from the town of Havířov (Vlček 1998). Twelve years later, a breeding population was found in this area, which is considered a highly unusual biotope, quite distant from the known habitats of the species in the Czech Republic and even in a new drainage basin for the species (Vlček et Jablonski, 2010, Vlček et al. 2011). The dice snake requires a very specific environment and, as mentioned above, its habitats are mostly exclusively in river valleys in the Czech Republic. According to Mikátová et al. (2001), it seeks natural watercourses with a favourable climate and increased sun exposure, clean (i.e., not cloudy or contaminated) water, and a lot of shallows with a low flow rate and an indented bottom where small fish, which the dice snake mainly feeds on, gather. It also requires a biotope having a lot of various species of fish, enough spawning grounds, and natural vegetation on stony, gravel, or sandy banks (according to the water level). In the vicinity, there must be areas of steppe-like character with rocks, cracks and crevices, dry-stone walls, terraces, etc. offering sunny sites with long sun exposure, hiding places, and wintering sites. Suitable places for laying and hatching eggs are essential as well. Sediments of decaying plants and leaves which maintain a constant microclimate, stone walls, and larger stone blocks on the banks usually serve this purpose perfectly.

The Silesian population, on the other hand, has many distinguishing characteristics. Even though it lives in one of the coldest parts of its European natural range, it is not bound up with a river, as no large waterstream can be found there (Vlček et Jablonski 2010, Vlček et al. 2011). The biotope of the dice snake in Silesia includes a series of small water reservoirs with stagnant water. However, the distance to the nearest Sušanka rivulet is only approximately 25 meters. The reservoirs were used for the sedimentation of sludge during waste-water treatment in the hard-coal mines, and the whole area is still affected by anthropogenic burden. The banks, consisting of very dark waste rock, accumulate warmth and create an ideal microclimate. The dice snakes could find suitable hiding places and places for laying eggs under the metal piping until it was removed in 2010. In spite of that, the snakes are still breeding there. We are going to concentrate on the specifics of the Silesian population separately in one of the next parts of this series of articles.

Threats

All the populations of the dice snake in the Czech Republic have one thing in common: They are extremely susceptible to change and to the destabilisation of their biotope. They have very strong ties to various parts of their habitat in the course of the year (wintering sites, places for laying eggs, sunbathing, and hunting and fishing grounds), and damage to a single part of the biotope can have far-reaching consequences for



Map of the natural range of the dice snake in the Czech Republic
Origin: AOPK ČR

Close-up of the head of the dice snake
Photo by Radka Musilová

The dice snake sunbathing in a heap of brushwood *Photo by Karel Janoušek*

the population (Mikátová et al. 2001). The topical aggravating factors include non-native predators such as the American mink (*Mustela vison*), the racoon dog (*Nyctereutes procyonoides*), and the common racoon (*Procyon lotor*). The dice snake is also unfortunately being pursued and killed by man. It has traditionally been considered a damage-causing animal, especially in fisheries, and the killing of dozens of snakes was not exceptional in the recent past (1969, Rehák 1992). Thanks to increasing public awareness, such acts of vandalism are rare now.

The dice snake populations in the Czech Republic

A range of authors have researched the state of the dice snake populations. The oldest studies took place in the 1970s, and their subject was the population living in the Berounka River basin in the vicinity of Křivoklát castle. The size of the local population on a stretch of land of 1,500 meters was estimated at 510-1,220 by means of designation marks. Besides the population characteristics, the author dealt with the variability of head shields (Laňka 1973, 1978 a, b), and the protection of the snakes (Laňka 1983). More than 25 years later, Mr. Šváb, a student of biology, tried to repeat the study in the same habitat. However, he managed to catch only 13 animals during the first two months of the peak activity of snakes (May, June). This dramatic fall in the population is probably attributable to a non-native predator, the American mink (Šváb 2003). Subsequently, the author directed his attention to the population in the Sázava River valley near the village of Pikovice. There, he estimated the population living on a stretch of land of 1,500 meters at 236–622 animals, and obtained valuable information about the ecology, ethology, and biometrics of the species. A population standing at approximately the same size can be found in the vicinity of the Brno Dam, where the levels were from 280–420 animals on a stretch 900 meters long in 1996–1999 (Mikátová et al. 2001).

Quite recently, in 2005–2006, a survey on the dice snake was conducted in the Moldau River valley in Prague-Trója, close to the zoological garden. It was carried out by Mikuláš Velenský under the "secondary school professional activity" project, and the practical application of its findings in the protection of the species highly aided many a university dissertation. Velenský used the variability of head shields to distinguish individual snakes, as their combinations are unique. By employing this method, he estimated the Prague population at 373-1,301 animals on a stretch 715 meters long. This comprehensive survey gives valuable information on the morphology, ecology, ethology, dangers, and protection of the species (Velenský 2006, 2007). The author arrived at the reasonable conclusion that, according to all criteria, the studied population is one of the healthiest and largest in Bohemia, and that its value is enormous.

In 2009–2010 we paid attention to another large population of the dice snake, this time in the Ohře River valley near the town of Kadaň. The area of the population on the Ohře River ranks among the northernmost habitats in Europe. Based on our calculations, the size of this population can be estimated at 200-400 animals on a stretch 1,200 meters long, and it is to be examined in a separate article as well.

Introduction and reintroduction

As mentioned above, there are several introduced populations in Switzerland. The first of them, around Lake Geneva, was being introduced from 1925-1935 and was enlarged in 1950. The second population, near Lake Alpnach, was created by introducing 20–25 animals from the Maggia River. Another population, near Lake Brienz, was created in the 1950s by transferring approximately 50 animals from Lake Alpnach; and the last, the fourth, was introduced quite recently by Lake Zurich (Gruschwitz et al. 1999, Gautschi et al. 2002). All these populations, in spite of being small at the beginning, have become comparatively large. For example, the population of Lake Alpnach stood at 2,408 in 1992 and at 1,996 in 1993 (Hofer et al. 2001). It is widely known that, due to inbreeding, the share of homozygotes increases to the detriment of heterozygotes, which threatens their viability. It has been discovered that the number of heterozygotes in the Swiss-introduced populations dwindled, the apparent effects of which included scale anomalies (Gautschi et al. 2002). The native isolated populations of the dice snake in Germany and in the Czech Republic have gone, or are going, through similar processes. In consequence of less or more favourable conditions, the size of a population may decrease dramatically and subsequently increase again. It is no wonder that frequent scale anomalies have been recorded in these populations. It means incomplete, partly, or completely grown-together head shields, or unusually shaped ones. Similar anomalies can be found in more than 80% of animals in Germany (Lenz et al. 2000). Genetic studies have also confirmed the lower genetic variability of German and Czech populations, and they indicate that these populations have been through a genetic bottleneck, i.e., a dramatic decrease in size (Guicking et al. 2004).

Some populations have become extinct in consequence of many adverse effects. We can take the population living on the Elbe near Meissen as an example: It died out in the mid-20th century, probably due to pollution. In 1999–2000, an expensive reintroduction project was carried out, which received close German media attention and which required many preliminary technical measures necessary for the successful habitation of the dice snake. They included, for example, wintering sites, and barriers along cycle paths (Gruschwitz et al. 2001). The conservationists

The biotope of the dice snake in the Ohře River valley *Photo by Radka Musilová*

transferred 188 young animals from habitats near the Ohře and the Berounka rivers to the Elbe near Meissen (Gruschwitz et al. 2001, Schmidt et Lenz 2001).

Conclusion

The natural range of the dice snake, similar to other thermophiles, oscillated significantly during the Quaternary Period. During cold and unfavourable periods, the dice snake took sanctuary in the Balkans; and in the Holocene Epoch or postglacial period, it expanded northward through the Danube, Elbe, and Rhine basins (Gruschwitz et al. 1999). The northernmost populations currently live in Germany and the Czech Republic, and their high conservation value is further raised by the fact that they differ genetically from southern European populations (Guicking et al. 2004). However, the dice snake lives almost at the limits of its existential possibilities on the northern edge of its natural range. That is why its requirements for the ecology of the habitat are so demanding and its sensitivity to changes in this area is so extreme. If we take into consideration the constantly intensifying pressures from human society, we must admit that the dice snake rightfully ranks among the critically endangered species of our herpetofauna. It is absolutely essential to take all steps to protect it, and especially to protect and maintain the biotopes in which it lives.

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