

Population Structure of European Pond Turtles, *Emys orbicularis* (Linnaeus, 1758) in Narta Lagoon (Vlora Bay, Albania)

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Abstract—In this study was monitored the population of the European Pond Turtle, *Emys orbicularis* (Linnaeus, 1758) in the area of Narta Lagoon, Vlora Bay (Albania), from August to October 2014. A total of 54 individuals of *E. orbicularis* were studied using different methodologies. Curved Carapace Length (CCL), Plastron Length (PL) and Curved Carapace Width (CCW) were measured for each individual of *E. orbicularis* and were statistically analyzed. All captured turtles were separated in seven different size – classes based on their carapace length (CCL). Each individual of *E. orbicularis* was marked by notching the carapace (marginal scutes). From all individuals captured resulted that 37 were females (68.5%), 14 males (25.9%), 3 juveniles (5.5%), while 18 individuals of *E. orbicularis* were recaptured for the first and some for the second time.

Keywords—*Emys orbicularis*, female, juvenile, male, population, size – classes.

I. INTRODUCTION

WITHIN vertebrates, turtles are among the most endangered species. Approximately 10% of the 317 recent turtle species worldwide belong to the IUCN Red List category “critically endangered” [12], [17]. In Albania, the threatened status of European Pond Turtle, *Emys orbicularis* is Low Risk (LR) [13]. This species is one of the most widely distributed water turtle species ranging from Northwestern Africa in the west to the former Aral sea in the east, and from the Moscow region in the north to the Turkishsyrian border in the south [1], [2].

The populations of the European Pond Turtle are threatened due to many factors, primarily destruction and disappearance of habitats [4], [17], [18]. Although the species is considered within the scope of the species requiring conservation in the Bern Convention and in ANNEX II of the European Habitat and species directives, it is included in the category of “*near threatened*” in the Red List of IUCN [16].

The European populations of the species are threatened by destruction (especially swamps) and disappearance of their habitats, industrial and agrochemical contamination, destruction of eggs due to cultivation of the soil, and the occupation of the habitat of the species by foreign freshwater

turtles [15]. Albanian populations are endangered, particularly due to habitat destruction [11].

Data on *Emys orbicularis* in Albania had been very scarce. They consisted of sporadic surveys or accidental observations, mainly on geographical distribution of sea turtles in Albania [5]–[10]. This species is mostly distributed on western lowland of Albania (see Fig. 1).

The present study aims to provide information on the population structure of *E. orbicularis*, its sex ratio, and body sizes, thereby contributing to the scarcely known ecology of the Albanian populations of the species.

II. MATERIAL AND METHODS

The study was carried out between August and October 2014 (a three month period). The study site comprises a small pond covered with dense vegetation with an area of about 0.3 ha in Narta Lagoon [40°31' 52''N, 19°25' 26''E] western Albania (see Figs.1 and 2). Dominant plants in the pond vegetation include *Phragmites australis*, *Typha angustifolia*, *Juncus* sp., *Carex* sp. and *Potamogeton* sp. The pond was covered with algae, where the dominant species was *Chara* sp. and other green algae. Except of *E. orbicularis*, one amphibian *Rana balcanica*, two reptilians *Mauremys rivulata* and *Natrix natrix*, some water birds as *Fulica atra* inhabit the pond. During the study period, the air temperature was 28-34°C, water temperature was 27- 31.5°C, and the weather was clear. Turtles were caught during daytime between 08.00-12.00 h and 14.00-17.00 h by net and hand. Each captured turtle was individually marked by notching its marginal scutes [3], (see Fig. 3). This was a very important method, because it gives the information about their reproduction biology, as well as incremental growth. Then, the individuals were released, each to its place of capture.

The following measurements were taken:

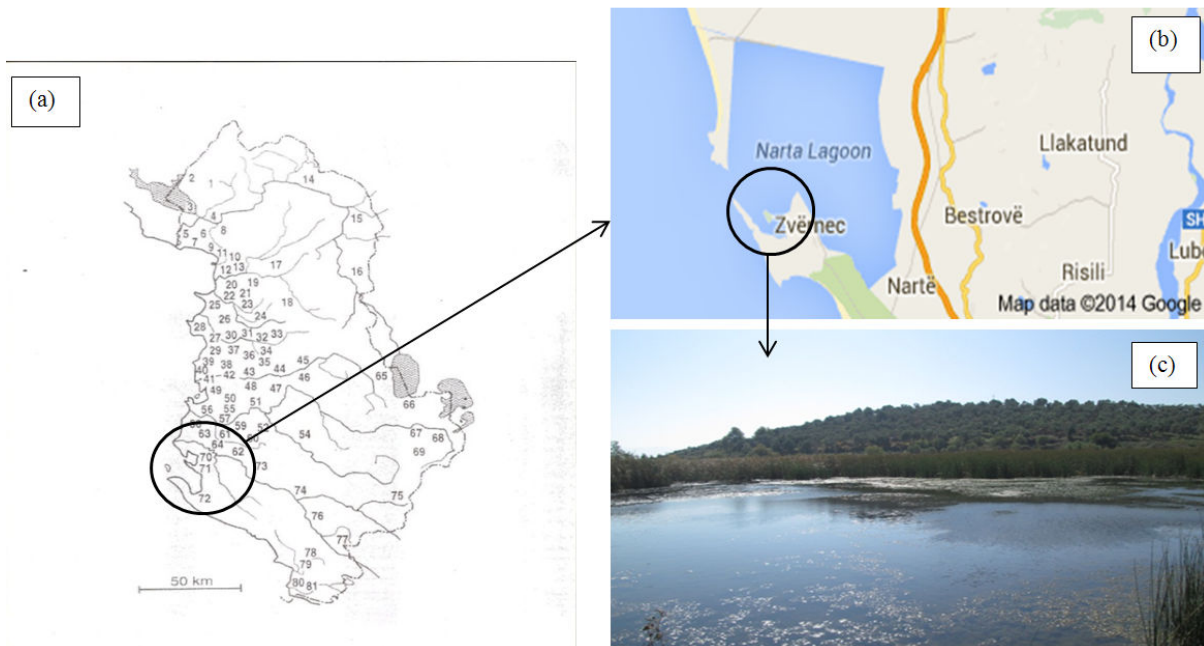
- Curved carapace length (CCL): curved distance between the nuchal shield and posterior margin of supracaudal shield;
- Curved carapace width: curved maximal width of carapace.
- Plastron length (PL): distance between gular and caudal shields; Plastron width (PW): maximal width of plastron; Body size (B): the weight of individual (g).

Sex was determined by secondary sexual characteristics (e.g., plastral concavity, length of tail) [14]. Turtles of less than 12 cm (120 mm) CCL were considered too small for

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sexing and were classified as juveniles. The rest of individuals were classified as males and females.



Figs. 1-3 (a) Geographical distribution of *Emys orbicularis* in Albania; (b) Study area (map of Narta lagoon); (c) The habitat of *E. orbicularis* (small pond where the turtles were caught)

Females were larger than males, with a curved and higher carapace, shorter and thinner tail, while males were smaller, with a flattened lower carapace, longer and thicker tail. The shape of plastron was an important element in determining the sex. Females had a flat (or a bit convex) plastron, while males had obviously a concave plastron (see Fig. 4). Some of the data were statistically analyzed.



Fig. 4 An adult male of *E. orbicularis* marked by a notch in two of right marginal scutes



Fig. 5 An adult female of *E. orbicularis* above and an adult male of the same species below

III. RESULTS AND DISCUSSION

A total number of 54 individual of *E. orbicularis* (37 females or 68.5%, 14 males or 25.9%, 3 juveniles or 5.5%) were captured and marked, where 13 turtles were recaptured for the first time and 5 were recaptured for the second time (18 recaptures) (see Tables I and II). Of these recaptured turtles, 9

were females (69.2%), 4 were males (30.7%) and none of the juveniles were recaptured during the period of study. Recaptures are a very important data, because they show the incremental growth of the individual during time. In our study the recaptured individuals did not showed any differences in growth, because the period of time within two captures was very short (the longest period was 54 days after first captures) and differences were insensible.

The sex ratio of marked individuals was 12.3:4.6:1 (female : male : juveniles). It is clearly seen that the females dominate the population of *E. orbicularis* in this area (68.5%), while juveniles are represented with a few individuals (5.5%). This may be explained with the threatened factor, where juveniles stay more hidden in the vegetation or in the bottom of the pond and do not show up very often.

TABLE I
CAPTURE HISTORY OF *EMYS ORBICULARIS* IN THE SMALL POND (NARTA LAGOON) FROM AUGUST – OCTOBER 2014

	05 Aug	09 Aug	27 Aug	28 Aug	30 Aug	31 Aug	09 Sept	20 Sept	21 Sept	30 Sept	01 Oct	02 Oct	03 Oct	09 Oct	10 Oct	11 Oct	12 Oct	19 Oct	Total
N	3	5	1	6	2	3	4	6	4	8	4	4	1	7	4	1	4	5	72
U	3	5	1	6	2	3	3	5	1	5	3	2	0	6	2	1	4	2	54
M	0	0	0	0	0	0	1	1	3	3	1	2	1	1	2	0	0	3	18

N – Total Number of Animals Caught, U - Number Of Animals Caught Once, M - Number Of Recaptures

TABLE II
THE SEX RATIO AMONG THE *EMYS ORBICULARIS* SPECIMENS IN THE SMALL POND (NARTA LAGOON) CAPTURED FROM AUGUST – OCTOBER 2014

	05 Aug	09 Aug	27 Aug	28 Aug	30 Aug	31 Aug	09 Sept	20 Sept	21 Sept	30 Sept	01 Oct	02 Oct	09 Oct	10 Oct	11 Oct	12 Oct	19 Oct	Total
M	2	1	0	0	1	1	1	2	0	0	0	0	3	0	0	3	0	14
F	1	4	1	6	1	2	2	3	1	5	3	1	3	2	1	1	0	37
J	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	3

M - Males, F - Females, J – Juveniles.

In Tables III-V are given some statistical data referring to these parameters: curved carapace lengths (CCL), curved carapace width (CCW) and plastron lengths (PL) for each group of individuals, female (Table III); male (Table IV); juvenile (Table V). From statistical data tables it is seen that the average curved carapace lengths (CCL) is 15.37 cm for females, 13.75 cm for males and 11.43 cm for juveniles. The average curved carapace width (CCW) is 14.08 cm for females, 12.21 cm for males and 10.23 cm for juveniles. The average plastron lengths (PL) were 13.67 for females, 11.31 for males and 9.33 for juveniles. The largest female had a CCL of 17.1 cm, CCW of 15.8 cm and a PL of 15.9 cm, while the smallest female turtle had a CCL of 13.5 cm, CCW of 11.9 cm and PL of 11.2 cm. The largest male had a CCL of 14.9 cm, CCW of 13.4 cm and a PL of 12.6 cm, while the smallest male turtle that showed secondary sexual characteristics had a CCL of 12.8 cm, CCW of 11.0 cm and PL of 10.5 cm. The largest juvenile, that did not showed any secondary sexual characteristics in this study, had a CCL of 11.7 cm, CCW of 10.6 cm and PL of 9.8 cm, while the smallest juvenile turtle had CCL of 11.1 cm, CCW of 10.0 cm and a PL of 8.9 cm. From these data it is clearly seen that for all parameters (CCL, CCW, PL) the average value was higher in females individuals. This result is a test that proves females are larger animals than males.

All captured individuals of *E. orbicularis* were separated in seven different size – classes based on their carapace length (CCL). Turtles were allocated into 1 cm (10 mm) size – classes (length frequency distribution), where the first size – class was from 11.1 - 12.0, the second from 12.1 – 13.0 cm and till the last one, that was from 17.1 – 18.0. First, altogether individuals of *E. orbicularis* were classified according to size

– classes and then by each group of sex (female, male and juveniles) (see Figs. 6 and 7).

TABLE III
STATISTICAL DATA FOR FEMALE INDIVIDUALS (N=37)

	CCL	CCW	PL
Mean	15.37	14.08	13.67
Standard Error	0.17	0.15	0.18
Median	15.5	14.3	13.5
Mode	15.5	15	14.2
Standard Deviation	1.07	0.96	1.11
Sample Variance	1.16	0.93	1.24
Kurtosis	-1.11	-0.76	-0.39
Skewness	0.04	-0.14	0.11
Range	3.6	3.9	4.7
Minimum	13.5	11.9	11.2
Maximum	17.1	15.8	15.9
Sum	568.7	521.2	505.8
Count	37	37	37
Confidence Level (95.0%)	0.35	0.32	0.37

TABLE IV
STATISTICAL DATA FOR MALE INDIVIDUALS (N=13)

	CCL	CCW	PL
Mean	13.75	12.21	11.31
Standard Error	0.16	0.16	0.17
Median	13.8	12.2	11.3
Mode	13	12.6	10.5
Standard Deviation	0.6	0.58	0.62
Sample Variance	0.36	0.33	0.39
Kurtosis	-0.4	1.31	-0.09
Skewness	0.05	-0.11	0.46
Range	2.1	2.4	2.1
Minimum	12.8	11	10.5
Maximum	14.9	13.4	12.6
Sum	178.8	158.8	147.1
Count	13	13	13
Largest (1)	14.9	13.4	12.6
Smallest (1)	12.8	11	10.5
Confidence Level (95.0%)	0.36	0.35	0.37

From Figs. 6 and 7 it is clearly seen that the largest number of individual of *E. orbicularis* belongs to the class 15.1-16.0cm (14 individuals), while the smallest number to the class 17.1 – 18.0 cm (2 individuals). From this result we see that typical size – class for juveniles is 11.1- 12.0 cm (all individuals of juveniles belong to this class). Males resulted to be in three different size – classes: 12.1- 13.0 cm (3 individual belongs to this class); 13.1- 14.0 cm (6 individuals); 14.1 – 15.0 cm (4 individuals). So, typical size – class for males is 13.1- 14.0 cm, because in this class we had the largest number of males. Females resulted to be in 5 different size – classes: 13.1- 14.0 cm (5 individuals); 14.1 – 15.0 cm (9 individuals); 15.1 – 16.0 cm (14 individuals); 16.1 – 17.0 cm (7 individuals); 17.1 – 18.0 cm (2 individuals). So, typical size – class for females is 15.1 – 16.0 cm, because in this class we had the largest number of females (14 individuals). Two size – classes are common for both males and females, as we see from the chart. So, we have the class 13.1- 14.0 cm, which was typical for males, but we had in this class 5 females, also. In the class 14.1 – 15.0 cm we had 4 males and 9 females.

Carapace length of males has a range from 12.1 – 15.0 cm, while carapace length of females from 13.1 – 18.0.

TABLE V
STATISTICAL DATA FOR MALE INDIVIDUALS (N=3)

	CCL	CCW	PL
Mean	11.43	10.23	9.33
Standard Error	0.17	0.18	0.26
Median	11.5	10.1	9.3
Standard Deviation	0.3	0.32	0.45
Sample Variance	0.09	0.1	0.2
Skewness	-0.93	1.54	0.33
Range	0.6	0.6	0.9
Minimum	11.1	10	8.9
Maximum	11.7	10.6	9.8
Sum	34.3	30.7	28
Count	3	3	3
Largest (1)	11.7	10.6	9.8
Smallest (1)	11.1	10	8.9
Confidence Level (95.0%)	0.75	0.79	1.12

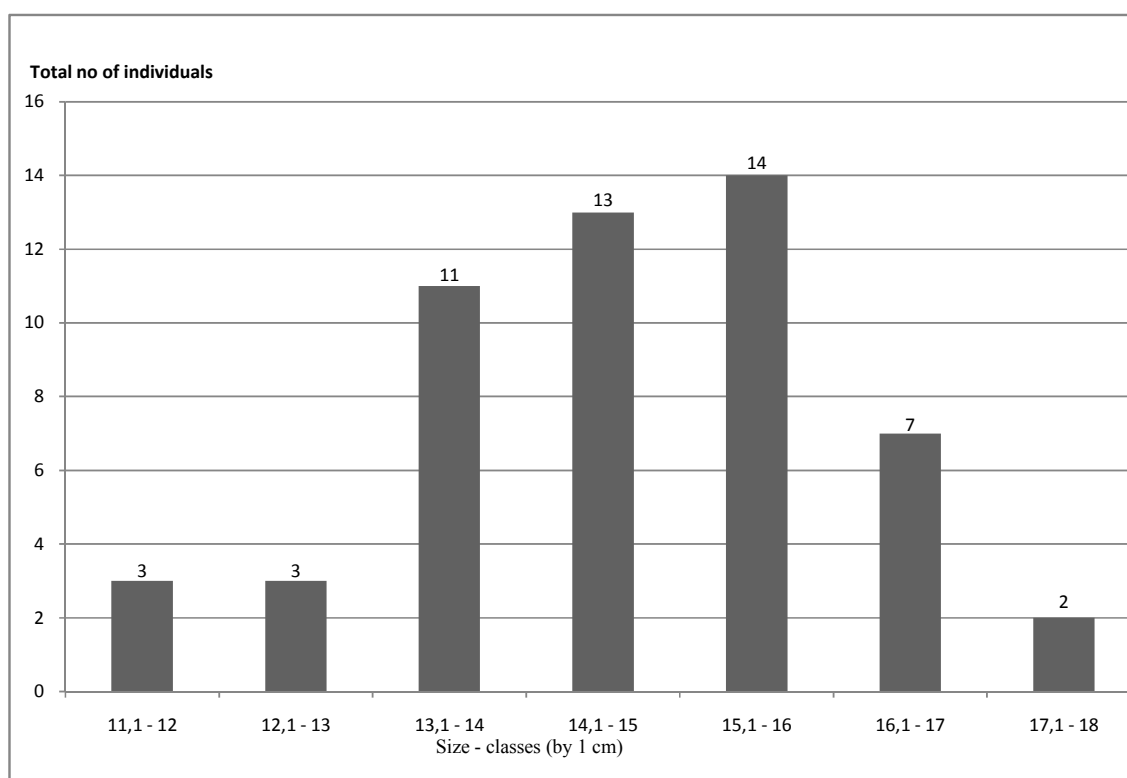


Fig. 6 General distribution of individuals of *E. orbicularis* by 1 cm size – classes (7 size – classes)

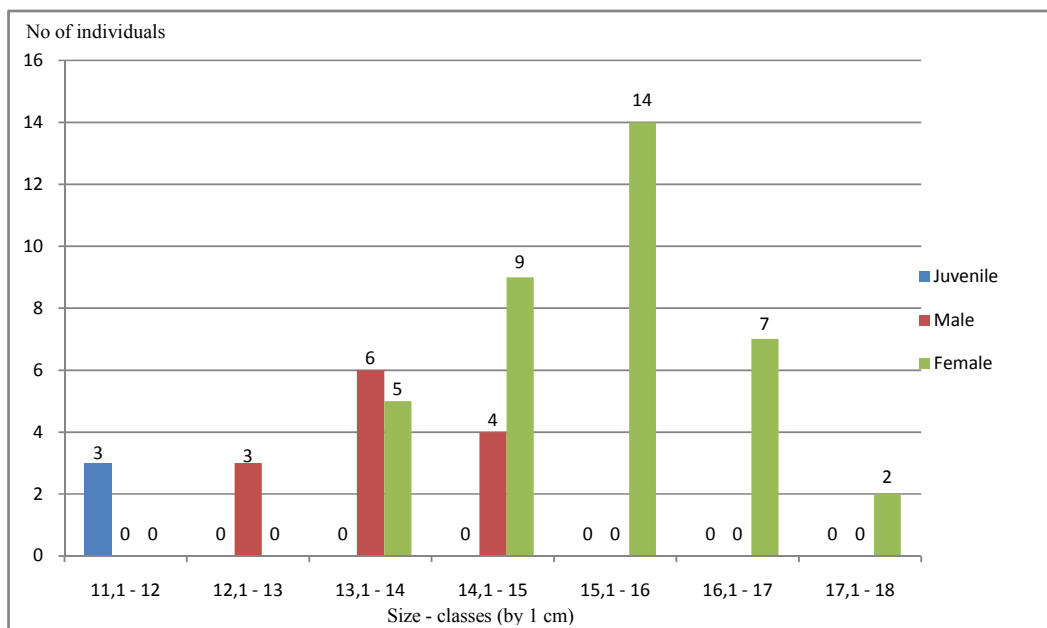


Fig. 7 Distribution of Females, males and juveniles individuals of *E. orbicularis* by 1 cm size – classes (7 size – classes)

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