Predation plays a major role in shaping the structure and dynamics of communities and is of pivotal importance in reptile ecology (Zug, Vitt and Caldwell, 2001). The most important predators of adult reptiles are birds, small carnivores, and other reptiles, including conspecifics (Arnold, 1988; Pianka and Vitt, 2003; Žagar and Carretero, 2012). These predators also attract the attention of the majority of researchers. As a consequence, predation on reptiles by large carnivores has so far been rarely documented in Europe (e.g. see Krofel et al., 2011 for predation on snakes by Eurasian lynx *Lynx lynx*). This is probably also due to the differences in activity patterns and habitat use between the two groups: while European large carnivores mainly occur in forest habitats and are nocturnal or crepuscular (Linnell et al., 1998), reptiles are mainly diurnal and usually select open habitats in order to achieve efficient thermoregulation (Zug, Vitt and Caldwell, 2001). Therefore it is not surprising that encounters between large carnivores and reptiles are rather uncommon and rarely reported.

Here I report on a case of predation and describe a manner of consumption of an adult Hermann’s tortoise (*Testudo hermanni* Gmelin, 1789) by a brown bear (*Ursus arctos* Linnaeus, 1758) in Northern Greece. Although bear experts in the Balkans are generally familiar with this interaction, it is mainly unknown among the herpetological scientific community and very few published records exist. For example, Mertzanis (1994) and Paralikidis et al. (2009) reported about the proportion of tortoises in bear diet, however without providing information about the species of tortoise being consumed and the manner of predation and consumption.

During a field trip to northern Greece in spring 2012 we visited a location near Kastoria, where a female brown bear with offspring had been regularly observed for several days. I noted fresh remains of a dead Hermann’s tortoise at the edge of a field, not far from the location where the bear was observed. The tortoise carcass was found lying on the back with all four legs eaten, while the head was unconsumed (Fig. 1 and Fig. 2). No damage was observed on the shell. Blood drops indicated that it was most likely killed while being eaten and not consumed during scavenging. In close proximity (3-5 meters) of the tortoise remains I also noted bear footprints in the soil, suggesting that the bear killed and consumed the tortoise.

Although I was not able to make a direct observation of the bear eating the tortoise, the footprints of the bear indicated that the bear was present at the location at the time when the tortoise was killed, i.e. during the night before observation. The only other potential predator in the area could be a domestic dog, however, no dog footprints were found in the soil around tortoise remains and also no dogs were observed at the location during the day we spent there. These evidences confirm that the tortoise was most likely killed by a bear. In addition, local bear researchers confirmed that a female brown bear with two cubs was constantly present at the location where the tortoise remains were found during the time of observation (she was spending the daytime in bushes about 30 m from the location of the tortoise remains and foraged for food during the night in close proximity of her daybed) and that the described observation is typical mode of how bears kill and consume adult tortoises in the region (Y. Tsaknakis, G. A. Mertzanis, and G. Giannatos, pers. comm.).

This record confirms opportunistic foraging behaviour of brown bears. Brown bears are characterised by their omnivorous nature and very variable diet, which may change considerably depending on food availability (Bojarska and Selva, 2012). They are also extremely adaptable and thanks to their well-known intelligence...
they are able of finding innovative ways for using new food sources (Stirling and Derocher, 1990). The observed predation represents another example of the rich repertoire of the brown bear’s foraging behaviours. Although the shell of the tortoise was too hard to open, the bear managed to obtain food by consuming the legs of the animal. Such partial consumption limits energetic gain, but since tortoises are relatively easy to capture and occur in high densities in northern Greece (Stubbs et al., 1985; Hailey, 2000), this type of foraging evidently still provides a source of highly nutritious food for the bears.

Adult tortoises have few natural predators and beside some raptors that occasionally break tortoise’s shell by dropping it from air on rocks (Van Lawick-Goodall, 1970), bears are probably one of the few species able to kill and consume (at least partly) an adult tortoise. Is it possible that bear predation could jeopardize tortoise populations in some areas of sympatry? Distribution ranges of Hermann’s tortoise (Gasc et al., 1997) and brown bear (Linnell et al., 2002) overlap in Western Croatia, Montenegro, parts of Serbia, Eastern Albania, Western FYR of Macedonia, Southern Bulgaria and Greece. Like most large carnivores, brown bears occur in low densities (Støen et al., 2006). In order to get a rough idea about the possible predation pressure of bears on tortoises, I estimated bear numbers in the area of sympatric occurrence of both species (89,000 km²) according to the data available online (KORA, 2007) to approximately 1,600 bears, which corresponds to an average of about 1.8 bears/100 km². Mertzanis (1994) and Paralikidis et al. (2009) found remains of tortoises in 1.4-1.5% scats of brown bears in northern Greece. If we extrapolate this figure according to the average bear defecation rate (3.3 scats/day; Roth, 1980), we can roughly estimate that around 28,000 tortoises could be consumed annually by brown bears in the area of sympatric occurrence of both species. This corresponds to approximately 31 tortoises consumed annually by bears per 100 km². Since tortoises occur at relatively high densities (typically 10,000-50,000 animals/100 km²; Stubbs, 1989), it seems that bear predation on tortoises could have only minor effects on tortoise populations, especially when considering that bears may include in their diet all species of tortoises living in the area (besides T. hermanni, also T. graeca and T. marginata) and that a certain portion of the consumed tortoises found in scats could have been scavenged and not necessarily killed by bears. In this estimation, I also assumed that remains of each consumed tortoise are always found in only one scat and that remains in each scat always represented only one tortoise, so the values should only be used to get an approximate idea of the scale of such predation.

Data from bear diet analysis (Mertzanis, 1994; Paralikidis et al., 2009) indicates relatively low importance of tortoises as food source for bears in general. However, bears are renowned for adopting individualized foraging behaviour and individual bears often specialize for certain type of food (Stirling and Derocher, 1990). Predation and partial consumption of tortoises is likely a learnt behaviour and thus it is probable, that some bears might become specialized tortoise eaters. For such bears, this type of prey could then represent an important addition to their regular diet, at least in some parts of the year. In addition, Hermann’s
tortoise populations vary considerably in terms of density, so high-density populations of tortoises (in some areas they reach densities of up to 1,000,000 animals/100 km$^2$; Stubbs et al., 1985) could comprise an important food source for some bears. Further studies are however needed to confirm this possible individual and local variation in tortoise predation by bears.

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**References**


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