



Original article

Long term variations in small mammal composition of a snake diet do not mirror climate change trends

Lorenzo Rugiero^a, Giuliano Milana^b, Massimo Capula^c, Giovanni Amori^{d,*}, Luca Luiselli^a^a Centre of Environmental Studies, Demetra s.r.l., via Olona 7, 00198 Rome, Italy^b Department of Biology and Biotechnology, Sapienza Università di Roma, Viale dell'Università 32, 00185 Rome, Italy^c Museo Civico di Zoologia, via Ulisse Aldrovandi 18, 00197 Rome, Italy^d CNR, Institute of Ecosystem Studies, Viale dell'Università 32, 00185 Rome, Italy

ARTICLE INFO

Article history:

Received 27 February 2012

Accepted 9 July 2012

Available online 9 August 2012

Keywords:

Climate change

Predator

Prey

Viper

Small mammals

Italy

ABSTRACT

The study of the dietary changes which have intervened over the years in generalist and opportunist predators may provide useful information on the temporal modifications of their prey communities, especially under a climate change scenario. In this study, we analysed the quantitative changes in the small mammal portion of the diet of a generalist and opportunist predator, the asp viper (*Vipera aspis*) at a forest zone in central Italy, for the period 1987–2010. In addition, small mammals were trapped in five of these years. *Apodemus* spp., *Mus musculus*, and *Myodes glareolus* were the main prey for vipers. Among the various taxa eaten by vipers, only two showed significantly consistent trends over the years, with *M. glareolus* increasing and *Sorex* spp. declining in the viper diet. There were no significant relationships between the number of years passed after the first year of sampling and the diversity and dominance indexes of prey composition. We also found a significantly positive relationship between small mammal abundance in the field and their relative frequency of occurrence in the viper's diet, thus demonstrating that vipers really sampled the small mammal species in relation to their local availability. Despite being temperate-zone forest-associated species, hence likely adversely affected by global warming, *Sorex* spp. and *M. glareolus* showed opposite trends over the years, thus suggesting that such trends may reflect more local scale perturbations (local forest overgrowth and diminution of logging).

© 2012 Elsevier Masson SAS. All rights reserved.

1. Introduction

Climate change is a global phenomenon which is currently impacting biodiversity in diverging ecological systems and regions of the world (Singer and Thomas, 1996; Root, 1999; Taulman and Robbins, 1996; Wentz et al., 2007; Miller-Rushing and Primack, 2008). There are several independent ways in which scientists are trying to monitor the effects of global warming on biodiversity (Root et al., 2003), and these include for instance shifts in bird migratory trends (e.g., Both and Visser, 2001), changes in breeding phenology (e.g., Sergio, 2003; Visser et al., 2006), changes in horizontal and vertical ranges (e.g., Colwell et al., 2008), and also modelling studies (e.g., Guisan and Zimmermann, 2000). In addition, indirect sampling methods have been employed in order of detecting whether global warming has impacted ecological assemblages of organisms in given environmental contexts. For instance, in purely generalist predators, the eventual long-term

changes in the frequencies of occurrence of their prey species may allow the experimenters to infer on the temporal variations of the relative abundances of these preys in the field (Szpunar et al., 2008). These putative variations may then be correlated with the intervening climate changes which have affected the study area. This putatively promising approach has been used with the predator–prey system ‘barn owl–small mammals’ using owl pellets, and showed that some of the variations in the taxonomic composition of the owl's diet may be linked effectively to a climate change scenario (Szpunar et al., 2008). However, these studies are hardly generalised unless a higher variety of independent systems is added to our analyses. Thus, in this article, we take opportunity of a field study of about 20 years on the diet of some populations of a snake (*Vipera aspis*: Viperidae) which is well known to be a generalist and opportunist forager in its selection of small mammal prey (Capula and Luiselli, 1990; Capizzi et al., 1995). By studying (a) the taxonomic composition of the viper diet and more precisely the relative frequencies of occurrence of the various small mammals in the diet, and (b) the relative abundance of the small mammals in the field, we analysed whether (i) there have been considerable changes over time in both the taxonomic composition

* Corresponding author.

E-mail address: giovanni.amori@uniroma1.it (G. Amori).

and the relative frequencies of occurrence of the various small mammal preys in the viper diets; and (ii) whether these eventual changes can be attributed to (a) global warming variations in the small mammal community composition and structure, or (b) variation in logging and forestry management.

In this regard, the a priori hypotheses are that:

- (1) The prey species which are linked to thermo-Mediterranean habitats should have benefited from global warming, and should have hence increased in the viper diets. On the other side, the prey species which are more linked to temperate bioclimates should have been depressed by global warming, and should have decreased in the viper diets.
- (2) The dietary diversity, in a global warming scenario, should decrease over years, whereas the dominance should increase. This pattern is expected from recent studies which highlighted both community diversity declines and dominances stable or even increasing under predicted and simulated climate change scenarios (Bakkenes et al., 2002; Klanderud and Totland, 2005; Thuiller et al., 2005; Kardol et al., 2010).
- (3) In a scenario of logging management changes unlinked to global warming effects, the abundance of species which are positively influenced by clear-cut operations should increase in case of forest loss, whereas the abundance of species which are positively influenced by forest overgrowth should decrease when logging increases.

2. Materials and methods

2.1. The predator study species

The asp viper (*V. aspis*) is a small sized, up to 80 cm long, viviparous snake with a considerable range over Central and Southern Europe, where it inhabits a wide variety of habitats, from Mediterranean to mountainous ones (Zuffi et al., 2011). This viper is one of the most investigated snake species in Europe (e.g., Bonnet et al., 1998, 1999; Lourdais et al., 2004), with several studies also detailing its feeding ecology (e.g., Capula and Luiselli, 1990; Luiselli and Agrimi, 1991; Bea et al., 1992; Capizzi and Luiselli, 1996). Regarding its diet, it is well known that the juveniles are laceratophagous and adults feed mainly on small mammals (Saint Girons, 1979, 1980; Bea et al., 1992). It has also been demonstrated that *V. aspis* preys on a wide variety of both rodents and soricomorphs

in relation to their relative abundance in the field (Capizzi et al., 1995), with its taxonomic diet composition being widely overlapped with that of other sympatric generalists feeding on small mammals (Capula and Luiselli, 1990; Capizzi and Luiselli, 1996). The asp viper population at the study area has been studied with capture-mark-recapture methodology since over 20 years, and has experienced considerable decline during the last decade probably owing to global change phenomena (Reading et al., 2010).

2.2. The prey study species

In the territory under study (Tolfa hills, central Italy), there is a very good knowledge of the small mammal species inhabiting the various habitat types since the '70s (Contoli, 1977; Amori et al., 1986b). In total, there are 8 species of Soricomorpha (*Talpa romana*, *Sorex samniticus*, *Sorex antinorii*, *Neomys anomalus*, *Neomys fodiens*, *Crocidura leucodon*, *Crocidura suaveolens*, *Suncus etruscus*) and 11 of Rodentia (*Sciurus vulgaris*, *Eliomys quercinus*, *Glis glis*, *Muscardinus avellanarius*, *Myodes glareolus*, *Microtus savii*, *Apodemus sylvaticus*, *Apodemus flavicollis*, *Rattus rattus*, *Rattus norvegicus*, *Mus musculus*) recorded in the area (Contoli, 1977). Out of these species, those which are more linked to the Mediterranean bioclimate (and which would have hence increased in the viper diets due to climate change) are: *S. etruscus*, *Crocidura* spp. (Amori et al., 2008), *M. savii*, *M. avellanarius*, *M. musculus*, and *R. rattus* (Amori et al., 1986a, 2008). The temperate species that should have decreased in the viper diet are: *Sorex* spp. and *M. glareolus* (Amori et al., 1986a, 2008).

2.3. Study areas and the climate change scenario

We included in this study only diet data concerning snake populations that were studied with enough accuracy for a large data-set to be collected. All data presented here came from field research conducted by the authors between 1987 and 2010. Snakes were captured in three study areas with a mixed oak-forest in the territory of Tolfa hills: (i) Oriolo Romano (Viterbo, at about 450 m a.s.l.); (ii) Rota (about 150–200 m a.s.l.); and (iii) Manziana (about 350 m a.s.l.) (Fig. 1).

Climatic data from the study area indicate that annual rainfall between 1990 and 2002 was on average 842 mm, but decreased by 13% in comparison with that recorded between 1970 and 1989 (963 mm; Musmeci and Correnti, 2002; see also Fig. 2). During the

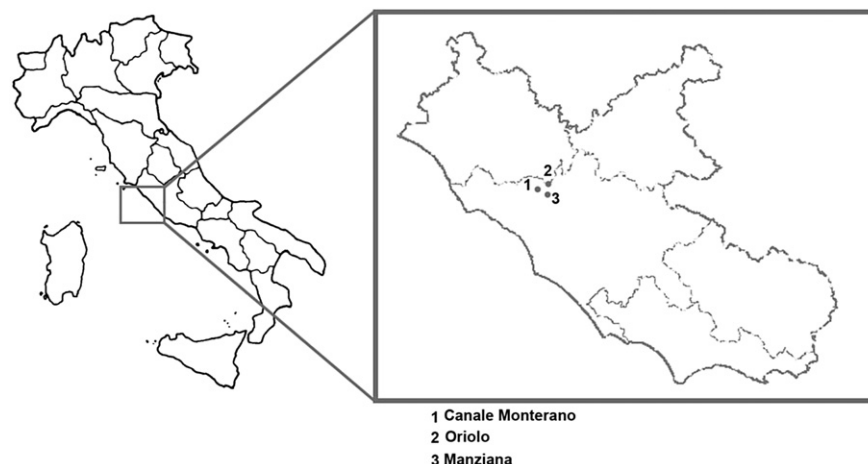


Fig. 1. Map of Italy, showing the three study sites.

Download English Version:

<https://daneshyari.com/en/article/4380873>

Download Persian Version:

<https://daneshyari.com/article/4380873>

[Daneshyari.com](https://daneshyari.com)