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Headstarting in a small population of European pond turtles (*Emys orbicularis*) in Central European conditions: first results

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Abstract. „Headstarting“ involves the captive rearing of hatchlings from eggs collected in the wild. The hatchlings are held for several months to help them avoid high mortality in their first year (Heppell, Crowder and Crouse, 1996). In 1999, we tried headstarting on 18 hatchlings from Tajba national reserve in South-Eastern Slovakia. The hatchlings, which were clutched in two nests, were marked using a marginal notching system to enable the identification of recaptured individuals. Two turtles were recaptured by 2010. After 1999, the headstarting program in Tajba national nature reserve was completed.

Keywords. Emydidae ; endangered species; growth rings; headstarting; NPR Tajba.

Introduction

Headstarting is a conservation approach in which young animals, either captive-bred or collected from the wild, are reared in captivity for varying lengths of time prior to release into natural habitats (Alberts, 2007), by which time they have outgrown their period of greatest vulnerability to predators (Spinks et al., 2003). This method is used in management of sea turtles (Nagelkerken, Pors, and Hoetjes, 2003), land-dwelling turtles (Pedrono and Sarovy, 2000) and also in management of fresh water turtles (Haskell et al., 1996; Mitrus, 2005; Vander Haegen et al., 2009). Similar to many other reptiles, *Emys orbicularis* is a critically endangered species. In Slovakia, it is the only reptile to be classified on the Slovak Red list as “critically endangered“ (Kautman, Bartik and Urban, 2001). Only one reproductive population of this species has been reported for Slovakia. This population was identified in a pond of the Tajba National Pond Reservation (NPR). We used the headstarting method for only one year because of the possible negative impact on small native populations living in this region whether by transfer of diseases (Flanagan, 2000) or because of abnormal behaviour (Nagelkerken, Pors and Hoetjes, 2003) caused by human intervention during the first year of life. Any mistake in the conservation plan could cause serious damage to this last and small, fragile population.

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The count of growth rings on the carapace and plastron scutes is a widely used method to estimate the age of turtles. Mitrus (2009) compared growth rings between young (5-9 years) wild and headstarted animals of *Emys orbicularis*. Wild animals showed a clear relationship between growth rings and age that supported the growth ring hypothesis. Headstarted animals, however, showed some abnormalities in the count of growth rings, including the occurrence of false growth rings. In comparison with growth rings, false rings are shallow and often incomplete (Wilson, Tracy, and Tracy, 2003).

Materials and Methods

The study was conducted in the National Nature Reserve Tajba (48° 23‘ N, 21° 47‘ E), situated in South-Eastern Slovakia, 1 km north-east of the town Streda nad Bodrogom. The protected area covers 27.36 ha and includes the Tajba pond (2 km long and 100–150 m wide, oxbow shaped) and a 100 m wide buffering area. Using capture recapture method the total number of adult turtles in this area in 2010 was estimated as 171 individuals. During the study period (12 years) we catalogued 88 turtles. Only 39 females and 90 nests were recorded in the nest area (Bona et al., 2012).

There is only one known experiment with headstarting on European pond turtles in Slovakia. Starting in 1999, we headstarted 18 hatchlings from two nests. We opened the nests on 8 October 1999. The first nest was laid on 29 May 1999 by female F 12 and contained nine living hatchlings and one dead embryo in an egg at the opening. The second one was laid on 5 June 1999 by female F 13 and contained nine living hatchlings and four unfertilised eggs at the opening. All these live hatchlings were placed in the breeding establishment of the veterinary university in Košice where four of them died. Fourteen surviving hatchlings were measured and weighed and released on 26 May 2000 in Tajba pond in places where the turtles had been observed previously. All the hatchlings were marked by notching the marginal scutes. In spring 2000, we opened the next two nests laid in previous year by Females F1 and F15 both on 2 June 1999. From the first one we picked seven dead

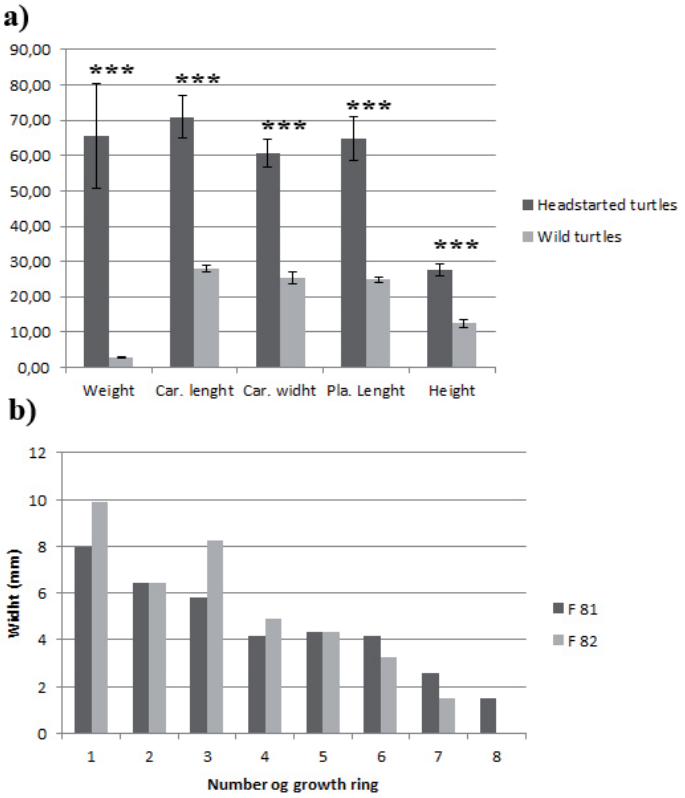

Figure 1. A) Comparison of biometrical data using Students t-test of wild and headstarted hatchlings shown as mean ± SD. The y axis represents grams, millimetres respectively. *** = P<0.001. B) Comparison of dimensions of growth rings of headstarted turtles (F 81, F 82).

hatchlings and one surviving one. From the latter we picked six dead ones. We measured and weighed the hatchlings. Only one out of 14 wild hatchlings survived the overwintering in the nest hole. This hatchling was marked by notching the marginal scutes to enable its identification if recaptured. For confirmation that there were no significant differences in biometrical data of wild dead and wild living animals from both nests we compared the means of biometrical parameters of wild dead hatchlings to all wild hatchlings using Students t-test (P>0.05 in all parameters), thus we were able to compare biometrical data of wild and headstarted turtles using Students T-test. In the year 2010 we found two of the headstarted female turtles in the nesting area. We measured them and placed a radiotracking receiver on their carapace, and released them in the same place that we found them; these turtles were catalogued as numbers F 81 and F 82. To monitor the activity of turtles, we used the radiotracking receiver Fieldmaster FM-100 and R1930 transmitter (24 g, 25x56x9 mm, 843 days by 40 ppm) (Advanced Telemetry Systems, Inc.). The transmitter was glued on the lateral part of the carapace using dentacryl (Spofa-Dental). Removal of the transmitter has no destructive impact on the carapace. We also recorded the pattern (count and width) of growth rings. For this we used the left abdominal scute. We measured the rings in a medial lateral direction. For dimensional analysis of growth rings, we used Adobe® Photoshop® CS5 software.

Table 1. Comparison of biometrical data of young and adult headstarted turtles (F 81, F 82). The dimensions are expressed in mm. Car - carapace; Pla - plastron.

	Car. lenght	Car. widht	Pla. lenght	Body height
F 81(1999)	63.5	54.7	56.4	25.9
F 81(2010)	164.1	125	152.7	67.7
F 82(1999)	64.9	56.1	58.3	26
F 82(2010)	162	124.4	157.1	74.4

Results

Comparison of biometrical data between wild and headstarted hatchlings using Students t-test are shown in Fig. 1A, which shows a significant difference in all measured biometrical data. The weight of headstarted hatchlings is on average almost 23-times bigger than in wild hatchlings. Carapace length is 2.5-times and width 2.4-times bigger. The weight of headstarted hatchlings varied considerably. The weight was mean ± SD = 65.57 ± 14.86 g (range: 48-88 g). Other biometrical data of headstarted turtles also varied considerably. The survival of headstarted turtles over the period of the study was 77.78% (14/18). Survival of turtles overwintering in nests was only 7.14% (1/14).

In the year 2010, we found two of the headstarted female turtles (catalogued as F 81 and F 82) from year 1999 in the nesting area. We have established the presence of eggs by both of them. The measurements compared with the hatchling dimensions of individual females are shown in the Table 1.

Radiotracking of F 81 and F 82 showed that the turtle F 81 returned back to the Tajba pond immediately after receiving the transmitter when she was found in the nesting area on 28 May 2010. The turtle stayed in Tajba pond for the rest of the season. The turtle F 82 travelled about 5 km through the slopes of the Tarbucka hill to sluiceways between the villages Streda nad Bodrogom and Malý Kamenec where turtles occur sporadically. The first time she was found on 29 May 2010 1.5 km South from Tajba pond in an area where we had never observed turtles before. On 24 June 2010, we radiotracked the female to somewhere in the sluiceways a minimum of 2.8 km from Tajba pond. Unfortunately, we were not able to find the exact place because of hard terrain. On 27 July 2010, the turtle was radiotracked to the Slovak/Hungarian border in the river Malá Krčava 4.8 km from Tajba. On 23 September 2010 she returned back 900 m north where she stayed until 28 February 2011. We had never observed such migration before.

We also recorded the pattern (count and dimensions) of the growth rings of both headstarted animals (F 81, F 82). For count and dimensional analysis, we used the left abdominal scute. We measured the rings in a medial lateral direction. Turtle F 81 has eight while F 82 has only seven growth rings. We also registered a false growth ring on ring number 4 in both females. The dimensions of the individual growth rings are shown in Fig. 1B. The difference between dimensions of growth rings is notable on rings 1 and 3.

Discussion

Headstarting is a conservation approach in which young animals, either captive-bred or collected from the wild, are reared in captivity for varying lengths of time prior to release into natural habitats (Alberts, 2007), until they have outgrown their period of greatest vulnerability to predators (Spinks et al., 2003). However, there are some data that show inefficiency of headstarting as a tool for increasing the population size of freshwater and sea turtles . There are also data on some negative impacts on the population such as transfer of diseases (Flanagan, 2000) or abnormal behaviour (Nagelkerken, Pors and Hoetjes, 2003) caused by human intervention during the first year of its life.

We use headstarting for only one year because of concerns of a negative impact (Flanagan, 2000; Nagelkerken, Pors and Hoetjes, 2003) on the small native population living in this region. However, the headstarting seems to function from the point of view of giving a headstart to hatchlings and decreasing mortality of hatchling during overwintering in the nest. We are not able to evaluate the impact of increasing the population size because of the short period of headstarting (only one year) and the small number of headstarted (n =18) / recaptured animals (n =2 females). We also observed a migration from Tajba pond to another location not suitable for nesting because of high levels of groundwater and intensive agricultural activity. Such migration had not been observed before in any wild females, so this may be a negative effect of headstarting. In this work, we also found that headstarted female turtles are capable of reproduction at the age of 11 years. However, they may have problems in finding a suitable site for laying the eggs.

The count of growth rings in carapace and plastron scutes is a non-invasive and widely used method to estimate the age of turtles (Zug, 1991). Despite this, turtles can produce zero, one, two or more growth rings per year (Tracy and Tracy, 1995; Germano, 1998; Stone and Babb, 2005). These works support findings of Wilson, Tracy and Tracy (2003), who found that there is currently no justification for generalising the use of growth rings to estimate the true age of many species. However, aging turtles from counts of growth rings might be feasible in some types of studies, for some species at some locations, but only after calibrating the relationship between ring counts and age for each circumstance. We observed an abnormality in the count of growth rings in connection with the age of the turtle. Turtles of the same age had a different number of growth

rings. Mitrus (2009) reported such abnormalities in the count of growth rings in headstarted animals in Poland, including the occurrence of false growth rings by headstarted animals. He also reported that wild animals showed a clear relationship between growth rings and age in Poland. We observed the presence of false growth rings on the fourth growth ring in both of females. Such false growth rings were never observed on wild animals. This could mean that the impact of headstarting can influence the behaviour for many years after release into the wild. We would like to monitor the movement and behaviour of headstarted animals in the future to determine more details of the impact of headstarting not only on the population but also on the individual.

With respect to the uniqueness of this area and vulnerability of population, we are able to capture individuals only during the egg-laying period (females) or during migrations (males). Given the small number of individuals in the studied population, is the sample adequate to give us valuable information about the influence of the headstarting program in this area.

We found that: (i) headstarting seems to function from the point of view of giving a headstart to hatchlings and decreasing mortality of hatchlings during overwintering in the nest, (ii) headstarted animals have abnormalities in the number of growth rings in connection with age of turtle, (iii) headstarted animals have false growth rings, (iv) headstarted female turtles are capable of reproduction at the age of 11 years.

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