

RED DEER IN ITALY: RECENT CHANGES IN RANGE AND NUMBERS

STEFANO MATTIOLI*, PIER GIUSEPPE MENEGUZZO,
ALESSANDRO BRUGNOLI** AND SANDRO NICOLOSO*°

* *Gruppo di Etologia e Ecologia Comportamentale, Dipartimento di Biologia Evolutiva,
Universit  di Siena, Via P.A. Mattioli 4, 53100 Siena, Italy*

° *Dipartimento Produzioni Animali, Epidemiologia ed Ecologia Universit 
di Torino, Via Leonardo da Vinci 44, 10090 Grugliasco (TO), Italy*

** *Servizio Faunistico, Provincia Autonoma di Trento,
Via G.B. Trener 3, 38100 Trento, Italy*

*° *Dipartimento Scienze Zootecniche Universit  di Padova, Agripolis,
35020 Legnaro (PD), Italy*

ABSTRACT - The following paper illustrates changes in distribution range and population size of the red deer *Cervus elaphus* in Italy in the last three decades. It mentions the main events of reintroduction and restocking together with hunting statistics. The mean yearly increase from 1970 to 1998 was 6% in range and 8% in population size: in 28 years the range had a five fold and the numbers a tenfold increase. In 1998 the total red deer population in Italy was estimated at 32,000 head, of which 75% are in the central and eastern Alps. In the central and eastern Alps the current population derives mainly from spontaneous recolonisation from neighbouring countries. In the western Alps the contribution of reintroduction prevails. In the northern and central Apennines the present occurrence of red deer is exclusively due to reintroduction. In Sardinia *C. e. corsicanus* is recovering gradually. The autochthonous nucleus from Mesola Wood needs a long term conservation plan.

Key words: red deer, distribution, abundance, reintroduction.

INTRODUCTION

Between the 17th and the beginning of the 20th century, deforestation and direct persecution led to the partial or total extinction of some mammalian species in Italy. Mainly since the 1950s there has been a partial and gradual recovery due to both spontaneous recolonisation and re-introductions. A general picture of the phenomenon is outlined in Lovari (1993), while regarding Ungulates Apollonio *et al.* (1988) have described wild boar expansion, and Perco and Cald  (1995) that of roe deer. Dupr  *et al.* (1998) documented changes in the abundance and range of the Alpine chamois.

The aim of this work is to reconstruct the ex-

pansion of red deer (*Cervus elaphus* L., 1758) in Italy in the last three decades, in terms of range extension and demographic increase. In fact, up until now for red deer only partial reconstruction exists (Mattioli, 1990, 1994).

METHODS

Published and unpublished data concerning population estimates, release events and hunting statistics from the last decades were collected and critically evaluated. To document the range spread, digitised maps were prepared (4 general maps of Italy and an area map): by means of Mapinfo 4.12 (Mapinfo Corp. Troy, New York), the gross planimetric surfaces of the distribution ranges were calcula-

Table 1 - Distribution range, population size and harvest in 1970

geographic area	range (km ²)	population size	harvest
western Alps	418	120	no
central and eastern Alps	5,557	3,025	313 (12.4%)
Emilia-Romagna and Tuscany	203	210	no
central Italy	48	20	no
Peninsular Italy	6,226	3,375	313
Sardegna	170	100	no
Italy (total)	6,396	3,475	313 (9%)

Table 2 - Distribution range, population size and harvest in 1980.

geographic area	range (km ²)	population size	harvest
western Alps	2,805	660	no
central and eastern Alps	13,378	6,210	726 (11.7%)
Emilia-Romagna and Tuscany	304	390	no
central Italy	286	280	no
Peninsular Italy	16,773	7,540	726
Sardegna	215	250	no
Italy (total)	16,988	7,790	726 (9.3%)

ted. The general maps for 1970 and 1990 were prepared on the basis of original data gathered for this work. The map for 1980 is based on the one edited by Perco (1981) suitably implemented. The map for 1998 comes from the one prepared by Mattioli (in press). Only permanent ranges and self-sustaining biological populations were taken into consideration. Generally, fenced herds in enclosures were excluded (e.g. La Mandria in Piedmont, Montalto di Castro in Latium). Our figures for pre-reproductive population size are all approximate estimates, due to the scarcity of real census data, mainly in the past. Moreover, the estimates should be considered as conservative. Population growth is described by the annual finite rate of increase ($= e^r$; cf. Caughley 1977). As regards the distribution ranges, the calculated areas must be used exclusively to get an order of magnitude for the pattern of range expansion in the red deer.

RESULTS

Distribution ranges and numbers (Figs. 1, 2; Tables 1-5)

Red deer disappeared from most of peninsular Italy between the middle of the 18th and the end of the 19th century. The only remnant native nucleus has survived in the Mesola Wood, in the Po delta area, in the province of Ferrara (Ghigi, 1911; Castelli, 1941). In Sardinia red deer became extinct in the central and northern zones around the end of the World War II (Beccu, 1989, 1993). By 1925-1935 red deer began to recolonize the central and eastern Italian Alps, entering from the Swiss Engadina in Val Venosta, in the province of Bolzano. At the end of the 1930s from the Canton Grisons in Switzerland the first animals also immigrated to the Lombard Alps (Valtellina). In the 1950s the natural spread from Switzerland and Austria began to become more generalised, with regular im-

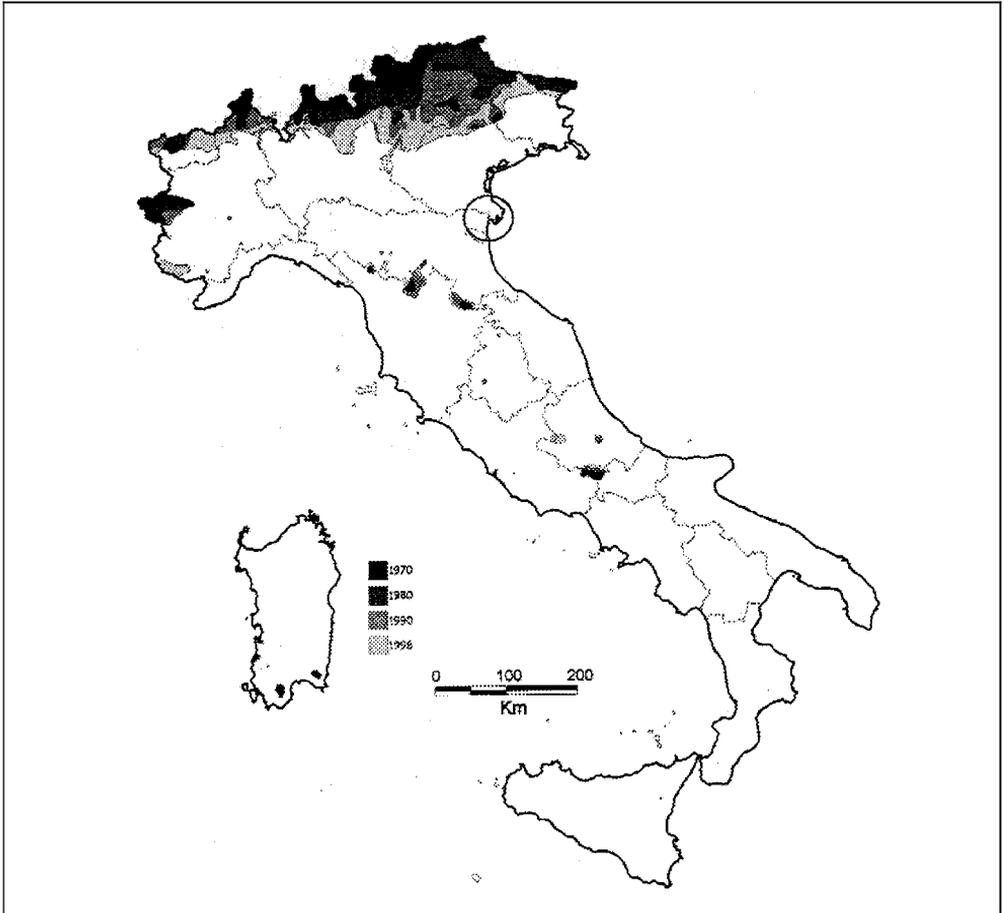


Figure 1 - Red deer distribution in Italy in 1970 (the circle indicates the Mesola Wood population), in 1980, in 1990 and in 1998.

migrations to the province of Udine and a range extension to South Tyrol and Trentino: the first sightings in Val di Sole (province of Trento) date back to 1950-51. In the 1960s the expansion reached the high Val d'Ossola in Piedmont (for immigration from Canton Valais) and the Ampezzo district in Veneto (from Carinthia; Righetti and Huber, 1982; Gill, 1990).

From our reconstruction, in 1970 red deer were present in 10 regions and 16 provinces; about 85% of the total range and the population size of peninsular Italy was concentrated in the central-eastern Alps (Fig. 1). In Sardinia red deer reached a level of maximum decline. Between 1970 and 1980 in Italy red deer

increased annually by 10.3% in distribution range and 8.4% in numbers.

In 1980 red deer were present in 12 regions and 25 provinces; about 80% of the total range and the population size of the Peninsula was still concentrated in the central and eastern Alps. Between 1980 and 1998 the re-established herds in the western Alps and in the northern and central Apennines began to grow, while in Sardinia red deer registered a gradual demographic recovery. The mean yearly increase in Italy for total range and for population size was 4.0% and 7.4% between 1980 and 1990, and between 1990 and 1998 the values were 4.3% and 9.1%. In 1998, red deer were present in 13 regions and 39 pro-

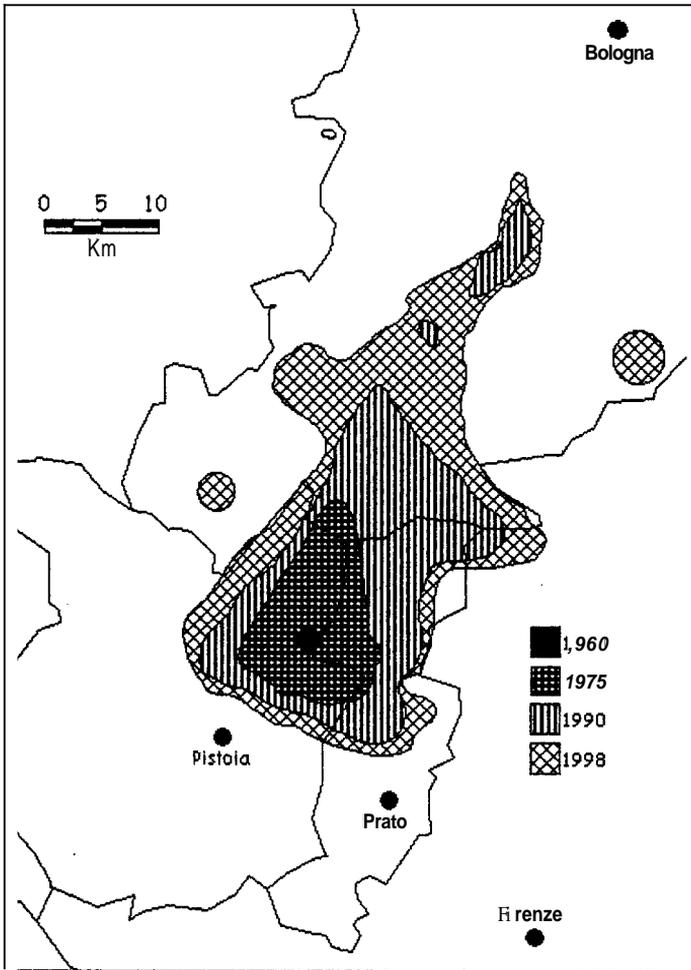


Figure 2 - Dynamics of range expansion in Acquerino, between 1960 and 1998.

vinces; 76% of the total range and 74% of population of the Peninsula was still concentrated in the central and eastern Alps. At present the species is still absent from the southern Apennines. A reintroduction to the Sila Mountains (Calabria), initially planned for 1990, has been delayed and not yet carried out.

In the northern Apennines, the Casentino population (provinces of Forlì and Arezzo) grew from 130 animals in 1984 to 950 in 1995, rising from 106 to 434 km² of total range and also colonising the nearby eastern Mugello (province of Florence; Mazzarone, 1986,

1996). The Acquerino red deer population (provinces of Bologna, Pistoia, Prato and Florence) rose from 900 head in 1994 (Mazzarone and Mattioli, 1996, corrected for the spring figures) to 1500 in 1998. Total range grew since the reintroduction up to 1998 as reconstructed in figure 2, increasing from 140 km² in 1975 to 430 km² in 1990 and 740 km² in 1998. The Acquerino population, for its range extension and its numbers, presently represents the most important of the entire Apennine range. In 1998 the total red deer population size in Italy was estimated at about 32,000 head. At a steady finite rate of increa-

Table 3 - Distribution range, population size and harvest in 1990.

geographic area	range (km ²)	population size	harvest
western Alps	4,211	1,330	388 (29.2%)
central and eastern Alps	19,495	11,580	1,659 (14.3%)
Emilia-Romagna and Tuscany	801	1,350	no
central Italy	477	700	no
Peninsular Italy	24,984	14,960	2,047
Sardegna	272	1,000	no
Italy (total)	25,256	15,960	2,047 (12.9%)

Table 4 - Distribution range, population size and harvest in 1998.

geographic area	range (km ²)	population size	harvest
western Alps	6,359	3,500	443 (12.7%)
central and eastern Alps	26,630	22,200	4,133 (18.6%)
Emilia-Romagna and Tuscany	1,368	2,810	no
central Italy	899	1,555	no
Peninsular Italy	35,256	30,065	4,576
Sardegna	368	2,000	no
Italy (total)	35,624	32,065	4,576 (14.3%)

se of 1.0911 (Table 5), the predicted population size for 2000 is about 38,000 head.

With a mean annual increase of 6.3% in distribution range and of 8.3% in population numbers between 1970 and 1998, red deer in Italy have experienced a fivefold growth in distribution and a tenfold in abundance in 28 years.

Reintroduction

Reintroduction have been fundamental, principally for the resettlement of red deer in the western Alps and Apennines. In the central and eastern Alps the contribution of spontaneous colonisation from bordering countries has prevailed. We have ascertained 45 episodes of red deer release from 1950 to 1998; for 38 of them (22 in the Alps and 16 in the Apennines) a detailed documentation has been collected (Tables 6, 7). Unfortunately, it should also be noted how in the last decade an adequate planning of reintroduction has often

been lacking, and that errors from the past have been repeated (lack of feasibility studies, use of founders from unsuitable stocks, incorrect schemes of release, insufficient health controls etc). Only some alpine districts have applied the proper procedure. The use of animals from La Mandria for establishing new herds in Castelporziano (province of Rome) and probably in Val d'Ozola (province of Reggio Emilia) is particularly worrying: not only the original stock is hybridised with North American wapiti, but it is also known to be a carrier of *Fascioloides magna* (Balbo *et al.*, 1987). Lastly, it must be emphasised that recently there has been an increase in the use of enclosures for deer farming and ornamental purposes, with quite high risks of accidental escapes. Unplanned liberation of farmed deer may give rise to new populations in unfavourable areas, or disrupt the genetic characteristics of resettled herds (Geist, 1992).

Table 5 - Mean annual finite rates of increase.

geographic area	1970-1980	1980-1990	1990-1998	1970-1998
western Alps	1.19	1.07	1.13	1.12
central and eastern Alps	1.07	1.06	1.08	1.07
Emilia-Romagna and Tuscany	1.06	1.13	1.10	1.10
central Italy	1.30	1.10	1.10	1.17
Sardegna	1.10	1.15	1.09	1.11
Italy	1.08	1.07	1.09	1.08

Table 6 - Main red deer reintroduction and restocking operations in the Italian Alps; accidental escapes are included.

Province	area	period	animals	source
Torino	Val Susa	1962-'64	10	Slovenia, Cuneo Zoo
Aosta		1986	5	Paneveggio
Aosta	Challand	1994-'96	15	local
Cuneo	Valle Stura	1990	14	Scotland (UK)
Cuneo	Valle Stura	1991-'94	102	Chambord (F)
Cuneo	Valle Po	1994	18	Chambord (F)
Cuneo	Valle Pesio	1996	ca 30	Tarvisio, Paneveggio, Hohe Tauern (A)
Alessandria	Valle Spinti	1988	ca 10	Hungary
Alessandria	Altavilla	1996	15	Scotland (UK)
Vercelli	Val Sesia	1994-'98	86	Gran Bosco, Chambord (F)
Biella	Val Sessera	1997	21	Chambord (F)
Bergamo	Val Brembana	1980	2	enclosure
Varese	M. Nudo	1990	6-7	
Brescia	Alto Garda	1993-'98	37	Stelvio N. P.
Trento	Paneveggio	1963	7-8	Val di Sole, Hungary
Trento	Val Rendena	1975	3	Paneveggio
Trento	Pasubio	1995-'97	20	Paneveggio
Vicenza	Asiago	1995-'96	17	Tarvisio, Paneveggio
Belluno	Cansiglio	ca. 1967	2	
Belluno	Feltrino	1978	5	Tarvisio
Belluno	Valle del Cordevole	1979	6	Stelvio N. P.
Pordenone	Cansiglio	1988	11	

Problems of conservation

The Sardinian red deer *C. e. corsicanus*, classified by I.U.C.N. as "endangered" (Bailie and Groombridge, 1996), has recovered gradually. The breeding programme in enclosures developed in the second half of the 80s and the expected translocations to areas

in northern and central Sardinia (Beccu, 1993) should keep this important population out of danger definitively. The relict nucleus of Mesola red deer, about 60 head in 1998, is still in a precarious situation and is urgently in need of a long term conservation plan.

Table 7 - Main red deer reintroduction and re-stocking operations in central Italy; accidental escapes are included.

Province	area	period	animals	source
Lucca	Orecchiella	1966-'72	ca 15	Tarvisio
Reggio E.	Val d'Ozola	1988-'96	20-25	La Mandria
Reggio E.	Val d'Ozola	1998	8	Scotland (UK)
Pistoia	Acquerino	1958 and 1965	7	Tarvisio
Bologna	Vergato	1986-'89	15	Scotland (UK)
Forlì	Casentino	1950-'60	11	Switzerland, Germany, Stelvio N.P., Tarvisio
Firenze, Arezzo	Casentino	1997	ca 15	Scotland (UK)
L'Aquila	Abruzzo N.P.	1972-'75	64	Engadina (CH), Bavaria (D), Triglav N.P. (SLO), Montalto di Ca- stro
L'Aquila	Velino Sirente	1990-'97	117	Stelvio N.P., Tarvisio
Pescara	Orfento, Majella	1983-'89	19	Tarvisio
Pescara	Orfento, Majella	1995	27	
Roma	Castelporziano	1957-'61	58	La Mandria
Cagliari	Maidopis	1992	9	local
Cagliari	Montimannu	ca 1996		enclosure

Hunting statistics

In the Italian Alps the first cullings took place in Val Venosta in the province of Bolzano in 1954 and in Val Fontana in the province of Sondrio in 1956 (but here selective hunting only began in 1989). The first cullings in the province of Trento go back to 1966 and 1970, while in Friuli selective hunting began in 1969, in Piedmont in 1978, in Veneto in 1979, and in Val d'Aosta in 1994. In the Apennines the first culling is expected for 2000 in Acquerino (Emilia-Romagna and Tuscany) and Casentino (Tuscany). The number of provinces where red deer hunting takes place has risen from 4 in 1970, to 5 in 1980, 7 in 1990, and 14 in 1998. The total harvest in Italy amounts to around 9% of the estimated population in 1970 as in 1980. Culling quotas for 1990 and 1998 accounted for 13-14% of the total population size (Tables 1-4). In 1998, 90% of the harvest was still located in the central and eastern Alps.

DISCUSSION

Compared to wild boar and roe deer, red deer has shown a distinctly more gradual pattern of range spread in Italy. This is not only due to fewer restocking operations or to a lower reproductive performance, but also to different spatial organisation. In red deer the centrifugal force of the dispersing young classes is slowed down by the strong ties of adults to the traditional rutting areas. The red deer expansion in Italy in the last few decades, with a tenfold growth in abundance between 1970 and 1998, fits into a more general phenomenon of recovery experienced by the species in Europe in the last few decades (Gill, 1990). The total European population size of red deer grew from about 865,000 head in the early Seventies to about 1,080,000 head in the early Eighties (Wagenknecht, 1986; Gill, 1990, modified). In neighbouring France numbers and range increased from 38,500 head and 70,000

km² in 1985 to 65,500 head and 90,000 km² in 1994 (Mouron and Boisaubert, 1997).

This recent considerable increase in distribution and numbers in Italy, calls for a radical adjustment of the present management practice and more comprehensive planning. For example, reintroduction programmes and censuses must standardise their procedures, current culling regimes are in need of a radical revision, many hunting districts should be re-designed. Ranging behaviour, food requirements and gregariousness make red deer particularly suitable to vast natural spaces such as large forest tracts, far from cultivation and urban areas. A careful planning of sustainable densities is crucial to minimise their impact on human activities. Future red deer restoration in the southern Apennines, where large protected areas contain suitable habitats, have particularly good prospects. Red deer could contribute not only to increase the biodiversity of southern Italy, but also to improve the status and management of the wolf, diverting it from preying on livestock (Meriggi and Lovari, 1997).

ACKNOWLEDGMENTS

This work would not have been possible without the invaluable contributions of E. Bracco, G. Carmignola, P. Ciucci, R. Fico, S. Focardi, M. Levriani, S. Lovari, F. Mari, C. Murgia, L. Pasa, C. Pascoli, L. Pedrotti, w. Radaelli, B. Ragni, V. Vergottini. We thank S. Lovari and R. Dzieciolowski for critically reading an early draft of the manuscript.

REFERENCES

- Apollonio, M., Randi, E. and Toso, S., 1988. The systematics of the wild boar in Italy. *It. J. Zool.*, 3: 213-221.
- Baillie, J. and Groombridge, B. (eds.), 1996. IUCN red list of threatened animals. IUCN, Gland, 378 pp.
- Balbo, T., Lanfranchi, P., Rossi, L. and Meneguz, P.G., 1987. Health management of a red deer population infected by *Fascioloides mngnn*. *Ann. Fac. Med. Vet. Torino*, 32: 3-13.
- Beccu, E., 1989. Il cervo sardo. Delfino Editore, Sassari, 167 pp.
- Beccu, E., 1993. Consistenza e prospettive di salvaguardia della popolazione di *Cervus elaphus corsicanus* presente in Sardegna. *Suppl. Ric. Biol. Selvaggina*, 21: 277-287.
- Castelli, G., 1941. Il cervo europeo. Olimpia, Firenze, 393 pp.
- Caughley, G., 1977. Analysis of Vertebrate populations. Wiley, London, 234 pp.
- Duprb, E., Pedrotti, L., Scappi, A. and Toso, S., 1998. Distribution, abundance and management of Ungulates in the Italian Alps: preliminary results. *Proc. 2nd World Conference on Mountain Ungulates*: 97-106.
- Geist, V., 1992. Deer ranching for products and paid hunting: threat to conservation and biodiversity by luxury markets. In: Brown, R.D. (ed.), *The biology of deer*. Springer Verlag, New York: 554-561.
- Ghigi, A., 1911. Ricerche faunistiche e sistematiche sui Mammiferi d'Italia che formano oggetto di caccia. *Natura*, 2: 289-337.
- Gill, R., 1990. Monitoring the status of European and North American Cervids. *GEMS Information Series 8*: UNEP, Nairobi, 277 pp.
- Lovari, S., 1993. Evoluzione recente delle popolazioni di grandi Mammiferi della fauna d'Italia. *Acc. Naz. Lincei, Contributi del Centro Linceo Interdisciplinare Beniamino Segre (Evoluzione biologica e i grandi problemi della biologia: faune attuali e faune fossili)*, 86: 21-37.
- Mattioli, S., 1990. Red deer in the Italian peninsula, with particular reference to the Po delta population. *Deer*, 8(2): 95-98.
- Mattioli, S., 1994. Le reintroduzioni di Cervidi in Italia, con particolare riferimento all'Appennino. In: Inglisa, M. (ed.), *Atti I Conv. Naz. P. Barrasso: La fauna appenninica e la sua conservazione*. Airone-CFS: 19-25.
- Mattioli, S., in press. *Cervo Cervus elaphus*.

- In: Boitani, L., Lovari, S. and Vigna-Taglianti, A. (eds.), *La Fauna d'Italia, Mammiferi, Ungulati e Carnivori*. Calderini, Bologna.
- Mazzarone, V., 1986. Indagine sulla popolazione di cervo delle Riserve Naturali Casentinesi e sulle sue relazioni con l'ambiente forestale: proposta di un piano di gestione. Laurea thesis, Univ. Firenze.
- Mazzarone, V., 1996. Censimento del cervo al bramito. In: Lovari, C. (ed.), *Studio sulla biologia del Lupo in rapporto alla presenza di Ungulati selvatici e domestici nel Parco. DREAM, Poppi (Ar)*: 81-98.
- Mazzarone, V. and Mattioli, S., 1996. Indagine sulla popolazione di cervo dell'Acquerino: relazione finale 1993-1995. Regione Toscana, Firenze, 133 pp.
- Meriggi, A. and Lovari, S., 1996. A review of wolf predation in southern Italy: does wolf prefer wild prey to livestock? *J. Appl. Ecol.*, 33: 1561-1571.
- Mouron, D. and Boisaubert, B., 1997. La situation du cerf élaphe en France: mise à jour de l'inventaire zoogéographique des massifs à cerf Claphe. *Bull. Mens. Office National de la Chasse* 218: 18-21.
- Perco, F., 1981. Cervo *Cervus elaphus*. In: Pavan, M. (ed.), *Distribuzione e biologia di 22 specie di Mammiferi in Italia*. CNR, Roma: 137-143.
- Perco, F. and Calò, C.M., 1995. The status of roe deer in Italy. In: Wotschikowsky, U. (ed.), *Proceedings of the 2nd European Roe Deer Meeting*, Wildbiologische Gesellschaft, München: 43-53.
- Righetti, A. and Huber, W., 1983. Ausrottung und Wiedereinwanderung des Rothirsches (*Cervus elaphus*) in Kanton Bern (Schweiz). *Rev. Suisse Zool.*, 90: 863-870.
- Wagenknecht, E., 1986. *Rotwild*. Neumann-Neudamm, Melsungen, 484 pp.