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Notes on the population reinforcement project for *Emys orbicularis* (LINNAEUS, 1758) in a natural park of northwestern Italy (Testudines: Emydidae).

Bemerkungen zu populationsstützenden Maßnahmen für *Emys orbicularis* (LINNAEUS, 1758) in einem Naturpark Nordwestitaliens (Testudines: Emydidae)

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KURZFASSUNG

In einem zweijährigen Versuch wurden populationsstützende Maßnahmen an *Emys orbicularis* (LINNAEUS, 1758) im "Parco Lombardo della Valle del Ticino" (Nordwestitalien) durchgeführt, wo die Art in ihrem natürlichen Bestand ernsthaft bedroht zu sein scheint. Die Eingewöhnung der wiedereinzubürgernden Individuen (Verbleib am Ort, Überdauern des Winters) verlief zufriedenstellend, jedoch wurde Fortpflanzung nicht beobachtet, obwohl die ökologischen Bedingungen des Gebiets den Ansprüchen der Sumpfschildkröte weitgehend genügen sollten. Der durch menschliche Eingriffe verursachte Mangel an geeigneten Nistplätzen ist wahrscheinliche Ursache für die heute lückenhafte Verbreitung von *Emys* im Parkgebiet.

ABSTRACT

Reinforcement of an *Emys orbicularis* (LINNAEUS, 1758) population was carried out during a two years pilot project in "Parco Lombardo della Valle del Ticino" (northwestern Italy), where the species seems to be seriously threatened. The acclimation (continuous presence, winter survival) of the reintroduced specimens seemed to be satisfactory, but reproduction was never observed. The ecological traits of the area meet well with the needs of the tortoise. Paucity of suitable nesting sites, due to human activities, probably causes the current scattered distribution of *Emys* in the park.

KEYWORDS

Emys orbicularis; descriptive ecology, population reinforcement; northwestern Italy

INTRODUCTION

Within the last 20 years, the distribution area of *Emys orbicularis* (LINNAEUS, 1758) has been markedly reduced in northwestern Italy (FRISENDA & BALLASINA 1990) where the species is patchily present throughout the region to date (ANDREONE 1988; ANDREONE & SINDACO 1989; FERRI 1990). The status of the European Pond Terrapin is largely critical along the Po river valley, except for most coastal areas. The reasons for this must be seen in the progressive decrease and/or destruction of suitable habitats, i. e. extended wet areas.

Among the natural residual areas of the Po valley, the Ticino river valley is undoubtedly still suitable for the species. Today, *E. orbicularis*, once abundant and common in this valley (VANDONI 1911), is restricted to the central and southern portion of the river and adjoining humid areas, with no more than 10 reliable recent observations (ZUFFI 1988). Two natural parks (fig. 1), established in the eighties, protect the valley's natural habitats.

In 1989 the authorities of "Parco Lombardo della Valle del Ticino" initiated a population reinforcement programme to test the acclimation potential of a limited number of terrapins to central northern territory conditions (ZUFFI & al. 1993).

The present paper describes the project and makes proposals for further reinforcement strategies and future management.

MATERIALS AND METHODS

To avoid potential subspecific gene flow (PARENT 1983; FRITZ 1989, 1992, 1993; ZUFFI & GARIBOLDI 1993a), specimens for population reinforcement (18 adult males and 23 adult females - spring 1989; 4 females - spring 1990) were taken from localities of the Adriatic Sea coast, mainly from "Gran Bosco della Mesola" Reserve (Province of Ferrara).

For long distance recognition two numbered graphite tallies were attached to each side of the carapace, as suggested by LEBBORONI (pers. comm. February 1989; LEBBORONI & CHELAZZI 1991). The specimens were weighed, and measured (plastron length, carapace length and width, shell height). For identification the terrapins were marked as reported by STUBBS & al. (1984) and SERVAN & al. (1986).

The tortoises were transferred to "La Fagiana" Reserve (a large protected area closed to the public - fig. 1), and kept in an outdoor enclosure (13 m^2 in size, with an artificial pool of about 3 m^2) for three weeks. Two specimens escaped during this period of acclimation.

The specimens were then released in a meander cut-off, called "Lanca Paradiso" (figs. 1, 2). This is an elongate freshwater lake, 157 m in length, stretching from north to south, furnished with dense riparian vegetation (*Carex*, *Typha*, *Rubus* species). The area is dominated by mature deciduous woodland (*Quercus*, *Carpinus*, *Populus* species) along the Delizia stream, which connects the Ticino river to "Lanca Paradiso". The southern portion of "Lanca Paradiso" was separated from the Delizia stream by a wire net and the terrapins were fed in situ for about two weeks, to avoid initial dispersion. Nevertheless, 14 specimens disappeared in the first two days after release.

The remaining *E. orbicularis* specimens (n=29) were observed continuously during spring and summer 1989 (188 observations, including recognized and unrecognized marked specimens), and regular controls were made from 1990 till 1992.

The pattern of activity (frequency of observation, frequency and distance of displacement), as well as thermal and environmental data were recorded on field cards. Data were analyzed using parametric and non-parametric statistical procedures, at $\alpha = 0.05$ (ARMITAGE 1979; SIEGEL 1986).

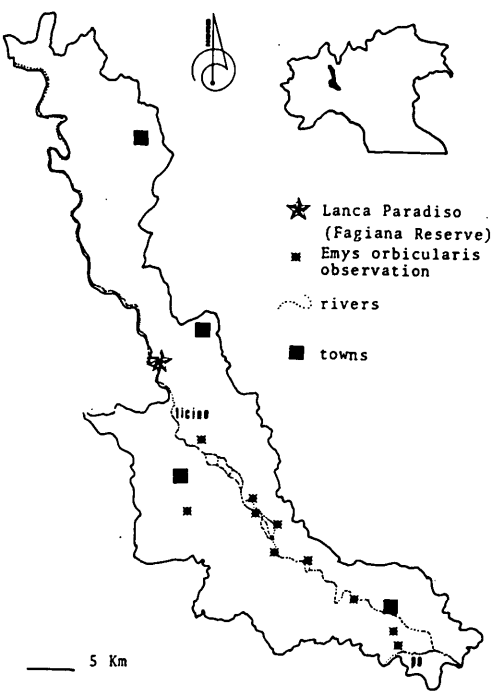

Fig. 1: "Parco Lombardo del Ticino" (northwestern Italy). Autochthonous locality records of *Emys orbicularis* prior to release, reintroduction site "Lanca Paradiso", and first acclimation site "La Fagiana".

Abb. 1: "Parco Lombardo del Ticino" (Nordwestitalien). Vorkommen von *Emys orbicularis* vor der Aussetzung, Ort der Wiedereinbürgerung "Lanca Paradiso" und erster Eingewöhnungsplatz "La Fagiana".

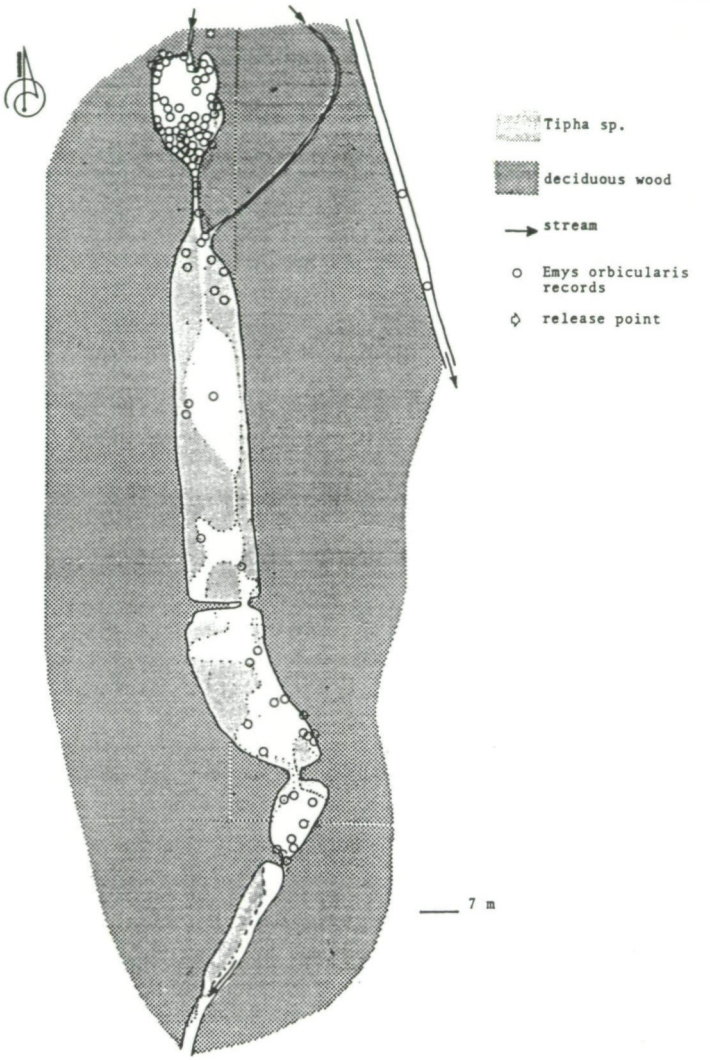

Fig. 2: The "Lanca Paradiso" basin. Release point and records of the released *Emys orbicularis* specimens in June 1989.
Abb. 2: Das "Lanca Paradiso" - Becken. Aussetzungsstelle und Fundorte der ausgesetzten *Emys orbicularis* Exemplare im Juni 1989.

RESULTS

In 1989 we recorded relatively constant thermal conditions for air and water temperature respectively with peaks in July and August (table 1), and a very scarce human presence (only the guards).

In summer 1992 several individuals (no. 4, 7, 23, 24, 32, 36) were found almost in the same locations where they were released. Similar observations were made in natural populations (LEBBORONI & CHELAZZI 1991). Almost all displacements occurred within the "Lanca Paradiso" area, where the dispersal of specimens along the main basin axis was noteworthy, especially in June 1989 (fig. 2).

In the year 1989 the terrapins were searched for from 8.00 a. m. to 6.30 p. m., with the highest frequencies from 8.30

Table 1: Air and water temperatures at "Lanca Paradiso" nature park from June to September 1989.
Tab. 1: Luft- und Wassertemperaturen im Naturpark "Lanca Paradiso" von Juni bis September 1989.

		June	July	August	September	ANOVA
Air/ Luft	Mean/Mittel±SE	22.96±0.23	25.8±0.45	23.95±0.23	21.63±0.54	f=20.182
	Range/Grenzen	19.2-28.0	19.3-28.5	23.0-25.6	19.5-23.8	p<0.0001
	n	48	30	14	11	
Water/ Wasser	Mean/Mittel±SE	15.29±0.23	16.04±0.3	18.93±0.27	16.17±0.35	f=26.016
	Range/Grenzen	13.0-19.0	14.9-20.4	15.8-19.5	14.1-16.8	p<0.0001
	n	42	18	14	7	

a. m. to 12.00 a. m. and from 2.00 p. m. to 6.00 p. m., especially in June-July (fig. 3). The number of observations was significantly dependent on the time of the day in June (Chi^2=93.47, 4 df, p<0.001), July (Chi^2=44.74, 4 df, p<0.001) and August (Chi^2=12.19, 4 df, 0.01 < p < 0.02), thus, revealing a clear-cut bimodal activity pattern. Data from September were not analyzed, due to small sample size.

Frequencies of male and female individuals observed were different from month to month. Males were seen less regularly than females in June-July and more regularly than females in August-September (table 2). This difference was highly significant (Chi^2=42.03, 3 df, p<0.001), indicating that females reduced their activity from midsummer to autumn or/and, at least, tended to be more elusive in late summer.

In the following year (1990) the terrapins became active between the last decade of April and the first decade of May. In the Emilia Romagna region, from where the specimens originated, activity usually started in March-April (pers. obs. 1990 - 1992), while in Tuscany (central Italy) the active period begins in February-March (LEBBORONI & CHELAZZI 1991).

In 1989 displacements from the reintroduction site (figs. 1, 2) ranged from 3 m to 172 m; on the average, males moved 33.12±5.31 m (n=73) and females 43.78±6.95 m (n=63) from the point of release (Mann-Whitney U test, z=0.53, p>0.05), indicating a relatively, not significantly higher mobility in females than in males (table 3). Two males and two females moved much more than other specimens (distances greater than 130 m), but no significant sexual difference was found between these four specimens (Mann-Whitney U test, z=0.54, p>0.05). In July and August, displacements from the reintroduction site were more pronounced than in June, but not significantly.

A four specimens group was observed from April 1990 to June 1992, about 4 km southeast along the Delizia stream, and an errant individual was found 3 km southeast in a meadow near the little town Casterno.

No breeding activities were recorded in the wild, whereas five couples bred in captivity. We were not able to determine whether predation occurred, nor did we find any dead Pond Terrapins.

Biometrical analyses confirmed the known sexual dimorphism in adults, where males are smaller and lighter than females (ROLLINAT 1934; LANZA 1983; DI TRANI 1989; ZUFFI & GARIBOLDI 1993b).

Table 2: Monthly (June to September) frequencies of male/female *Emys orbicularis* individuals observed in 1989 (in per cent of all males/females present in the area).

Tab. 2: Monatliche (Juni bis September) Beobachtungshäufigkeiten männlicher (m) / weiblicher (f) Individuen von *Emys orbicularis* im Jahre 1989 (in Prozent aller im Gebiet vorhandenen Männchen/Weibchen).

	Males (m)	Females (f)
June	37.7	49.1
July	42.5	52.5
August	55.2	24.1
September	81.8	18.2

Table 3: Displacement (distance in m from reintroduction site) of 29 *Emys orbicularis* from June to September 1989. No - individual number, n - number of observations, m - male, f - female.

Tab. 3: Ortsveränderung (Entfernung vom Aussetzungsort in m) von 29 *Emys orbicularis* zwischen Juni und September 1989. No - Exemplar Nummer, n - Anzahl der Beobachtungen, m - Männchen, f - Weibchen.

No	Sex	n	June	n	July	n	August	n	September
1	m	3	17.67±1.85						
3	f	4	46.25±1.88	1	29.00				
5	f	2	3.9-5.4	1	12.00				
6	f					1	14.00		
7	f	2	128.5-140.0						
8	f	1	20.00						
10	m	7	14.64±8.11	4	9.50±3.30	3	20.00±2.64	2	21.0-24.1
12	m					1	16.00		
13	f	5	136.20±33.23	1	167.00				
14	m			1	19.00	1	21.00		
15	f	3	58.67±42.68	1	172.00				
16	f	1	33.00	1	19.00				
19	f	5	57.80±27.14	2	13.2-13.2	1	13.00		
20	f	1	12.00	4	14.50±0.50				
21	m	2	169.2-175.0						
22	f	1	15.50						
23	f	1	20.00						
24	m	1	152.00	2	145.8-163.3	2	151.7-151.7	1	131.00
26	f	4	19.75±0.48			1	23.00	2	21.0-24.1
27	m	1	13.00	1	17.00	1	15.00		
31	f	3	17.00±11.00	3	8.66±4.25				
32	f	5	21.20±3.75	1	13.00				
34	m	4	11.63±2.51	1	17.50	3	18.00±2.88		
35	m	10	16.75±1.01	4	18.25±0.75	2	11.7-12.4	3	22.00±1.52
36	m	6	27.83±9.45	3	18.00±0.58	2	13.4-14.0	3	21.00±1.73
38	f			1	3.00				
39	f			1	26.00				
40	f			3	17.66±2.73	3	9.66±1.67		
41	m			1	3.00	1	21.00		

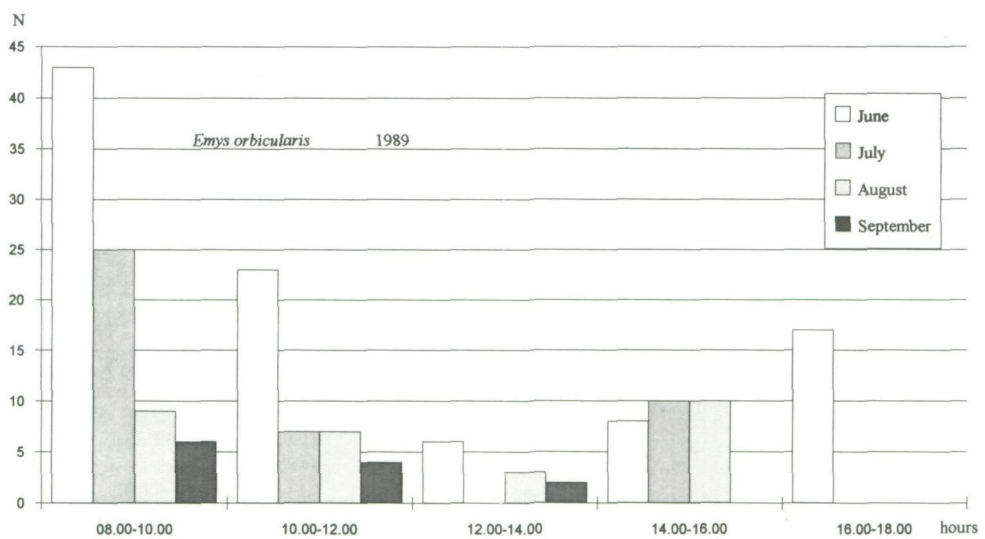

Fig. 3: Number of daily observations (N) of *Emys orbicularis* from June to September 1989, grouped in two-hours classes (the period from 6.00 to 6.30 p. m. (18.00 - 18.30) was excluded because of lack of data).

Abb. 3: Zahl täglicher Beobachtungen (N) von *Emys orbicularis* zwischen Juni und September 1989, zusammengefaßt in 2-Stunden-Klassen (die Zeit von 18.00 Uhr bis 18.30 ist aus Datenmangel unberücksichtigt).

DISCUSSION

Whether animals - introduced or reintroduced into a new ambience - will die, migrate or stay depends on the species' biology and ecology and may vary among sexes. Exact prediction of migration rate, displacement, home-range, homing ability, reproductive biology etc. of an introduced population in the new ambience is impossible. This is true even if the biotope where the animals were collected and the one where they are released show very similar features.

Special techniques of release were chosen to avoid most of the stress caused by capture and new ambience. With respect to originality and stability, the habitat selected is certainly suitable for releasing the animals.

Wild *Emys* in central Italy performed comparatively wider displacements (LEBBORONI & CHELAZZI 1991) than those observed in the "Lanca Paradiso" population. This can probably be explained by the absence of foraging and reproductive competition in the latter.

Recorded temperatures were similar to those considered suitable for this species (DI TRANI & ZUFFI submitted). The inland climate of northern Italy is typically subcoastal temperate continental, whilst it is typically Mediterranean along the Adriatic and Tyrrhenian Sea coasts; this probably led to different activity patterns (e. g. concerning beginning or/and ending of seasonal activity) in different populations.

We tend to the opinion that the acclimation of the Pond Terrapins was successful, although reproduction was never observed between 1989 and 1990. In 1992 the observation of couples as well as little groups of females with a single male each (cf. LEBBORONI & CHELAZZI 1991) seemed to indicate conditions under which reproduction could occur.

Paucity of reproductive and nesting sites along the Ticino river is probably the limiting factor for *E. orbicularis* in the park. In 1989, we planned to set up some sandy places all around the "Lanca Paradiso" basin, 5 - 6 m² in size. Cutting down the vegetation should improve the conditions for nesting and oviposition. Unfortunately, political problems associated with a change in the management of the park, and the consequent stop of financial aid for 1990 and 1991 prevented us from finishing this pilot project.

In the past, the nesting sites of *Emys* were probably situated in the sandy alluvial soils along the Ticino river, near channels, ponds and low marsh land. To date, most of these areas have been extensively used for the cultivation of poplar-groves, which are particularly common in northwestern Italy. This cultivation foresees regular hoeing and harrowing of the rows, with obvious damage to possible terrapin nests and clutches. A plan of restoration and naturalistic management of poplar-grove areas should be particularly suitable to sustain the population of *E. orbicularis* in the Ticino valley.

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