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Description of an Euphrates Softshell Turtle (*Rafetus euphraticus*) nest from the Tigris River (SE Turkey)

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Abstract. We present a first description of a single nest of the endangered Euphrates softshell turtle *Rafetus euphraticus* from the Tigris River in south-eastern Anatolia on 13th June 2009. The nest was excavated 4.12 m from the shoreline on a uniformly rising sand slope, reaching 1 m above the water table. The distance from the surface to the nest chamber was about 13 cm. Eggs were spherical, 29.47 mm ± 0.29 in diameter, and weighed 13.6 g ± 0.34 (n = 32). Sand grain size was predominantly (96.25%) 0.149 to 0.42 mm. The species is seriously threatened in this region by dam projects and routine sand mining.

Key words. Conservation, eggs, nest, Testudines, Trionychidae, *Rafetus euphraticus*, south-eastern Turkey, Tigris.

Introduction

The geographic range of Euphrates softshell turtle (*Rafetus euphraticus* Daudin, 1802) is limited to the Euphrates and Tigris basins of Turkey, Syria, Iraq, and Iran (Taşkavak & Atatür 1995, 1998, Ghaffari et al. 2008). The species has been categorized in the "Red List of Threatened Species" as Endangered (EN) since 1996, with the annotation "needs updating" (European Reptile & Amphibian Specialist Group 1996). The main cause for population decline is habitat destruction (e.g., Gramentz 1991, Taşkavak 1995, Ghaffari et al. 2008). Kinzelbach (1986) suggested that *R. euphraticus* in Mesopotamia should be considered as an endangered species because of the intensive use of its habitats by humans for water supply, irrigation, fisheries, or by water pollution. The situation turned critical, however, with the building of a series of dams both on the Euphrates and Tigris between 1975 and 2000 in the framework of a comprehensive development project in SE Turkey (known as "GAP"). Drastic changes in environmental conditions caused by the dam projects on the Euphrates lead to a serious population decline in *R. euphraticus* (Gramentz 1991). For instance, a population near Halfeti observed in 1989 was extirpated by 1991, and had apparently been caused by a drop in water temperature due to ongoing construction of the Atatürk dam approximately 60 km upstream (Gramentz 1991, 1993). Now, the Turkish part of the Euphrates is almost completely altered from a lotic to lentic habitat, and there are already five active dams on the Tigris and its tributaries.

The reproductive biology of this species is little known. Here, we present the characteristics of a *R. euphraticus* nest and eggs from the Tigris River in south-eastern Anatolia.

Materials and methods

This survey was carried out at the Tigris River in south-eastern Anatolia, Turkey. The climate in south-eastern Anatolia is hot and dry in summer. Mean ambient temperatures in the study region in June have been given as 26.1 to 26.8°C for the period 1975–2008 (DMI 2009).

The nest site was discovered on 17th June 2009 with the help of a local fisherman. He pointed out a beach where he had regularly witnessed softshell turtles laying eggs in recent years. He also shared his observation of one or two turtles having visited the beach, probably for oviposition, four days prior to the survey date. For conservation reasons, no topographic map, geographical coordinates and local name of the site are disclosed here.

We inspected several sites in the area where eggs could possibly have been buried, clearing the sand layer carefully with the aid of a gardening shovel, and feeling for harder structures like those of eggs if there were any. After a systematic search between 10:00 am and 12:30 pm, we found a nest. No additional nest cavities could be detected in the area. The sand was removed by hand until the egg chamber appeared. The eggs were removed for counting, measuring and weighing. Egg measurements were taken on the spot, using a digital slide callipers with an accuracy of 0.01 mm. The eggs were weighed by means of a portable digital scale to the nearest 0.1 g. Nest dimensions were taken with a measuring tape (4 m max.) and a metal ruler (12 cm).

In order to keep the nesting spot as undamaged as possible, a sample of the sand (ca. 3 kg) was collected from a spot close to the nest at about 30 cm deep. The sample was dried in open air for several weeks and than weighed on a digital scale to the nearest 0.01 g. Volume was measured

in a graduated cylinder to the nearest 0.5 ml, always after vibrating it for 5 minutes on a standard shaker. Weight and volume of the test material were highly correlated (Pearson's correlation coefficient was 0.999).

We used a serial of test sieves (No. 30, 40, 60, 80, 100, 200 and 250, corresponding to 0.063 mm to 0.59 mm mesh size) to ascertain the sand grain distribution. Average density of the sample was calculated by using the values obtained from sixteen subsamples, ranging from 10.5 to 1000 ml, in which both weight and volume were virtually measured. The physical characteristics of the sand were analysed at the materials laboratory of the faculty for construction and engineering at the local university.

No information is available on the subsequent fate of the nest, because it was not revisited.

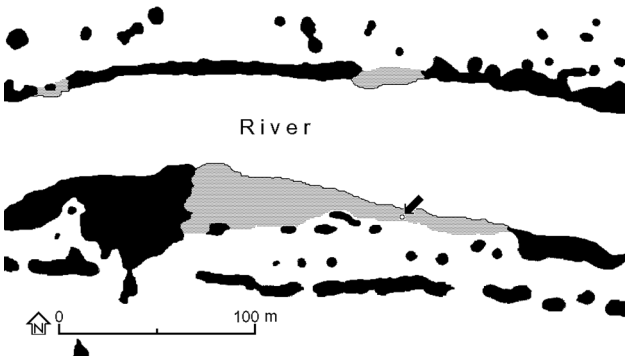

Figure 2. Schematic illustration showing the nesting site of *Rafetus euphraticus* at the Tigris, Turkey. The patterns indicate tree or bush vegetation (*dark*), sandy zones (*dotted*) and steppe (including a few rocky areas) (*blank*). The dark arrow and the circle point out the location of the nest chamber.

Results

The general appearance of the nest site is shown in Figure 1. At the nest site, the river was flowing in a single bed, without any branches, islands or adjacent ponds, and its width ranged from 45 to 70 m. The current was fast in a W–E direction. The water table was at its middle level, and the water was clear and of intermediate quality in accordance with the season. Water surface temperatures were 17 and 18°C at 09:30 am and 01:30 pm, respectively. There were a few sandy patches on the shore, which were always separated from each other by large silt banks and had vegetation on them. These sandy areas were surrounded mainly by shrubs (predominantly *Tamarix* sp.) and herbs growing on the alluvial sediments and a few trees (e.g., *Populus euphratica* and *Salix* sp.). Aside from the Caspian pond turtle (*Mauremys caspica caspica*), no other river turtle species were present in this habitat,.

On the southern shore, there was a remarkably large accumulation of fine-grained sand. The accumulation measured 5.0 to 10.5 m in width, 130 m in length, and up to 165 cm in height from the water table. The whole section was free of pollution, and no industrial contaminants or domestic waste were detected either on the surface or at several levels of depth.

Figure 1. View of the nesting habitat of *Rafetus euphraticus* at the Tigris River, Turkey.

The nest was situated towards the far edge of this strip of sand (Figures 2, 3). Its distance to the shoreline was 4.12 m on a slight and homogenous incline of ca. 14°. The nest chamber was about 13 cm deep. The hollow space above the eggs was round or slightly ellipsoid in shape with ca. 9–10 cm in diameter. The eggs had been deposited as a single cluster and more or less at three strata. Some sand filled the gaps between the eggs especially at the lowest stratum without fully covering eggs' surfaces. Temperature was measured as being 22°C in the nest chamber at 12:30 pm, immediately after its detection, whereas sand temperatures at a depth of ca. 30 cm were 23 and 23.5°C at 10:30 am and 12:15 pm, respectively.

The clutch consisted of 32 eggs (Figure 4). The eggshells were hard, with a pinkish colour that nearly half covered most eggs, suggesting that the clutch was fresh. The eggs were spherical in shape, 29.47 mm ± 0.29 (mean ± SD, range: 28.81–29.93 mm, n = 32) in diameter, and weighed 13.6 g ± 0.34 (mean ± SD, range: 13.0–14.2 g, n = 32).

The nesting substrate was pure sand with the density of the total sample being 1.32 g/cm^3 ± 0.23 (mean ± SD, n = 16). Most of it (96.25% in weight) consisted of particles between 0.149 and 0.42 mm (Table 1).

Discussion

According to Gramentz (1991, from Griehl 1981), oviposition occurs from end of May to early June in Birecik in the Turkish (upper) part of the Euphrates; nests are excavated to about 50 cm deep, and clutchs may comprise as many as 30 eggs. Our findings are consistent with this statement.

With a diameter of 23.34 mm ± 0.13 (n = 19), the eggs taken from two dissected females by Taşkavak & Atatür (1998) are completely out of the range of naturally laid ones even though standard deviation values of not more than ca. 0.6 and 1% of the mean show a remarkable degree of conformity and the ranges extend only by 3.8% in diameter and 8.8% in weight. Unfortunately, small sample sizes prevent us from making conclusive inferences for comparison. Although the same limitation also applies to the

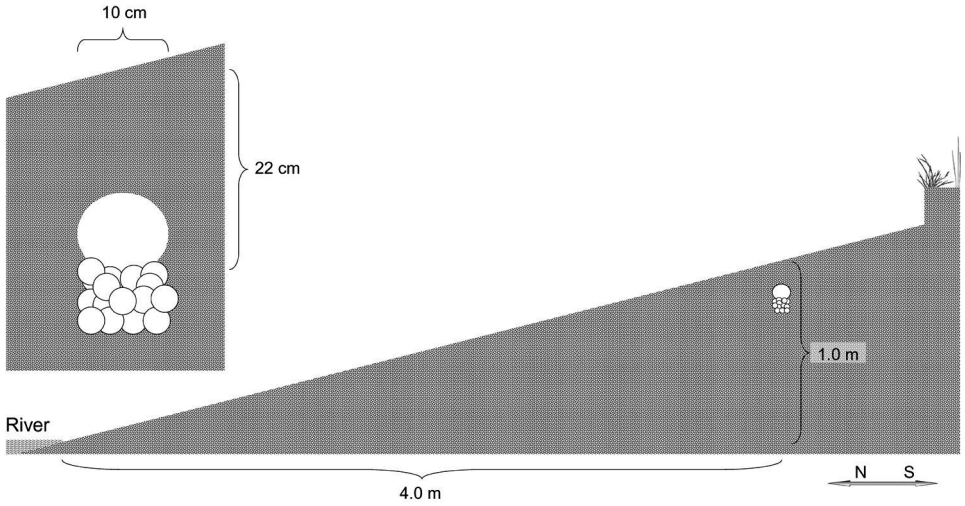

Figure 3. Diagram showing the dimensions of the nest of *Rafetus euphraticus* at the Tigris, Turkey (for details, see text).

Figure 4. Eggs from a single clutch of *Rafetus euphraticus* at the Tigris, Turkey.

eggs of the closely related Nile softshell turtle (*Trionyx triunguis*), it is noteworthy that the eggs of *R. euphraticus* we measured are obviously smaller than those of *T. triunguis* for which four mean values ranging between 31.76 and 36.04 mm (n = 50) were given by Gramentz (2005). This may be primarily a function of different body masses in the two species, with *T. triunguis* growing larger (max. 101.5 cm in carapace length) than *R. euphraticus* (max. 63 cm) (Ernst et al. 2009).

In the study area, the Tigris River has relatively few sandbanks and sand beaches. We presume that the scarcity of available nesting spots is one of the most significant limiting factors for the reproduction of *R. euphraticus*. A comparison of the distances and heights of the nests relative to the water edge indicates that *R. euphraticus* might use lower places closer to the water line than *T. triunguis* (Gramentz 2005). The position of the nest towards the far border of the sandy area could be the result of a spontaneous use of a less suitable spot caused by scarcity of more appropriate nesting places. Moreover, use of the larger sandbanks near the nesting spot (e.g., at the westernmostend; see Fig. 2) may be pre-empted by their intensive utilization by local people although they could possibly be better suited for nesting.

The relatively high content of fine to medium sand we determined is similar to the pattern described by Bonach et al. (2007) for Giant Amazon Turtle (*Podocnemis expansa*) nests at the Araguaia River in the Amazon basin (Brazil) for instance, and to that found by Gramentz (2005) in one nesting spot of *T. triunguis* at Dalyan, but differs from another natural nesting spot at Lake Kükürt (both SW Turkey) where the coarser fraction (larger than 0.63 mm) of grains and organic substrates was remarkably higher (ca. 26%). In spite of the small extent of data available for comparison, this difference could possibly be associated with *R. euphraticus* being more particular to nesting in finer sand. This assumption may find support in our observations that showed the absence of nests on shores covered by coarser sand in other sectors of the river. The lack of relatively fine sand on riverbanks is essentially a consequence of extensive sand quarrying throughout the region. Quarrying sand is particularly common in the vicinity of large cities on the Tigris or its tributaries like Diyarbakır and Batman and is no longer done with traditional tools like shovels and small carriers, but with large industrial machinery. Thus, it took only a very short time to bring about substantial destruction (Moll & Moll 2004).

Table 1. Distribution of sand granulation of a nesting spot of *Rafetus euphraticus* at the Tigris River in south-eastern Anatolia, Turkey.

Grain size (mm)	Weight (%)	Volume (%)
>0.59	0.97	1.8
0.590–0.420	0.02	(beyond measurable limits)
0.420–0.250	31.37	30.7
0.250–0.180	49.33	48.7
0.180–0.149	7.59	7.6
0.149–0.075	7.96	8.2
0.075–0.063	1.04	1.1
<0.063	1.72	1.9

Taşkavak (1995) concluded that dams, besides quarrying sand, was a major threat to *R. euphraticus* in Turkey. Dams prevent upstream sediment from replacing what is lost through erosion downstream. As long as no dams were present upstream, the lost sand deposits would be replaced whenever the river flooded, but now they disappear forever (Moll & Moll 2004). This is presently the case in the upper parts of the Tigris where five small to medium-sized dams (Devegeçidi, Kralkızı, Dicle, Göksu and Batman) have suppressing effects on natural sand renewal. Even more substantial damage may in the future be caused by the construction of the large dam Ilısu. Once completed, this hotly debated dam will flood ca. 300 km² of land along some 136 km of the river, including the nesting site described here.

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