

Distribution and Habitats of the Euphrates Softshell Turtle, *Rafetus euphraticus*, in Southeastern Anatolia, Turkey, with Observations on Biology and Factors Endangering its Survival

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ABSTRACT. – The Euphrates softshell turtle, *Rafetus euphraticus*, largely confined to the Euphrates and Tigris basins, is a thermophilic species. It prefers relatively calm tributaries and oxbow lakes. It is largely carnivorous, but sometimes consumes plant material. The northernmost limit of its range in Turkey in the Euphrates basin is between Karakaya and Atatürk dams. The population in this area is in jeopardy because of decreased temperatures of the dam impoundment waters (min. 7°C, max. 12°C during the summer months) and a lack of suitable sandy banks for nesting. Information on status of the species in the Tigris basin in Turkey is scarce. The three completed dams on the Euphrates (Keban, Karakaya, and Atatürk), and two others under construction (Birecik and Karkamis) seriously threaten the survival of the species in southeastern Anatolia. Former basking and nesting areas are now submerged, and daily water level fluctuations complicate the establishment of new nesting sites. We surveyed the distribution of *R. euphraticus* prior to and after the construction of Atatürk Dam. The number of suitable habitats and apparent population levels have declined and we believe the species is endangered in Turkey.

KEY WORDS. – Reptilia; Testudines; Trionychidae; *Rafetus euphraticus*; turtle; distribution; status; conservation; habitat; ecology; Turkey

The Euphrates softshell turtle, *Rafetus euphraticus* (Daudin, 1802), is known to be thermophilic in habit (Atatürk, 1979; Kasperek and Kinzelbach, 1992). The general distribution of the family is within the tropical-subtropical belt (Webb, 1962; Ernst and Barbour, 1989). The northernmost distribution of *R. euphraticus* is in southeastern Anatolia, Turkey.

Kinzelbach (1986) documented the main factors endangering the survival of Turkish softshells and chronologically recorded the works on the distribution of *R. euphraticus* in Upper Mesopotamia. Gramentz (1991) described specimens from Halite, Ehnes, and Kirkiz in southeastern Anatolia, Turkey, and listed the factors endangering the species. Detailed general distribution maps of *R. euphraticus* were given by Iverson (1992). The species is largely confined to the Euphrates and Tigris basins of Turkey, Syria, Iraq, and the Khuzestan province of Iran.

In this paper we document the distribution and habitats of *R. euphraticus* in the Euphrates and Tigris basins of southeastern Anatolia, Turkey.

METHODS

We performed field surveys to document the presence of *R. euphraticus* in suitable habitats. Most of our observations were made prior to the construction of Atatürk Dam in the Euphrates Basin. Repeat field surveys after completion of the dam and the formation of its impoundment lake allowed us to observe resultant habitat alterations and population changes.

In both the Euphrates and Tigris basins, shallow, relatively calm waters with access to basking and nesting areas were usually chosen for observations, which were made with the naked eye or with binoculars. In some cases, small temporary pools formed during spring floods were also investigated. It was possible to attract softshells by utilizing bait such as poultry meat and intestines, sheep meat, heart and liver, and small carp (*Cyprinus* sp.), or even such plant material as watermelon rinds. Four specimens collected from Bozova were dissected for analysis of their gastrointestinal contents [methods of Atatürk (1979) and Plummer and Farrar (1981)]. All collected specimens were deposited in the Zoology Museum of the Department of Zoology, Ege University Science Faculty (ZDEU). Information on the observations conducted are given in Table 1, and localities shown on the map in Fig. 1. Some of the impoundments shown on the map are presented in their anticipated complete extent.

CLIMATE

Southeastern Anatolia is subject to high pressure zones formed over the Eastern Mediterranean and Siberia during the autumn and winter, and to a low pressure zone usually formed over the Persian Gulf during the spring and summer. The northern part of the region (excepting the vilayets Elazığ and Van) is surrounded by extensions of the southeastern Taurus Mountains, which obstruct the passage of cool air from eastern Anatolia to more southerly parts during the summer. The region has a typical steppe climate: cold winters with scarce precipitation, and hot, arid summers.

Table 1. The examined localities of *Rafetus euphraticus* (numbers correspond to map in Fig. 1) in the Euphrates Basin prior to filling of Atatürk Dam impoundment, and in the Tigris Basin, with number of specimens seen; M = main river, T = tributary or creek, P = pool.

No.	Locality	Date	Water °C	Air °C	Time	No. Spec.	Comments
Euphrates Basin							
1	Hüseyini and Gevrek villages	28.07.1989	26	34	1400	3	
2	Köprü, Zengeçur and Geldik creeks	27.07.1989	19 M 21 T 24 P	35	1100	0 1 8	
3	Haskamil (= Çamdere) Creek	26.07.1989	27	36	1630	3	
4	Geçitazgi (Hilvan, Sanliurfa)	25.07.1989	25 T	35	1730	42	Nests and eggshells seen.
		26.07.1989	18 M		1030	16	
5	Kantar (Bozova, Sanliurfa)	21.07.1989	25 M	36	1000	0	Stomach analysis 2 specimens
		25.07.1989	29 T 31 P	38		25 17	
6	Geçitbasi (Bozova, Sanliurfa)	23.07.1989	24	36	1300	55	1 collected
7	Saska (İgdeli) Village (Bozova, Sanliurfa)	24.07.1989	26 P 18 M	35	1300	7 0	
8	Damlıca Village, (Akpınar, Adıyaman)	31.05.1989	19	28	1500	5	
		01.06.1989	18	30	0900	7	
9	Küncülük (Gölbasi, Adıyaman)	19.05.1989	17-18	28	1100	0	
10	Seske Village (Gölbasi, Adıyaman)	23.05.1989	15-17	28	1330	0	
11	Kisla (Tut, Adıyaman)	25.05.1989	20	29	1400	3	
12	Köklüce and Asagimülk villages (Araban, Gaziantep)	03.06.1989	23	30	1030	2	
13	Habes Creek (Araban, Gaziantep)	04.06.1989	19 M	31	1130	1	
14	Bozatlı Creek (Yavuzeli, Gaziantep)	05.06.1989	26	31	1300	0	Main creek dry, shallow water in pools, 1 carcass seen
15	Birecik, Sanliurfa						
	a-main river	18.08.1988	25	36	1600	1	
	b-connected with river	15.09.1988	24	30	1530	5	Nests and eggshells seen
	c-no connection	16.09.1988	27	31	1300	9	
16	Kirkiz Village (Birecik, Sanliurfa)	19.08.1988	28-30	38	1215	5	
17	Gürçay Village (Nizip, Gaziantep)	19.08.1988	27-29	39	1510	13	1 collected
		17.09.1988	25-27	32	1215	6	
18	Turkish – Syrian Border (main river)	26.12.1991	–	–	–	1	Seen on TV documentary
19	Kisas Village (Sanliurfa)	20.08.1988	–	41	1300	0	Creek totally dry
Tigris Basin							
20	Devegeçiti Dam Road (Diyarbakir)	19.07.1990	37 T	48	1130	1	
21	Road to Dicle University (Diyarbakir)	23.07.1990	31 M	48	1030	7	
22	Kale Altı (Diyarbakir)	22.07.1990	35 M	49	1100	2	
23	Çarıkli Fabrika Village (Diyarbakir)	20.07.1990	33-35 M	49	1200	35	
		21.07.1990	32 P		1400	0	
24	Göksu Creek (Çınar, Diyarbakir)	17.05.1988	20	28	1200	0	Vernacular name: Seliave
		22.07.1990	33	49	1500	5	

The Euphrates River is formed by the junction of Murat and Karasu streams approximately 10 km north of Keban Dam Lake. With a yearly mean flow rate of 635 m³/sec, the Euphrates is one of the most important rivers of Turkey. The flow of the river is seasonally uneven, with 70% of its yearly flow occurring when the snow melts from March to June, and maximal flow in April and May. During the last 30 years, the least flow was 1190 m³/sec in 1961 and the most was 8416 m³/sec on 10 April 1980 (DSI, 1982).

The Tigris River originates from a major spring (Alt. 1220 m) at Hazer Baba Mountain, northwest of Vilayet Diyarbakir, and begins as a stream known as Ergani or Maden. The regimen of the river reflects the climatic conditions of its drainage basin. In spring, melting snow feeds large streams such as the Batman, Garzan, and Botan, originating from the southeastern Taurus Mountains and joining the river from the north. The monthly mean flow rates of the river clearly illustrate the nival effects on its

yearly regimen. Small streams and creeks which join the river from the south have pluvial regimens. The Tigris demonstrates a typical pluvio-nival regimen. The snow of the region usually starts melting in March, and the maximal flow of the river occurs in the second half of April and the first half of May (April mean being 920 m³/sec between 1960–1970), while the minimal flow rate occurs in early fall (September 1965; 73.4 m³/sec, October 1965; 78.6 m³/sec). Fall rains, together with a lessening of evaporation, steadily raise the river level, until the precipitation turns to snow.

Air temperature values of the region for the year 1990, together with 7 reference points in Anatolia, are given in Figs. 2 and 3 (General Directorate of the Dept. of Meteorology of the State, Ankara). These values show that southeastern Anatolia is the hottest region of Turkey in July. During the same month, the middle and eastern Mediterranean coastal strip of Turkey, which coincides with the distribution of *Trionyx triunguis* in the country, has temperatures similar

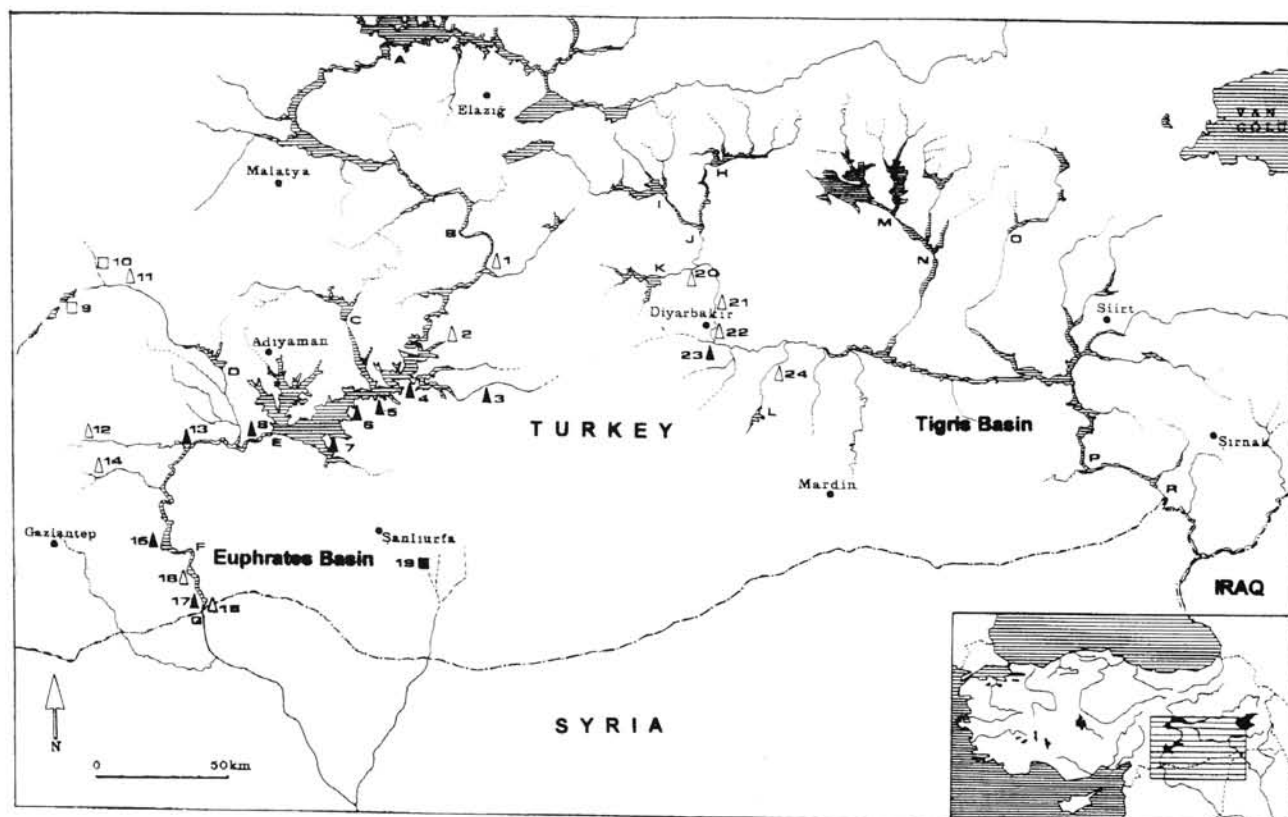


Figure 1. Observation localities of the investigated *Rafetus euphraticus* populations. **Euphrates Basin:** 1. Hüseyini and Gevrek villages (Siverek, Sanliurfa). 2. Zengeçur and Geldik creeks (Siverek, Sanliurfa). 3. Upper Menzilecik and Ekincik villages, Çamdere (Haskamil Creek, Hilvan, Sanliurfa). 4. Geçitgazi (Hilvan, Sanliurfa). 5. Kantar (Bozova, Sanliurfa). 6. Geçitbasi (Bozova, Sanliurfa). 7. Saska (= Igdeli) Village (Bozova, Sanliurfa). 8. Damlica Village (Akpınar, Adiyaman). 9. Küncülük (Gölbasi, Adiyaman). 10. Seske Village (Gölbasi, Adiyaman). 11. Kısila (Tut, Adiyaman). 12. Köklüce and Asagimülük villages (Araban, Gaziantep). 13. Habes Creek and Karasu Stream (Araban, Gaziantep). 14. Bozatli Stream (Yavuzeli, Gaziantep). 15. Birecik, Sanliurfa. 16. Kirkiz Village (Birecik, Sanliurfa). 17. Gürçay (= Gırlavik) Village (Nizip, Gaziantep). 18. Turkish–Syrian Border. 19. Kısas Village (Sanliurfa). **Tigris Basin:** 20. Devegeçidi Dam Road (Diyarbakir). 21. Dicle University Road (Diyarbakir). 22. Kale Altı (Diyarbakir). 23. Çarikli Fabrika Village (Diyarbakir). 24. Çınar, Diyarbakir. **Existing or planned dams:** **Euphrates Basin:** A. Keban Dam (completed). B. Karakaya Dam (completed). C. Kahta Dam (planned). D. Adiyaman Dam (planned). E. Atatürk Dam (completed). F. Birecik Dam (under construction). G. Karkamis Dam (under construction). **Tigris Basin:** H. Dipni Dam (planned). I. Kralkizi Dam (completed). J. Dicle Dam (planned). K. Devegeçidi Dam (completed). L. Göksu Dam (planned). M. Silvan Dam (under construction). N. Batman Dam (completed). O. Garzan Dam (planned). P. Iisu Dam (completed). R. Cizre Dam (planned). ▲ = sample collecting localities, ■ = locality of previously collected samples present in our museum (no specimen seen during this study), Δ = localities of specimens observed by us, but not collected, □ = localities where we could not observe any specimens.

to those of the southeastern Anatolia region (Fig. 2). A sharp rise in temperature is evident in Sanliurfa and Diyarbakir from April to August (Fig. 3).

DISTRIBUTION AND HABITATS

Rafetus euphraticus is rarely seen in deeper fast-flowing sections of the Euphrates. Rather, it usually occurs in side pockets of the main branch where eddies are much slower, at the junctions of various streams and creeks with the main river, and in the numerous tributaries. Specimens were even seen within small pools only 5–6 m in diameter, formed after spring floods or during the first water containment experiment of Atatürk Dam in 1989–90. In the Tigris, we usually observed *R. euphraticus* in the main channel, where the currents were slow and the water temperature was rather high. Juveniles were seen in much shallower and accordingly warmer waters. In southeastern Anatolia, some differ-

ences were evident between the various microhabitats inhabited by *R. euphraticus*. Some of the microhabitats were destroyed by flooding as Atatürk Dam Lake progressively filled.

We now document all of the observation stations visited, as shown on the map given in Fig. 1, with air and water temperatures of these stations, together with number of specimens of *R. euphraticus* observed given in Table 1.

Euphrates Basin, Pre-Atatürk Dam

1. Hüseyini and Gevrek villages. — Adjacent to these villages, 16 km northwest of Ağaçhan, a stream emerging from the direction of Çermik passes within a deep valley of limestone and joins the Euphrates at Kayık Geçidi. This is the northernmost point we reached on the Euphrates. Here, the two banks of the Euphrates were lined with large boulders and the river flowed rapidly between them, forming strong eddies and

whirlpools. Nearby, only 1500–2000 m eastwards, the small stream was very calm. On 28 July 1989 we observed two adult specimens in the water and one basking on a small sand dune near the shore. The shores were hard soil with a few sandy areas, which contained no nest traces or eggs. The main vegetation in this environment was *Cynodon dactylon*, with occasional *Malva sylvestris*, *Cichorium intybus*, *Urtica* sp., *Chondrilla juncea*, *Hordeum bulbosum* and *Poa bulbosa*. In some small plains *Ecbalium elaterium* or *Verbascum lasianthum*, *Minuartia juriperina*, and *Echinops viscosus* were dominant. The creek waters were quite warm (26°C), compared with those of the Euphrates (18°C).

2. *Zengeçur and Geldik creeks*. — These creeks, about 5 km southeast of Bucak, formed small pools where they ceased to flow. These pools were surrounded by wheat fields and occasional *Salix* sp. and *Populus* sp. Shores were formed by hard soil with some rough rocks. In three of the interconnected pools, seven adult specimens of various sizes were observed on 27 July 1989. One of them was on shore about 3.5 m from the water. Water temperature was 25–26°C close to shore at a depth of 30 cm (1100–1200 hrs). Near Hadro and Güngörmez villages 7–8 km northwest of Bucak the main Euphrates flowed very fast, its shore water temperature being 16°C. At the eastern shore of the river, within a pocket where eddies formed a small whirlpool, a large adult specimen was observed on 27

July 1989 lying partially in the water, apparently feeding on unidentified material. The shore was formed by hard soil and large rocks, with an unvegetated 10 m strip parallel to the shore. The near slopes were covered with *Centaurea solstitialis*, *Echium* sp., *Moltkia coerula*, and occasional representatives of Scrophulariaceae, Umbelliferae, Curciferaceae, and Compositae, with a few *Morus* sp. on the hilltops. This environment was not suitable for nesting.

3. *Upper Menzilecik and Ekinlik villages, Çamdere (Haskamil Creek)*. — Here, a large part of Haskamil Creek was dried up to a weak stream, forming pools 40–100 m long where the creek bed was wider and deeper. The environment was similar to that at Zengeçur and Geldik creeks. Several specimens were seen in these lakes on 26 July 1989, as well as numerous *Mauremys caspica caspica* and *Rana ridibunda* in both the pools and on the shores. Shore water temperature was 27°C.

4. *Geçitagi (Hilvan, Sanliurfa)*. — At this locality Haskamil Creek (7–8 m wide) joined the main Euphrates, about 21 km southwest of Hilvan. Here the southern shore of the creek was a muddy, rocky strip 10–13 m wide which became submerged under 50–65 cm of water each day at noontime following the nightly closure of the Atatürk Dam gates in 1989. Excess waters retreated in the afternoon, when we observed many softshell tracks on the mudbank. The juncture of the creek with the Euphrates was also very shallow (approximately 65 cm). The northern shore was covered with fine sand. A nest of 17 softshell eggs had been found in this sandy area at a depth of 25–30 cm by local people in early May, all foul smelling when broken; we saw only the shell fragments of these eggs. On 25–26 July 1989 we also observed 37 specimens basking on the muddy southern shore, and 5 more were seen in the slowly flowing creek waters, moving passively with the current. We followed these up to the juncture of the creek and the Euphrates itself. The turtles did not enter the river, instead returning to the creek. We saw 16 specimens there. The vegetation of the area consisted of a few *Echinops viscosus*, occasional *Centaurea solstitialis*, *Ecbalium elaterium*, *Taraxacum seratinum*, *Moltkia coerula*, various Compositae, and a few species of Cruciferae. Adjacent to this environment were fields cultivated by local people. Water temperature was quite high in the creek (25°C), lessening towards the main Euphrates and reaching a minimum near the main river shores (18°C). This was a very suitable habitat for nesting, but has since been submerged by the waters of Atatürk Dam Lake.

5. *Kantar (Bozova, Sanliurfa)*. — This was a wide major branch of the Euphrates with numerous tributaries, about 35 km from Bozova, forming an ideal habitat for *R. euphraticus*. Some tributaries had wide junctures with the main river, with daily depth fluctuations of 45–70 cm, depending on the closure cycles of Atatürk Dam in 1989. Other tributaries were barely connected to the first group by thin streams, the banks of which showed numerous softshell tracks. We observed that softshells drifted towards the secondary tributaries nocturnally and returned to the primary Euphrates area diurnally. The tertiary area of the locality had no direct contact with the main Euphrates during our stay (21–25 July 1989). Spread over

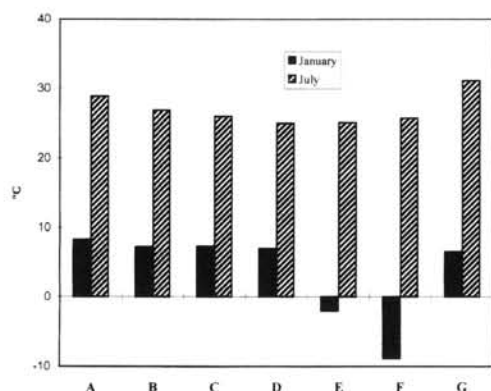


Figure 2. Mean maximal temperatures in various regions of Turkey for January and July 1990. A: Mediterranean, B: Aegean, C: Marmara, D: Black Sea, E: Central Anatolia, F: Eastern Anatolia, G: Southeastern Anatolia.

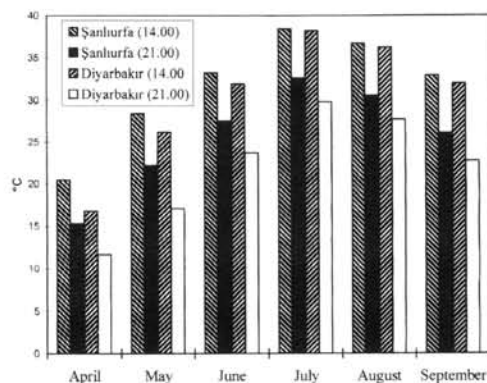


Figure 3. Maximal temperatures at 1400 and 2100 hrs in 1990 in Diyarbakir (Tigris Basin) and Sanliurfa (Euphrates Basin).

almost 4 km, there was a series of pools from 20 m² to 2000 m² in area, even the smallest of which included softshells. Some of these had injuries (ZDEU-24/1989-4 and ZDEU-27/1989-1), which were probably inflicted by people sandmining in the area. The water of the pools looked dirty and cloudy, their bottoms oily and muddy, while in tributaries directly or indirectly connected to the Euphrates the water was relatively clear with soft sand bottoms, occasionally mixed with clay. The pools in the tertiary area were formed by a one-month continuous closure of the dam gates in March–April. Salicacea species were observed on the shores and banks of the tributaries joining the Euphrates; those banks were usually covered with *Cynodon dactylon*. Numerous *Bolboschenus maritimus* and *Typha* sp. were present both on the shores and in shallows. In the surrounding area occasional *Althaea officinalis*, *Anchusa azurea*, *Malva sylvestris* and *Ecbalium elaterium* were present and towards the slopes, *Centaurea solstitialis*, *Helminthotheca echioides*, *Sonchus asper*, *Verbascum lasianthum*, *Avena barbata*, *Prilostemon chamaepeuce*, *Hordeum bulbosum*, *Phragmites australis*, and *Poa bulbosa* were observed. Two bulldozers were present in the area for sandmining before flooding. Water temperatures of the whole system varied from 25°C in the main river to 29°C in the tributaries and 33°C in the pools.

6. *Geçitbasi (Bozova, Sanliurfa)*. — This locality was on the eastern side of the Euphrates opposite Samsat, Adiyaman. Here a shallow side branch joined the main river where sandmining occurred before flooding. The vegetation of the area included *Typha* sp., *Juncus acutus*, *Phragmites australis*, *Arum nickellii*, and *Bolboschenus maritimus*. This was an excellent softshell nesting area. We observed numerous adults as well as a few nests and hatchlings.

7. *Saska (= Igdeli) Village (Bozova, Sanliurfa)*. — A large pool was present southeast of the village, which had been severely impacted by flood waters originating from water-holding experiments at the dam. The pool was connected to the Euphrates by a narrow creek. Many softshells were observed in this pool. The western and southern shores of the pool facing the Euphrates were swampy, and we saw many softshell tracks in the mud. The distance from the pool to the Euphrates proper was 800–1000 m, the banks of the river being hard soil, and the river bottom clay and mud. The water was shallow up to 20 m from shore. Temperature of the lake waters was 26°C, and of the shore waters of the river 15°C. Seven specimens were observed in the lake but none in the river. The swampy area of the lake had no vegetation while the river banks included abundant *Cynodon dactylon*, and occasional *Urtica* sp., *Malva sylvestris*, *Sinapis alba*, and *Convolvulus arvensis*.

In the last three localities, all of which lie just north of Atatürk Dam, numerous softshells and their tracks were observed, but in the few nests examined, no eggs were found. When the dam was completed in 1991, these localities were completely submerged.

8. *Damlıca Village (Akpınar, Adiyaman)*. — This village is adjacent to the bridge on the road from Besni, Adiyaman to Bozova, Sanliurfa. It is 1.5–2 km south of Atatürk Dam, on the shore of the main channel of the Euphrates. The western bank

of the river formed a cove 800–1000 m south of the village, a water area of approximately 1500 m² without obvious eddies. The shores were formed by very hard soil with occasional boulders and pebbles. The vegetation consisted of a few *Anthemis chia*, *Erodium malacoides*, and *Malva sylvestris*, with *Anchusa azurea* towards the slopes, as well as *Onopordum illyricum*, abundant *Centaurea solstitialis*, and *Helminthotheca echioides*. Here, both sides of the Euphrates were formed by high limestone escarpments harboring numerous ancient rock dwellings, which we found very suitable for observing the softshells. We observed 12 adult specimens in this way. Water temperature in the cove at a depth of 1 m was 19°C.

9. *Küncüllük (Gölbasi, Adiyaman)*. — This locality consisted of two connected lakes 1 km northwest of Gölbasi, almost completely surrounded with reeds. A branch of the Euphrates, the Göksu River, is quite close to the lakes, but not connected. The lakes empty into the Mediterranean Sea at Iskenderun Bay, by means of Aksu Creek and Ceyhan River. No softshells were observed at this otherwise suitable region, and the local fishermen did not recognize the species. The water was colder than the other localities (Table 1) but rich in catfish, carp, and the freshwater turtle, *Mauremys caspica rivulata*.

10. *Seske Village (Gölbasi, Adiyaman)*. — This locality was near a tributary of the Euphrates, Göksu River, on the road from Gölbasi to Doganşehir, Malatya, 23 km north of Gölbasi. Here, the fast flowing Göksu was 20–45 m wide in a mountainous area. The bottom was covered with large pebbles and occasional boulders. There were some relatively calm side pockets but no softshells were observed in them. Water temperature was 15–17°C; the vegetation on the banks consisted of *Robinia pseudoacacia*, *Salix* sp., and *Populus* sp.

11. *Kisla (Tut, Adiyaman)*. — The vicinity of Çiftlik and Havutlu villages on Tut road where the Göksu River was wider, relatively slow, and shallow (depth 75–150 cm), the water temperature being 20°C. Two large and one smaller specimens were observed in the water, moving passively with the slow current. Wide sand banks were present on each side of the river but no softshell nests or eggs were found. On the shores, vegetation included *Cynodon dactylon* with occasional *Raphanus* sp., *Convolvulus* sp., and *Lagurus ovatus*.

12. *Köklüce and Asagimülk villages (Araban, Gaziantep)*. — This locality was at Karasu Creek about 27 km west of Araban. A partially dried creek formed some pools and lakes in depressions. One of them, known as Kanligöl, was almost 200 m in length and 45–50 m in width, surrounded with dense *Salix* sp. and *Populus* sp., and numerous *Urtica* sp., *Iris* sp., *Taraxacum serotinum*, *Capsella* sp., *Papaver* sp., and *Alcea* sp. in addition to a dense population of *Arum nickellii*, *Typha angustifolia*, and *Nympha* sp. both in and around the lake, which was teeming with *Rana ridibunda* and *Mauremys caspica caspica*. Two large softshells were observed in this habitat.

13. *Habes Creek (Euphrates and Karasu Creek)*. — The local name of the juncture between Karasu Creek and the Euphrates, 26–30 km east of Araban. Here, the Karasu flowed in a deep valley, but formed a wide sandy area at the juncture,

the creek reaching 15–20 m in width with a depth of 50–75 cm. Current was slow-flowing on the day of our observations (4 June 1989). The steep slope of the northern bank was densely covered with the nests of Hirundinidae species. Banks of the Euphrates were hard soil with small rocks. We observed an adult softshell here and the local farmers and fishermen recognized the species and claimed the presence of a healthy population here, with numerous hatchlings seen in late spring each year. Water temperature was 22°C in Karasu and 19°C at the shores of the Euphrates. The vegetation of the locality included a dense population of *Cynodon dactylon*, and occasional *Matricaria* sp., *Centaurea* sp., *Geranium* sp., *Onopordum illyricum*, and *Cistus* sp., as well as cultivated fields and orchards.

14. *Bozatli Creek (Yavuzeli, Gaziantep)*. — On the road from Yavuzeli to Gaziantep, 2–3 km south of Yavuzeli. Local people have cotton and vegetable fields in the region, irrigated by water from the creek. The creek was dried up in many places and shallow (to 20 cm) in others. The bottom had rough stones. We did not observe any live specimens here, but did find a carcass. Water temperature was 25°C. The local fishermen claimed that softshells were present at the juncture of the creek with the Euphrates.

15. *Birecik, Sanliurfa*. — Two separate field trips were conducted here in August and September 1988. Softshells were not observed in the main river but were seen in streams flowing from Saray region, in numerous side pockets formed by sand islets where the currents were very slow, and in small pools formed after spring floods. The locality consisted of wide sandy areas, sandy river banks, and a series of large or small sand islets in the middle of the river, forming an ideal breeding and nesting place for softshells. However, we did not find any nests or eggs here, but did find a few eggshell remains in a 25–30 cm deep nest in the Saray region when we followed a softshell track 1–1.5 m from the water line on 16 September 1988. The Saray region is full of large pools formed as a result of intense sandmining. The dominant vegetation consisted of *Populus* sp. following the main and side branches of the river, and *Taraxacum* sp., *Matricaria* sp., *Malva sylvestris*, *Rubus canescens*, *Portulaca oleracea*, *Ranunculus ficaria*, *Typha* sp., and *Anchusa azurea* were also present, in addition to cotton and vegetable fields.

16. *Kirkiz Village (Birecik, Sanliurfa)*. — Another suitable habitat for softshells, the pool-like side pocket and separate pool formed here were quite shallow (45–75 cm). Water temperature was relatively higher than in the other localities (Table 1). The bottom was partly sandy, partly muddy. The water contained rich stocks of *Cyprinus* sp. and *Silurus* sp. fry, as well as numerous *Rana ridibunda* tadpoles. A few softshell hatchlings were also observed on 19 August 1988, but no specimens were caught. Vegetation consisted of occasional *Malva sylvestris*, *Portulaca oleracea*, *Rumex acetosella*, *Matricaria* sp., and various *Cruciferae* members, as well as a few *Morus* sp. trees and cultivated fields 400 to 800 m from the river.

17. *Gürçay (= Gırlavik) Village (Nizip, Gaziantep)*. — This locality was quite close to the Turkish–Syrian border. DSI (State Water Works) conducted an earth filling project

between the village and the river, resulting in numerous artificial pools. We observed 13 softshells landlocked in these pools. We removed eight buckshot from a specimen caught here (ZDEU-41/1988-1). The locality was rich with *Cynodon dactylon* with a few *Rumex acetosella*, the surrounding hilly area having abundant pistachio trees. Two *Natrix natrix* were observed within the pool. Villagers kept numerous ducks in and around the pools. The water was muddy and the substrate covered with large rocks and pebbles. There were no suitable nesting grounds in the vicinity.

18. *Turkish–Syrian Border*. — In a Turkish television documentary on the Euphrates and Tigris rivers that we saw on 26 December 1991, the Euphrates was shown at the point where it passed from Turkey into Syria, a heavy helical barbed wire fence extending from one bank to the other, and on the surface of the river a softshell was clearly recognizable.

19. *Kisas Village (Sanliurfa)*. — Three specimens collected earlier (Basoglu and Baran, 1972; Atatür and Üçüncü, 1986) originated at this locality, 4–5 km southeast of Sanliurfa. On our trip of 20 August 1988 the creek near the village was completely dried up, and no softshells were in evidence.

Tigris Basin

20. *Devegeçidi Dam Road (Diyarbakir)*. — On the road from Diyarbakir to Elazığ, approximately 25 km to the north-east of Diyarbakir, there is a bridge over Bogaz Creek; 3–4 km to the west is Devegeçidi Dam. The creek had little water, the banks partial rock and soil; 800–1000 m east of the bridge a softshell was seen in the water (37°C).

21. *Road to Dicle University (Diyarbakir)*. — This locality was 2500 m north of the bridge on Diyarbakir–Silvan road, where the Tigris flowed slowly in a wide riverbed, the banks being wide and sandy. Sandmining in the area resulted in wide pools. The local farmers do not like the softshells, alleging that they damage their melon and watermelon crops. The natural vegetation of the locality consisted of occasional *Malva sylvestris*, *Portulaca oleracea*, *Cynodon dactylon*, and a few members of *Compositae* and *Cruciferae*. Several softshell specimens were observed in the water (31°C), but no nests or eggs were found in the sand-clay shore areas.

22. *Kale Altı (Diyarbakir)*. — This locality is within the city of Diyarbakir, under the bridge on the road connecting the city to Dicle University. Here, the waters of the Tigris were polluted with domestic sewage. The local vegetation consisted of *Cynodon dactylon*, *Cynosurus echinatus*, *Typha* sp., *Bolboschenus maritimus*, and *Juncus acutus*. Two softshell specimens were observed in the dirty, rather hot, and foul smelling water (35°C).

23. *Çarikli Fabrika Village (Diyarbakir)*. — A gentle slope leads to the Tigris River from the village, 17 km south of Diyarbakir. Quite large boulders were present along its banks. During our visit, the partially dried up river had exposed dried, cracked riverbed mud in some places. The opposite bank was smooth hard soil. Here, vegetation was scarce, but 1000–1500 m southwards abundant *Capsella* sp., *Cichorium intybus*, *Echium plantagineum*, *Anchusa azurea*, and *Rumex acetosella*

were present, and towards the slopes occasional *Onopordum illyricum* and *Centaurea solstitialis*, while the opposite bank was covered with *Robinia* sp. trees. Many softshells were observed at this locality. At the shores of the river the water temperature was 35°C. Two km north of this locality there is an alcohol factory, effluent from which drained directly into the river, sometimes causing major fish kills, according to the local people. The effects of this pollution on the *R. euphraticus* population, if any, are not known. Esirkul Creek joins the Tigris 800 m to the north; it being the dry season, the creek was reduced to a weak stream, but 500 m west of the juncture a pool of approximately 2000 m² was present, but no softshell were seen there. The area teemed with *Mauremys caspica caspica* and *Rana ridibunda*. Water temperature at a depth of 25 cm was 40°C, the area being completely surrounded with *Salix* sp. and *Populus* sp. trees.

24. Çınar, Diyarbakir. — We saw several softshells here in Göksu Creek, in addition to numerous *Mauremys caspica caspica*.

Euphrates Basin, Post-Atatürk Dam

One of us (ET) was able to visit the general area together with Michael Reimann three more times, in October 1995, March 1996, and May 1996. These trips were generally centered around Kantar/Bozova, Geçitbasi-Cümdüme, and Saska (İgdeli), localities previously found suitable for breeding of the species. All of these localities were now submerged by the waters of Atatürk Dam. The villagers of the newly formed villages in Bozova County and the fishermen of the area reported that they had not seen softshells in the previous 2–3 years. Students of the High School of Aquatic Products in Bozova and DSI workers reported likewise. The water temperature of the dam lake near Bozova County was 13°C (16 October 1995, 1450 hrs), and its pH was 6.8–7.0. The daily water level fluctuation was around 15 cm.

Subsequent to the formation of the Atatürk Dam impoundment, newly formed Samsat County, Adiyaman, was visited on 17 October 1995. The junctures of three small streams (approximately 2 km apart) with the dam lake near Samsat – Kahta road were investigated with the help of two local fishermen. The water temperatures were 12–13°C (1030–1200 hrs). No softshells were observed, although one fisherman reported incidental capture of a large specimen by hook and line (August 1995); he released it by cutting the line. According to the fishermen, the once abundant softshells were now very rarely seen, and no juveniles and hatchlings had been seen recently.

According to the local director of DSI, the daily fluctuation of the impoundment was 1–5 cm at the shores, but our observation at Geçitazgi, Hilvan, indicated fluctuations of almost 15 cm. The director's data on the temperature at lake bottom was 8–10°C, and at the surface 10–20°C (means of 1994–95), while the mean lake surface elevation was 534.21 m (max. 542.00 and min. 532.50 m) above sea level.

The water temperature at Damlica Village, Akpinar, approximately 3 km south of the dam gates was 9°C on 18

October 1995. Twelve softshells had been seen here in 1988, but during a four hour survey in 1995 no specimens were observed. The local people also reported that no softshells were seen after the completion of the dam.

Surtepe Village of Birecik County on the old road from Birecik to Halfeti was visited on 19 October 1995. There were four variously sized pools between the village and the Euphrates River, three of which were connected to the river (11–12°C), while the fourth one was not (15°C). A basking adult softshell was observed on the shores of the last pool (air temperature 19°C, 1430 hrs). On our later field trips we saw further specimens in the same locality (18 March 1996, water temperature 14°C; 6 May 1996, water temperature 15°C). This locality is approximately 2 km south of the Birecik Dam gates which are currently under construction. The area will be completely altered as a result of the shore improvement works.

In spite of the continuing sandmining activities, the Saray/Birecik locality, a place of many softshell sightings on our previous visits, still keeps its wetland characteristics. Within numerous pools of various sizes at this locality a few softshells were observed on 19 March 1996 (water 15°C and air 20°C) and on 7 May 1996 (water 16°C and air 28°C). Water level fluctuation between 7–14 May 1996 was more than one meter, a strongly negative influence upon an otherwise suitable nesting locality. During the construction of the Birecik Dam and its related shore improvement works, almost all of this locality will be used as a landfill (Nezih Akan, George H. Hölzl, and Peter Baerr, *pers. comm.*).

All of our three visits to the area were concentrated on Gırlavik, the farthest point southwards from the new dam's gates. In October 1995, the water surface temperature was 9°C at Damlica, the closest locality to Atatürk Dam, while at Gırlavik Village, which is very close to the Syrian border, it was 14°C. During our observation in March 1996, two adult softshells were seen basking on the shores of the pools (water temperature 16°C, air 20°C); the daily water level fluctuation was small. During a four day trip in May 1996, however, water level fluctuation was quite significant (1.05 m). The DSI personnel working in the village reported a difference of 1.85 m during April and May. The pool is connected to the Euphrates by a very narrow, shallow channel, and communication with the pool is possible only with the rising level of the Euphrates. The temperature of the river was 17°C, while the pool was 23°C (pH 6.8–7.0; air temperature 28°C). The pool is inhabited by a variety of fish fry, and a few snakes (*Natrix natrix*, *N. tessellata*) were seen. Being quite near the village, the softshells and terrapins (*Mauremys caspica caspica*) face no difficulty in finding abundant food. Numerous turkeys and ducks also inhabit the area, the young of which were occasionally consumed by the softshells (abundant feathers were observed within the excrement of a specimen observed in May 1996). On completion of the Karkamis Dam (in about 4 years), the construction of which started in May 1996, this locality will be completely submerged.

Biology and Factors Endangering Survival

The pH values of the Euphrates and Tigris rivers were between 6.7 and 7.6, the lowest value being Çarikli Fabrika Village on the Tigris and the highest from Geçitazgi on the Euphrates.

In both river systems, fish species were present representing the families Cyprinidae, Cobitidae, Gobiidae, Bagridae, Mastacembelidae, Salmonidae, and Sisoriidae; the most abundant taxa were *Leuciscus cephalus orientalis*, *Barbus* sp., *Bertinius* sp., *Condrostoma* sp., *Cyprinodon* sp., *Capoeta* sp., *Acanthobrama* sp., *Alburnoides* sp., *Chalcalburnus* sp., *Nemacheilus* sp., *Mastecembelus* sp., *Glyptothorax* sp., *Mystus* sp., *Silurus* sp., and *Salmo* sp. (Kuru, 1975; Kelle, 1978; DSI, 1982). Phytoplankton were represented by the families Bacillariophyceae, Dinophyceae, Chlorophyceae, Cyanophyceae, Cryptophyceae, Euglenophyceae, and Chrysophyceae, while the dominant zooplankton groups were Ciliata, Rotifera, Cladocera, Copepoda, and Hydrozoa (DSI, 1982). Benthic forms were oligochaets, *Chironomus* larvae (Diptera), and various gastropods (DSI, 1982).

We observed numerous Euphrates softshells feeding on a drifting horse carcass in the Euphrates at Geçitazgi, Hilvan, in 1989. During our studies, leaking nylon bags filled with fresh lamb blood lowered into the water proved to be a strong attractant for softshells. They also responded to every kind of bait of animal origin, as well as watermelon rinds. However, we could not find any matter of animal origin in several stomach contents examined, probably because of the timing of our analysis, but we found certain plant material, chiefly *Chaetomorpha linum* (Cladophoraceae). One freshly caught adult specimen defecated a large amount of tomato remains and skins. Near Diyarbakir, farmers who raise watermelons on alluvial soils inundated periodically by the Tigris report that softshells continuously eat their watermelon crop, even the young shoots, in fields adjacent to the river. Excrement of a specimen caught near Gürçay Village contained several feathers, probably of young turkeys or ducks. A few specimens kept alive at our laboratory were fed raw frog (*Rana*) meat, chopped beef and liver, live white mice, and plant material such as watermelon, cucumbers, and tomatoes.

The softshells we observed were primarily diurnal, but approximately 30% of our observations were nocturnal. We observed almost comparable activity and abundance throughout our study period from April to October, but the local people and fishermen reported an absence of sightings during the winter months — not unexpected in view of the severity of winter cold in this area.

Because of the changed, and continuously changing, structure of the aquatic ecosystems in southeastern Anatolia, and the progressive completion of numerous dams, our observations on the breeding and nesting of the species in this most northern part of its range were unfortunately very limited. According to Lortet (1883), Basoglu and Baran (1977), Griehl (1981), and Gramentz (1991) nesting and egg laying occur towards the end of April to early June. Our

observation of several small juveniles (probably post-hatchlings) at Saray, Birecik (15 September 1988) and Habes Creek (4 June 1989) also supports the view that egg laying occurs during the spring months. As far as we could determine, the northernmost nesting locality was the sand banks on the north shores where the Çamdere joins the Euphrates at Geçitazgi, Hilvan.

We found no literature on eggs of the species collected from a nest; however, 8 eggs were dissected out of a specimen caught at Goosba, Shul-el Arab (the swampy area southwest of Shatt-el Arab in Iraq), now in the BMNH collection (C. McCarthy, pers. comm.). According to McCarthy, the eggs are hard-shelled and brittle and almost all are spherical, but one is slightly ellipsoidal. There are no differences between the measurements of the 8 BMNH eggs and those of 11 spherical, brittle-shelled eggs we dissected out of a female specimen (ZDEU-41/1988-1) caught at Gürçay Village, Gaziantep (17 September 1988; Table 1 and 2). The eggs are approximately spherical with a mean diameter of 23.34 ± 0.13 mm (min. 22.30, max. 24.15 mm, $n = 19$). A comparison of the diameters of these *R. euphraticus* eggs with those of *Trionyx triunguis* (Atatür, 1979) showed that the former are distinctly smaller than the latter (Table 2). From the viewpoint of this characteristic the CD value (coefficient of difference; Mayr, 1969) between the two species is 11.17, which is one of the most distinctive differences between them. Taking into consideration the mature eggs dissected out of a Euphrates softshell in the middle of September, the nesting season of the species might be extended into late summer, probably with multiple nesting. Retention of mature eggs within the female's oviducts until the following spring is another possibility.

The incomplete nest in Saray was 1.75–2 m from the water line while the one on the sand bank on the northern shore of Çamdere – Euphrates juncture was only 50–60 cm from the water (the latter measurement is a rough approximation because of the daily water fluctuations). According to the local people, the eggs in the second nest were foul smelling when opened, which was not unexpected in that, under the influence of the newly completed Atatürk Dam, the area was flooded several times in the spring, probably killing the eggs in the process. During our field visit, 21–28 June 1989, we observed several juveniles at suitable Euphrates localities south of Atatürk Dam, but none were seen within

Table 2. A: Comparison of the diameters of *Rafetus euphraticus* eggs dissected from two adult specimens ($F_{\text{cal}} = 1.197$; $p = 0.2892$). **B:** Comparison of the egg diameters of *Rafetus euphraticus* and *Trionyx triunguis* ($F_{\text{cal}} = 999.999$; $p < 0.0001$) from Turkey.

A				
Samples	<i>n</i>	Range	Mean \pm SE	SD
BMNH	8	22.30 - 24.00	23.24 ± 0.19	0.54
ZDEU	11	22.80 - 24.15	23.50 ± 0.14	0.48
B				
Species	<i>n</i>	Range	Mean \pm SE	SD
<i>R. euphraticus</i>	19	22.30 - 24.15	23.34 ± 0.13	0.57
<i>T. triunguis</i>	31	34.30 - 36.25	35.29 ± 0.09	0.50

similar environments such as Kantar, Geçitbasi and Igdeli, which lie north of the dam, and are now submerged by the dam lake.

While the majority of the observed specimens were seen not in the main Euphrates, but in the tributaries, side pockets, and temporal pools, some were observed within the main river, both swimming with and against the current.

The Euphrates soft-shelled turtle is now seriously endangered in southeastern Anatolia. The northernmost limit of its range in the Euphrates is between Atatürk and Karakaya dams. With the beginning of water retention by Atatürk Dam in early 1989, the eggs in nests built the same spring were undoubtedly lost due to rising waters. Our observations at Bozova and Hilvan in 1989, 1995, and 1996 support this view. Gradually increasing water levels have completely submerged the natural sand banks, which has resulted in an irreversible loss of nesting areas. It is highly doubtful that there will be suitable nesting areas on the shores of the completely filled dam lake. The daily fluctuations in the water level are also a negative factor for successful nest building.

Retained waters of Atatürk Dam also endanger the survival of the species further southwards in the Euphrates. In the summer of 1991, water temperature was 12°C in the main river at Birecik (Gramentz, pers. comm.). In October 1995 it was 9°C at Damlica, just south of the dam gates, while at Gırlavik, right next to the Syrian border, it was 14°C. In May 1996 it was 17°C at Gırlavik. This cooling effect is due to the large volume of cold waters, originating from heavy snow melts, being collected in the dam lake and periodically released from the impoundment into the Euphrates. This cooling environment will undoubtedly negatively affect the thermophilic *R. euphraticus*.

Large scale sandmining was observed at Samsat, Kantar, and Geçitbasi during the construction of the dam, with resultant complete submersion of these localities between 1989–92. South of the dam at Saray near Birecik, heavy sandmining continues.

Adjacent to Gürçay Village near the Turkish – Syrian border, much gravel has been deposited over wide areas on each side of the Euphrates, disrupting the natural sand banks

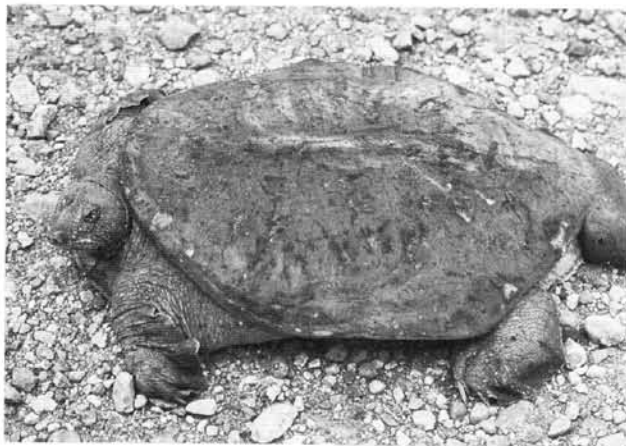


Figure 4. A female *Rafetus euphraticus* from Geçitbasi in Bozova-Sanlıurfa with posterior carapace injury (ZDEU-25/1989-5).

here, and isolating some softshells within newly formed pools.

Due to a lack of heavy industrialization of the general region and scarcity of domestic sewage, there is currently no serious pollution problem in the Euphrates. A few fishermen operate in the region with somewhat primitive technology, but incidentally hooked softshells do not usually escape with their lives. The local people are usually hostile towards the softshell; we removed seven buckshot from one specimen (ZDEU-41/1988-1), and another (ZDEU-25/1989-5) had a serious wound in its soft posterior carapace (Fig. 4), probably caused by a blow with a shovel.

In the limited segment of the Tigris investigated, pollution was evident, especially at Kale Altı, Diyarbakir, where the river water was turbid with domestic sewage. However, in these relatively calm waters we observed several adult specimens not obviously affected by the pollution. Effluent from an alcohol distillery near Çarikli Fabrika Village, Diyarbakir killed numerous fish, but again no information was available on possible effects upon *R. euphraticus*.

Adjacent to numerous tributaries of both the Euphrates and the Tigris (Çamdere, Zengeçur Creek, Geldik Stream, Karasu, Bozatli Creek, Güllap Stream, etc.), irrigation was carried out during the summer months, leading to a reduction of water levels, and even to drying up of some stretches, leaving isolated temporary pools. Softshells isolated in such areas were exposed to the mercy of local farmers and fishermen.

The local people inhabiting the same region as the Euphrates softshell turtle in southeastern Anatolia do not consume the meat, but a few Armenian families at Diyarbakir are reported to eat softshells.

In addition to these points endangering the survival of the Euphrates softshell in southeastern Anatolia, we should mention the mechanical destruction of its habitat and the heavy chemical pollution which resulted from the Gulf War in Iraq in 1991.

DISCUSSION

The northernmost limit of the range of *R. euphraticus* had been reported as Zengibar (or Negreos) Creek, a tributary of the Euphrates (Ainsworth, 1842). Kinzelbach (1986) located this point between Samsat and Halfeti, while in Gramentz (1991) it was shown more to the north than it actually is. However no creek by the name mentioned by Ainsworth (1842), which he described in detail, is listed in modern references, nor was it recorded in old Ottoman records, so the name is no longer valid. Within the described area Zengeçur Creek flows in a deep valley, after joining with Geldik Creek, then joins the Euphrates near Kazo Village. However, this locality is not between Samsat and Halfeti as Kinzelbach (1986) claims, but approximately 12 km north of Samsat. As far as we could establish, the northernmost limit of the species' range in the Euphrates is the juncture of a small stream, coming from the direction of Çermik, Diyarbakir, with the Euphrates, 45 km north of

Zengeçur Creek. An incorrect locality record is given by Giebel (1866), who claims the presence of the species on Bangka Island, northeast of Celebes Island (= Sulawesi, Indonesia). Most probably this old record concerns *Amyda cartilaginea* or *Pelochelys cantorii*. Also, Lambert (1981), when introducing *R. euphraticus* to the list of endangered reptiles provided by Gryn-Ambroes (1980) and DeKlemm (1980), had included the Mediterranean coastal zones of Syria and Lebanon, together with southeastern Anatolia, in the range of the species. Anderson (1979) too, in his distribution map of *R. euphraticus* included the eastern Mediterranean coasts in its general range. However, these Mediterranean coastal zones are parts of the general range of *T. triunguis* (Atatür, 1979; Kinzelbach, 1986; Gramentz, 1991; Kasperek and Kinzelbach, 1992; Iverson, 1992), and not *R. euphraticus*.

While it has been stressed that *R. euphraticus* is more abundantly seen in spring and less in autumn (Lortet, 1883, 1887; Bodenheimer, 1944; Bagoslu and Baran, 1977), during our field work from April to October its abundance was seasonally even. But it cannot be said that the species is active during the whole year; local people and fishermen within the range of the softshell in southeastern Anatolia claim that it is never seen during the winter months.

References to the feeding biology of *R. euphraticus* indicate a carnivorous habit. Ainsworth (1888) recorded an observation of a few Euphrates softshells feeding on the carcass of an antelope drifting with the current, and also stressed the aggressive behavior of the species. Mertens (1957) reported on the powerful bites of the turtle when handled. Hirsch (1976) and Anderson (1979) listed crabs, insects, insect larvae, worms, frogs, and fish as dietary items. Gramentz (1991) observed pieces of wood and parts of a pigeon within the stomach of a specimen of *R. euphraticus*. He also mentioned keeping five juveniles and subadult specimens caught at Kirkiz, Birecik, in large aquaria, feeding them with flesh of various *Salmo* species, tenebrioid larvae, grasshoppers, butterfly larvae, earthworms, de-shelled snails, and heart meat of poultry, turkey, and cattle, as well as small pieces of orange and banana (Gramentz, pers. comm.). Radek (1969) reported that a 15 cm juvenile kept in 30 cm of water was fed with food of animal origin, lettuce leaves, and some filamentous algae. It is possible that some plant material may be taken inadvertently while feeding on foods of animal origin, as reported by Webb (1962) for North American trionychids and by Atatür (1979) for *T. triunguis*. However, this is not the case for *R. euphraticus* in that we found much plant material in digestive tracts examined, and also observed its active feeding on watermelons, cucumbers, and tomatoes. Siebenrock (1913) also reported a specimen with its stomach full of plant material.

Both Lambert (1981) and Kinzelbach (1986) regarded *R. euphraticus* as an endangered species. A TÇSV publication (1990) reported that the meat of this turtle is generally not consumed locally in southeastern Anatolia (although in some areas it is recognized as a delicacy), but makes no mention of the primary endangering factor, i.e., the ongoing

gradual physical destruction of its environment. Illegal sale of several reptile species (*R. euphraticus* among them) by local people to tourists is also stressed. Gramentz (1991) reported significant decreases both in herpetofauna and ornithofauna since the completion of the Keban Dam (1975), and stressed a possible exacerbation of these losses after the completion of Karakaya and Atatürk dams and their integral irrigation projects, which, according to him, may together ultimately lead to the disappearance of *R. euphraticus* from the Euphrates. Van Dijk (1990) was of the opinion that the species had been negatively affected by Atatürk Dam in the north, and by the Iran – Iraq War in the south. Our findings completely support these views, and we believe the physical and chemical damage inflicted upon the southern parts of the species' range during the Gulf War is also quite serious.

The temperature of the Euphrates has fallen in recent years south of Atatürk Dam because of the episodic cold water outflows from the impoundment, and this will probably have long-term deleterious effects on the ecology of the thermophilic *R. euphraticus*.

CONCLUSIONS AND SUGGESTIONS

The Euphrates softshell turtle prefers shallow, calm waters, small lakes, and even small temporary pools, rather than the deep, fast-flowing main river channels. During our field work we made detailed investigations of its status and distribution in the southeastern Anatolian part of the Euphrates basin, but our study of its distribution in the Tigris basin was limited to the Vilayet Diyarbakir.

Presently no conservation measures for the Euphrates softshell exist anywhere in its known range in Turkey, Syria, Iraq, or the Khuzestan province of Iran. Necessary considerations to insure the survival of the species at least in southeastern Anatolia of Turkey are as follows.

A large population of softshells has been isolated within the Atatürk Dam impoundment lake since its filling in 1989–90. The present shores of the lake should be surveyed from the viewpoint of possible nesting sites and such regions should be taken under legal protection.

If nesting sites are not found, shallows with adjacent sandy banks should be constructed artificially at suitable points on the impoundment shorelines to provide warmer waters for breeding and normal activity of the species. One or two such artificial nesting sites are essential to safeguard the turtle population in this lake. It would also greatly facilitate study of the movements, migrations, and habitat preferences of this population if suitable tagging programs were instituted.

In sparsely populated southeastern Anatolia industrialization is still slight, a positive consideration for the survival of the Euphrates softshell, but the ongoing trend of dumping waste of every kind, domestic or otherwise, directly into the Euphrates and Tigris systems is quite alarming. Even today, heavy domestic and industrial pollution is evident in relatively calm waters of the Tigris. The remedy lies in con-

structing waste disposal facilities in the region. Local farmers and fishermen should be educated to prevent the unnecessary killing or abuse of softshells in the wild. The activities of the large scale sandmining in Saray, Birecik, should be stopped to preserve a potential nesting area for the species.

Rafetus euphraticus has been mentioned only as a newly renamed taxon by IUCN/SSC Tortoise and Freshwater Turtle Specialist Group (1989), and is not listed either in the Red Data Book (RDB) or in the IUCN, Action Plan Rating (APR) system. In view of the various factors given above, all negatively affecting the survival prospects of the species, we believe that *R. euphraticus* should be categorized as APR 1, a species critically endangered in Appendix 1, at least within the borders of Turkey.

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