

Aspects of the ecology and conservation of the Meadow Viper, *Vipera ursinii*, in the Duchessa Mountains Natural Park (Latium, central Italy)

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ABSTRACT — The population of Meadow Vipers (*Vipera ursinii*) living in the Duchessa Mountains Natural Park (Latium, central Italy) was studied from June to September 2000 and 2002. In this area the vipers were not homogeneously distributed over the whole territory, but occurred just at a few places. Most of the specimens were observed inside or around (within 5 m) *Juniperus* bushes, and some specimens also in open grass. There was a clear preference for bushes of large size (i.e. those > 6 m diameter). Meadow Vipers are apparently rare in the territory surveyed, where they coexist with *Vipera aspis* and *Coronella austriaca*. Females were significantly larger than males, and the sex-ratio was close to equality. The main conservation issues affecting *V. ursinii* in this area are the intentional killing of snakes by people, over-grazing, and also the likely over-population of Wild Boar (*Sus scrofa*).

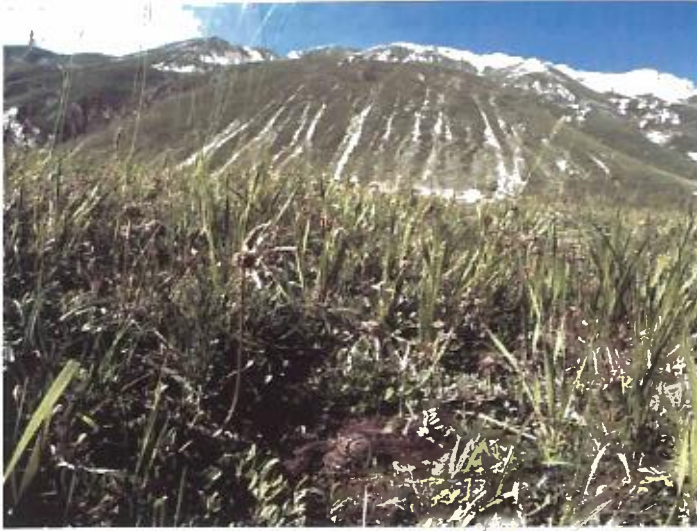
THE Meadow Viper (*Vipera ursinii*) is one of the most threatened snake species in Italy (Filippi & Luiselli, 2000a). It has a scattered distribution in some Apennine massifs (Bruno & Maugeri, 1979; Capula & Luiselli, 1992), and in Latium it occurs in just two mountain ranges (Capula & Luiselli, 2000). Although some aspects of the ecology of this viper have been studied in Italy (Agrimi & Luiselli, 1992; Filippi, 2001), very little is known on the population inhabiting the Duchessa Mountains, where they appear more isolated than in other massifs like Gran Sasso, Sibillini, and Majella (Filippi, 2001). In this area, the Meadow Viper was discovered in relatively recent years (Mangili, 1946), and has always been reported to be very rare (Calò, 1983; Capula, 1989, 1995; Capula & Luiselli, 2000). During a research study funded by the Authorities of the Duchessa Mountains Natural Park, we collected some field data on this viper population. In this report we address the data collected during the execution of this project.

MATERIALS AND METHODS

All data were gathered inside the territory of Duchessa Mountains Natural Park, province of Rieti (Latium). Detailed data on the status and distribution of *V. ursinii* in this territory are presented elsewhere (Filippi & Luiselli, 2000b). Field research was conducted at sites between 1700 m and 2000 m. a.s.l., i.e. 'Monte Morrone' (NW, W, and SW facing slopes), 'Caparnie', surroundings of 'Lago della Duchessa', 'Solagne del Lago', and 'Malopasso', in two distinct phases: (i) between June and September 2000, and (ii) between June and September 2002.

On average, the area receives 1090–1173 mm of annual rainfall and mean annual temperatures range from 11.3 to 12.7°C (based on data for 1886 and 1986 provided by Ministero dei Lavori Pubblici).

We searched for snakes along standardised routes in the various micro-habitats frequented by snakes. We captured snakes by hand, and always recorded the site of capture and the habitat at each capture site. Each snake was measured for snout-



Immature female *Vipera ursinii* in habitat at 1900 m, Campo Imperatore, Gran Sasso Massif, Central Italy. Photograph ©Tony Phelps.

vent length (SVL, to the nearest ± 0.1 cm) and tail length, sexed by examining the morphology of the cloacal region, weighed with an electronic balance, and individually marked by ventral scale clipping for future identification.

Statistical tests were two-tailed, and alpha was set at 5%. We used STATISTICA (Windows version 5.0) for all tests.

Vipera ursinii from the Duchessa Mountains. Photograph ©L. Luiselli.

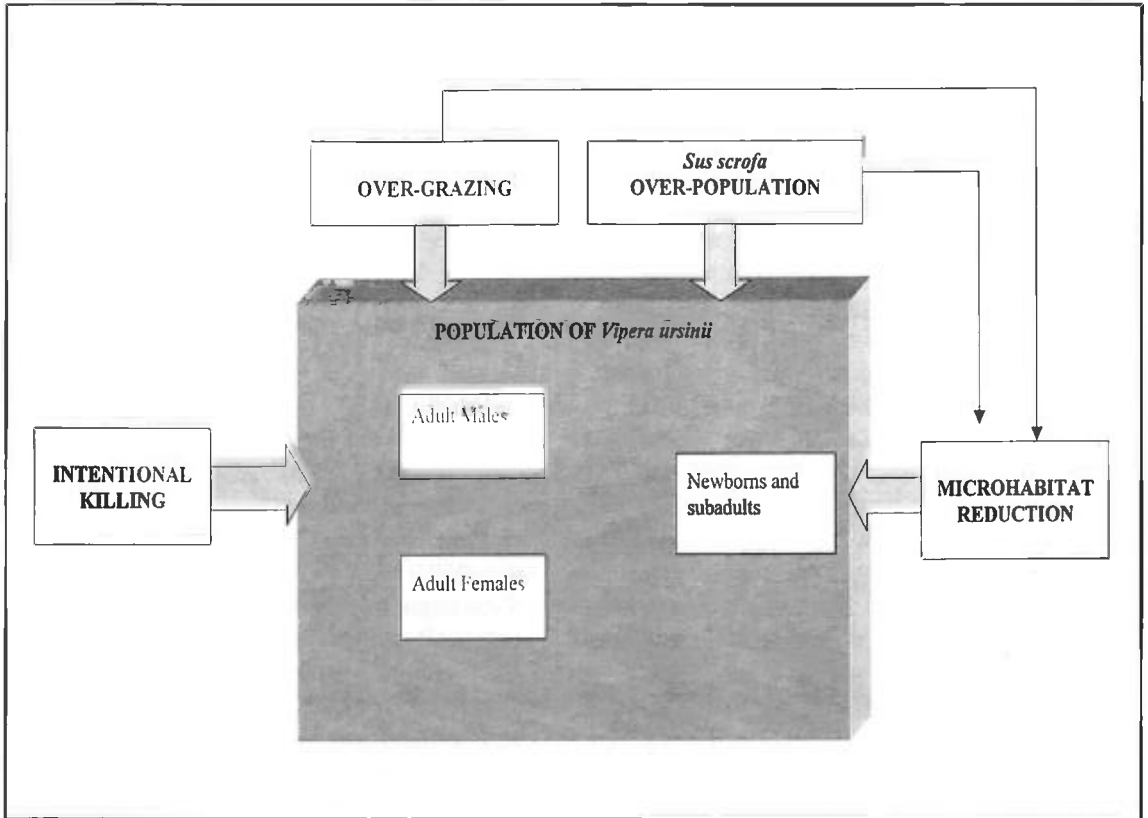


RESULTS AND DISCUSSION

In both phases of the research, specimens of *V. ursinii* were seldom observed, and only on the SW facing slopes of 'Monte Morrone' (area of 'Pratone della Cesa' to crest of the massif and up the 'Lago della Duchessa', and at 'Malopasso' (coordinates: 42° 12' N, 0° 54' 30" E of 'Monte Mario'). Approximately 85% ($n = 19$) of all specimens were observed inside, or around (within 5 m), prostrate Dwarf Juniper (*Juniperus nana*) bushes, and 15% in open grass. In the year 2000, the preferred microhabitat consisted of *Juniperus* bushes of large size (i.e. > 6 m diameter; total $n = 31$),

whereas bushes of smaller size (i.e. those of diameter < 2.99 m, and those of diameter < 5.99 m) were used less ($\chi^2 = 23.5$, $df = 2$, $P < 0.01$). These data mirrored data collected in 2002 (not shown here for brevity). The species is apparently rare in the territory surveyed, where it coexists with two potential competitors: *Vipera aspis* (abundant on the slopes of 'Monte Morrone'), and *Coronella austriaca* (apparently very rare in this territory). It is noteworthy that *Vipera aspis* appears very common also around bushes of prostrate Dwarf Juniper, which are usual habitats of *V. ursinii*. On four different days we have observed basking activity by one *V. ursinii* and one *V. aspis* in the same spot, always at the border of a *Juniperus* bush. Thus, we may conclude that the territory of Duchessa Mountains is one of the few known places in the Apennines where these two *Vipera* species are spatially syntopic. Studies on niche divergence between these species are in progress, under the financial support of the same Park which has sponsored this research.

Between June and September 2000, 19 specimens were captured: 10 males and 9 females. Twelve additional specimens escaped capture, but were positively identified to species level.



Between June and September 2002, we captured 13 specimens (8 males and 5 females), and four additional specimens escaped capture.

In both the years the adult sex-ratio did not differ significantly from equality (for each year, Yates' χ^2 , $df = 1$, $P > 0.05$). In 2000, the mean length of adult males was 29.9 ± 0.04 cm ($n = 7$; maximum size = 31.8 cm), and the mean length of adult females was 35.1 ± 3.5 cm ($n = 8$; maximum size = 41.2 cm). In 2002, the mean length of adult males was 27.8 ± 2.03 cm ($n = 8$; maximum size = 31.9 cm), and the mean length of adult females was 33.7 ± 2.6 cm ($n = 5$; maximum size = 42.5 cm). The females attained on average larger sizes than males in both study periods (for year 2000: Student t -test with $df = 13$, $P < 0.001$; for year 2002: Student t -test $df = 11$, $P = 0.0008$), as expected on studies of conspecifics from elsewhere (Agrimi & Luiselli, 1992; Baron et al., 1996; Baron, 1997; Filippi, 2001; Filippi & Luiselli, 2002a). The mean length of the females was not significantly different between 2000 and

Figure 1. Principal direct and indirect threats to *Vipera ursinii* in the Duchessa Mountains Natural Park.

2002 (Student t -test with $df = 11$, $P = 0.295$), whereas the mean length of the males was significantly different between years (Student t -test with $df = 13$, $P = 0.017$).

In 2000, although the absolute values of mean tail length (tL) were not significantly different intersexually (males: 4.1 ± 0.6 cm, $n = 7$; females: 3.5 ± 0.4 cm, $n = 8$; inter-sample difference: $t = 1.8$, $df = 13$, $P > 0.09$), ANCOVA on slopes of the respective regressions SVL against tL revealed that, at the same body length, males had significantly longer tails than females ($F_{1,17} = 12.064$, $P = 0.00001$). These morphometric measurements mirrored data collected in 2002 (not shown here for brevity) as well as data collected on other *V. ursinii* populations from elsewhere, both in Italy (Filippi, 2001; Filippi & Luiselli, 2002a) and in France (Baron et al., 1993; Baron, 1997).

The main direct and indirect threats to the continued existence of Meadow Vipers in the Duchessa Mountains are summarised in Figure 1. Parts of the area inhabited by *V. ursinii* were regularly visited by Wild Boar (*Sus scrofa*). Although we did not study the effects of these large ungulates on the vipers, at lower elevations in the same mountain massif we demonstrated (Filippi & Luiselli, 2002b) that over-population of Wild Boars affected negatively the local snake populations, via both direct effects of micro-habitat disturbance and predation, and indirectly via predation and disturbance on potential prey species. Thus, it is very likely that over-population of these animals may also negatively affect populations of *V. ursinii* in the Duchessa Mountains. Accordingly, we would urge the competent authorities to always consider the potential effects of Wild Boar in the few areas inhabited by *V. ursinii*, and to instigate additional studies on this. We suggest:

(i) to monitor the effects of the Wild Boar on the viper populations year-by-year, by following the same protocol of Filippi & Luiselli (2002b);

(ii) to build electric fences around the areas inhabited by the Meadow Vipers, particularly around their communal hibernacula (see Filippi & Luiselli, 2000b, 2002a) and their spring mating areas, where these snakes are exposed to particularly high mortality risks (Filippi & Luiselli, 2000a). Indeed, electric fences have proved to be useful tools in preventing Wild Boar entering into areas where their presence would have otherwise resulted in damage to cultivations or wildlife (Fermanelli & Rossetti, 1999; Toso & Pedrotti, 2001).

Another major threat facing *V. ursinii* in the Duchessa Mountains is over-grazing, which is especially acute in the vicinity of Duchessa Lake, and in the same microhabitats inhabited by the vipers (Filippi & Luiselli, 2000b). On the other hand, the effects of trekking by tourism seems to be less harmful for the vipers, at least in the area studied. Nonetheless, this must be monitored, because we found two dead vipers apparently killed by excursionists or shepherds, along two mountain paths in 2000.

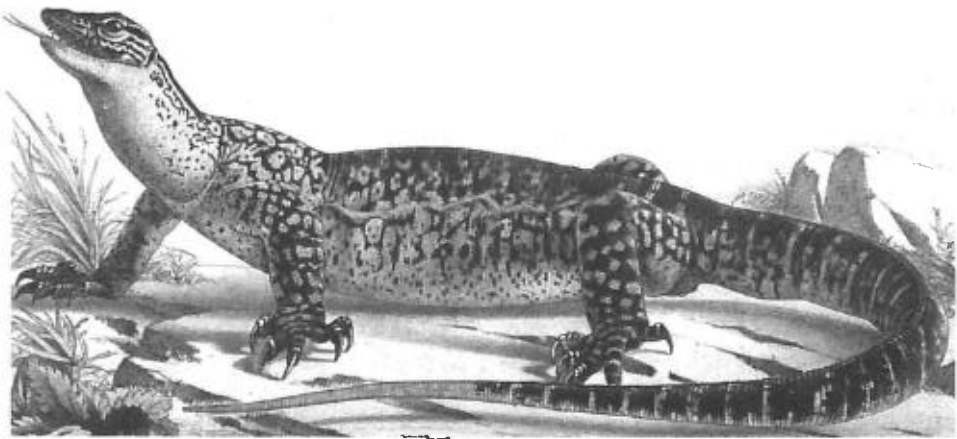
ACKNOWLEDGEMENTS

We are indebted to Dr Grazia Pulzoni and Dr Cosimo Marco Calò (respectively former and current director of the Duchessa Mountains Natural Park) for having financed the present study project, and the rangers of the park for having escorted us in the field on many occasions. The snake specimens were captured under authorisation (protocol no. 79/2000) of the 'Regione Lazio Dipartimento Ambiente e Protezione Civile'.

REFERENCES

- Agrimi, U. & Luiselli, L. (1992). Feeding strategies of the viper *Vipera ursinii ursinii* (Reptilia, Viperidae) in the Apennines. *Herpetol. J.* **2**, 37-42.
- Baron, J.P. (1997). Démographie et dynamique d'une population française de *Vipera ursinii ursinii* (Bonaparte, 1835). Thèse de Doctorat, EPHE, Paris. 201 pp.
- Baron, J.P., Ferriere, R., Clobert, J., Saint Girons, H. (1996). Stratégie démographique de *Vipera ursinii ursinii* au Mont Ventoux (France). *C. R. Acad. Sci. Paris* **319**, 57-69.
- Baron, J.P., Ferriere, R. & Saint Girons H. (1993). Différentiation morphologique de quatre populations françaises de *Vipera ursinii ursinii* Bonaparte, 1835 (Reptilia, Viperidae). *Rev. Suisse Zool.* **100**, 187-196.
- Bruno, S. & Maugeri, S. (1979). *Rettili d'Italia*. Firenze: Giunti-Martello Editore. 363 pp.
- Calò, C.M. (1983). La situazione ambientale nei Monti della Duchessa. *Natura Montagna* **30**, 39-54.
- Capula, M. (1989). Anfibi e Rettili. In *Piano pluriennale regionale per la tutela e la difesa della fauna autoctona in via di estinzione* (L.R. 48/82), pp. 1-94. Vol. 5, Regione Lazio, Assessorato Agricoltura, Università di Roma 'La Sapienza', Dipartimento di Biologia Animale e dell'Uomo, Roma.
- Capula, M. (1995). Rettili e Anfibi. In *Natura 2000 - Guida agli habitat e alle specie di interesse comunitario nei nuovi parchi nazionali dell'Appennino centrale*, pp. 1-79.

- Febbo, D. (Ed.). Roma: Commissione Europea, Ministero Ambiente - Servizio Conservazione della Natura - Legambiente.
- Capula, M. & Luiselli, L. (1992). Distribution and conservation of *Vipera ursinii* (Reptilia: Viperidae) in Italy. In *Proceedings of the Sixth Ordinary General Meeting of the Societas Europaea Herpetologica*, pp. 101-105, Korsos, Z. & Kiss, I. (Eds.). Budapest: Societas Europea Herpetologica.
- Capula, M. & Luiselli, L. (2000). *Vipera ursinii* (Bonaparte, 1835). In *Anfibi e rettili del Lazio*, pp. 106-107. Bologna, M.A., Capula, M. & Carpaneto, G.M. (Eds.). Rome: Fratelli Palombi.
- Fermanelli, A. & Rossetti, A. (1999). Il cinghiale nel Parco. Impatto sulle coltivazioni e sistemi di prevenzione. Pollenza: Parco Nazionale dei Monti Sibillini. 36 pp.
- Filippi, E. (2001). *Vipera ursinii* (Bonaparte, 1835) in Italia: conservazione e gestione di una specie prioritaria. Unpublished Dissertation, University of Camerino. 95 pp.
- Filippi, E. & Luiselli, L. (2000a). Status of the Italian snake fauna and assessment of conservation threats. *Biol. Conserv.* **93**, 219-226.
- Filippi, E. & Luiselli, L. (2000b). Studi sulle comunità di serpenti (Reptilia, Serpentes) della Riserva Parziale 'Montagne della Duchessa'. Ecologia del popolamento e conseguenze gestionali, con speciale riferimento a *Vipera ursinii ursinii*. Unpublished Report to the Directorship of the Reserve, Corvaro di Borgorose. 63 pp.
- Filippi, E. & Luiselli, L. (2002a). *Vipera ursinii* nel Parco Nazionale della Majella: risultati dell'anno 2001. Unpublished Report to the Directorship of the Park, Guardiagrele. 83 pp.
- Filippi, E. & Luiselli, L. (2002b). Negative effect of the wild boar (*Sus scrofa*) on the populations of snakes at a protected mountainous forest in central Italy. *Ecol. Medit.* **28**, 93-98.
- Mangili, G. (1946). Relazione preliminare sui lavori erpetologici effettuati nell'agosto 1945 durante la campagna naturalistica sul gruppo dei monti della Duchessa Velino (Abruzzi). *Hist. Nat. Roma* **1**(3), 70.
- Toso, S. & Pedrotti, L. (2001). Linee guida per la gestione del cinghiale (*Sus scrofa*) nelle aree protette. Roma. Ministero dell'Ambiente e Istituto nazionale per la Fauna Selvatica 'Alessandro Ghigi'. 61 pp.
- Ministero dei Lavori Pubblici. (1886-1986). *Annali idrologici*. Uffici del Poligrafico dello Stato, Rome and Naples.



Gould's Monitor (*Varanus gouldii*). From an original plate in *Natural History of Victoria*. 1887. Reproduction courtesy of The Natural History Museum.