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Dynamics of a Central Anatolian population of *Emys orbicularis* (LINNAEUS, 1758)

(Testudines: Emydidae)

Dynamik einer zentralanatolischen Population von *Emys orbicularis* (LINNAEUS, 1758)

(Testudines: Emydidae)

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KURZFASSUNG

In den Jahren 2010 bis 2013 wurden unter Verwendung der Rückfangmethode Abschätzungen zur Populationsgröße und -dichte sowie Überlebensrate, und Fangwahrscheinlichkeit bei *Emys orbicularis* (LINNAEUS, 1758) aus einem Vorkommen bei Yağmapınar (Karapınar, Konya, Türkei) durchgeführt. Daneben erfolgte eine Bestimmung des zahlenmäßigen Geschlechterverhältnisses, einiger morphometrischer Merkmale und ökologischer Habitateigenschaften. Im Projektverlauf wurden 226 Schildkröten markiert, von denen 58 insgesamt 75mal wiedergefangen wurden Von den markierten Tieren waren 98 (43,36 %) Männchen, 109 (48,23 %) Weibchen und 19 (8,41 %) Jungtiere. Das Geschlechterverhältnis war ausgewogen (Männchen : Weibchen = 1 : 1,11). Die Populationsgröße wurde auf 726 ± 127 (477 - 976) Individuen geschätzt, ihre Dichte daraus mit 242 ± 42 (158-325) Individuen je Hektar berechnet. Die berechnete Gesamtbiomasse betrug 82 ± 14 (54 - 111) kg/ha. Nach der Jolly-Seber Formel berechnete sich die Überlebensrate mit 0.94 ± 0.02 (0.89 - 0.96) für Adulte und 0.79 ± 0.06 (0.64 - 0.89) für Juvenile Exemplare. Die Fangwahrscheinlichkeit war im Mittel 0.17 (0.09-0.28) und für Männchen, Weibchen und Jungtiere ähnlich. Die mittlere Carapaxlänge betrug bei den Männchen 115.7 ± 7.2 mm, bei den Weibchen 135.1 ± 8.5 mm und bei den Jungtieren 91.6 ± 7.2. Ein Geschlechterdimorphismus zeigte sich u. a. in der Körpergröße, indem Weibchen signifikant größer als Männchen waren (*t*-test, $t = 17.726$, $df = 204$, $P < 0.001$). Die Yağmapınar-Population is ist durch klimabedingten Habitatverlust und direkte anthropogene Schadeffekte bedroht.

ABSTRACT

Using mark-recapture techniques, this study conducted from 2010 to 2012 aims to estimate size, density, survival rate, and capture probability in the Yağmapınar (Karapınar, Konya, Turkey) population of *Emys orbicularis* (LINNAEUS, 1758). In addition, sex ratio and some morphometrical characters of the individuals, as well as ecological features of the habitat were determined. During the project, 226 turtles were marked, and 58 of these were recaptured 75 times in total. Of the marked turtles, 98 (43.36 %) were males, 109 (48.23 %) females, and 19 (8.41 %) juveniles. The sex ratio of the population was balanced (male : female = 1 : 1.11). The population size was estimated as 726 ± 127 (477 - 976), and the population density was calculated as 242 ± 42 (158-325) individuals/ha, accordingly. Total biomass was calculated as 82 ± 14 (54 - 111) kg/ha. According to the Jolly-Seber formula, the survival rate was estimated to be 0.94 ± 0.02 (0.89 - 0.96) in adults and 0.79 ± 0.06 (0.64 - 0.89) in juveniles. The capture probabilities did not show differences between the groups and were estimated as 0.17 (0.09-0.28) on average. The mean carapace length was 115.7 ± 7.2 mm in males, 135.1 ± 8.5 mm in females, and 91.6 ± 7.2 mm in juveniles. Sexual dimorphism was identified in terms of body size. Females were significantly larger than males (t-test, $t = 17.726$, $df = 204$, $P < 0.001$). The Yağmapınar population is threatened mainly by habitat loss due to climate and immediate anthropogenic detrimental effects.

INTRODUCTION

According to the IUCN/SSC Turtle Taxonomy Working Group (TTWG 2009), 134 (40.2 %) of 333 turtle species living on earth are threatened. When the recent species which are no longer present in nature (i.e., only surviving in captivity) and those which became fully extinct are taken into account as well, 48.3 % of modern turtle species represent extinct or threatened species. In conclusion, turtles are among the most threatened vertebrate groups (TTWG 2009).

Emys orbicularis (LINNAEUS, 1758) is among the freshwater turtle species with the most extensive distribution; however, today it tends to be scarcely encountered in some countries of its range. Although the decrease in the populations of *E. orbicularis* is well documented, discussions about the causes of the decline are ongoing. The most addressed causes include their being hunted for food, habitat losses resulting from the desiccation of wetlands for agriculture, water pollution

and the introduction of foreign species into the environment (FICETOLA et al. 2004).

Although the number of studies dealing with *E. orbicularis* in Turkey increased during recent years, the majority focused on morphology and taxonomy (e.g., TAŞKAVAK & REIMANN 1998; AYAZ & BUDAK 2006; TAŞKAVAK & AYAZ 2006; AYAZ et al. 2004, 2007a, 2008b) whereas, the number of studies on its ecology remained small. Some were based on the anectodal data obtained during other studies (e.g., TAŞKAVAK & REIMANN 1998; AYAZ 2003; AYAZ & ÇIÇEK 2011a; ÇIÇEK & AYAZ 2011) and only four studies provided detailed information on the population ecology of the species (AUER & TAŞKAVAK 2004; AYAZ et al. 2007b, 2008a; AYAZ & ÇIÇEK 2011b). Nevertheless, all of these studies refer to west Anatolian populations.

The present study aimed to estimate the size and density of the a central Anatolian Yağmapınar (Karapınar) population of *E. orbicularis*, a freshwater turtle conserved by the Bern Convention and specified on the IUCN Red List of Threatened Species. In addition, demographic parameters, sex ratio, body size and ecological characteristics of the habitat were assessed along with the factors that threatened the population.

MATERIALS AND METHODS

The studies were performed at the village of Yağmapınar (37°49'N, 33°43'E), located 18 km north-east of Karapınar (Province of Konya). Two natural springs supply the village with water. Pools for agricultural irrigation were constructed by the villagers to tap these springs, the water of which constitutes the aquatic habitat of the *Emys* population studied. Since rainfall is abundant in spring and irrigation activity is not intensive, water originating from the springs percolates through the pools and creates a temporary pond. In April, when water was most abundant, a pond up to 60 cm deep and about 0.5 hectares in size was formed. Upon the increase in air temperature and the drawing of water for agricultural irrigation as of June, the wetland completely desiccates, water remains only in pools. The sampling area covered about three hectares. Regarding the vegetation, *Juncus* sp. is common along the south-western and south-eastern sections of the study area and along the bed of the water. Willow (*Salix* sp.) and oleaster (*Elaeagnus angustifolia*) are seen at intervals along the road that surrounds the area, *Circium* sp., *Ononis spinosa* and *Centaurea spinosa* are sparsely found.

In total, eight sampling days (2010: May 15, July 11 and 19, September 13 and 17; 2011: June 14; 2012: April 19, May 30) were spent in the field. Uneven between-sampling periods were taken into account in the program MARK. Each sampling campaign was conducted from noon to sunset, the turtles' period of maximum activity during the day. The turtles were captured either with a scoop net or by hand, then marked individually by marginal notching according to ERNST et al. (1974). After taking the following measurements, the specimens were released to their habitats: body mass (BM) was assessed with a digital scale sensitive to 1 gram; carapace length (CL), plastron length (PL) and carapace height (CH) were measured with a special ruler (precision 1 cm), and the distance between plastron and cloaca (PC) with a digital compass (precision 0.01 mm). Descriptive statistics of the morphological data were computed with the software package SPSS 18.00. Student's *t*-test and Mann-Whitney *U* test were used to test for potential morphological differences between sexes. Observed shell anomalies, injuries or ectoparasitoses were noted, and photographed.

In the present study, a total of 226 individuals (98 males, 109 females and 19 juveniles) were marked.

As the sampling period covered a time span of several years, it was reasonable to regard the population an open system (where there are individuals which enter the population by birth and immigration and others which leave the population by death and emigration). The computer program POPAN developed by SCHWARZ & ARNASON (1996), which fits models of the classical JOLLY-SEBER type to capture-mark-recapture-data, was used to calculate population

size. The models underwent a Goodness-of-fit test (Test 2, Test 3) with the RELEASE application (BURNHAM et al. 1987) of the program MARK (LEBRETON et al. 1992; COOCH & WHITE 2010). The model with the smallest AIC_c value (Akaike's Information Criterion, corrected for finite sample sizes) was selected as the most appropriate model. AIC is a measure of the relative quality of a statistical model, for a given set of data. The smaller the AIC value, the more consistent is the model with the set of observations (BURNHAM & ANDERSON 2002; COOCH & WHITE 2010). After the selection of the most appropriate model, population size (N) was computed individually for each sampling campaign by using the JOLLY-SEBER formula; the super population size (N*) was computed by evaluating all samplings. Annual survival rate (Φ), capture probability (p) and the probability of entry into the population (PENT) were computed for each sampling campaign and the former two separately for juveniles and adults. The population density (d) was obtained by dividing the calculated super population size (N*) by the study area.

RESULTS AND DISCUSSION

Morphological measurements

The geographical location of the population and environmental conditions are important factors that affect the body size of *Emys orbicularis* (FRITZ 2001, 2003). Individuals living at high geographic latitudes must be expected to grow to larger body size and develop larger clutches in terms of egg number than animals of lower latitudes (ROVERO & CHELAZZI 1996; ZUFFI et al. 1999). Similar observations regarding the effect of latitude were made for *Chrysemys picta* (SCHNEIDER, 1783) (MOLL 1973; IVERSON & SMITH 1993). In some populations from central Anatolia, individuals can reach large carapace lengths (CL) of up to 200 mm, whereas other central Anatolian populations and the populations from the nearby Aegean and Mediterranean coasts are composed of small or moderate-sized individuals (FRITZ 2001, 2003; TAŞKAVAK & AYAZ 2006). The carapace length of central Anatolian specimens assigned to the subspecies *E. o. luteofusca* (FRITZ, 1989) *sensu lato* was 122.9 (89-155) mm in males and 137.3 (105-183) mm in females (AYAZ et al. 2008b). In this study, which covered the entire territory of Turkey, the longest CL (183 mm) came from a central Anatolian female. In the Yağmapınar population, the largest specimen measured was a female individual of 154 mm CL. Additional morphometric data obtained from 226 Yağmapınar specimens is presented in Table 1.

One of the reasons why the individuals in the Yağmapınar population are small in size when compared with other central Anatolian populations is the shortness of the active period the animals will spend feeding. The factors which restrict this time are the continental climate and the unfavorable environmental conditions prevailing (ZUFFI et al. 2007). If habitat degradation adds to these unfavorable conditions, growth rates are small. Availability of the aquatic habitat in the area of the Yağmapınar population is restricted to about two months (April and May) during which time feeding and breeding, following hibernation, has to take place. This has a substantially negative effect on the turtles' development.

Turtles display great diversity in terms of sexual size dimorphism. In the majority of species, females are larger than males; furthermore, female-biased size dimorphism is a rule for some groups (e.g., Emydidae, Geoemydidae, Trionychidae) and vice versa for others (e.g., Testudinidae, Kinosternidae) (COX et al. 2007). Sexual size dimorphism is typical to *E. orbicularis*, in which males are generally smaller than females (ZUFFI et al. 1999; FRITZ 2003). According to the results of the present research, statistically significant differences between males and females were found in all characters measured (CL: males < females, t-test, $t = 17.726$, $df = 204$, $P < 0.001$; PC: males > females, t-test, $t = 23.725$, $df = 166$, $P < 0.001$; PL: males < females, Mann-Whitney $U = 79$, $P < 0.001$; CH: males < females, Mann-Whitney $U = 14$, $P < 0.001$; W: males < females, Mann-Whitney $U = 248$, $P < 0.001$).

Table 1: Descriptive statics of marked individuals of *Emys orbicularis* (Linnaeus, 1758) from the Yağmapınar population (Karapınar, Konya, Turkey). CL - Carapax Length, PL - Plastron Length, CH - Carapax Height, PC - Distance between Plastron and Cloaca, BM - Body Mass, SE - Standard Error of the Mean, SD - Standard Deviation.

Tab. 1: Beschreibende Statistiken der markierten Individuen von *Emys orbicularis* (Linnaeus, 1758) aus der Yağmapınar-Population (Karapınar, Konya, Türkei). CL - Carapaxlänge, PL - Plastronlänge, CH - Carapaxhöhe, PC - Entfernung Plastronrand zu kloake, BM - Körpermasse, SE - Standardfehler des Mittelwertes, SD - Standardabweichung.

Sex / Geschlecht	Chacacter Merkmal	*N*	Minimum	Maximum	Average Mittel	SE	SD
Males / Männchen	CL [mm]	97	99	136	115.73	0.73	7.21
	PL [mm]	97	90	120	102.58	0.62	6.07
	CH [mm]	85	34	49	43.22	0.28	2.58
	PC [mm]	85	16.8	28.9	22.8	0.28	2.56
	BM [g]	98	154	420	252.05	4.70	46.52
Females / Weibchen	CL [mm]	109	108	154	135.14	0.81	8.50
	PL [mm]	108	105	147	128.22	0.79	8.21
	CH [mm]	83	47	67	57.02	0.52	4.75
	PC [mm]	83	8.5	18.8	13.8	0.26	2.33
	BM [g]	109	222	660	455.60	8.46	88.33
Juveniles / Jungtiere	CL [mm]	19	80	107	91.63	1.66	7.24
	PL [mm]	19	76	103	86.89	1.78	7.77
	CH [mm]	17	33	47	36.94	0.84	3.45
	PC [mm]	17	6.4	15.8	10.1	0.55	2.25
	BM [g]	19	97	240	138.74	9.16	39.93

Population structure

In the Yağmapınar population, 43.4 % of the individuals captured were males, 48.2 % females, and 8.4 % juveniles. Sex ratio (male : female) of the whole sample was 1:1.11 = 0.90, which is not significantly different from one ($\chi^2 = 0.585$, $df = 1$, $P = 0.445$). Within each of the eight sub-samples, the proportion of sexes was largely balanced, except in the first which was significantly female-biased ($\chi^2 = 5.158$, $df = 1$, $P = 0.023$).

In *E. orbicularis*, sex ratios may vary by population. Female-biased populations were reported from Spain (Bataller et al. 2008; Sancho & Ramia 2008), Switzerland (Mosimann & Cadi 2004), and Italy (Mazotti 1995). Besides, balanced populations (Balázs & Györffy 2006) and male-biased populations (Nemoz et al. 2004; Rivera & Fernández 2004) were found. However, male-biased sex ratios seemed to be common in Turkey (Auer & Taşkavak 2004; Ayaz et al. 2007b, 2008b; Ayaz & Çiçek 2011b).

Juvenile individuals made up 8.41 % of the population. Their rate is a measure of population viability. For the Yağmapınar population, the above ratio cannot be called high. Auer & Taşkavak (2004) reported 55 % of juveniles in the Çukurköy population from the Aegean Region. However, lower rates were observed in other studies (Ayaz et al. 2007b, 2008a; Ayaz & Çiçek 2011b). The low rate of juveniles observed in the Yağmapınar population may not necessarily reflect reality. Juveniles of *E. orbicularis* prefer shallow waters with abundant vegetation where they can both find food easily and hide from predators. As a consequence, they live a more secret life than adults do (Zuffi 2000; Mosimann & Cadi 2004) and thus, tend to be underrepresented in the samples.

The smallest juvenile measured in the study period of three years was captured in the first year (2010) and had a CL of 80 mm. Four growth rings were detected on the shields of this individual. This finding supports the assumption that the population failed successful breeding since 2006 or had given birth to a very small number of juveniles only, which were not encountered during the studies. A similar condition was observed in the emydid freshwater turtle *Malaclemys terrapin* (Schoepff, 1793) (Gibbons et al. 2001). The causes of breeding failure may be seen in changing envi-

Table 2: Number of the individuals of *Emys orbicularis* (LINNAEUS, 1758) from the Yağmapınar population (Karapınar, Konya, Turkey) captured and recaptured in field studies. i - sampling campaign number, $n_{(i)}$ - total number of animals captured in the sampling i (= $u_{(i)} + m_{(i)}$), $u_{(i)}$ - number of animals captured for the first time (unmarked), $m_{(i)}$ - number of animals recaptured (marked).

Tab. 2: Anzahl der Individuen von *Emys orbicularis* (LINNAEUS, 1758) aus der Yağmapınar-Population (Karapınar, Konya, Türkei), die im Verlauf der Feldstudien gefangen und wiedergefangen wurden. i - Sammelvorgang Nummer, $n_{(i)}$ - Gesamtzahl der in Sammelvorgang i gefangenen Tiere (= $u_{(i)} + m_{(i)}$), $u_{(i)}$ - Zahl der erstmalig gefangenen (= unmarkierten) Individuen, $m_{(i)}$ - Zahl der wiedergefangenen (= markierten) Individuen.

i	I	II	III	IV	V	VI	VII	VIII	Total
$n_{(i)}$	40	32	50	50	23	45	35	26	301
$u_{(i)}$	40	28	32	33	10	41	25	17	226
$m_{(i)}$		4	18	17	13	4	10	9	75

ronmental conditions. The individuals of the Yağmapınar population are forced to estivate upon the complete desiccation of waters as of June. ZUFFI et al. (2004) stated that very little information was available regarding the effect of estivation on the turtles' breeding biology and that more studies on this matter should be performed. After all, they emphasized that interruption to the metabolic activity due to estivation would not only affect feeding but also trigger the reabsorption of developing egg follicles.

Population size estimates

In total, 226 individuals, 98 males, 109 females, and 19 juveniles, were marked in eight sampling campaigns performed between 2010 and 2012. From these 226 turtles, 58 individuals were recaptured in 75 recapture events (Table 2).

According to the Goodness-of-fit test, the difference in the fit of tests 2 and 3 (χ^2 = 12.7603, *df* = 15, *P* = 0.6208) was statistically insignificant, suggesting that a fully time-dependent model {$\Phi(g*t)$p($g*t$)} can be used. The model selection analysis showed that the model in which (1) the survival rate varied by group, irrespective of time [$\Phi(g)$] and (2) the capture probability did not vary by group, but depending on time [p(t)], was the most suitable model for the present data set. The model in which an individual evaluation was made according to groups [$\Phi(g)p(t)$] was found to be about eleven times more suitable than the model in which all data was evaluated together without discrimination of groups [$\Phi(t)$ p (t)] (AIC_c $W_{[\Phi(g)\,p(t)]}$ / AIC_c $W_{[\Phi(t)p(t)]}$ = 0.662/ 0.061 = 10.85).

According to the Jolly-Seber formula, the 3-year super population size was calculated as 726 (SE = 127, range = 477-976) individuals. Accordingly, the population density was 242 ± 42 (158-325) individuals/ha, and the total biomass 82.4 ± 14.3 (53.9-110.7) kg/ha. The survival rate was found to be 0.94 ± 0.02 (0.89-0.96) for adult individuals and 0.79 ± 0.06 (0.64-0.89) for juveniles. The capture probability did not vary by group, and its average was computed as 0.17 (0.09-0.28). The average probability of entry into the population (PENT) was calculated to be 0.32 (0.12-0.51) for adult individuals and 0.30 (0.02-0.82) for juveniles.

Population density is a reliable indicator to compare among different populations. MAZOTTI (1995) reported population densities of 7.2 individuals/ha in the Po River Delta (Italy), while MOSIMANN & CADI (2004) found 64 individuals/ha in Switzerland. BALÁZS & GYÖRFFY (2006) estimated 128-242 individuals/ha at Feketevíz (Tisza river), and stated that it was the largest turtle population found in Hungary. The population densities reported from Turkish locations ranged from 22.5 to 130 individuals/ha (AUER & TAŞKAVAK 2004; AYAZ et al. 2007b, 2008a; AYAZ & ÇIÇEK 2011b). Densities were lower in Mediterranean coastal populations than in central Anatolian, western and central Black Sea populations (AUER & TAŞKAVAK 2004). The lowest densities of *E. orbicularis* were observed on Mediterranean and Aegean coasts where *Emys* occurs in sympatry with the Western Caspian Turtle *Mauremys rivulata* (VALENCIENNES, 1833), a competitor that displays a wider ecological tolerance than *Emys* (AYAZ & ÇIÇEK 2011b).

Several reasons contribute to the high population density at Yağmapınar. Most important is the absence of other turtle species potentially competing for a common ecological niche. Although *Emys* is in competition with sympatric *M. rivulata* in Aegean and Mediterranean populations (Auer & Taşkavak 2004), this phenomenon is rarely seen among sympatric *Emys* and *Mauremys caspica* (Gmelin, 1774) in central Anatolian populations. Another beneficial reason is that the place concerned is the most convenient habitat within the Karapınar Basin. Thus, the desiccation of the temporary pond as of June makes the turtles obliged to live within a narrow area and keeps them from spreading, which in turn causes the high population density.

In some freshwater turtles, annual survival rates of adult individuals are quite high. For instance, they were reported to range from 0.96 to 0.98 in *Emydoidea blandingii* (Holbrook, 1838) (Congdon et al. 1993, 2000), to be 0.95 in *Kinosternon flavescens* (Agassiz, 1857) (Iverson 1991), and to range from 0.95 to 0.96 in *Actinemys marmorata* (Baird & Girard, 1852) (Ashton et al. 2011). *Emys orbicularis* with rates of 0.94 ± 0.02 (0.89 - 0.96) (Ayaz et al. 2008a; Mitrus 2008; Ayaz & Çiçek 2011b) is not an exception.

Most researchers assumed equal survival rates of the sexes (Iverson 1991; Congdon et al. 1993, 2000). Besides, several studies (Congdon et al. 1993; Heppell et al. 1996; Gibbs & Amato 2000) set forth that the population balance (which in its theoretical approach is determined by the birth and death of particles) is affected primarily by the survival rates of adult and juvenile individuals (Spinks et al. 2003). In the Yağmapınar population, the survival rate was calculated to be 0.94 for adults and 0.79 for juveniles, similar to that in Mitrus (2008).

Factors threatening the Yağmapınar population

The most important factors threatening the population of *E. orbicularis* living in Yağmapınar are (i) habitat degradation, and (ii) certain anthropogenic deleterious effects.

Due to its location, Yağmapınar is exposed to a harsh continental climate. - Yağmapınar is one of the driest places in Turkey, its total annual rainfall being 250-300 mm (period 1971-2000) as compared to the country as a whole (642.8 mm for the period 1970-2011) (data source: Turkish Directorate-General of Meteorology). The low rainfall and the hot and arid summers negatively affect the aquatic habitat of the population. When the discharge of water for agricultural irrigation is added, the aquatic habitat of the population is fully degraded. According to the authors' observations, during 2011 water was available in the pond only in June. In 2010 and 2012, the pond completely dried out as of June and remained in that condition until late September. Upon desiccation of the pond, the individuals must be expected to face difficulties in obtaining food and stress associated with reproduction in those which entered the process of estivation due to hot weather (Zuffi et al. 2004).

Ayaz et al. (2008b) reported that most of the central Anatolian *E. orbicularis* collected came from almost completely desiccated ponds (e.g., Akgöl, Boget). On a trip to Akgöl by the authors of the present paper in May 2010, no specimens of *Emys* could be encountered. Similar cases of habitat degradation were reported from Anatolia also by Fritz & Andreas (1999). Thus, the central Anatolian populations of *Emys* appear seriously endangered due to habitat loss resulting from aridification processes owing to global warming and exploitive irrigation policies.

Another important factor that threatens the Yağmapınar population is direct or indirect adverse effects of human beings on turtles. During the interviews with residents of the Yağmapınar village, it was learned that the children threw stones at turtles and that the villagers who performed irrigation tried to take turtles away from the area on the supposition that they prevented irrigation. Additionally, sheep/goat and cattle husbandry was common in the village. Hoof kicks and dog attacks may contribute to the observed injuries. The aquatic habitat in question interacts with these animals both because of meeting the water need of the animals and because it is used as a transit route. Likewise, Olivier et al. (2010) established that the grazing of cattle had negative effects on

Fig. 1: Injuries on shells of *Emys orbicularis* (LINNAEUS, 1758) from the Yağmapınar population (Karapınar, Konya, Turkey).

Abb. 1: Verletzungen bei *Emys orbicularis* (LINNAEUS, 1758) aus der Yağmapınar-Population (Karapınar, Konya, Türkei).

the survival rates of adult individuals in the populations of *E. orbicularis* and stated that this should not be disregarded when conducting studies of conservation of the populations. They emphasized that cattle should be prevented from entering the areas where turtles feed and lay eggs. Another anthropogenic intervention potentially affecting the Yağmapınar population survival is the wastewater discharged from houses into the temporary pond in which *Emys* lives. Apart from fecal and urinary pollution and possible chemical-induced toxic effects, the high rate (23.9 %) of injuries (Fig. 1) observed in the population and thereby increased risk of infections might reach such a proportion that substantially reduce the individual's chance to survive.

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