

## Shrewd shrikes and spiny shrubs: a calamity for hatchling Moorish tortoises (*Testudo graeca graeca*)

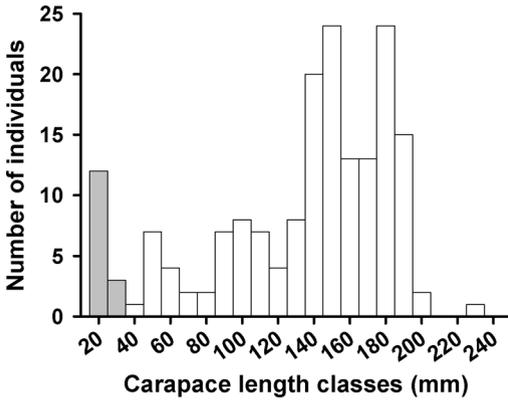
F. Barje<sup>1</sup>, T. Slimani<sup>1</sup>, E.H. El Mouden<sup>1</sup>, F. Lagarde<sup>2</sup>, X. Bonnet<sup>2</sup>, K. Ben Kaddour<sup>1</sup>

Chelonians live in a safe-box that offers an efficient protection against most predators, at least in adults and sub-adults (Wilbur and Morin, 1988). Nevertheless, in hatchlings, and to a lesser extent, in juveniles the shell is soft and/or not solid enough to resist to many predators such as monitors, dogs, or birds for example (Douglas and Winegarner, 1977; Fitzpatrick and Woolfenden, 1978; Branch and Els, 1990; Geffen and Mendelssohn, 1997; Keller et al., 1998; Hill, 1999; Lagarde et al., 2001; Boarman, 2002). In an open landscape, the predation on these fragile tortoises can be severe; sometimes leaving strong marks on the population dynamics (Boarman, 2002). In April 2003, during a field study on the ecology of *Testudo graeca graeca* in Morocco (Essaouira region, 31°23'N, 9°42'W), we found several hatchling tortoises impaled on spiny shrubs (*Argania spinosa*) in a typical shrike manner (Cramps and Perrins, 1993). Therefore, several observations of shrike (*Lanius excubitor*) were made in the study area and even on the involved shrubs. We searched intensively the study site and the surrounding area (the total prospected area was 50 ha) and discovered a total of 25 impaled tortoises in 3 spiny shrubs (respectively 17, 7 and 1 tortoises per shrub). With an average Shrike territory size of 75 ha (Cramps and Perrins, 1993), such predation may be due only to one Shrike breed-

ing pair. Nevertheless, we found another tortoise impaled by shrikes in our second study area, in the Central Jbilets, near Marrakech. Predation on hatchling and juveniles *Testudo graeca* has already been documented for several birds and mammals (Schleich et al., 1996; Geffen and Mendelssohn, 1997; Keller et al., 1998). Our data provide the first record of shrike hunting this species. A closed related species (*Lanius ludovicianus*) was observed preying on turtles in Oklahoma (Tyler 1991). Our preliminary results on *Testudo graeca* give a mean clutch size of 3.8 per female (range 1 to 5, N = 10 clutches). Broadly speaking, the shrike(s) destroyed the equivalent of 5 clutches. The size of 15 of the impaled tortoises was measured; the 10 others were apparently similar in size but were impossible to reach. The mean carapace length was  $28 \pm 3$  (range: 25 to 35 mm). We did not find any evidence of post-hatchling growth ring indicating that the tortoises were caught less than one year after they hatched. Surprisingly, despite an intensive searching, we never find such hatchlings in the field; probably because immature tortoises adopt a very secretive style-live as observed in many reptiles (Madsen and Shine, 2000; Nagy, 2000) (Figure 1). Such a cryptic behaviour may well be extremely pronounced in the soft hatchlings. Perhaps that the shrikes prospect areas where the concentration of juveniles is potentially high, typically around laying sites after emergence. Whatever the case, the ability of *Lanius excubitor* to find and catch such secretive preys is obviously greater than ours. All the impaled tortoises were located on scattered shrubs around

1 - Laboratoire d'Ecologie Animale Terrestre, Université Cadi Ayyad, Faculté des Sciences Semlalia, BP 2390, 40000 Marrakech, Maroc

2 - Centre d'études biologiques de Chizé, C.N.R.S., 79360 Villiers en Bois, France  
e-mail: lagarde@cebc.cnrs.fr



**Figure 1.** Size distribution of tortoises observed (white bars) and preyed by shrikes (grey bars) in the Arganian forest, near Essaouira, Morocco.

the cultivated areas, and none of them was found in the *Argania spinosa* forest although *Lanius excubitor* has been observed prospecting both areas. Cultivated zones possess abundant food resources and a relatively deep and loose soil; they may be attractive for females before laying. By contrast, the surrounding forest areas are subject to a severe overgrazing that depletes the vegetal cover (scarcity of feeding resources) and the sandy soil is usually completely absent, the substrate being very rocky (precluding nest digging). We did not quantify the impact of shrike's predation on the *Testudo graeca graeca* populations. However, assessing more precisely such prey/predator interactions is of importance both to better understand the effect of landscape structure on the tortoise's space utilisation, notably during nesting and in terms of anti-predator tactics. *Testudo graeca graeca* exhibits a marked decline in almost all its distribution range in North Africa, Greece and Spain (Stubbs, 1989; Lambert, 1995). In Morocco, the destruction of suitable habitats is particularly important and mostly caused by overgrazing (Quezel, 2002). Not only the disappearance of the vegetation deprives tortoises of feeding resources, it remains also fully possible that in the absence of sufficient plant cover that offers the main shelter for immature tortoises, predation may precipitates the decline of populations (Boarmann, 2002). In such a context, where the

degradation of the habitat modifies the prey-predators relationships, our somewhat "anecdotal" results may nonetheless be important for conservative purposes. For instance a simple conservation measure could be the protection of laying sites from overgrazing.

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## References

- Branch, W.R., Els, S.F. (1990): Predation on the angulate tortoise *Chersina angulata* by the kelp gull *Larus dominicanus* on Dassen Island, Western Cape. *S. Afr. J. Zool.* **25**: 235-237.
- Boarman, W.I. (2002): Reducing predation by Common Ravens on Desert Tortoises in the Mojave and Colorado deserts. Bureau of land management. Sacramento, California.
- Cramps, S., Perrins, C.M. (1993). Handbook of the birds of Europe, the Middle East and North Africa. The birds of the Western Palearctic. Volume VII. Oxford University Press.
- Douglass, J., Winegraner, C.E. (1977): Predators of eggs and young of the gopher tortoise, *Gopherus polyphemus*, in southern Florida. *J. Herpetol.* **11**: 236-238.
- Fitzpatrick, J.W., Woolfenden, G.E. (1978): Red-Tailed Hawk preys on juvenile gopher tortoise. *Florida Field Natur.* **6**: 49.
- Geffen, E., Mendelssohn, H. (1997): Avian predation on tortoises in Israel. In: Proceedings: Conservation Restoration and Management of Tortoises and Turtles. Van Abbema, Ed., New York turtle and tortoise society, New York, U.S.A.
- Hill, R.A. (1999): Size-dependent tortoise predation by baboons at De Hoop Nature Reserve, South Africa. *South African Journal of Science* **95**: 123-124.
- Keller, C., Diaz-Paniagua, C., Andreu, A.C. (1998): Survival rates and causes of mortality of *Testudo graeca* hatchlings in southwestern Spain. *J. Herpetol.* **32**: 238-243.
- Lagarde, F., Le Corre, M., Lormée, H. (2001): Species and sex-biased predation on hatchling green turtles by frigatebirds on Europa Island, western indian ocean. *The Condor* **103**: 405-408.
- Lambert, M.R.K. (1995): Tortoise situation in northern Africa. Pp. 1-19. In: Red data book on Mediterranean chelonians. D., Ballasina Ed., Edagricole, Bologna, Italy.
- Madsen, T., Shine, R. (2000): Restoration of an inbred adder population. *Nature* **402**: 34-35.

- Nagy, K.A. (2000): Energy costs of growth in neonate reptiles. *Herpetological Monographs* **14**: 378-387.
- Quézel, P. (2002): Réflexions sur l'évolution de la flore et de la végétation au maghreb méditerranéen. Ibispress, Paris, France.
- Schleich, H.H., Kästle, W., Kabisch, K. (1996): Amphibians and reptiles of North Africa. Koeltz Scientific Publishers, Koenigsberg, Germany.
- Stubbs, D. (1989): Tortoises and freshwater turtles: an action plan for their conservation. IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, Canterbury, England.
- Tyler, J.D. (1991): Vertebrate prey of the Loggerhead Shrike in Oklahoma. *Proc. Okla. Acad. Sci.* **71**: 17-20.
- Wilbur, H.M., Morin, P.J. (1988): Life history evolution in turtles. In: *Biology of the reptilia*. Vol. 16, p. 387-437. Ecology B. D. C., Gans, B., Huey, A., Riss, Eds, New York.

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