

COMPARISON OF MOVEMENTS AND GROWTH RATE OF WILD AND CAPTIVE BRED JUVENILES OF THE WESTERN HERMANN'S TORTOISE AT SERRA DE L'ALBERA; NORTHEASTERN IBERIA.

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Abstract

Although a few studies have been carried out with juvenile or hatchling testudinids, most having documented their movements and growth rates during a specific period of time, none of the presently known studies have compared behaviour and growth rate of young wild tortoises with those of released animals. In the present study such an attempt has been made in order to determine the response of captive bred animals to their new environment, comparing a group of wild western Hermann's tortoise (*Testudo hermanni hermanni*) with a group of captive bred. Individuals, hatched and reared at the CRT l'Albera Captive Breeding Centre, in Garriguella, in the foothills of the "Serra de l'Albera", where a small population of these tortoises still survives and is the only spot in the Iberian peninsula where wild autochthonous Hermann's tortoise can still be found. Three naturally hatched young animals together with three other captive-bred tortoises were fitted with transmitters so as to compare movements and growth rates of each animal of both groups during the season. Captive bred juveniles were released at the beginning of the season (April - May), one by one and at the same moment and on the same spot a wild young tortoise was found, and just after both were fitted each other with their transmitter. They were then recaptured on a weekly basis. The present study shows the results obtained and reveals that no significant differences in movements or growth rates can be appreciated between both groups, suggesting that juveniles reared at the CRT l'Albera are fit to survive in their natural habitat.

Key words: Growth rate, home range, *Testudo hermanni*, Albera.

Introduction

The distribution of the last natural population of the Hermann's tortoise is only to the Massís de l'Albera (NE Spain) in the north of the Girona province (Llorente, 1995). This population has due scarce population troops mainly to different causes as the capture for the trade, the modification and destruction of the habitat and the forest fires (Llorente, 1997).

One of the strategies to make in front of these causes and to reinforce the natural populations is the reintroduction of individuals born in captivity emulating the natural conditions (Mascort, 1998).

Although they are few the studies carried out on newly born and juvenile testudines, most has documented their movements and their growth rate during very specific periods of time, but none of the current studies has compared the behaviour and the growth rate between the turtles of the natural populations and those recently liberated ones.

Material and Methods

The comparative one has been carried out with three individuals of the Centre and three wild individuals located in the study area, of characteristic similar among them (Caparace length (Lg), weight (Tw) and external aspect in general). They were placed a tag (AVM LTD., SM1-H; 151.092-151.266MHz and 8 g of weight) fixing it with cianocrilate potter in the later part of the caparace, allowing a later localization of the individuals.

The liberations were carried out for even in function of their likeness and the sampling consisted of two localizations a week during the period May 1999 - October 1999. During each localizations one wrote down the precise point of this (UTM 1x1m.), they took two biometric measure (Caparace length (Lg) and Weight (Tw)) as well as you notice on the state and/or the individuals' activity.

With the obtained data has been considered each individual's home range starting from the Kernel method by means of the Gauss' adaptative curve to the 90 and 50% of the localizations (TRACKER software).

The surface obtained for a wild turtles and *a centre turtle* was compared with Mann-Whitney U test (STATISTICA for Windows release 4.3). The growth rate is an estimated parameter of the Lg and Tw. The comparisons of this rate were made with ANCOVA (SPSS for Windows release 7.5 and STATISTICA for Windows release 4.3). Results were considered significant at $\alpha < 0.05$.

Results

For the present study they were carried out 45 sampling sessions: the localization and/or capture for to take their Lg (longitude) and Tw (weight), and liberation.

In the vital domains obtained by the Kernel method, for the different individuals (Figure 1) significant differences don't appear between the turtles of the centre and the savages for 90% of the localizations ($P_U = 0.2752$) neither to 50% ($P_U = 0.5127$). But the surfaces occupied by these two classes of individuals if that are different, being more reduced for the individuals of the centre ($\bar{x}_{90\%} = 444012.97\text{m}^2$; $\bar{x}_{50\%} = 8571,79\text{m}^2$) than for the savages ($\bar{x}_{90\%} = 65237,52\text{m}^2$; $\bar{x}_{50\%} = 10156,48\text{m}^2$) (Table1).

	Individual number	90% Surface (m ²)	50% Surface (m ²)
Wild	1636	184600.41	29112.32
	1646	5934.71	25.35
	1676	5177.44	1331.76
	\bar{x}	65237,52	10156,48
Centre	2222	69535.60	3594.93
	2223	1240591.97	12138.85
	2244	21911.35	9991.59
	\bar{x}	444012.97	8571,79

Table 1: The surface obtained for a *wild* turtles and *centre* turtles from the Kernel method by means of the Gauss' adaptative curve to the 90 and 50% of the localizations.

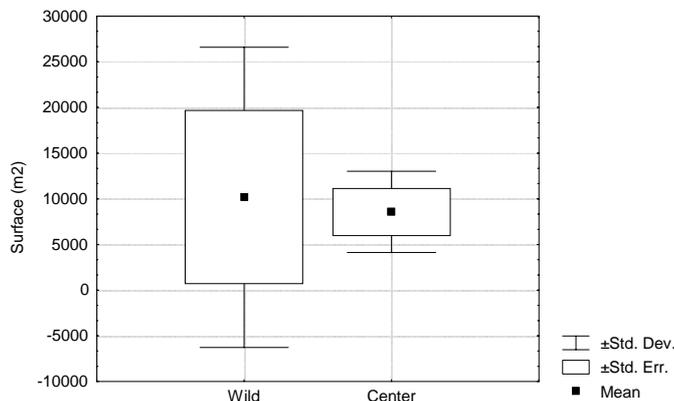


Figure 1: Boxplot of the home range of *wild* turtles and *centre* turtles in a 50% of the localizations. Both have the same central tendency but the home range of *wild* turtles are more heterogeneous.

The results of the comparative one between the growth rate of the wild turtles and the centre ones are not significant between two even (1636-2222 $p= 0.492$ y 1646-2223 $p=0.847$) and so alone in a couple, 1676-2244 appear significant differences ($p=0.003$) (Table2). If we notice the ratio of body mass (Tw) divided by length (Lg), used by Jackson (1980) and that it's an index of the state of health of the turtles, between the wild turtles and those of the centre prominent differences are appreciated in the first and the last interval.(Figure 2)

		Variation source	df	ss	F	p	R squared
Couples (Wild - Centre)	1636-2222	Origin of turtle	1	66.67	32.11	0.000	0.503
		Growth rate	1	1.00	0.48	0.492	
		(total)	31	129.62			
	1676-2244	Origin of turtle	1	35.38	23.52	0.000	0.804
		Growth rate	1	21.51	14.30	0.003	
		(total)	14	107.51			
	1646-2223	Origin of turtle	1	51.22	29.95	0.000	0.596
		Growth rate	1	0.07	0.04	0.847	
		(total)	20	84.68			

Table 2: ANCOVA (Basic Design) for the three couples of compared individuals. The parameter 'Growth rate' has been dear starting from $\ln(Lg_0-Lg_i) \times \ln(Tw_0-Tw_i)$.

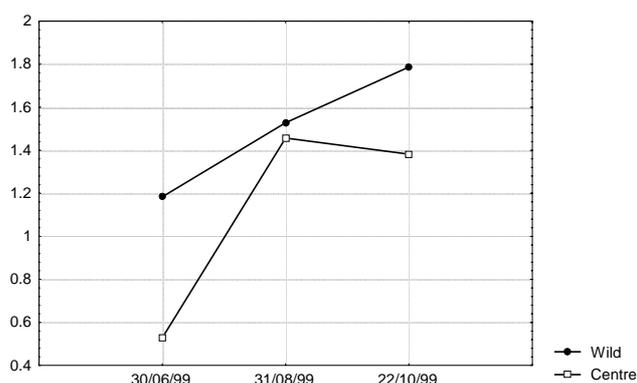


Figure 2: The ratio of body mass (Tw) divided by length (Lg), is calculated from $\bar{x} (Tw_0-Tw_i)_i / \bar{x} (Lg_0-Lg_i)_i$

Discussion

The differences in the surface occupied by the turtles can be attributed to several factors, but the one that takes bigger force, is the ignorance of the land on the part of the recently liberated centre turtles: The half surface for 90% of the localizations, is 6.8 times superior in the turtles of the centre that in the savages but in 50% there is an investment from the tendency to the 1.2 superior in the wilds. This great variation could be that when ignoring the land, those of the centre, spread to carry out big displacements - reflected in the great obtained surface of 90% of the localizations - but these they cease when finding a place with some minimum favourable conditions reducing the busy surface to similar values to the wilds.

If we also keep in mind that the period of study includes the summer, time of the individuals' low activity (Félix, 1990), this reduction of the busy surface could be due to the inactivity product of the rigorous summer that would affect equally so much the wild turtles as the centre ones (similarity of results in 50% of localizations).

The ignorance of the land would be the decisive factor if we keep in mind that the area of activity of the turtle is always defined in terms of individual economy (Behavioural thermoregulation, search for a mating partner foraging,...) (Chelazzi, 1979).

The reduction until similar values for 50% will be caused by a fundamental element in this individual economy, the food availability or for the ceasing of activity of summer's period. Those will condition the seasonal activity in a concrete area and certain surface (Swingland, 1986), and will be the same one, in general terms, for all the individuals because all are in the same space-time (similar surface means), but because of small variations inside the same habitat, differences can arise among individuals (bigger heterogeneity among the wild turtles).

In the growth rate we only find differences in one of the three compared couples. With this we could say that seemingly the turtles of the centre follow a pattern of similar growth to the savages.

These results can be tinged if we relate the ratio body mass/Length with the activity and the individuals' mobility. The wild turtles in spite of considerable activity differences as it can be among principles of summers / autumn - with prominent mobility -, and summer - very reduced or practically null activity (Félix, 1990), they seem to have a good and upward physical condition, in forecast, possibly for the hibernation. This way, the turtles of the centre would follow the same upward pattern, but with an inferior grade of physical condition and with a central value outside of the lineal tendency of growth. This value that is very superior, could be because wins physical condition when reducing the mobility drastically investing the spare energy in reservations, and therefore, increasing the weight. This would be not very probable in the wild turtles if we keep in mind that those of the centre reduce 8.07 times more the occupation surface when passing from 90% to 50% of localizations, indicating this way the great reduction of mobility of the turtles of the centre respect the savages.

Conclusions

The vital domains of the wild turtles and the liberated of the centre are not significantly different among them and only appear differences in one of three couples. That make us suppose that the breeding in captivity any handicap doesn't behave in the moment to liberate individuals to the habitat of the turtle. It is necessary this way to keep in mind certain initial difficulties of adaptation to the new environment.

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