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A GREY WOLF (*CANIS LUPUS* LINNAEUS, 1758) FROM FIEMME VALLEY
(MAMMALIA, CANIDAE; NORTH-EASTERN ITALY)

Riassunto. *Un lupo (Canis lupus Linnaeus, 1758) dalla Val di Fiemme (Mammalia, Canidae; Italia nord-orientale).* Gli autori presentano i primi dati oggettivi sulla presenza del lupo (*Canis lupus* L.) nell'Italia nord-orientale, prima di tutto basati sulla scoperta di un esemplare morto in Val di Fiemme (Trentino Alto Adige). L'interpretazione del valore storico di questo problematico reperto rimane per certi versi aleatoria, ma dati più recenti sulla presenza di *Canis lupus* nella stessa zona (Trentino Alto Adige e Friuli Venezia Giulia) confermano che il lupo sta tornando in diverse zone dell'Italia nord-orientale.

Parole chiave: *Canis lupus*, Biometrics, North-Eastern Italy, Trentino Alto Adige, Friuli Venezia Giulia

Summary. The authors present the first recent objective records on the occurrence of the grey wolf (*Canis lupus* L.) in North-Eastern Italy, first of all based on the discovery of a dead specimen in Fiemme Valley (Trentino Alto Adige). The interpretation of the historic value of this problematic finding remains still dubious, but more recent data on the presence of *Canis lupus* in the same area (Trentino Alto Adige and Friuli Venezia Giulia) confirm that the wolf is coming back in various zones of North-Eastern Italy.

Keywords: *Canis lupus*, Biometrics, North-Eastern Italy, Trentino Alto Adige, Friuli Venezia Giulia

INTRODUCTION

The recent natural expansion of the grey wolf (*Canis lupus* L.) in the Western Alps has been intensively monitored by various authors and institutions, by means of a combination of different techniques, such snow-tracking, radio-telemetry, wolf-howling sessions, non-invasive genetic analysis of hairs, scats and other organic samples (for an updated synthesis see LUCCHINI et al., 2002; VALIÈRE et al., 2003; SALVATORI & LINNELL, 2005; FABBRI et al., 2007; MARUCCO et al., 2007; LINNELL et al., 2008; WEBER & FATTEBERT, 2008; MARUCCO, 2009).

This impressive expansion originated from the Italian peninsula population, that in the early nineties of the last century started to colonize Western Italian Alps (CORSI et al., 1999; BOITANI, 2003; MARUCCO et al., 2007; WEBER & FATTEBERT, 2008) and the neighbouring French Alpine Mountain Chain (DUCHAMP et al., 2004) with a steadily growing number of resident packs (FABBRI et al., 2007; MARUCCO, 2009). Since 1996 also Switzerland has been reached by a scattered flow of dispersing wolves (VALIÈRE et al., 2003; WEBER & FATTEBERT, 2008), with an increasing trend of their presence in recent years (ANONYMOUS, 2009a). The whole picture of this phenomenon is rapidly changing, due to a high dispersal rate of Italian wolves (see also CIUCCI et al., 2009), which – originating from some packs in the Western Alps – reached various localities of Central Europe, including Germany, and even the French Pyrenees (WEBER & FATTEBERT, 2008). Recently (October-November 2008) in the central part of the Alpine Mountain Chain a (presumably lone) wolf of Italian lineage roamed across Müstair-Monastero Valley (H. Haller, in litteris, 2008, see also fig. 1), very close to the border with South Tyrol-Alto Adige in Italy.



Fig. 1. Footprint of an Italian grey wolf from Müstair-Monastero Valley (Switzerland), later determined by genetics (Photo H. Haller, 27.11.2008). Considering the long dispersal distances of the wolves, the locality is in potential ecological continuity with the Fiemme Valley (Varena Municipality, Trento Province), where the skull of the wolf described in this paper was found (fig. 4).

Fig. 1. *Impronta di un lupo italico ripresa in Val Müstair-Monastero (Svizzera), successivamente determinata per via genetica (Foto H. Haller, 27.11.2008). Considerando le grandi distanze di dispersione dei lupi, la località è in contatto ecologico potenziale con la Val di Fiemme (Comune di Varena, Provincia di Trento), dove è stato rinvenuto il cranio di lupo descritto nel presente lavoro (fig. 4).*

Nevertheless, until now the Eastern Alps were not particularly involved in wolf expansion, presumably because the Slovenian part of the wolf population, at the moment the only possible source for the colonization of the Eastern Alps, is relatively well controlled by management activities in Slovenia (WEBER & FATTEBERT, 2008). Wolves in Slovenia represent the north-western part of the larger continuous Dinaric-Balkan wolf population, that stretches to north-central Greece and is estimated to contain 5000 wolves (LINNELL et al., 2008). In the 1980s wolves were close to extinction in Slovenia, with the last few wolves left close to the border with Croatia. After the hunting ban adopted by the Slovenian hunting association in 1990 and the legal protection in 1993, the number of wolves in Slovenia increased steadily (ADAMIČ et al.,

2004). However, also some local decreases have been recorded in recent years, e.g. on Menišija and Logatec plateau (M. Krofel, unpublished data). Today the wolf in Slovenia is distributed mainly in the Dinaric range, in the southern part of the country. No reliable estimates of the present number of wolves are available. According to the available data on wolf distribution (ADAMIČ et al., 2004) and to telemetry studies (VIDOJEVIČ, 2006; Kos et al. unpublished data; Kusak et al. unpublished data), there are perhaps about 8 packs currently present in the country, some of them shared with neighbouring Croatia. The first reliable estimates are expected to become available in the next years from studies within the new Life plus Project, entitled "Conservation and surveillance of conservation status of wolf (*Canis lupus*) population in Slovenia" (ANONYMOUS, 2008). In the frame of this project, a big male was already caught on Mount Sneznik (April 2010), very near to the Italian-Slovenian border.

In the last 15 years, however, the Dinaric-Balkan population has been slowly expanding towards the Alps. This expansion was probably hindered by, besides legal and illegal hunting and natural habitat fragmentation, also the Ljubljana-Trieste 4-lane highway that has no crossings designed for wildlife. Most records from the western part of Slovenia come from Nova Gorica Pre-Alpine region (Mount Čaven: LAPINI et al., 1996), Brkini, Vremščica, Nanos, Hrušica and Trnovski gozd (TURK, 2006; ČERNE, 2007; Krofel in LAPINI et al., 2009). These are also the only areas with reliable wolf records (photos, killed animals and confirmed damages to livestock). On Trnovski gozd plateau, however, there has been also recorded reproduction (TURK, 2006). In addition, there are several uncertain records (direct observations and tracks) available from regions closer to Italy: Banjščice, Čepovan, Idrijsko-Cerkljansko hribovje, as well as few unconfirmed records from Soča valley and Matajur (LAPINI et al., 1996; TURK, 2006; ČERNE, 2007).

In Western Austria the autochthonous reproducing population of grey wolf was exterminated in 1930, while in the Eastern part of the country the wolf was virtually extinct at the turn of the 19th-20th century. Nevertheless, single vagrants from the Balkan population were observed in Carinthia and East Tyrol between 1914 and 1996, while in Upper Austria a scattered flow of stragglers from the Carpathian population was registered between 1940 and 1996 (SPITZENBERGER & BAUER, 2001). The Austrian situation seems to increase recently, with a noticeable presence of wolves in recent years. After some rumours in 2008 various field signs of presence in the field could be collected throughout 2009, documenting that a first wolf coming from the Dinaric-Balkan population reached Central Carinthia (ANONYMOUS, 2009b). It was genotyped by Luca Fumagalli from the University of Lausanne (Switzerland), who after only a few months could identify other five wolves from Austria (Tyrol, Carinthia and Styria). One of these originated from the Dinaric-Balkan population too, three from the Italian population and another one from the Carpathian Mountains (see also ANONYMOUS, 2009d). All these specimens were dispersing males, but in October 2009 also a single female of *Canis lupus italicus* was detected in South Tyrol.

In North-Eastern Italy the wolf seems to be extinct over 80 years ago. The last wolf from this region was captured in 1931 in the locality "Campo Bon, Baita di Dosoledo", Upper Comelico in Belluno Province (FOSSA, 1988). In spite of the proximity of the Dinaric-Balkan population, at present there are no confirmed records of wolf presence in the whole North-Eastern Italy (Trentino Alto Adige, Veneto and Friuli Venezia Giulia Regions).



Fig. 2. A young female of golden jackal (*Canis aureus*) road-killed on 10 December 2009 in the Hunting Reserve of Socchieve (Carnian Alps, Udine Province) (data in LAPINI et al., 2009) (Photo L. Dorigo - L. Lapini).

Fig. 2. Una giovane femmina di sciacallo dorato (*Canis aureus*) investita da automobili il 10 dicembre 2009 nella Riserva di Caccia di Socchieve (Alpi Carniche, provincia di Udine) (dati in LAPINI et al., 2009) (Foto L. Dorigo - L. Lapini).

The unverified wolf data published by FILACORDA (2006), seem to be actually referred to the golden jackal (*Canis aureus* L.) (LAPINI et al., 2009), and the same is probably true for all the data from Friuli Venezia Giulia noted as wolves by ČERNE (2007). In this region of Italy up to now all undoubted records (photos, dead specimens and other diagnostic materials) belong to the golden jackal, which is regularly confused with the wolf in the whole Italian-Slovenian border area (LAPINI et al., 2009). Sightings of wild canids are particularly uncertain in areas where both wolf and golden jackal sporadically occur together and should be treated with caution. In these situations it is necessary to consider only confirmed data supported by diagnostic samples, like road-kills, harvested specimens or other records obtained by means of photo-trapping (fig. 2) or genetic studies from hairs, swabs, droppings or other biological material collected in the wild.

In June 2009 we received and studied the first recent wolf specimen from North-Eastern Italy, collected in Fiemme Valley (Varena Municipality, Trentino Alto Adige Region). The aim of this paper is to detail the description of this finding (already mentioned in LAPINI et al., 2009), that represents the first recent confirmed record of the wolf presence in North-Eastern Italy.

A WOLF FROM FIEMME VALLEY: THE FACTS

On November 5th 2006, a hunter from Varena Municipal Reserve (Augusto Polesana, actually the President of this Reserve) spotted with binoculars a defecating ‘wolf-like’ wild canid, at a distance of about 130 m, close to “Passo degli Oclini”, a mountain pass near the border between South Tyrol-Alto Adige and Trentino (see fig. 3, loc. n. 1). The hunter phone-called a local forester, Maurizio Poli, who subsequently collected a canid dropping at the same locality of the sighting. The hunter attributed his own sighting to a ‘wolf’, but the scat was labelled as ‘golden jackal’s dropping’ and sent to the ISPRA (Institute for Environmen-

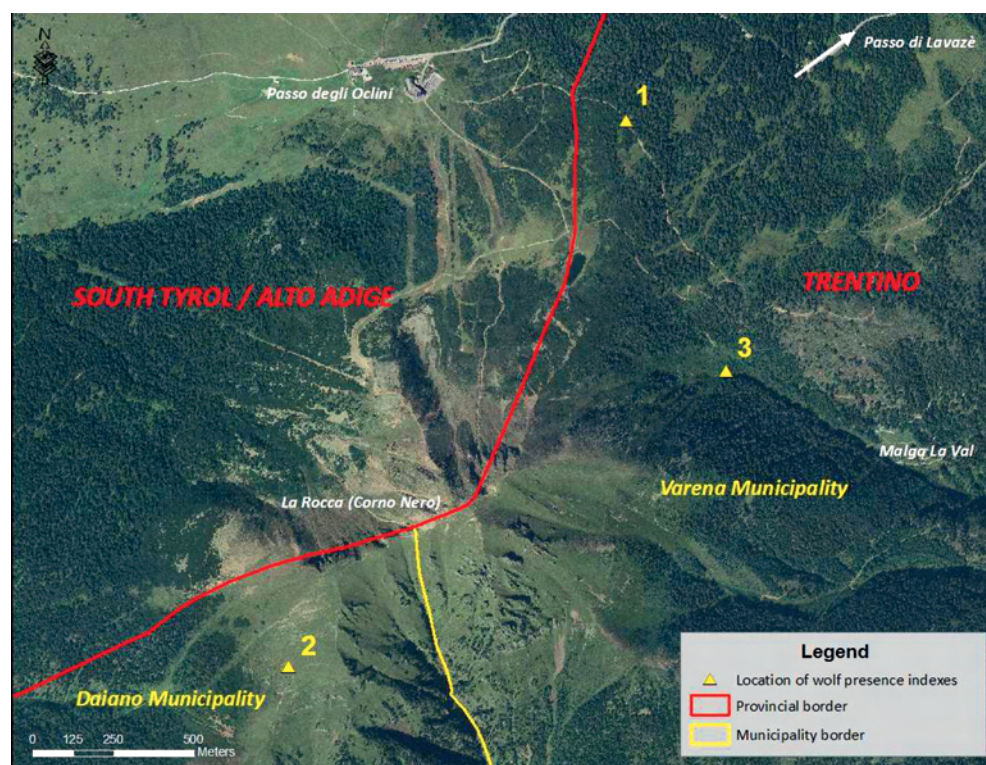


Fig. 3. Map of Varena Municipality, “Passo degli Oclini” and “Passo di Lavazè” area. 1: location of the first sighting (5th November 2006), 2: location of the area of sheep depredations in summer 2007, 3: location where the remains of the wolf from Fiemme Valley were discovered (November 2007). (Aerial flight IT2006, ortophoto by Provincia Autonoma di Trento).

Fig. 3. Mappa della zona del Comune di Varena, fino al Passo degli Oclini ed al Passo di Lavazè. 1: localizzazione del primo avvistamento (5 novembre 2006), 2: localizzazione della predazione di pecore avvenuta nell'estate 2007, 3: localizzazione del punto dove sono stati rinvenuti i resti del lupo della Val di Fiemme (novembre 2007). (Volo aereo IT2006, ortofoto della Provincia Autonoma di Trento).

tal Protection and Research, ex INFS - National Institute for Italian Wildlife) for genetic studies, whose results are not available yet.

In the late December 2006, a ‘wolf-like’ canid was spotted again, crossing the paved road between “Passo degli Oclini” and “Passo di Lavazè” (fig. 3, see the white arrow), by a witness at that time employed in a local restaurant. He referred his own sighting to a ‘true wolf’ (A. Polesana pers. comm., 2009).

Then, in summer 2007 two depredations of sheep – at that time attributed to ‘wild dogs’ – were reported (G. Carmignola and R. Ploner pers. comm., 2009) in “La Rocca (Corno Nero)” area, Province of Bolzano/Bozen (Trentino Alto Adige Region, North-Eastern Italy: see fig. 3, loc. n. 2).

Some months after these depredations, in November 2007, a hunter from Varena Municipal Reserve found the carcass of a recently dead canid in close proximity to “Malga La Val”, 1940 m a.s.l. (Varena Municipality, Fiemme Valley, Trentino Alto Adige Region; fig. 3, loc. n. 3). In his own opinion its death could be dated back to about one week (A. Polesana, pers. comm., 2009). The carcass was partially snow-covered, and the hunter didn’t collect it until the following year, when he went back to the area and retrieved the complete skull, thinking that it could be of ‘scientific’ interest. Finally, in May 2009, the skull was delivered to A. Polesana, who in turn gave it to M. Poli of Trentino Forestry Corp. In June 2009 the same forester went again to the locality of the find, searching for other carcass remains. He collected a few other bones of the canid, at the time completely decomposed. All the remains were then consigned to the Mammal Section of the Natural History Museum of Trento, together with the skull of the canid previously collected by hunters.

DETERMINATION OF THE SPECIMEN

Some digital pictures of the skull (fig. 4) were sent to one of the authors (L. L.), who immediately attributed the cranial remains to *Canis lupus*.

A more detailed confirmation of this specific determination was then obtained by means of the examination of 14 parametric and non-parametric features, studied on the skull by the same author (see LAPINI, 2009 and tab. I). The skull was attributed to *Canis lupus* particularly for the large condylo-basal length (tab. I: n. 1), the length of the crown of Pm^4 (tab. I: n. 7), large neurocranium capacity (about one-third wider compared to two dogs of similar size, tab. I: n. 9), medium orbital angle (tab. I: n. 10), the wolf-like position of its palatal border (tab. I: n. 12, see also the big arrow in fig. 4b), large and rounded tympanic bullae (tab. I: n. 13). The studied skull, moreover, shows a typical feature of the wolf visceral cranium. In wolves, the basal corpus of the praesphenoid bone develops two symmetric large lateral widenings similar to the wings of a moth (tab. I: n. 14). A moth shaped basal corpus of the praesphenoid bone is diagnostic for *Canis lupus* (see the thin arrow in fig. 4b), because in the domestic dog (*Canis [lupus] familiaris* Linnaeus, 1758) the same part of this bone is thin, lancet-shaped, more rarely Y-shaped. Of these characters only the number 12 may be sometimes contradictory, because in some very old dogs it is rarely possible to observe a similar wolf-like palatal structure.

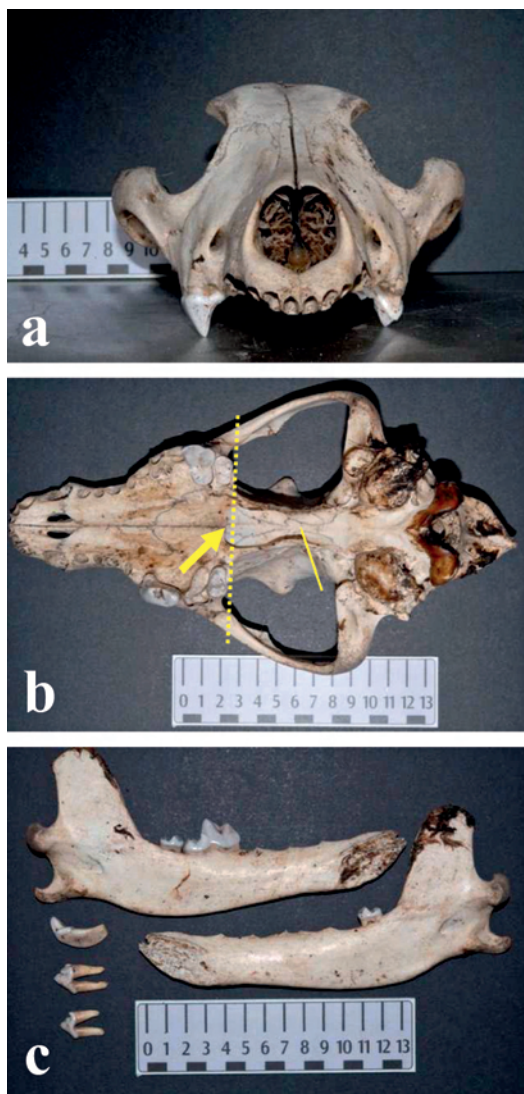


Fig. 4. The skull of the grey wolf from Fiemme Valley (Varena Municipality, Trento, North-Eastern Italy). Photo K. Tabarelli De Fatis (Trento). **a:** frontal view; **b:** ventral view; **c:** mandibles. The big arrow in **b** indicates the typical wolf-like position of the postero-mesial palatal border in the studied skull. The thin arrow in **b** shows the typical moth-shaped basal corpus of the wolf's praesphenoid bone.

Fig. 4. Il cranio del lupo della Val di Fiemme (Comune di Varena, Trento, Italia nord-orientale). Foto K. Tabarelli De Fatis (Trento). **a:** visione frontale; **b:** visione ventrale; **c:** mandibole. La freccia grande in **b** indica la posizione del bordo palatale postero-mesiale tipica del lupo nel cranio studiato. La freccia piccola in **b** mostra la caratteristica forma a falena del corpo basale dell'osso presfenoideo nel cranio di lupo studiato.

n.	Type of character	Wolf	Dog 1	Dog 2
1	Cbl (Condylar basal length - Gnathion-Henselion)	242,22	240,3	236,6
2	TL (Total Length - End of sagittal crest-Gnathion)	263,24	258,5	253,1
3	ZB (Zygomatic Breadth)	143,52	138,4	131,32
4	CH (Coronoid High)	75,58	78,22	-
5	ML (Mandibular Length – Center of the Condylus articularis-Mandibular tip)	190,9	193,24	-
6	MH (Mandibular High – Mandibular high at the level of the last molar)	37,82	36,54	-
7	Pm ⁴ L (Length of upper Pm 4)	26,48	21,6	22,3
8	Pm ₄ L (Length of lower Pm 4)	29,84	28	-
9	NC (Neurocranium Capacity in cm ³)	170	120	120
10	Medium orbital angle (Left + Right / 2) at the level of zygomatic and supraorbital apophyses, in sessagesimal degrees	38,5°	52,5°	51°
11	Volumetric Index (Cbl in mm/Neurocranium Capacity in cm ³)	1,4248	2,0025	1,9716
12	Postero-mesial palatal border cephalic with respect to a line touching the posterior borders of the last upper molars (see the big arrow in fig. 4b)	Yes	No	No
13	Tympanic bullae very great, rounded and prominent (evaluated in direct comparison with various dog skulls)	Yes	No	No
14	Basal corpus of the praesphenoid bone typically moth-shaped due to the presence of two conspicuous lateral widening (the “wings”: see the thin arrow in fig. 4b)	Yes	No	No

Tab. I. Biometry of the specimen (modified and integrated from LAPINI, 2009). Parametric (in mm: numbers 1-8; in sessagesimal degrees: n. 10; in cm³: n. 9) and non parametric data (numbers 12-14) obtained from the wolf skull collected in Fiemme Valley and from two large dogs stored in the Friulian Natural History Museum (MFSN: Z/T numbers 273 and 287).

Tab. I. *Biometria dell'esemplare (modificata ed integrata da LAPINI, 2009). Dati parametrici (in mm: numeri 1-8; in gradi sessagesimali: n. 10; in cm³: n. 9) e non parametrici (numeri 12-14) ottenuti dal cranio di lupo rinvenuto in Val di Fiemme e dai crani di due grandi cani conservati nel Museo Friulano di Storia Naturale (MFSN: Z/T numeri 273 e 287).*

The large dimensions of the studied skull, moreover, were not compatible with those of Italian wolves (*Canis lupus italicus* Altobello, 1921), which exhibit smaller size (see for example the biometric range reported by SIRACUSA & LO VALVO, 2004, and the consideration made by LAPINI, 2009). Its measurements, on the other hand, were in agreement with the biometric characterization of larger Dinaric-Balkan wolves (KRYŠTUFEK, 1995). These wolves, some of which had been previously regarded as a separate subspecies (*Canis lupus kurjak* Bolokay, 1925), most probably belong to the nominal race *Canis lupus lupus* Linnaeus, 1758 (KRYŠTUFEK, 1995).

Measurements and proportions of the skull seemed to indicate a male, while the preliminary examination of the dissected root of an upper incisor permitted to estimate its age to 3-5 years.

Later, in September 2009, the specific determination was confirmed also by bio-molecular analysis performed on the material obtained by dissecting the pulpar-chamber of a molar (Randi, in litteris, 2009). This wolf possessed a bio-molecular marker absent in the Italian wolf and normally present in wolves from the Croatian population.

This confirms previous conclusions from biometrics (tab. I), also giving indication about the possible origin of the studied wolf.

REMARKS AND DISCUSSION

The described wolf specimen from Fiemme Valley (Trentino) represents the first reliable record of this species from North-Eastern Italy in the last 80 years. The confirmed determination of the remains supports the credibility of previous uncertain indices of wolf presence recorded in this area (fig. 3, see also text above), indicating that the individual was probably present in the same mountain range of Trentino Alto Adige Region (North-Eastern Italy) for about one year, at least between the fall 2006 and 2007.

As for its origins, however, there are still some uncertainties. First, at present it is still unclear if the genetic marker determined in its genome is actually exclusive for the Croatian population (Randi, in litteris, 2009). Secondly, there are undocumented rumours (ANONYMOUS, 2009c) about the recent possible illegal introduction of captive wolves of uncertain lineages in the surroundings of the locality where the wolf's carcass was found. Finally, there are no complete and up-to-date data on the distribution and origin of captive wolves in Lower Austria, that are quite common in various private wildlife enclosures.

Only additional comparisons between the genome of the wolf from Fiemme Valley with the genotypes of the wolves recently tracked in Austria (Carinthia and Styria), and those from Slovenia and other parts of the Dinaric-Balkan population will definitively solve the question about its origin.

Nevertheless, it is certainly possible that this wolf could originate from the Dinaric-Balkan population, since long dispersal distances have been recorded several times before in wolves, both in North America and in Europe (MECH & BOITANI, 2003; VALIÈRE et al., 2003; KOJOLA et al., 2006; CIUCCI et al., 2009).

If the wolf from Fiemme Valley indeed originates from the Dinaric-Balkan population,

this area could represent a first unprecedented contact zone with dispersing Italian wolves, which reached the very near Müstair-Monastero Valley in Switzerland (fig. 1), and more recently the Adamello-Brenta National Park (Trentino-Alto Adige) (fig. 5). This last wolf presence was detected by means of bio-molecular analyses performed on a biological sample collected in the Park on 13 April 2010 (ANONYMOUS, 2010).

Also in Friuli Venezia Giulia there is a first thin confirmation of the presence of wolves. In December 2009-January 2010 a undetermined wild dog preyed upon sheep and goats between the little town of Basovizza (Province of Trieste) and the Slovenian border. On the basis of the naturalistic evaluation of signs and traces collected around the site of predation, the predator was determined as a probable wolf by the gamekeepers of the Provincial Administration of Trieste and by other Italian and Slovenian experts. The genetic analyses performed on the swab of this predator, on the other hand, indicates that it probably was a wolf-dog hybrid, sharing both the bio-molecular markers of domestic dogs and Dinaric-Balkan wolves (E. Randi, *in litteris*, 14 May 2010).

In spite of some uncertainty about the origins of the wolf from Fiemme Valley, these more recent data confirm that the wolves are coming back in various zones of North-Eastern Italy. Such a re-colonization seems to follow both North-Western (Trentino Alto Adige) and South-Eastern paths of expansion (Friuli Venezia Giulia).

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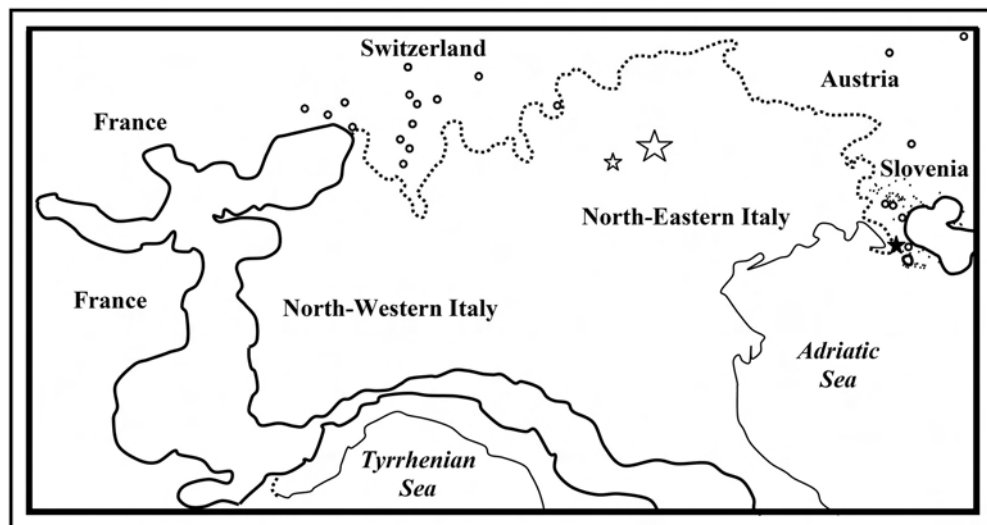


Fig. 5. Approximate distribution of the grey wolf (*Canis lupus*) on the Alpine Mountain Chain and surroundings in recent years (redrawn and adapted mainly from ADAMIĆ et al., 2004, VIDOJEVIĆ 2006, FABBRI et al. 2007, WEBER & FATTEBERT, 2008).

Bold lines represent the approximate borders of various areas more or less permanently occupied by wolves; single dots (·) indicate unsure records; small circles (○) indicate ascertained vagrants presence; the big star (☆) indicates the location of the wolf from Fiemme Valley, the small star (☆☆) indicates the presence of an Italian wolf in the Adamello-Brenta National Park, the black star (★) indicates the ascertained presence of a probable wolf-dog hybrid on the Italian Karst (explication in the texts). Dotted line indicates the Italian borders.

Fig. 5. Distribuzione approssimativa recente del lupo (*Canis lupus*) sulla Catena Alpina e dintorni (ridisegnato e adattato soprattutto da ADAMIĆ et al., 2004; VIDOJEVIĆ, 2006; FABBRI et al., 2007; WEBER & FATTEBERT, 2008). Le linee più spesse rappresentano i confini approssimativi di varie zone più o meno permanentemente occupate dai lupi; singoli puntini (·) indicano dati incerti; piccoli cerchi (○) la presenza accertata di esemplari erratici; la stella grande (☆) indica la località dove è stato trovato il lupo della Val di Fiemme; la stella piccola (☆☆) indica la presenza di un lupo italico nel Parco Nazionale Adamello-Brenta; la stella nera (★) indica la presenza accertata di un probabile ibrido lupo-cane sul Carso italiano (spiegazioni nel testo). La linea punteggiata indica il confine italiano.

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Addendum: On 23 October 2010 a freshly dead old buck of *Canis lupus* was discovered near Most na Soči (in Italian "Santa Lucia di Tolmino", North-Western Slovenia). It was killed by a train along the river bed of the River Soča-Isonzo. This is the North-Westernmost sure record for the grey wolf in Slovenia and it is also very near to the Italian Julian Pre-Alps.

The big male of grey wolf radio-tagged in the frame of the Slovenian Life Plus Project (see the Introduction) was studied from April up to October 2010. The fixings performed on the movements of this male and its pack have shown that these wolves dwell in a large longitudinal Slovenian-Croatian area North-South oriented. This longitudinal area is extended up to one km to the Italian-Slovenian border, around the zone of Grad Socrb-San Servolo, very near to the Italian municipalities of S. Dorligo della Valle and Muggia (Province of Trieste).

