

# Distribution, Habitats and Preliminary Data on the Population Structure of the European Pond Turtle, *Emys orbicularis* (Linnaeus, 1758), in Vlora Bay, Albania

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**Abstract:** This study provides information about the distribution, habitats and population structure of the European Pond Turtle (*Emys orbicularis*) in the understudied area of Vlora Bay, Albania. We monitored two main types of habitats – freshwater channels (several channels in different areas) and two different ponds between June 2014 and October 2015. We observed a high number of *E. orbicularis* basking aerially and in the water; we captured 147 previously unmarked individuals and recaptured 22 of them. All caught individuals of *E. orbicularis* were measured, individually marked, photographed and released again at the point of capture. In the sampled population of *E. orbicularis* in Vlora Bay, the mean curved carapace length (CCL) for adult males was 12.8 cm (range 11.1–14.9 cm; n = 40), 15.0 cm (range 12.6–17.1 cm; n = 92) for adult females and 7.5 cm (range 4.0–10.6 cm; n = 11) for juveniles. The sex ratio was 2.3 : 1 (female : male) – 63.8% of all captured *E. orbicularis* were females, 28.8% were males and 7.7% were juveniles.

**Key words:** Zverneci Pond, sex ratio, juveniles, morphometrics

## Introduction

Albania is inhabited by two species of freshwater turtles: the more common European Pond Turtle *Emys orbicularis* (Linnaeus, 1758) (family Emydidae) and the Balkan Terrapin *Mauremys rivulata* (Valenciennes, 1833) (family Geoemydidae), which has a limited distribution (HAXHIU 1998). *Emys orbicularis* has a large distribution area ranging from North Africa, most of Europe and the Middle East to the Aral Sea, having at least 13 subspecies with pronounced morphological and genetic differences (FRITZ 1996, 1998, 2003, FARKAS et al. 1998, LENK et al. 1999, AYRES FERNÁNDEZ & CORDERO RIVERA 2001). In Albania, it inhabits permanent water bodies distributed mainly in the western lowlands, from the Shkodra Field in the north to the Saranda Field in the south (HAXHIU 1998) (Fig. 1a). *Emys orbicularis* is regarded as Near Threatened in Europe and Vulnerable in the EU (IUCN 2016) as a result of sig-

nificant long-term population declines. Habitat loss caused by urbanization, road construction, wetland drainage, and overexploitation of water resources is responsible for the species decline (GIBBONS et al. 2000). In Albania, the conservation status of *E. orbicularis* is Near Threatened (NT) (RED LIST OF ALBANIAN FAUNA 2013).

Although there is a number of ecological studies about *E. orbicularis* in many parts of its range (LEBBORONI & CHELAZZI 1991, ROVERO & CHELAZZI 1996, AUER & TAŞKAVAK 2004, CADI et al. 2004, FICETOLA et al. 2004, FICETOLA & BERNARDI 2006, VAMBERGER & KOS 2011, VAMBERGER et al. 2013, VELO-ANTON et al. 2015, KAVIANI & RAHIMIBASHAR 2015, ZUFFI & FOSCHI 2015), studies in Albania are scarce, consisting of sporadic surveys or accidental observations, mainly concerning its distribution (HAXHIU 1985, 1995, 1997, 1998, HAXHIU &

BUSKIRK 2000). Recently, there has been increased interest in the population structure of this freshwater turtle species in Albania (SAÇDANAKU & HAXHIU 2015). The present study aims to provide information about the distribution, habitats and population structure of *E. orbicularis* in Vlora Bay, Albania.

## Materials and Methods

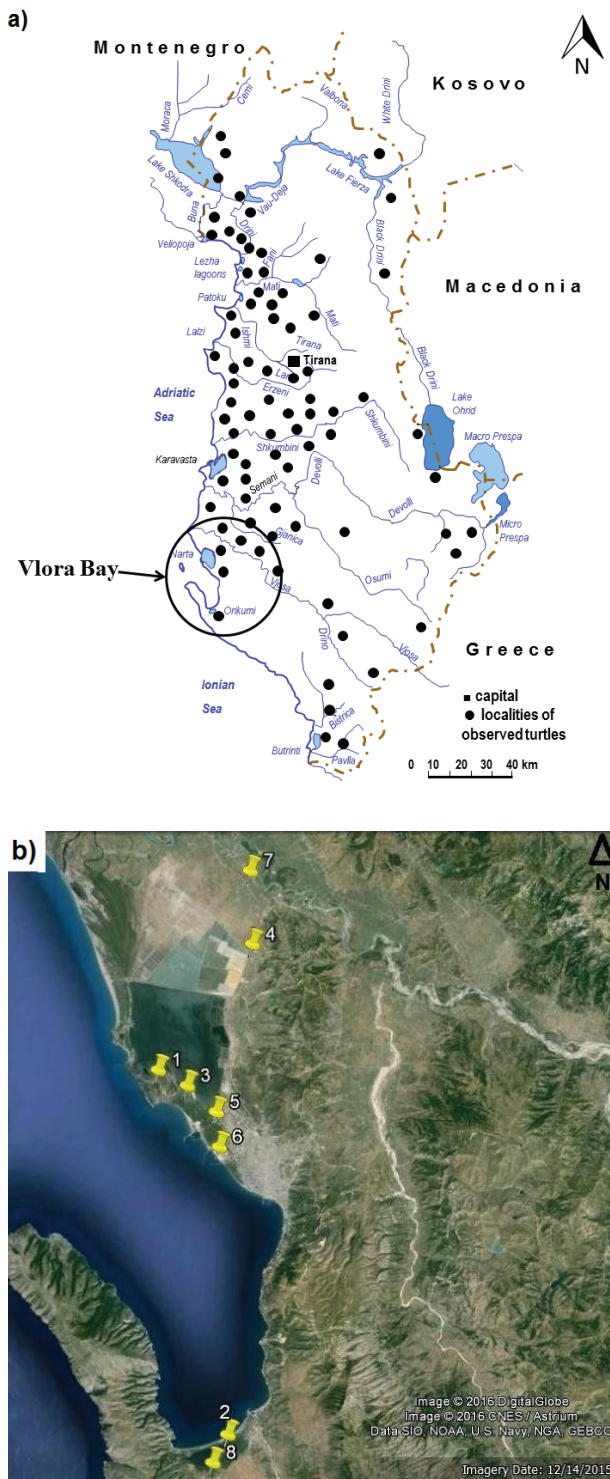
The study was carried out between June 2014 and October 2015. The study sites consisted of the Zverneçi Pond (ca. 0.3 ha) covered with dense vegetation, the Narta Lagoon, a wide area (ca. 0.8 ha) of the Orikumi Wetland and some artificial and natural freshwater habitats (Fig. 1, Table 1).

Dominant plants in the ponds and channels included *Phragmites australis*, *Typha angustifolia*, *Juncus* sp., *Carex* sp., *Potamogeton* sp., while the dominant algae species was *Chara* sp. Turtles were observed by binoculars or with naked eyes and captured using a simple hand net. Each captured turtle was individually marked by notching its marginal scutes (CAGLE 1939), measured with a caliper to the nearest 1.0 mm, photographed and released at the capture site. The following measurements were taken: CCL – curved carapace length (curved distance between the nuchal shield and the posterior margin of the supracaudal), CCW – curved carapace width (curved maximal width of carapace), PL – plastron length (distance between the gular and caudal shields), PW – plastron width (maximal width of plastron), Plas-Clo (distance from the end of the plastron to the middle of the cloacal opening), TTL – total tail length (the distance from the end of the plastron to the top of the tail). Sex was determined based on secondary sexual characteristics (ZUFFI & GARIBOLDI 1995). The smallest turtle showing clear secondary sexual characteristics was a male with a CCL of 11.1 cm, while the largest individual, which did not show any secondary sexual characteristics, had a CCL of 10.6 cm (Table 2); thus, animals under CCL of 11 cm were considered juveniles.

Descriptive statistics of the measurements and rates were calculated using Excel 2010 (Microsoft, USA) software. All of the measurement values were summarized to a mean, one standard error (SE) and range. The ANOVA Single factor test was applied to examine the differences in morphometry (CCL, CCW, PL, PW, Plas-Clo and TTL) between the sexes.

## Results

A total of 147 European Pond Turtles were captured and analyzed. Twenty-two individuals were recap-



**Fig. 1.** (a) Distribution of the European Pond Turtle in Albania (HAXHIU 1998); (b) Locations where surveys were conducted

tured (six males, fifteen females and one juvenile; Table 1). Around 200 individuals were observed from the distance (basking, floating and feeding) in suitable habitats (Fig. 2). Turtles were observed mostly basking out of the water, floating on the surface and feeding on algae.

**Table 1.** The number of captured individuals of *Emys orbicularis* in each location of Vlora Bay, Albania

Habitat type	Location	Coordinates (WGS84)	No. of captured individuals
Freshwater ponds with dense vegetation dominated by <i>Phragmites australis</i>	1. Zvernec	N40°30'42.06"; E19°24'23.46"	89
	2. Orikum	N40°19'19.38"; E19°27'14.10"	1
Freshwater channels with vegetation dominated by <i>Phragmites australis</i> , <i>Juncus</i> sp., <i>Tamarix</i> sp., etc.	3. Near Zverneci Village	N40°30'12.72"; E19°25'34.80"	3
	4. Panaja	N40°34'37.56"; E19°28'15.18"	47
	5. Kavalona Park	N40°29'23.58"; E19°26'46.26"	0
	6. Soda Forest	N40°28'18.18"; E19°26'53.52"	0
	7. Novosel - Akerni	N40°36'54.84"; E19°28'9.84"	3
	8. Marmiroi church	N40°18'27.54"; E19°26'37.80"	4
<b>TOTAL</b>			147

**Table 2.** Morphometrics (in cm) of female, male and juvenile *Emys orbicularis* from Vlora Bay, Albania (mean, standard error, range). \* –  $p < 0.05$ ; \*\* –  $p < 0.01$ 

	Females (n = 92)	Males (n = 40)	Juveniles (n = 11)
CCL	15.0 ± 0.11 (12.6–17.1)**	12.8 ± 0.16 (11.1–14.9)**	7.5 ± 0.80 (4.0–10.6)
CCW	13.7 ± 0.10 (11.5–15.8)**	11.3 ± 0.14 (10.0–12.8)**	6.8 ± 0.65 (4.0–9.5)
PL	13.3 ± 0.11 (11.2–15.9)**	10.4 ± 0.14 (8.9–12.2)**	6.3 ± 0.77 (3.0–9.5)
PW	7.5 ± 0.06 (6.1–8.7)**	5.9 ± 0.08 (5.1–7.0)**	3.6 ± 0.41 (1.9–5.4)
Plas-Clo	0.8 ± 0.03 (0.3–2.0)**	2.0 ± 0.07 (0.7–3.0)**	0.5 ± 0.07 (0.2–0.9)
TTL	6.5 ± 0.12 (3.0–8.6)**	7.2 ± 0.21 (1.5–9.5)**	4.4 ± 0.36 (2.5–6.0)

The sex ratio was 2.3 : 1 (female : male) for the whole population of Vlora Bay, while for the Zverneci Pond and Panaja Channel it was 2.7 : 1 and 1.8 : 1, respectively. Female turtles were most abundant in the population of Vlora Bay (63.5%), followed by males (28.8%) and juveniles (7.7%). Female turtles were abundant in Zverneci Pond (73.0% females, 27.0% males and no juveniles) and Panaja Channel (50.0% females, 28.3% males and 21.7% juveniles). We captured the largest number of juveniles in Panaja Channel (10 individuals).

Mean carapace, plastron and tail measurements (cm) are provided for the 92 females, 40 males, and 11 juveniles captured in the Vlora Bay (Table 2).

Adult females had the largest CCL values. In general, males had a longer tail than females. The Plas-Clo length of females was generally smaller than that for males.

Analyses of variance showed that there were highly significant differences in the six carapace, plastron and tail measurements between females and males in the whole population of *E. orbicularis* in Vlora Bay (CCL:  $F_{1,130} = 114.8$ ,  $p < 0.01$ ; CCW:  $F_{1,130} = 168.6$ ,  $p < 0.01$ ; PL:  $F_{1,130} = 220.0$ ,  $p < 0.01$ ; PW:  $F_{1,129} = 241.3$ ,  $p < 0.01$ ; Plas-Clo:  $F_{1,123} = 287.1$ ,  $p < 0.01$ ; TTL:  $F_{1,124} = 9.4$ ,  $p < 0.01$ ;  $\alpha = 0.05$ ).

## Discussion

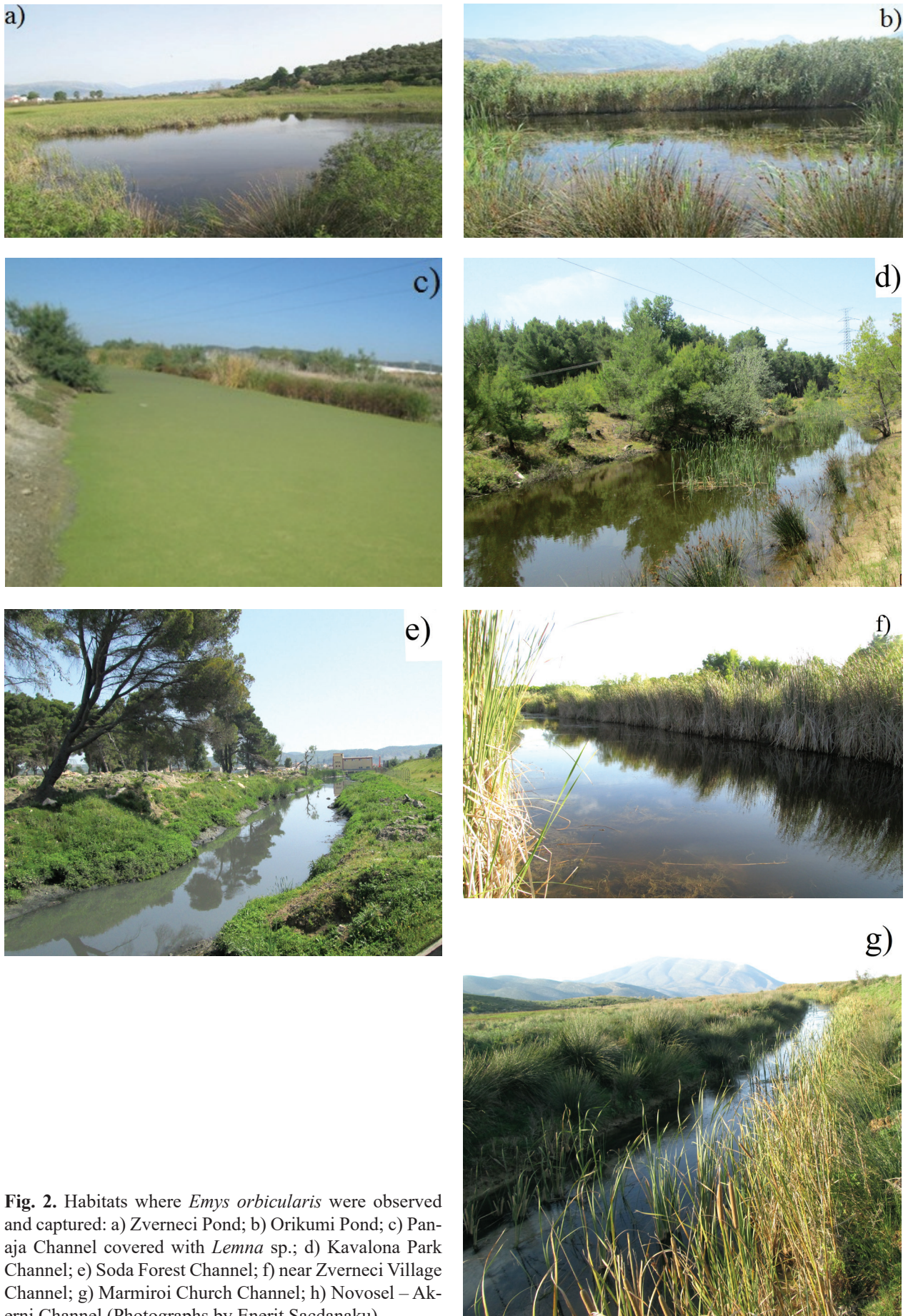
*Emys orbicularis* is reported to inhabit a large variety of habitats throughout its European range, such as ponds, slow moving streams, ditches, marsh lands, also with turbid waters; it prefers mud-stones and abundant aquatic vegetation (STREET 1979). Its abundance is not related to habitat extension, so that small pools can support a high numbers of specimens (ROLLINAT 1934, FRETTEY 1975). The population studied in the Vlora Bay seems to exploit a range of quite typical habitats in Albania: lentic and lotic habitats, both polluted (Soda forest channel) and unpolluted.

The carapace and tail measurements in the present study are in line with previous studies, which have found that females of the European Pond Turtle are larger than males (AYAZ & ÇIÇEK 2011, KAVIANI & RAHIMIBASHAR 2015) and Plas-Clo is larger in males than in females (KAVIANI & RAHIMIBASHAR 2015).

We are in line with the result of AYAZ & ÇIÇEK (2011) who found that the smallest turtle showing secondary sex characteristics was a male with SCL of 112.0 mm; smaller specimens were considered juveniles.

The amount of captured juveniles in our study was rather low. BURY (1978) stated that juvenile





**Fig. 2.** Habitats where *Emys orbicularis* were observed and captured: a) Zverneci Pond; b) Orikumi Pond; c) Panaja Channel covered with *Lemna* sp.; d) Kavalona Park Channel; e) Soda Forest Channel; f) near Zverneci Village Channel; g) Marmiroi Church Channel; h) Novosel – Akerni Channel (Photographs by Enerit Saçdanaku)

proportions of freshwater turtles in different populations vary between 0 and 70%. He also suggested that juveniles, in general, appear to comprise a variable but low percentage of most populations, in contrast to a high proportion of long-lived mature individuals. Studies on other populations of *E. orbicularis* in Europe revealed similar results, with 18.9% (MATZOTH 1995), 29% (KELLER et al. 1998) and 6.8% (AYAZ & ÇIÇEK 2011). In other studies on the species, the proportion of juveniles ranged from 1.9% to 55% (KELLER 1997, SERVANT 1998, AUER & TAŞKAVAK 2004, CADI et al. 2004, AYAZ et al. 2007, 2008). On the other side, the lack of records of juvenile turtles from Zverneci Pond likely does not reflect the real situation, but is possibly a result of a bias in the detection and capture methods we utilized and possibly specific habitat characteristics. Generally, juvenile European Pond Turtles prefer small, shallow water bodies with dense vegetation, where they can easily find food, shelter and protection from predators, and live a more cryptic life than adults (e.g., ZUFFI 2000, MOSIMANN & CADI 2004).

The sex ratio in adults observed throughout the study was generally female-biased. Differently

skewed sex ratios were observed in different European Pond Turtle populations: female-biased (GIRONDOT & PIEAU 1993, MATZOTH 1995, MASCORT 1998, SERVANT 1998, SNIESHKUS 1998, AYAZ & ÇIÇEK 2011), balanced (TAŞKAVAK & AYAZ 2006) and male-biased (AUER & TAŞKAVAK 2004, FRITZ 2001, 2003, CADI et al. 2004, MOSIMANN & CADI 2004, AYAZ et al. 2007, 2008). This variation could also be related to environmental temperature, since sex is determined in this species by temperature (i.e., temperature sex determination, TSD) (EWERT & NELSON 1991, JANZEN & KRENZ 2004), as in all other known species of Chelonia (ALDERTON 1997, MOLL & MOLL 2004). In turtles with TSD, males are generally produced at cooler temperatures, ranging between 22.5°C and 27°C. Female turtles are produced at warmer temperatures, around 30°C (EWERT & NELSON 1991). Our study site in western Albania (Vlora Bay) typically has a Mediterranean climate and experiences high temperatures during the breeding period of *E. orbicularis*. It is therefore probable that most of the nests have been producing females and our population, therefore, is skewed toward females.

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