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Notes on a Nest and Emergence of Hatchlings of the Euphrates Softshell Turtle (*Rafetus euphraticus*) at the Dez River, Iran

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ABSTRACT. – We report on a Euphrates softshell turtle (*Rafetus euphraticus*) nest and hatchlings that emerged from the nest that was constructed in a sand patch of the Dez River in southwestern Iran and discovered on 8 July 2012. Information on nest location and structure and hatchling morphology is presented.

Freshwater turtles are long-lived animals characterized by low mortality in adults but often high mortality in embryonic and hatchling stages (Cagle 1950; Gibbons 1968; Moll and Legler 1971; Wilbur 1975). An important source of mortality for hatchlings is emergence and dispersal from the nest, which often entails high risk because of the increased exposure to predators, temperature extremes, and desiccation while the hatchlings find their way to water (Plummer 2007). Most of our knowledge regarding emergence of hatchling turtles comes from the many studies on sea turtles (e.g., Dial 1987; Witherington et al. 1990; Hays et al. 1992; Gyuris 1993; Godfrey and Mrosovsky 1997), while emergence behavior of freshwater turtle hatchlings is less well known (Doody 1995; Kuchling 1999; Doody et al. 2001; Butler et al. 2004; Plummer 2007).

The Euphrates softshell turtle (*Rafetus euphraticus* Daudin 1802) is a medium-sized trionychid turtle with a geographic range confined to the Euphrates and Tigris basins of Turkey, Syria, Iraq, and Iran (Taşkavak and Atatür 1995, 1998; Ghaffari et al. 2008; Biricik and Turğa 2011). The range of *R. euphraticus* in Iran is limited to Khuzestan Province. It is one of the biologically least known trionychid species and is probably the most threatened freshwater turtle in Iran (Ghaffari et al. 2008).

The reproductive biology of the Euphrates softshell turtle is poorly known (Biricik and Turğa 2011), and there is no information on the species concerning hatchling morphology or emergence from natural nests in Iran. This article provides data on the characteristics of a Euphrates softshell turtle nest, hatchling emergence, and hatchling morphology from the Dez River in Khuzestan Province, Iran.

Study Area. — The Dez River flows southward from the mountain regions north of the cities of Dezful and Andimeshk onto the Khuzestan plain. The river has alluvial soil and sandy banks that provide suitable nesting habitat for *R. euphraticus* (Ghaffari et al. 2008). The vegetation along the banks and sandbars of the Dez River consists of *Tamarix* sp., *Populus euphratica*, *Lycium shawii*, *Vitex pseudonegundo*, *Salix* sp., *Capparis spinosa*, *Prosopis stephaniana*, and *Calotropis procera*. The climate of Khuzestan is generally hot and humid (Ghaffari et al. 2008). From 2005 to 2010, the mean ambient temperature at the Dezful station was 34°C in June and 36°C in July (Anonymous 2012).

Methods. — During the *R. euphraticus* breeding season in June and July, we conducted field surveys for possible nests on sandbars in the counties of Dezful and Andimeshk, Khuzestan Province. After the single nest described in this article was found, we centered a 4-m^2 plot on the nesting site. Within this area, we counted and measured the number of tree stems per square meter, the number of tree species, the number of shrub species, tree height, and distance to nearest tree within the plot. Tree and shrub height were ranked into 4 categories (< 0.5 m, 0.5–2 m, 2–5 m, and > 5 m). The distance between the river and the nest and nest dimensions were measured

Figure 1. Euphrates softshell turtle nest location (left) and close-up of nest chamber (right) at the Dez River, Khuzestan, Iran. Photo by Hanyeh Ghaffari.

with a tape and metal ruler. Soil temperature was determined with a mercury laboratory thermometer. Soil samples were collected at depths of 0–20, 20–40, and 40–60 cm from the closest point to the nest chamber and a randomized location around the nesting site. The soil samples were weighed on a digital scale to the nearest 0.01 g. We used a serial of test sieves comprising Nos. 0.2, 1.5, 1, 3.4, 3.8, 3.16, 8, 16, 30, 50, 100, and 200 with 50–0.075-mm mesh sizes for grain size determination.

Immediately after hatchling emergence from the nest, we measured their morphometric characteristics with digital calipers to the nearest 0.01 mm and weighed hatchlings with a digital scale to 0.01 g. While measuring hatchlings, we followed the morphometric protocol described by Taşkavak (1998). After measurement, hatchlings were released into the river at the point nearest the nest.

Results. — On 8 July 2012, a nest (Fig. 1) was discovered while Euphrates softshell hatchlings were emerging on a sandbar 1.20 km from the village of Zavieh Mash Ali, Dezful County, in the vicinity of the Dez River.

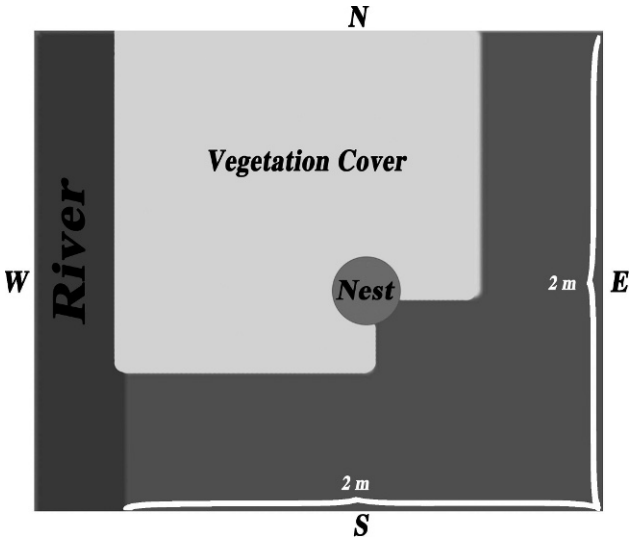

Figure 2. Location of nest chamber toward vegetation cover and river in a 4-m^2 plot.

In the nest site area, the dominant vegetation included *Typha domingensis*, *Populus euphratica*, *Tamarix* sp., *Ziziphus spinachriti*, and *Vitex pseudonegundo*. The river near the nest site was 4–5 m wide and 70 cm deep; at 10 m upstream from the nest, the river was 2–3 m wide and 20 cm deep; at 10 m downstream from the nest, the river was 8–10 m wide and 100 cm deep. The water current was slow and flowed southward.

The nest was situated in a sand patch; there were no rocks, gravel, or stones at the nest site, although most parts of both sides of the river contained gravel and rubble. It was situated under tamarisks (*Tamarix* sp.) and a nabk tree (*Z. spinachriti*). Canopy cover directly over the nest chamber was 90%. Vegetation cover density in the 4-m^2 plot centered on the nest location was 44% (Fig. 2). The total number of woody stems with a diameter of $\geq$ 4 cm within the plot was 12, and the height of tallest woody stem was 5 m. Sixty percent of stems were 2–5 m tall, and 40% were 0.5–2 m tall. The distance to the nearest tree stem was 30 cm. The direct distance from the nest to the river was 2.3 m, and the height of nest site to the water level was 90 cm (Fig. 3). The nest was 40 cm above the most recent high-water mark.

The surface soil temperature in the vicinity of nest site was 49°C. The nesting soil was composed of silt (77%) and sand (23%) with a density of 1.47 g/cm^3. Grain size was smaller than 0.6 mm.

Thirty-six Euphrates softshell hatchlings emerged on the day of nest discovery at 1730 hrs (Fig. 4). The mean time between emergence of the first and last hatchlings was 25 min. One unhatched egg remained in the nest and was infertile (total clutch size = 37).

The hatchling carapace is oval with tubercles arranged in longitudinal rows. Tubercles are absent on the marginal parts of carapace. The ground color of the carapace is olive gray with scattered light spots and black blotches. The light spots on the sides of the neck are distinctly larger than the spots on the head and carapace. The plastron is sandy gray to sandy yellow colored. The mean carapace length (± SD) for 6 hatchlings was 41.5 ± 1.4 mm (range 39.3–43.5 mm),

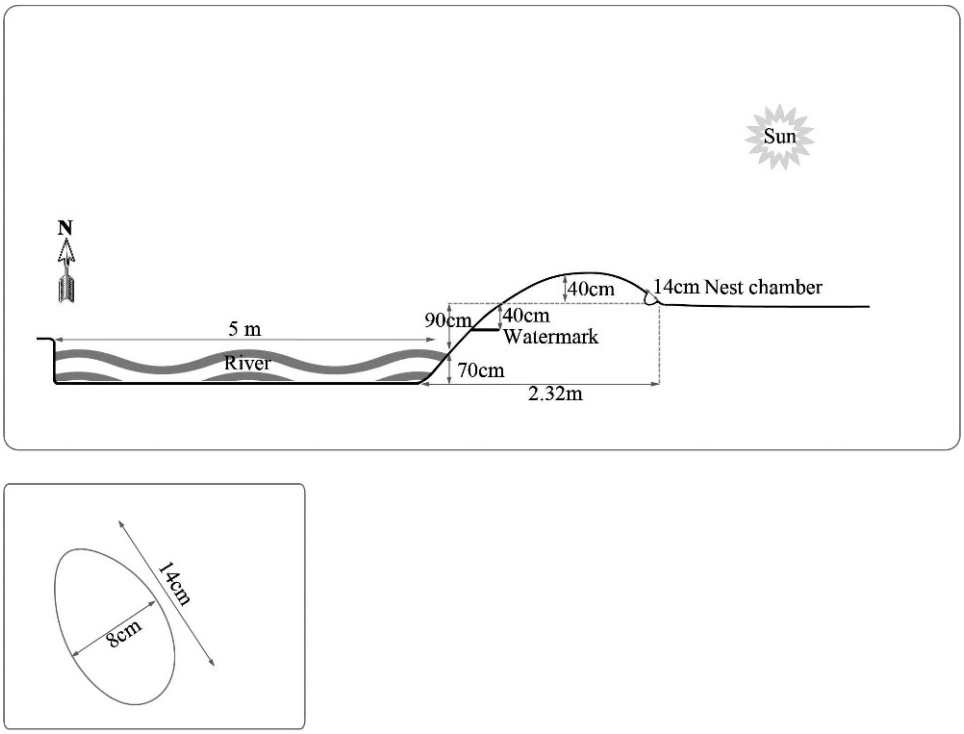

Figure 3. Dimensions of *a Rafetus euphraticus* nest at the Dez River, Iran (illustration by Mina Aghvami).

and the mean mass was 10.8 ± 0.64 g (range 9.61–11.47 g). Additional morphological features of the 6 hatchlings are given in Table 1.

Discussion. — Little is known about the reproduction of the Euphrates softshell turtle. Oviposition has previously been reported to occur toward the end of May to early June (Griehl 1981; Gramentz 1991). Ghaffari et al. (2008) observed egg laying on 2 June 2005 in Iran. Based on the observation of several small juveniles on 15 September 1988 (probably posthatching) at Habes Creek, a tributary of the Euphrates River in Turkey, Taşkavak and Atatür (1998) claimed that oviposition occurs during the spring months. Biricik and Turğa (2011) described a single nest from the Tigris River in southeastern Anatolia discovered on 17 June 2009. Emergence behavior of *R. euphraticus* hatchlings in a natural habitat is also poorly known. Our study shows that *R. euphraticus* hatchlings can emerge from their nest in early July; however, because our sample consisted of only 1 nest, we do not know what the range of emergence dates might be.

Reported distances to water for 4 *R. euphraticus* nests are all less than 5 m (Taşkavak and Atatür 1998; Biricik and Turğa 2011; present study). For 416 *Apalone* softshell nests from 7 localities, distance from nest to water ranged from 5 to 260 m (mean = 66 m; Steen et al. 2012). Variability in the distance of nests to water for sandbar-nesting softshell turtles could be partially due to differences in maximum water level or differences in the slope of the sandbar between the nest and water (Plummer 1976; Doody 1995; Steen et al. 2012).

The nesting substrate of our nest was mostly similar to that reported by Biricik and Turğa (2011). The main difference was that our sample consisted of 77% silt, whereas the Biricik and Turğa (2011) sample consisted of pure sand. The chamber depth of the Dez River nest compared favorably with that of 2 nests reported by Taşkavak and Atatür (1998).

Nest site choice and nest construction often play biologically significant roles in the reproductive fitness of organisms, including turtles (Scholz 2006). Likewise, because emergence from the nest may entail high risks for hatchling freshwater turtles, timing of emergence may also be an important fitness issue. For both sea turtles and freshwater turtles, emergence time for species that nest in vegetated areas occurs typically during the daylight hours, whereas emergence for beach and sandbar nesting species typically occurs during nighttime hours (Doody et al. 2001; Plummer 2007). The Dez River *Rafetus* nest was situated in a vegetated area, and emergence occurred during daylight hours, which is consistent with previous emergence studies (sunset on 8 July 2012 was 2021 in Dezful city; thus, *R. euphraticus* hatchlings emerged 3 hrs before sunset).

The Dez River surface in the vicinity of nest site experienced extreme heat (49°C) at the time of hatchling emergence. Because vegetation cover surrounding a nest typically lowers the nest temperature (Kolbe and Janzen 2002; St. Juliana et al. 2004), nesting within vegetation could affect egg and hatchling survival of *R. euphraticus*. In contrast, the softshell turtle *Apalone mutica* avoids vegetation in the vicinity of its nest and constructs nests

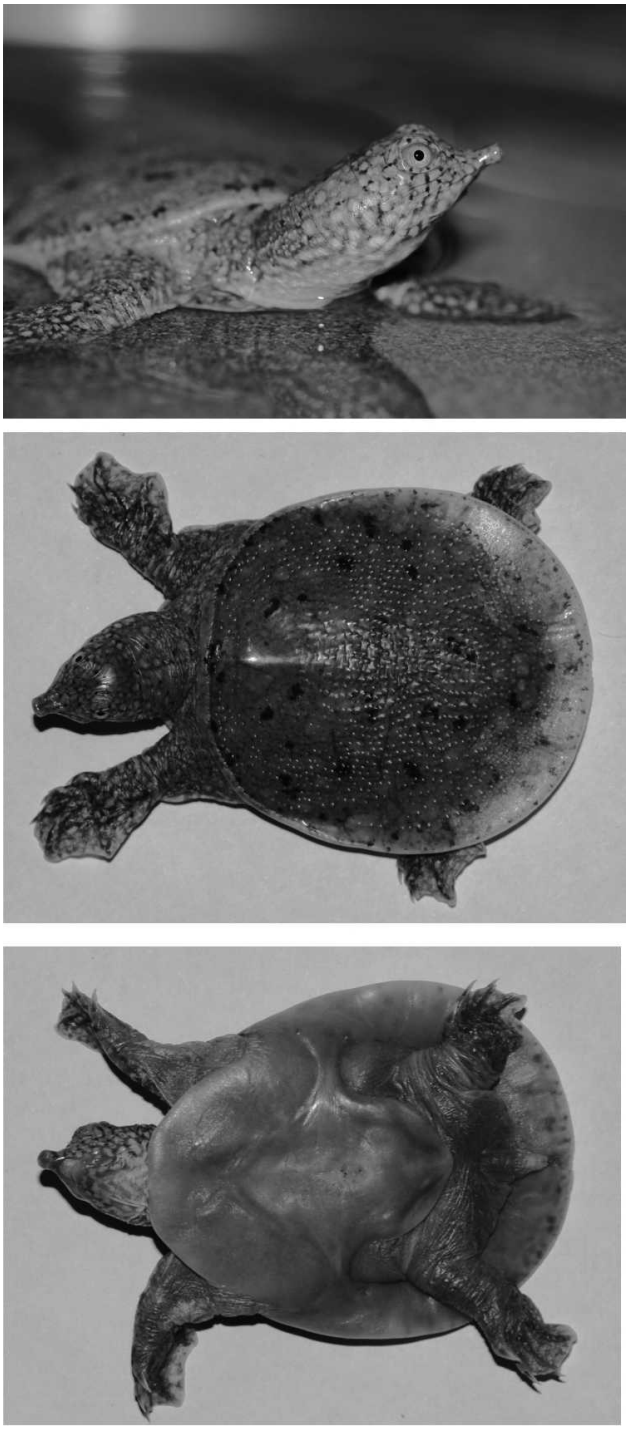

Figure 4. A hatchling Euphrates softshell turtle from the Dez River: head (top), carapace (middle), and plastron (bottom). Photographs by Barbod Safaei Mahroo.

only in clean sand on open sandbars (Fitch and Plummer 1975; Plummer 1976; Plummer et al. 1994; Doody 1995). Eggs of *A. mutica* do not develop above constant temperatures of 33°C, and although the topmost eggs in a nest occasionally experience brief periods of ~ 40°C (Plummer et al. 1994), emergence occurs only when surface temperatures are < 36°C (Plummer 2007).

Table 1. Morphometric measurements (mm) of 6 hatchlings.

Measured character[a]	Hatchlings					
	1	2	3	4	5	6
CL	41.67	40.67	43.52	39.31	41.85	41.72
CW	36.34	36.98	38.83	34.59	37.11	36.99
PL	31.92	30.99	32.03	30.37	33.62	31.20
PW	28.29	33.39	36.28	31.46	34.79	32.48
TL	5.78	4.91	6.09	5.30	5.99	6.80
RL	7.05	7.75	6.73	6.86	7.47	6.09
SL	2.56	2.02	3.06	2.44	2.68	2.59
SW	1.95	2.20	2.05	2.45	2.40	2.70
ID	6.35	5.45	5.90	5.14	5.08	5.54
HW	10.39	10.17	09.96	10.26	10.47	10.71
W	10.98	10.94	11.47	9.61	10.70	11.19

[a] Abbreviations: plastron length (PL), plastron width (PW), carapace length (CL), carapace width (CW), tail length (TL), head width (HW), interorbital distance (ID), snout width (SW), snout length (SL), rostrum length (RL), all in mm; weight (W) in g. Definitions as per Taşkavak (1998).

Freshwater turtle populations and assemblages are influenced by anthropogenic changes at the landscape level (e.g., Rizkalla and Swihart 2006; Sterrett et al. 2011; Steen et al. 2012). In Khuzestan Province, industrial development has resulted in ever-increasing pollution of water sources (Jafarzadeh et al. 2004). In the Dez River basin, 87,716 mt of organic and 93,380 mt of inorganic loads from industries are discharged annually (Ghaffari et al. 2008). Anthropogenic loss of nesting habitat is a major threat in both the Euphrates River and the Tigris River basin especially because of inundation of nesting habitat resulting from dam construction (Taşkavak and Atatür 1998). Other threats to the survival of *R. euphraticus* in Khuzestan Province include fisheries interactions (intentional killing) and physical and chemical habitat destruction resulting from the Iran–Iraq War (Ghaffari et al. 2008).

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