

*Overwintered Hatchlings of *Emys orbicularis* from Lake Sülüklü (Western Anatolia, Turkey)*

Dinçer Ayaz, Kerim Çiçek

Ege University, Faculty of Science, Biology Department, Zoology Section, Bornova,
Izmir/TURKEY, E-mail: dincer.ayaz@ege.edu.tr

Abstract. During our monitoring survey of amphibians and *Emys orbicularis* in Lake Sülüklü (Western Anatolia, Turkey), we observed four overwintered hatchlings of European pond turtle on May 4 and 10, 2010. The average straight-line maximum carapace length of the neonates captured was 26.48 mm and their average weight was 4.18 g. This observation is the second record for the Turkish population of *Emys orbicularis*.

Keywords: *Emys orbicularis*, neonate, overwintering, Western Anatolia, Turkey

Introduction

European pond turtle, *Emys orbicularis* (L., 1758), one of two representatives of the Emydidae family distributed in the Palearctic region, is one of the freshwater turtle species distributed from Northwest Africa in the West to the former Aral Sea in the East and from the Moscow Region in the North to the Turkish-Syrian border in the South (FRITZ, 2001, 2003). The European pond turtle is an endangered and protected species in many European countries and it is protected by the Bern Convention (1979) (Appendix II) and ANNEX II of the European Habitat and Species Directives (1992) and it is raised in the vulnerable category in the last IUCN report for the Mediterranean basin (COX & TEMPLE 2009).

Reproductive biology of the species has been well studied by many authors (e.g. ZUFFI & ODETTI, 1998; ZUFFI *et al.*, 1999, 2004, 2007). However, most of these papers focused on European populations (see reviews in FRITZ, 2001; 2003), and little information is available on Anatolian populations (AYAZ, 2003; AYAZ *et al.*, 2008).

Overwintering behaviour is well known for many freshwater turtles (review ULTSCH, 2006). However, only little is known about the overwintering behaviour of *E. orbicularis* in many countries (e.g. PARDE *et al.*, 2000, MITRUS & ZEMANEK, 2003; THIENPONT *et al.*, 2004; NOVOTNY *et al.*, 2004) and whether overwintering occurs also at embryonic stages is still under debate. Here we present the second record of four hatchlings of *Emys orbicularis* found active in early May and also give new additional morphological data of overwintering hatchlings in Turkey.

Materials and Methods

Lake Sülüklü (Manisa, Western Anatolia) is situated on the north-eastern slope of Mt. Spil [38.565035° N, 27.532617° E, 612 m a.s.l.] and surrounded by a pine forest (*Pinus brutia*). The surface area of the lake is nearly 1.58 ha and its depth 2-4m. The lake is nourished by ground water, snow melt, and rain. The water level drops drastically, especially in summer (July and August), due to a decrease in spring waters and monthly rainfall.

During the monitoring survey of amphibians (*Pelophylax bedriagae*, *Lissotriton vulgaris* and *Triturus karelinii*) and turtles (*Emys orbicularis*), in the samplings of May 4 and 10, 2010, 4 *E. orbicularis* neonates, 2 on each date, were captured in the section on the lakeside in the depth of approximately 20-30 cm and with dense plant cover (*Typha angustifolius*, *Phragmites australis*, *Juncus* sp., *Carex* sp. and *Potamogeton* sp.). Air temperature was 27 and 30°C during the field studies, respectively.

The straight-line maximum carapace length (SCL), carapace width (CW), carapace height (CH), plastron length (PL), gular suture length (GuL), humeral suture length (HumL), pectoral suture length (PecL), abdominal suture length (AbdL), femoral suture length (FemL), anal suture length (AnL), and tail length (TaL) of the captured neonates were measured with digital callipers sensitive to 0.01mm. Colour pattern features were recorded and photographed, and then hatchlings were released into the place where they had been captured.

Results and Discussion

Mating takes place from the beginning of January to June as soon as after hibernation depending on latitude (ERNST & BARBOUR, 1989). Nesting starts in late May in the south, and in early July in the north (ZUFFI *et al.*, 1999; AYAZ *et al.*, 2007). The clutch number varies among different regions (ZUFFI *et al.*, 1999, 2007). In the southern European populations of *E. orbicularis*, females lay their first eggs in the first half of June, with the earliest time being the second half of May, while females in the Central and East European populations generally lay their first eggs in the first half of June (FRITZ, 2001, 2003). On the other hand, there is great variation in the Caucasian Region (FRITZ, 2001, 2003). The number of eggs in a clutch is 3-16, but usually 9-10 (ERNST & BARBOUR, 1989). After approximately 90 to 117 days of incubation, the young hatch from August to late October, depending on the latitude as well as seasonal conditions (LEBBORONI & CHELAZZI, 1991; ANDREAS & PAUL, 1998;

SCHNEEWEISS *et al.*, 1998; SERVAN, 1998; SCHNEEWEISS & JABLONSKY, 2000). Hatchlings have carapaces of 20-25 mm, weigh about 5 g, and have large heads, long tails, and a carapace with a well-developed medial keel (ERNST & BARBOUR, 1989; FRITZ, 2001, 2003). Some neonates may overwinter in nest chambers or on land and emerge in the following spring (BANNIKOV, 1951; ZEMANEK & MITRUS, 1997; MITRUS & ZEMANEK, 1998, 2003; SERVAN, 1998; KOTENKO, 2000; SCHNEEWEISS & JABLONSKY, 2000; NOVOTNÝ *et al.*, 2004; THIENPONT *et al.*, 2004).

Our measurements for the specimens from Lake Sülüklü are presented in Table 1. The average body weight of the specimens was 4.18 (4.0-4.6) g and the median keel and a pair of low lateral keels were evident. Axillary and inguinal scutes are absent. Plastral formula is: Anale > Abdominale > Pectorale > Gularel > Femorale > Humorale. In all specimens, anal suture was the longest, whereas the femoral suture was the shortest. Limbs were covered with small- to medium-sized scales. No abnormalities were encountered regarding the keratin plates on carapace and plastron. Nuchal plates were parallel. Any carapacial horny plate was completely covered by granules, and no growth marks were present (Fig. 1a). The latter features along with the small body size and the relatively big head are clear indicators of a very early post-hatchling developmental stage. The carapaces of all studied hatchlings from Lake Sülüklü were olive brown. The edge of the marginal plates was slightly light yellow. The plastron was distinctly darker. This dark blotches cover at least around two-thirds of the plastron, and only the lateral rim was yellow (Figure 1b). Ground colour of soft parts was blackish with yellow dots.

For the last 20 years, the breeding biology of the European populations of *E. orbicularis* has been studied in detail (e.g. LEBBORONI & CHELAZZI, 1998; ZUFFI *et al.*, 1999, 2007). However, in Turkey, reproductive biology of the European pond turtle has not been investigated yet, except for a few observations made by AYAZ (2003). He observed the mating behaviour of *E.*

orbicularis in the Aegean Region at the beginning of May and discovered eggs in a nest built at a distance of about 16 meters from water in Turkey's Lake District on July 2, 2001, which was later destroyed by predators.

Table 1. Morphometric data of neonates of *Emys orbicularis* from Lake Sülüklü (Manisa/Turkey)

Charac- ters	n	Mean+SE	Range	SD
SCL	4	26.48+0.40	25.82-27.58	0.80
PL	4	23.74+0.23	23.22-24.20	0.46
CH	4	18.24+3.19	12.15-24.14	6.38
CW	4	18.40+3.30	12.67-24.97	6.60
GuL	4	3.94+0.27	3.13-4.30	0.55
HuL	4	2.68+0.31	2.20-3.60	0.63
PecL	4	3.57+0.16	3.24-3.97	0.31
AbdL	4	3.49+0.23	2.85-3.86	0.45
FemL	4	2.10+0.18	1.77-2.58	0.36
AnL	4	6.52+0.13	6.30-6.90	0.27
TaL	3	23.13+0.29	22.67-23.66	0.50

Located among high and steep mountains in the north of western Taurus Region, Turkey's Lake District comprises a number of lakes of various sizes (e.g. Lake Beyşehir, Lake Eğirdir, etc.). He reported that turtles laid their eggs in captivity between early June and the first week of July. Moreover, AYAZ (2003) presented measurements for hatchlings from the Lake District in early July. Considering these findings, it can be concluded that hatching in Turkish populations starts in early July and continues till the end of summer. Mating was observed to be in April-May in Lake Sülüklü supporting the findings by AYAZ (2003).

In the present study, the average straight-line carapace length of the neonates captured from Lake Sülüklü was calculated as 26.48 mm and their average weight as 4.18 g. FRITZ *et al.* (2006) stated that in different subspecies of *E. orbicularis*, the values of carapace length ranged from 23.4 to 30.8 mm and the values of weight from 3.7 to 6.7 g. Likewise, DROBENKOV (2000) gave the average straight-line carapace length of hatchlings in the populations in the north of the distributional range of the

species as 28.0 mm (25.9-29.0) and the average weight as 6.1 (5.65-6.45) g. At the same time, AYAZ *et al.* (2007) reported a neonate, captured from Lake Uluabat and having a straight-line carapace length of 22.3 mm, for the first time for Turkey. The results we obtained in our study remain within the limits of the values given in the above-mentioned studies, and the fact that no growth ring was observed in our specimens reveals that they were neonates (Figure 1b).

Related studies have reported that more than one egg-laying occur annually in many European populations and specimens that hatch at the end of summer spend their first winter in the nest (RÖSSLER, 2000a, b; also see the reviews in FRITZ, 2001, 2003). The neonate we captured probably hatched from an egg towards the end of the reproduction period and exhibited overwintering behaviour due to unfavourable climatic conditions.

The climate of the Aegean Region is partly continental and partly Mediterranean (TURKISH ECOLOGY FOUNDATION, 1993). In areas where the dominant climate is continental, environmental conditions can significantly change in a very short period of time. It is likely that Lake Sülüklü, located in the north-eastern slope of Mt. Spil (1,517 m a.s.l.), has an important impact on the changing environmental conditions. Probably, the bad weather conditions in some years stimulate the overwintering behaviour of hatchlings.

According to our observations in the study area, this area is convenient for both egg laying and the overwintering behaviour of neonates. Nevertheless, it is extremely difficult to state whether the overwintering behaviour is spent in the nest (e.g. KOTENKO & FEDORCHENKO, 1993; MITRUS & ZEMANEK, 2003) or on land after leaving the nest (e.g. BANNIKOV, 1951). Clarification of this dilemma will make a great contribution to the breeding behaviour of the species.

References

- ANDREAS, B., R. PAUL 1998. Clutch size and structure of breeding chambers of *Emys o. orbicularis* in Brandenburg. - *Mertensiella*, 10: 29-32.



Fig. 1. Dorsal (a) and ventral (b) view of two neonates of *Emys orbicularis* from Lake Sülüklü (Manisa/Turkey)

- AYAZ, D. 2003. *Göller Bölgesi ve Doğu Akdeniz Bölgesi Emys orbicularis (Testudinata: Emydidae) ve Mauremys rivulata (Testudinata: Bataguridae) türlerinin sistematik durumu, morfolojisi, dağılışı, üreme ve beslenme biyolojisi üzerine araştırmalar*. Ph.D. thesis, Ege University Graduate School of Natural and Applied Sciences, 239 pp. (In Turkish with English summary).
- AYAZ, D., C.V. TOK, K. ÇİÇEK 2007. Overwintered hatchling of *Emys orbicularis* (Linnaeus, 1758) observed in Turkey. - *Herpetozoa*, 19(3/4): 189-192.
- BANNIKOV, A.G. 1951. Materialy k poznaniyu biologii kavkazkikh cherepakh. - *Uchebnye Zapiski Moskovskogo Gorodskogo Pedagogicheskogo Instituta imeni V. P. Potemkina*, 18: 129-167. (In Russian)
- COX, N.A., H.J. TEMPLE 2009. *European red list of reptiles*. Luxembourg: Office for Official Publications of the European Communities, 32pp.
- DROBENKOV, S.M. 2000. Reproductive ecology of the pond turtle (*Emys orbicularis* L.) in the Northeastern part of the species range. - *Russian Journal of Ecology*, 31(1): 49-54.
- ERNST, C.H., R.W. BARBOUR 1989. *Turtles of the World*. Washington, DC. Smithsonian Institution Press. 314 p.
- FRITZ, U. 2001. *Emys orbicularis* (Linnaeus, 1758) - Europäische Sumpfschildkröte. In: FRITZ, U. (Ed.): *Handbuch der Reptilien und Amphibien Europas, Band 3/IIIA: Schildkröten I*, Aula, Wiebelsheim, pp. 343-515.
- FRITZ, U. 2003. *Die Europäische Sumpfschildkröte*. Bielefeld, Laurenti, 224 pp.
- KOTENKO, T.I. 2000. The European pond turtle (*Emys orbicularis*) in the steppe zone of the Ukraine. - *Stapfia* 69: 87-106.
- FRITZ, U., S. D'ANGELO, M.G. PENNISI, M. LO VALVO 2006. Variation of Sicilian pond turtles, *Emys trinacris* - What makes a species cryptic? - *Amphibia-Reptilia* 27: 513-529.
- KOTENKO T.I., A.A. FEDORCHENKO 1993. Reproductive cycle of *Emys orbicularis* in the Danube Delta. - In: Llorente, G.A., A. Montori, X. Santos, M.A. Carretero (Eds.): *7th Ordinary General Meeting Societas Europaea Herpetologica*. Universitat de Barcelona, Barcelona, pp. 86.
- LEBBORONI, M., G. CHELAZZI 1991. Activity patterns of *Emys orbicularis* L. (*Chelonia Emydidae*) in central Italy. - *Ethology Ecology and Evolution*, 3: 257-268.
- MITRUS, S., M. ZEMANEK 1998. Reproduction of *Emys orbicularis* (L.) in Central Poland. - *Mertensiella*, 10: 187-191.
- MITRUS, S., M. ZEMANEK 2003. European pond tortoise, *Emys orbicularis*, neonates overwintering in the nest. - *Herpetological Journal*, 13: 195-198.
- NOVOTNÝ, M., S. DANKO, P. HAVAŠ 2004. Activity cycle and reproductive characteristics of the European pond turtle (*Emys orbicularis*) in the Tajba National Nature Reserve, Slovakia. - *Biologia*, 59(14): 113-121.

- PARDE, J.-M., S. HURSTEL, A.-C. LEFEVRE 2000. Etude eco-ethologique de la Cistude d'Europe dans le Bas-Armagnac (Gers, France), en vue de sa conservation. - In: BUSKIRK, J., J. SERVAN (Eds): *Proceedings of the 2nd International Symposium on Emys orbicularis*. Chelonii 2, pp. 73-82.
- RÖSSLER, M. 2000a. Die Fortpflanzung der Europäischen Sumpfschildkröte *Emys orbicularis* (L.) im Nationalpark Donau-Auen (Niederösterreich). - *Stapfia* 69: 145-156.
- RÖSSLER, M. 2000b. The ecology and reproduction of an *Emys orbicularis* population in Austria. - *Stapfia* 69: 69-72.
- SCHNEEWEISS, N., A. JABLONSKY 2000. The reproduction of *Emys orbicularis* in relation to climatic factors in northeast Germany and eastern Poland. - In: BUSKIRK, J., J. SERVAN (Eds): *Proceedings of the 2nd International Symposium on Emys orbicularis*. pp. 83-87.
- SCHNEEWEISS, N., B. ANDREAS, N. JENDRETZKE 1998. Reproductive ecology data of the European pond turtle (*Emys o. orbicularis*) in Brandenburg, Northeast Germany. - *Mertensiella*, 10: 227-234.
- SERVAN, J. 1998. Ecological study of *Emys orbicularis* in Brenne (Central France). - *Mertensiella*, 10: 245-252.
- THIENPONT, S., A. CADI, R. QUESADA, M. CHEYLAN 2004. Overwintering habits of the European pond turtle (*Emys orbicularis*) in the Isère department (France). - *Biologia*, 59(14): 143-147.
- TURKISH ECOLOGY FOUNDATION 1993. *Wetlands of Turkey*. - Ankara, Türkiye Çevre Vakfı Yayını, Önder Matbaası, 225pp. (In Turkish)
- ULTSCH, G.R. 2006. The ecology of overwintering among turtles: where turtles *overwinter* and its consequence. - *Biological Reviews*, 81(3): 339-367.
- ZEMANEK, M., S. MITRUS 1997. Biologia i ochrona zolwia blotnego *Emys orbicularis* w województwie radomskim. - *Chrońmy Przyrodę Ojczystą*, 53: 67-83.
- ZUFFI, M.A.L., F. ODETTI 1998. Double egg deposition in the European pond turtle, *Emys orbicularis*, from central Italy. *Italian Journal of Zoology*, 65: 187-189.
- ZUFFI, M.A.L., A. CELANI, E. FOSCHI, S. TRIPEPI 2007. Reproductive strategies and body shape in the European pond turtle (*Emys orbicularis*) from contrasting habitats in Italy. - *Journal of Zoology*, 271: 218-224.
- ZUFFI, M.A.L., M.F. DI BENEDETTO, M.E. FOSCHI 2004. The reproductive strategies in neighbouring populations of the European pond turtle, *Emys orbicularis*, in central Italy. *Italian Journal of Zoology* 2 (Suppl.): 101-104.
- ZUFFI, M.A.L., F. ODETTI, P. MEOZZI 1999. Body-size and clutch-size in the European pond turtle, *Emys orbicularis*, from central Italy. *Journal of Zoology*, 247: 1-8.

Received: 14.02.2011

Accepted: 14.07.2011