



The European green lizard is another rare inhabitant of the Želina Meander Natural Monument

The Dice Snake in the Czech Republic (4)

The fourth and last part of our series about the distribution of the dice snake in the Czech Republic is devoted to the occurrence of this critically endangered species in North Bohemia, in an isolated population on the River Odra near Kadaň. The dice snake can be found there mainly in the Želina Meander Natural Monument, which is a 5 km long section of the River Odra valley between the village of Želina near Kadaň and Nechranice water reservoir. The protected area, which lies at 275–285 m above sea level, contains a geomorphologically important, deep cut valley and the meandering river that formed it. The rocky, hard-to-access slopes are covered by steppe, forest steppe and forest vegetation. The locality has long been known for the occurrence of large populations of heat-loving reptile species, including the European green lizard (*Lacerta viridis*) as well as the dice snake (*Natrix tessellata*).

In the Želina meander, the dice snake is tied to the river phenomenon (just like the isolated populations on the Lahn and Lahne Rivers in Germany). The population on the River Ohře is one of the northernmost ones in Europe; a more northern occurrence is recorded only on the River Elbe near Meissen in Germany, where it was eradicated in the first half of the past century. However, in 1999–2000, conservationists released 50 young dice snakes there that had originated from localities on the Ohře and Berounka rivers (Laňka 2001, Schmidt and Lenz 2001). In another, more northern German locality on the River Weser, only one pair has been found and its occurrence was later evaluated as non-indigenous by specialists.



Detail of the pholidosis of the head of a dice snake at the Želina meander



A view of the Želina meander in the spring, before the main onset of vegetation growth

History of findings and research

According to Šapovaliv and Zavadil (1990), the occurrence of the dice snake around Kadaň was mentioned by monogrammist R.K. for the first time in 1939 and somewhat later by e.g. Klement (1943/44). The first data on the number of individuals observed during individual excursions come from as late as the end of the 1980s, after a long break, when specialists observed up to several tens of individuals on the left bank of the River

Ohře during a single day (Šapovaliv and Zavadil l. c.). More detailed results were provided by Petr Šapovaliv in the unpublished News from Herpetological Research for the Nature Conservation Agency of the Czech Republic in 1998–1999, partially in connection with the above-mentioned planned re-introduction project on the Elbe near Meissen.

With the support of the Ministry of Environment, our civic association, Zamenis, carried out



Detail showing how individual snakes are marked – two triangular cuts on the ventral scales in the area above the anal plate. Every snake caught was marked in this way on different plates and thus obtained a unique code

systematic research into the dice snake in the Želina meander in 2009-2010. Its purpose was to determine the basic population characteristics (such as the population size, age and gender structure, etc.) and the main endangering factors. It was the first time the size of the population had been examined in the Želina meander using exact methods. However, even before our research took place many specialists (e.g. Gruschwitz, Laňka, Zavadil – *oral report*) considered the population on the River Ohře to be one of the most numerous ones in our country and perhaps even in central Europe based on many years of experience and in comparison with other dice snake populations. An indication of a high population was the tens of adult individuals observed during one-day counting sessions - Mikátová et al. (2001) reported 62, 98 and 109 adult specimens registered during individual days.

Present state of the population




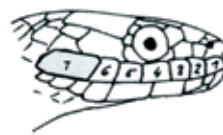
During the above mentioned research in 2009–2010, we recorded 151 adult dice snakes with a complete body length of over 400 mm and 19 young individuals with a complete body length of less than 400 mm. We estimated the size of the population based on the marking of individuals via the making of cuts in the outer edges of broad belly scales and the subsequent repeated capture of the marked individuals. According to our results, the size of the population is within the range of 200-400 individuals. As we only monitored the 1 200 m long central section of the area with the most plentiful number of dice snakes, the size of the population in the whole area of the natural monument could be several times higher.

The mutual ratio between the numbers of males and females in the populations which live in the countryside is usually stated as 1:1 (Rehák 1989). The chance of capturing an individual of a certain gender depends on many factors, e.g. on the different activities and lifestyle of each sex. At the beginning of the season, the males are more active than the females in the wintering places

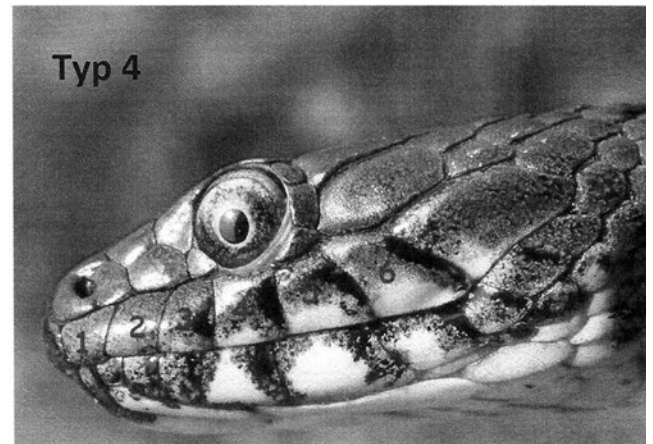
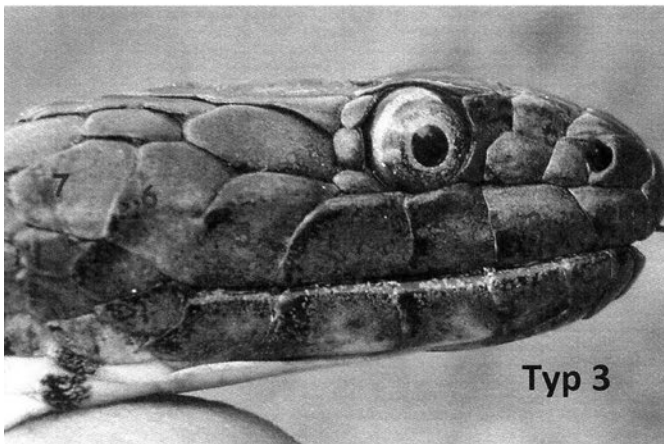
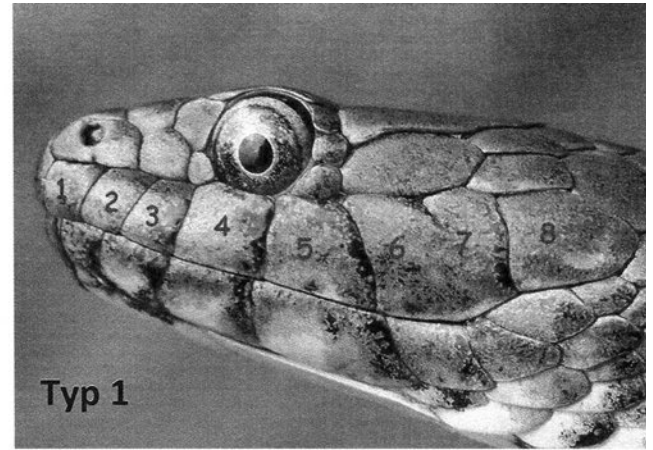
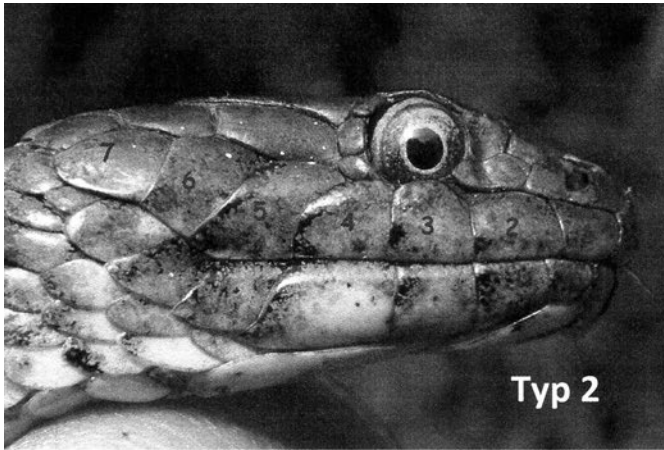
(which increases the probability of capturing a male), while the females, on the other hand, can be caught more easily during their pregnancy, when they bask more and have a shorter escape distance. Depending on the type of study, these facts can shift the recorded ratio in the favour of one sex or the other. However, most studies conducted on isolated populations in our country or

in Germany have proved that the ratio is in favour of the females (e.g. Velenský 2007, Šváb 2003 or Lenz and Gruschwitz 1993a). It was similar in the case of the population on the River Ohře, where we found that the ratio of sexes is 1: 1.29 in the favour of females. However, the question remains as to whether this ratio is influenced by the different activities of the individual sexes or if it's a non-standard situation that occurs in small populations.

As far as body size is concerned, the 60–69 cm category (60 individuals, 37.50 %) prevailed in our population; this category also prevailed in males while the 70–79 cm size category was dominant with females. Females reach greater lengths and thus the size category of over 80 cm is only for this gender. The longest female was 88 cm long, while the largest male was 70 cm in length. The result of comparing this data with the population near the River Vltava in Prague-Trója (Velenský 2007) is that the males on the River Ohře are about 10 cm smaller on average and the females are even 15 cm smaller. This smaller average body size could be the result of outside pressure on larger specimens, e.g. in the case of active persecution by people (mainly fishermen) during which larger individuals are more noticeable and hence more vulnerable to the risk of being caught.

Rank according to the frequency of occurrence	View/Description	Occurrence on the right profile (Number of indiv.)	Occurrence on the left profile (Number of indiv.)	Occurrence on both profiles (Number of indiv.)	Total occurrence (Number of indiv.)	% population
1	 8 supralabial shields, 6th and 7th shield partially merged	24	18	5	37	24.18
2	 7 supralabial shields	21	15	2	34	22.22
3	 7 supralabial shields, 5th and 6th shield partially merged	19	10	3	26	16.99
4	 7 supralabial shields, 7th shield elongated (obviously two shields merged)	8	18	5	21	13.73

Most frequent types of anomalies of supralabial shields



Photograph of the pholidoses of the heads of dice snakes corresponding to the types shown in the table on page 2

Anomalies of the pholidosis

The study of pholidosis – the shape and arrangement of scales (shields) on the surface of the body – helps with the classification of reptiles. Based on pholidosis, we can identify the species, subspecies and forms of reptiles; deviations in pholidosis can reveal relationships between closer and more distant populations of the same species. The pholidosis of snakes in isolated populations often shows various shape and number anomalies which are often specific to a certain population. This has been proved by many studies (e.g. Lenz and Gruschwitz 1993b, Lenz et al. 2000, Strödicke and Gerisch 1999). Our research paid special attention to the pholidosis of the heads of dice snakes.

Numerous anomalies in the population of dice snakes on the River Ohře near Kadaň were recorded in the area of supralabial shields. Only 12 individuals out of 153 examined (7.84 %) had the standard number of 8 supralabial shields on both sides (profiles) of the head; the remaining 92.16 % individuals had an anomaly on at least one side. The table on the page 2 shows the most frequent types of anomalies of supralabial shields, including the number of individuals showing an anomaly and the percentage of its occurrence in the population.

Activity and behaviour of the dice snake

We observed the first signs of dice snake activity as early as April, with the highest activity recorded in May, June and July, which is mainly due to mating and the laying of eggs. From August, the activity of individuals gradually became lower in intensity, though it lasted until September. Mainly the males are active in the marginal periods (April, September), and in June and July, the activity of females increases significantly, which is related to the frequent basking of gravid females and the laying of eggs.

Dice snakes often mate while still at their wintering place and continue with mating through May. Females lay eggs approximately at the end of June or in the first half of July, depending on how the weather develops.

Exposure

Even though the valley of the meandering River Ohře between the village of Želina and Nechranice water reservoir provides a very favourable microclimate for dice snakes, it is necessary to realize that one of the northernmost populations in central Europe lives there. The species is thus at the outermost limit of the area where it is able to survive. In the event of unfavourable weather,

the number of hatched young decreases or they are weakened and subsequently die during wintering. Several unfavourable years in a row can have a fundamental negative impact on the population (Mikátová et al. 2001).

Riparian zones with natural vegetation and open stony, gravel or sandy banks are considered to be the optimum environment for dice snakes. However, the riparian zone of the larger part of the monitored section is rather muddy and a several metre wide bank without vegetation cover is created when the water level is lower. The snakes have to overcome this obstacle when they set forth into the current of the River Ohře to hunt for fish, thus exposing themselves to great risk of predation. The natural predators of dice snakes are, among others, birds of prey and wading birds, as well as some mammalian predators (e.g. the common fox and carnivorans of the weasel family). However, non-indigenous predators are a great danger, particularly the American mink (*Mustela vison*), the raccoon dog (*Nyctereutes procyonoides*) and the raccoon (*Procyon lotor*). All three of these predator species have been recorded in the valley of the River Ohře, the most numerous of which appears to be the raccoon. Its negative influence on the snake population is being monitored within the framework of the conservation programme for the population of the dice snake in the surroundings



Dry stone walls are an attractive biotope for snakes; however, they gradually become overgrown without regular maintenance

of the River Ohře (Musilová et al. 2011). Even though no one has examined the negative influence of the raccoon on the population of the dice snake in detail so far, it can be assumed with certainty. Also, German conservationists attempting to preserve isolated populations, who have built artificial hatching places for dice snakes, have had negative experience with raccoons, which were able to enter these hatching places and consume the laid eggs. The subsequent building of fencing was helpful in dealing with this (Gruschwitz – oral report).

As far as another of the predators, the American mink, is concerned, quite worrying data are available. Kapler (1994) describes a meeting with an American mink near the Slapy water reservoir near Cholín. During one hour of observation the mink travelled a distance of 1 km and caught five dice snakes, eating

only their heads. Such behaviour means the predator represents an obvious danger for our herpetofauna.

The presence of rocky places with cracks or dry stone walls is essential for dice snakes – they provide sunny habitat with long sun exposure, hiding places and wintering options. These biotopes occur plentifully in the Želina Meander Natural Monument. Sunny rocks on slopes with south or south-west exposure can serve as wintering places and aren't separated from the river by a road, unlike at other localities in the Czech Republic (e.g. on the River Berounka). Because of this, snakes are not killed here by passing vehicles during their movement between the river and the rocks. However, a great danger for the biotopes lies in the massive overgrowth of wind-dispersed woody plants, mainly wild cherries. The river banks, and thus the fundamental biotopes of dice snakes,

are also endangered by the propagation of neophytes (a non-indigenous, invasive plant species).

Snakes have always evoked fear in people since ancient times, and this led to their persecution in the past, just as today. Even these days, some fishermen consider dice snakes to be pests. It isn't unusual to find a specimen which has been killed, unfortunately, and such finds are described by perhaps all authors who have focused on dice snakes in the Želina Meander Natural Monument. These days, the situation is somewhat better thanks to progressing education and informedness; however, the dice snakes have mainly benefited from a barrier across the access road which prevents the entry of cars to the examined protected locality. Even though this measure probably wasn't related to the protection of herpetofauna, it has contributed to it considerably.

A closing word

Dice snakes have very specific requirements as regards their living environment under the conditions present in the Czech Republic, and today far from all of the parameters influencing their existence in the area of the Želina Meander Natural Monument can be considered as being optimal. If we take all the above mentioned factors into consideration, it is necessary to consider the population at that location to be endangered significantly, despite the current numbers of individuals present.

The long-term management of the dice snake population in the Želina Meander Natural Monument should comprise the regular, annual removal of wind-borne plant species and neophytes alongside an education programme and permanent monitoring of the population in order for possible deteriorating trends to be discovered in time.

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