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REPRODUCTION OF THE GOLDEN JACKAL
(*CANIS AUREUS MOREOTICUS* I. GEOFFROY SAINT HILAIRE, 1835)
IN JULIAN PRE-ALPS, WITH NEW DATA ON ITS RANGE-EXPANSION
IN THE HIGH-ADRIATIC HINTERLAND (MAMMALIA, CARNIVORA, CANIDAE)

Riassunto. Riproduzione dello sciacallo dorato (*Canis aureus moreoticus* I. Geoffroy Saint Hilaire, 1835) nelle Prealpi Giulie, con nuovi dati sulla sua espansione areale nell'entroterra alto-adriatico (Mammalia, Carnivora, Canidae).

Vengono presentati alcuni dati sulla recente espansione dello sciacallo dorato *Canis aureus moreoticus* I. Geoffroy Saint Hilaire, 1835, nelle Prealpi italo-slovene, aggiornando le conoscenze sulla distribuzione della specie nell'entroterra Alto-Adriatico. In quest'area lo sciacallo ha recentemente aumentato la sua presenza, con varie evidenze che indicano la stabilizzazione dell'area di influenza di alcuni gruppi familiari sia in Italia, sia in Slovenia. Dal 2003, infatti, questo canide ha stabilizzato la posizione di alcuni punti tradizionali di richiamo vocale in varie zone delle Prealpi Giulie, riproducendosi con certezza almeno nel 2007. Questo quadro sembra congruente con una nuova blanda tendenza all'espansione dell'areale della specie, che sembra comprendere il Carso e le Prealpi Giulie italo-slovene. La conservazione di questa fragile popolazione trans-nazionale di sciacalli dorati sembra essere interamente dipendente da campagne di sensibilizzazione del pubblico venatorio, sia in Italia, sia in Slovenia.

Summary. Data on the recent expansion of the golden jackal *Canis aureus moreoticus* I. Geoffroy Saint Hilaire, 1835, in the Italian-Slovenian Pre-Alps are presented, updating the knowledge on the distribution of this species in the High Adriatic hinterland. In this area, the species has recently increased its presence, with evidence of the range-stabilization of local family-groups both in Italy and in Slovenia. Since 2003 this canid has established some traditional howling spots in various zones of the Julian Pre-Alps, reproducing with certainty at least in 2007. This picture seems to be congruent with a new bland trend of range expansion of the species that seems to encompass the whole Italian-Slovenian Karst and the adjacent Italian-Slovenian Julian Pre-Alps. The conservation of this trans-national fragile population of golden jackals seems to be entirely dependent to public awareness campaigns directed to the hunters, both in Italy and in Slovenia.

Keywords: *Canis aureus*, range-expansion, North-Eastern Italy, North-Western Slovenia.

INTRODUCTION

The first data on the presence of the golden jackal *Canis aureus moreoticus* in Slovenia were published by BRELIH (1955), who reported about the sighting of various jackals packs, some of these in the surroundings of Kobarid, in Julian Pre-Alps. At the beginning of the 1950's in northern Slovenia three specimens were shot, two near the wood of Razor, near Vrhnika (Ljubljana), and one third near Smast (Kobarid). According to BRELIH (1955), only one of the first two jackals was stuffed and preserved in the Museum of Bistra (Vrhnika, Ljubljana) (probably the specimen in fig. 1). In the same period, the early 1950's, groups of golden jackals probably reached also various zones of north-eastern Italy, particularly in the wild Catchment of the River Natisone (Julian Pre-Alps, Udine Province). These data, usually referred to sightings of "wolves packs", were sometimes published also by local



Fig. 1. Male golden jackal shot in the wood of Razor (Vrhnika, Ljubljana) in January-February of the 1953 (Unlabelled specimen from the Museum of Bistra, Ljubljana, Photo L. Lapini). The data of this specimen, together with various sightings from Julian Pre-Alps, were firstly published by Savo BRELIH (1953).

Fig. 1. Sciacallo dorato maschio abbattuto nel bosco di Razor (Vrhnika, Ljubljana) nel Gennaio-Febbraio del 1953 (Esemplare privo di cartellino del Museo di Bistra, Ljubljana, Foto L. Lapini). I dati di questo esemplare, assieme a varie segnalazioni delle Prealpi Giulie, furono pubblicate per la prima volta da Savo BRELIH (1953).

Italian newspapers (see for example the “Gazzettino” of 28 October 1956).

Nevertheless, this first expansion of the golden jackal to the north of its Balkan range seemed end in the following years, apparently without particular consequences.

A second, impressive, expansion of the species started in the early 1980’s of the XX Century, when the golden jackal colonized the Istrian Peninsula, expanding its Balkan range up to NE Italy, Austria, Hungary, probably due to a strong increase of its Dalmatian and Bulgarian populations (DEMETER, 1984; MILENKOVIC, 1987; LAPINI & PERCO, 1988, 1989; RALLO, 1989; SPASSOV, 1989; HOI-LEITNER & KRAUS, 1989; KRYŠTUFEK & TVRTKOVIC, 1990; KRYŠTUFEK, 1991; DEMETER & SPASSOV, 1993; KRYŠTUFEK et al., 1997, BAUER, 2002).

In this period, the spreading of the species to the North followed various paths of expansion; some of these encompassed the Karst and part of Julian Pre-Alps, various zone of the Republic of Slovenia, and the adjacent Italian mountains and lowlands.

The first reliable data on the presence of the golden jackal in north-eastern Italy was published only in the later 1980’s (LAPINI & PERCO, 1988), when it was possible to ascertain the reproduction of the species near Udine. In this zone a young (in 1985, fig. 2) and a big pluriparous female (in 1987, LAPINI & PERCO, 1988, 1989) were shot, while another young was killed by cars on a highway (in 1985). The prosecution of the researches permitted to gather further information on “Italian” jackals, that surprisingly turned out to be present in north-eastern Italy at least from 1984, when one of the two specimens sighted near S. Vito di Cadore (Belluno Province) was captured by a game-



Fig. 2. A five to seven months old golden jackal born in the wild and shot in the surroundings of Udine, north-eastern Italy, in September 1985. Note that the specimen was at the end of the milk dentition, showing the double canine tooth-pattern typical of this age (Photo L. Lapini, P. Gori Collection, Terenzano, Udine). This is probably the first golden jackal reproductive data available from north-eastern Italy (LAPINI & PERCO, 1988, 1989).

Fig. 2. Un giovane sciacallo dorato di 5-7 mesi nato in natura ed abbattuto nei dintorni di Udine, Italia nord-orientale, nel Settembre 1985. Si noti che l'esemplare era alla fine della dentizione da latte, mostrando il tipico doppio canino tipico di questa età (Foto L. Lapini, Collezione P. Gori, Terenzano, Udine). L'immagine si riferisce probabilmente al primo dato riproduttivo disponibile per l'Italia nord-orientale (LAPINI & PERCO, 1988, 1989).

keeper. It was confused with a big fox and the datum was published only nine years later, when one of us (L. L.) saw a photo of the specimen, exposed in the game-keeper offices of Belluno Provincial Administration (this picture was published by LAPINI et al., 1993). In this period, at least up to the beginning of the 1990's, in these Pre-Alpine areas a reproductive family-group of golden jackals probably dwelled (see for example LAPINI, 1994). On 25 June 1992, in fact, a two years-old golden jackal was killed by cars in the surroundings of the little town of Preganziol (Treviso Province), that till now constitute the south-western limit of its expansion in northern Italy (LAPINI et al., 1993). In the following years its presence was also documented in the Karst around Gorizia (LAPINI et al., 1996; DELLA PIETÀ, 1998) (see also Fig. 3). A complete review of the information about the distribution of the golden jackal in Italy was published in 2003 (LAPINI, 2003), while a popular synthesis of the same data was also made by SPAGNESI & DE MARINIS (2002).

The expansion of the Balkan range of the species seemed to stop around at the end of the 1990's of the XX Century, probably due both to the occasional hunting pressures in Italy, Austria and Slovenia and following the oscillation of the density of Croatian populations (Krofel, in litteris).

During its last expansion, however, the species has established new reproductive



Fig. 3. Two golden jackals photographed in the polje of the Lake of Doberdò (Community of Doberdò del Lago, Gorizia, July 1997) (Photo A. Scarpa).

Fig. 3. Due sciacalli dorati ripresi nel polje del lago di Doberdò (Doberdò del Lago, Gorizia, Luglio 1997) (Foto A. Scarpa).

households in Hungary, where it is now relatively common in some areas of the country (LANSKI et al., 2007). The spontaneous restoration of its populations in the Carpathian Basin at the end of the XX Century constitute interesting news, because in these zones the native jackals underwent to the extinction about one hundred years ago (DEMETER, 1984; DEMETER & SPASSOV, 1993).

In Austria, moreover, the species has recently began to reproduce in the National Park of Neusiedlersee, with a family-group probably arrived from Hungary (HERZIG-STRASCHIL, 2008).

In Slovenia the species seems to be always concentrated at the border between Trieste's Karst and northern Istria (KROFEL, 2008a), showing recent trends to the colonization of the North of the country. A young female was recently shot in the Savinja Valley (KROFEL & POTOČNIK, 2008) and there are new recent records of territorial groups in the Ljubljansko Barje (KROFEL, 2009). Jackal penetration in Slovenia, however, seems still to be strictly dependent to Croatian populations, recently monitored only by KROFEL (2007, 2008b).

In Italy the species seems to have recently increased its presence in Julian Pre-Alps,

where it is regularly confused with the wolf (or with red foxes in moulting or affected by sarcoptic mange). However, apart from the already quoted data published by BRELIH (1955) up to now there are few and uncertain data from Julian Pre-Alps. At the end of XX Century it was possible to collect some data about the presence of wild canids on these mountains - snow traces on Mount Kolovrat (Drenchia, Udine Province) and a sighting on the Mount Matajur (Savogna, Udine Province)- but it was never possible to ascertain their identity without any doubt (tab. 1). Only in 2003 it was possible to obtain new information about the presence of the golden jackal along the Italian-Slovenian border. The verification of these and other data, mainly obtained in a preliminary survey performed between 2003 and 2009, constitutes the subject of the present paper.

MATERIAL AND METHODS

For our survey we used a range of methods performed following an opportunistic rather than a systematic strategy, but integrated between them to obtain a better resolution of the information. These were the methods employed:

Systematic verification of all the available sightings, also when they were referred to wolves. Most hunters, game keepers and local people are clearly not able to distinguish the golden jackal from the wolf (and often also the jackal from the red fox). This fact is easily demonstrable from the comparison between our results and the affirmations of hunters, local people and newspapers, that in most cases consider golden jackals as “little wolves”. There are many proofs of this, both in Italy and in Slovenia. In this respect, however, the short Slovenian article on a “Mali Volk (=little wolf)” (ANONYMOUS, 1992) quoted by LAPINI et al. (1993) is particularly clear. This is surely referred to a particularly confident golden jackal that in 1992 dwelt in and around the small village of Gropada, Padriciano Community (Trieste). Also when it was shot (and destroyed) by a local hunter it remained “a little wolf”, in spite of the fact that our research group had already established its identity thanks to numerous detailed sightings (see again LAPINI et al., 1993).

Localization and verification of howling spots. The information about the position of the howling spots were obtained occasionally, or thanks to the indication of researchers, hunters or local people, that in all cases had referred on howling of “wolves”. Howling spots were usually verified and attributed to jackals by means of photo-trapping, or by other naturalistic methods, like the search of footprints or other signs of jackal presence (hairs, droppings, etc.).

Acoustic stimulation. The jackal-howling method was performed both with empiric methods (sometimes also by simple vocal stimulations) and following the indication in GIANNATOS (2004) and GIANNATOS et al. (2005), also thanks to specific advice by the same Author. His standard method (already utilized also in Hungary and in Dalmatia respectively by LANSKI et al., 2007 and KROFEL, 2008b) consists in play-back sessions composed by six

emission of 30 sec. of pre-recorded howls repeated every 5 min., always changing the direction of the emissions to cover 360° of the surveyed territory. These sessions were performed at an intensity of 15-20 Watts, no more than one time per month in each of the surveyed localities. Golden jackals, in fact, rapidly learn to avoid sites that are overexploited as play-back stimulation point (Giannatos, in litteris). The intensity of our emissions can be heard within a radius of about 2 km from the emission points, particularly in good weather conditions. If the emissions are performed at the crossing points of a 4x4 km grid overlapped to a map of the surveyed area it is possible to cover large areas in short times. For the moment, however, our survey was not systematic, but opportunistically directed to some particular situation or zones.

Utilization of photo-traps. This method, largely employed in the U. S. A., in the tropics, in Turkey, in the Balkans and in Switzerland to study nocturnal carnivores, was firstly introduced in north-eastern Italy in 1998 by one of us (P. M.), and after it was employed by various researchers of the University of Udine in their works on big carnivores (see for example FATTORI & ZANETTI [2009]). This is a quite expensive method and in our researches on the golden jackal it was performed at random along big game mammals paths, or in proximity of the surveyed howling spots, mostly in sites that were baited with caproic acid (= n-Hexanoic Acid), or/and meat and pig's fat. The utilize of n-Hexanoic Acid, a canids-directed specific attractant, was utilized on the golden jackal for the first time.

Study of specimens obtained from road-mortality or by means other casualties. The examination of all the available jackals has been performed with standard techniques, in order to establish the causes of their death, to search for rests of alimentation in their guts and faeces, to obtain data about their physiologic and health status (body size, sex, estimated age, nutrition and reproductive status, presence of ecto and endo-parasites, etc.).

RESULTS

Between 2003 and 2009 only a little part of our field efforts gathered some data, about less than 10% of the whole field efforts. Our positive results are summarized in tab. I, and they may be commented as follow.

Locality	Community	Province	Country	Date	Sources	Typology of the data
Mount Kolovrat, along Italian-Slovenian border	Drenchia	Udine	Italy	08/12/1993	R. Peressini	Various photos of snow traces compatible with jackals, disposed in a very long path
Mount Matajur	Pulfero	Udine	Italy	12/12/1995	L. Lapini (Indirect)	Diurnal sighting of a wolf (Sic!), more probably a jackal
North-western slopes of the Mount Matajur	Savogna	Udine	Italy	23/01/2003	R. Peressini & W. Grion	About thirty min. of choruses of more animals, at least two or more, heard from the little church on the top of Mount Matajur
Pedrobaz surroundings	Pulfero	Udine	Italy	01/02/2003	L. & L. Lapini	In the morning (9,30-10,45 a. m.), more than one hour of howls of a single specimen
Pedrobaz surroundings	Pulfero	Udine	Italy	21/02/2003	T. Fiorenza	Spontaneous howls
Ponds of the Noghere	Muggia	Trieste	Italy	09/08/2004	L. Lapini & L. Dorigo	Howls of a group
Bosco Vignano	Muggia	Trieste	Italy	18/08/2004	L. Lapini	Occasional Play-back survey. Three responses of a group
Bovec surroundings, at the beginning of Trenta Valley	Bovec	Bovec	Slovenia	01/02/2006	P. Molinari	Photo-trapping of an adult male
Mersino Alto (Medves) surroundings	Pulfero	Udine	Italy	2004-2006	Local shepherd	Repeated presences of wolves (Sic!), more probably jackals, around the fences of the nocturnal enclosures of a sheep flock
Forno di Zoldo, Val di Zoldo	Forno di Zoldo	Belluno	Italy	2006-2007	M. Cassol (Indirect)	Groups of two-three jackals were commonly seen near the village of Forno di Zoldo in 2006 and 2007 (various witnesses). They were also filmed near a camping, but this digital-recorded film it was not examined yet
Pedrobaz surroundings	Pulfero	Udine	Italy	14/02/2007	E. Sbrugnera	Howls and sighting of a wolf (sic!), more probably a jackal, howling in the same howling point of 2003. The howls were heard since "some months"
Pedrobaz surroundings	Pulfero	Udine	Italy	16/09/2007	T. Fiorenza	Photo-trapping of an adult female with a 6-7 months young
Pedrobaz surroundings	Pulfero	Udine	Italy	17/09/2007	T. Fiorenza	Sighting of an adult female, with a free-hand digital photo
Tomaj	Sesana	Koper	Slovenia	01/01/2008	Fa. Perco (Indirect)	Sightings of two reproducing couple of wolves (more probably jackals) in the surroundings of Tomaj village
Pedrobaz surroundings	Pulfero	Udine	Italy	28/12/2008	L. Lapini	Standard Play-back survey. Responses of a single specimen
Around Rio Lemagna, above Montemaggiore	Taipana	Udine	Italy	22/01/2009	S. Filacorda (Indirect)	Diurnal sighting of two wolves (Sic!), more probably jackals
Tarçetta surroundings	Pulfero	Udine	Italy	16/02/2009	S. Filacorda (Indirect)	Sighting of two wolves (Sic!), more probably jackals
About one km East to Sistiana (Highway Raccordation, progr. km 125+500)	Duino-Aurisina	Trieste	Italy	25/02/2009	Statal Forestry Corps (CFS) of Tarvisio	A sub-adult (about two years old) male road-killed on a highway. Collected by the Statal Forestry Corps (CFS), the specimen was studied by L. L.
Pedrobaz surroundings	Pulfero	Udine	Italy	28/02/2009	L. Lapini	Standard Play-back survey. Responses of a single specimen
Centre of San Dona' di Piave	San Dona' di Piave	Venice	Italy	30/04/2009	G. Are	A tail-less male jackal was caught in the centre of the town. It was prisoner of a metallic fence in a private garden. Released from the metallic fence after a bland anaesthesia, it was then put free in a protected area near San Stino di Livenza (Venice)

Tab. 1. Positive results of 2003-2009 survey activities. In the table have been shown also some data of 1993 and 2005 already quoted in this paper (see the Introduction).

Tab. 1. Risultati positivi delle attività di monitoraggio 2003-2009. Nella tabella sono inseriti anche alcuni dati del 1993 e del 1995 già citati in questo lavoro (si veda l'Introduzione).

The verification of the available sightings has been conducted with a discrete systematic effort, but only in rare cases we were able to gather reliable information on the jackals, i.e. to confirm the species. During these verification, on the contrary, it was possible to confirm that the totality of the witnesses -hunters, game-keepers and local people- regularly mistake red foxes affected by sarcoptic mange (or in a problematic state of moult) for golden jackals. The sighting of a true golden jackal, on the contrary, was always referred to as a wolf, or a little wolf. This was proofed both with photo-trapping sessions and with the study of the traces, confirming previous observation on this matter (see again LAPINI et al., 1993). This erroneous and controversial perception of the golden jackal may be due to the fact that its presence is still not traditional, neither in Italian and Slovenian humanistic culture, nor in hunting and game-keepers traditions. On the contrary, wolves are a traditional presence both in literature, folklore and hunting traditions of the high Adriatic Hinterland, in spite of the fact that they are extinct in North-Eastern Italy at least from the Thirties of the XX Century (the last wolf of these zones was captured in 1931 in the locality “Campo Bon, Baita di Dosoledo”, Upper Comelico, Belluno Province: FOSSA, 1988), and that in Slovenia they dwell only in the South of the country (Adamic, in KROFEL & POTOČNIK, 2008). There are some exceptions to this rule, but they are very rare. The only available data on this subject must be referred to some recent reports (photos and videos) of at least one (vagrant?) wolf occurring on Hrušica and Pokljuka plateau, around to the Triglav National Park (KROFEL, in litteris), or to a recent wolf skull collected in Val di Fiemme (North-eastern Italy, Trentino Alto Adige Region, Trento Province) and studied by one of us (L. L.) in May-June 2009. Also the bio-molecular confirmation of a sporadic Balkan-wolf presence in Carinthia (near St. Veit: ANONYMOUS, 2009), for the moment agrees with a similar picture of absolute exceptionality. In Friuli Venezia Giulia and Veneto Region, however, at present there are no proofs of the presence of the wolf (in spite of the unverified data published by FILACORDA, 2006), and in a first approach all the sightings attributed to wolves must be referred to golden jackals and verified by photo-trapping sessions, play-back campaigns, or genetics.

The survey of jackal howling-spots has surprisingly revealed that some of these were regularly utilised since at least five-six years, surely having a traditional importance in the social-behaviour and in the territorial economy of some family-groups. It seems to be probable that these traditional points of vocal stimulation serve to mark the border -or the core- of the area of influence of a pack (DEMETER & SPASSOV, 1993). In the surveyed area, a single jackal-howl has a 5-6 sec. mean duration and it is usually repeated once every minute, sometimes even for one hour (or longer). The best period to hear these single vocalizations is around January and February, but they can be heard in other periods of the year too. Choruses, on the contrary, have been heard for the moment only in late summer (border of the Karst).

Acoustic stimulation. The jackal-howling method has been gathering good results also in recently colonized areas, such as Hungary (LANSKI et al., 2007), but in the surveyed area jackals rarely responded to play-back stimulations thereby providing only patchy

information (see also KROFEL, 2009). This may be probably due to the rarity of reproductive and established family-groups in the surveyed areas, which are the ones that tend to vocalize (KROFEL, in litteris). In the golden jackal, in fact, the howls have a territorial function and in marginal populations they are very rarely utilized. The responses obtained in Italy, moreover, were mostly made up by individual howls (Julian Pre-Alps) and only rarely by collective choruses (border of Italian Karst). Choruses, however, are particularly important because they usually indicate the presence of a reproductive family-group. Curiously, for the moment, we have obtained proofs of the reproduction of the golden jackal only in the Julian Pre-Alps, where it was never possible to obtain collective responses or choruses. It must however be noted that in our preliminary play-back survey our field efforts were mostly concentrated on the Julian Pre-Alps, therefore increasing the chances to detect reproduction compared to other sites.

Photo trapping. Photo-traps were particularly useful to ascertain the identity of a jackal near Bovec (northern Slovenia, fig. 4) and that of some howling specimens in the Community of Pulfero (Udine, Italy). The utilisation of baited photo-traps has also permitted to verify the reproduction of the golden jackal near one howling-spot localized on Julian Pre-Alps. In September 2007, in fact, it was possible to obtain a portrait of a young golden jackal that seemed to be 5-7 months old. Its photo was submitted to various jackal experts, included Giorgios Giannatos (University of Athens), who has confirmed that the specimen was a young, surely born in the surroundings of the monitored howling-spot.



Fig. 4. A male golden jackal photo-trapped in February 2006 near Bovec (north-western Slovenia) (Photo P. Molinari).

Fig. 4. Un maschio di sciacallo dorato ripreso da foto-trappole nel febbraio 2006 vicino a Bovec (Slovenia nord-occidentale) (Foto P. Molinari).

In our preliminary field experience with attractants the n-Hexanoic Acid seemed to be a good attractant for the golden jackals, but no more than fresh meat, pig's fat or canned fish. These last baits, however, are surely less specific, attracting a lot of other species. During our generic field-experiments, in fact, it was possible to ascertain the presence of several un-target mammals (the yellow-necked wood mouse, the wood mouse, the striped field mouse, the brown bear, the wild cat, the wild boar, the red fox, the pine marten, the stone marten, the badger, the roe deer, the western hedgehog, etc.), while the exclusive utilisation of the n-Hexanoic Acid seemed more effective in attracting mainly canids (see fig. 5). From our experiences, however, it seems to be preferable to utilize mixed baits, allowing to obtain more information on the whole local mammal community.

The study and dissection of dead animals was performed on a single sub-adult male killed by cars. It was collected on 25 February 2009 along a highway near to the village of Sistiana (Duino-Aurisina Community, Trieste Province) by agents of the Italian Forestry



Fig. 5. Two red foxes photo-trapped by a deer-cam during the olfactory-exploration of a plant baited with n-Hexanoic Acid. The attractant was sprayed on a little cortical incision practiced on the small tree (10 September 2006, loc. Comesta, Tramonti di sopra, Pordenone) (Photo L. Lapini-M. Pavanello-R. Raue-L. Dorigo).

Fig. 5. Due volpi riprese da una fototrappola di tipo deer-cam durante l'esplorazione olfattiva di una pianta innescata con Acido Esanoico. L'esca è stata spruzzata su una minuta incisione corticale praticata sulla piccola pianta (10 Settembre 2006, loc. Comesta, Tramonti di sopra, Pordenone) (Foto L. Lapini-M. Pavanello-R. Raue-L. Dorigo).

Corps (CFS, Office of Biodiversity of Tarvisio) (fig. 6). The specimen was measured and ecto and endo-parasites were searched and collected. They were then determined at the species level by one of the Authors (P. B.). It was also possible to analyse the gut contents of this jackal, with special attention to the identification of the prey-species ingested during the two days preceding its death. Some tissues for the bio-molecular characterization of the specimen were also preserved. The results of these activities are synthetically summarized in tab. 2.

The examination of a live specimen caught in the wild it was carried out on the 30th of April 2009. This jackal, a sub-adult male that had lost its tail (fig. 7), was caught by the game-keepers of Venice's Provincial Administration in the centre of the town of San Dona' di Piave (Province of Venice). It was found entangled in a metallic fence of a private garden in the city (fig. 7). It was released from the fence following a bland anaesthesia and after a few hours it was released in the "Wood of Bandiziol", a protected area in the Community of San Stino di Livenza (Province of Venice) (fig. 7). From this golden jackal it was only possible to obtain samples (droppings, blood and hairs) for its future bio-molecular characterization.

CONCLUSION, DISCUSSION AND PERSPECTIVES

Our data show that the golden jackal is probably undergoing a range expansion in the high Adriatic Hinterland, having surely colonised the Italian and Slovenian Julian Pre-Alps with at least one reproductive family-group. The information collected so far is not sufficient to allow to estimate their number, but jackals in this area seem to be still very rare (perhaps 2-4 specimens). Nevertheless it is very likely that along the Italian-Slovenian border there are at least two family-groups: the first (1) located along a North-South oriented ellipse that encompasses the small town of Bovec, the village of Stupizza and the North-Western slope of the Mount Matajur, and the second (2) located along another ellipse that encompasses the area of the Vignano Wood, the village of Kozina and the Osopo-Risano Valleys in neighbouring northern Istria (fig. 8). This preliminary picture, surely more than a simple working hypothesis, results from considering the information deriving from (1) sightings, (2) play-back sessions, (3) the study of traditional howling spots, (4) the use of baited and un-baited photo-traps, (5) and the study of the distribution of recent road-kills and hunting records (for these see also KROFEL, 2008a).

The study of the sub-adult male road-kill near Sistiana on 25 February 2009 also seems to support this preliminary picture. This specimen is probably a 22-24 months old sub-adult and was probably born at the border of Italian Karst. In South Europe the young males usually leave their own family-group at about two year of age (Giannatos, in litteris, unpublished data), while females usually remain with their own family for a longer time, often becoming helpers (DEMETER & SPASSOV, 1993). For this reasons the presence of females may indicate a trend to the range expansion (KROFEL & POTOČNIK, 2008), a process that in the golden jackal may be sometimes ensured also by a single pregnant female.



Fig. 6. A sub-adult male about two years old road-killed in the surroundings of Sistiana (Duino-Aurisina Community, Trieste, north-eastern Italy) on the 25th february 2009 (Photo CFS, Territorial Office for the Biodiversity from Tarvisio, Udine).

Fig. 6. Maschio sub-adulto di quasi 2 anni investito da automobili nei dintorni di Sistiana (Duino-Aurisina, Trieste, Italia nord-orientale) on 25 february 2009 (Foto Corpo Forestale dello Stato, Ufficio Territoriale per la Biodiversità di Tarvisio, Udine).

The sub-adult without tail caught at San Dona' di Piave (Province of Venice) on the 30th April 2009, on the other hand, might indicate an under-estimation of jackal presence also in the whole of north-eastern Italy. Indeed, it must be in fact noted that this new distributive datum is in close proximity to a single datum of presence already published for the neighbouring Province of Treviso (LAPINI et al., 1993) (fig. 8). Both these data might be connected to a marginal reproductive population dwelling on Venetian Pre-Alps, that utilizes the Piave River Valley as faunal corridor to penetrate into Venetian floodplain (see the Introduction for some historic details on the golden jackal in the Province of Belluno).

In Italy, the species is nominally protected since 1997 (National Law 157/1997) and in Slovenia since 2004 (KROFEL & POTOČNIK, 2008), but the sole legal protection it is not enough. The golden jackal, indeed, is frequently shot during culling operations directed toward the red fox, both in Italy and in Slovenia. Moreover the species has been regularly confused with wolves and this increases the problems involved in its trans-national monitoring. In this situation whereby misidentification is common, a better comprehension of the golden jackal status might be ensured by non-invasive genetic-based researches

Standard measurements			
Body	P = Total weight		12530 g
	TC = Rhinarium tip - dorsal root of the tail		820 mm
	C = Tail tip - dorsal root of the tail		270 mm
	PP = Hind foot length (without claw)		162 mm
	O = Ear tip - bases of the acoustic meathus		95 mm
	T = Maximum x minimum diameter of righth and left testes		33x2,8 mm (both)
Skull	Condyl basal length (Gnathion - Henselion)		165,9 mm
	Zygomatic breadth		92,0 mm
	Skull breadth over canines		31,64 mm
	Skull breadth over molars		56,86 mm
	Basal distance between upper canines		20,8 mm
	Maximum palatal length (gnathion - palatal spine)		84,42 mm
	Orbital angle		46,5°
Mandible	Mandible length (center of the Condylus articularis - Mandibular tip)		128,8 mm
	Coronoid height		47,36 mm
	Max. length of the mandible (edge of the Condylus articularis – Mand. tip)		129,6 mm
Additional veterinary measurements			
Shoulder height	550 mm	Head circumference	313 mm
Neck circumference	245 mm	Thoracic circumference	540 mm
Abdominal circumference			445 mm
Front paw length (base of plantar pad - tip of the longer digital pad)			60 mm
Hind paw length (base of plantar pad - tip of the longer digital pad)			54 mm
Length of hairs on back, shoulder, flank, abdomen			84, 98, 55, 54 mm
Gut contents			
Stomach	About two hectograms of fresh fibrous meat without bones, feathers or hairs, with some dried leaves taken from the substratum of a karstic wood		
Intestine	Nothing		
Parasites (A: ectoparasites; B: endoparasites)			
A	<i>Dermacentor reticulatus</i> (Fabricius, 1794); <i>Ixodes ricinus</i> (Linnaeus, 1758). The first species is probably signalled for the first time in Friuli Venezia Giulia Region.		
B	In the small intestine (intestinum tenue) of the jackal, six specimens of <i>Metagonimus yokogawai</i> (Katsurada, 1912) -the smallest human fluke- were found. Mostly distributed in the Far East, this digenean trematode occurs in Siberia, Manchuria, Japan, Korea, India (rare), China, Taiwan, The Philippines, Indonesia, Russia, Romania, Bulgaria, the Balkan states, Israel and Spain. The life-cycle of this fluke includes at least two intermediate hosts, first a mollusc and after a freshwater fish (mainly Cyprinidae). The infection (called metagonimiasis) was linked to the ingestion of raw infected fish, and in humans it is typically due to the consumption of low-quality Sushi. These data represent the first available information on the occurrence of this trematode in Italy and also indicate that the studied jackal has surely eaten freshwater fishes		

Tab. 2. Standard body measurements and gut contents of the sub-adult male killed by cars in the surrounding of Sistiana (Duino-Aurisina, Trieste) on 25th February 2009. Additional veterinary measurements are also given, to compare them with those published by KROFEL & POTOČNIK, 2008, together with some consideration about the parasites collected on the studied jackal.

Tab. 2. Misure corporee standard e contenuto del tratto digestivo del maschio subadulto investito da automobili nei dintorni di Sistiana (Duino-Aurisina, Trieste) il 25 febbraio 2009. Vengono fornite anche alcune misure aggiuntive di tipo veterinario, per compararle con quelle pubblicate da KROFEL & POTOČNIK, 2008, assieme ad alcune considerazioni sui parassiti raccolti sullo sciacallo studiato.



Fig. 7. A sub-adult male without the tail caught in the centre of San Dona' di Piave (Province of Venice) on the 30th April 2009. The specimen it was found entangled in a metallic fence in the city (above: photo P. Serafin). It was rescued following a bland anaesthesia (below, on left: photo M. Cappelletto) and then released in the wild, within a protected area near San Stino di Livenza (Province of Venice) (below, on right: photo M. Cappelletto).

Fig. 7. Un maschio sub-adulto senza coda catturato nel centro di San Dona' di Piave (VE) il 30 aprile 2009. L'esemplare era rimasto incastrato in una inferriata metallica cittadina (in alto: foto P. Serafin). Liberato grazie ad una blanda anestesia (in basso, a sinistra: foto M. Cappelletto) è stato poi rilasciato in natura all'interno di un'area protetta vicino a San Stino di Livenza (Venezia) (in basso, a destra: foto M. Cappelletto).

performed on hairs (or droppings) collected in the wild, also by the use of specific hair-traps.

The conservation of the fragile and scattered jackal population occurring along the politic boundary between Italy and Slovenia, however, needs a special trans-national cooperation between Italian and Slovenian Politic-Administrative, Researchers and Hunter-organisations, with precise management decisions in favour of this species.



Fig. 8. Bibliographic (grey) and original (black, see also tab. 1) data on the distribution of *Canis aureus* in the studied area. Small circles indicate surely ascertained presences (dead animals, photos, etc.), bigger circle indicate ascertained reproductions; questionmarks (?) inscribed in the symbols indicate both uncertain data (most of sightings, not surely attributed howls, etc.) and some reproductive uncertainty (in this case they are overlapped to the bigger circles); dotted ellipses localize the presumed area of influence of territorial groups in the period 2003-2009; asterisks (*) indicate the position of some howling points traditionally utilized by jackals in the same period.

Fig. 8. Dati bibliografici (in grigio) e informazioni originali (in nero, vedi anche tab. 1) sulla distribuzione di *Canis aureus* nell'area indagata. I tondi più piccoli indicano presenze sicuramente accertate (animali morti, foto, ecc.), i tondi grandi indicano riproduzioni accertate; punti interrogativi (?) inscritti nei simboli indicano sia dati incerti (gran parte degli avvisamenti o degli ululati non sicuramente attribuiti), sia qualche incertezza sull'avvenuta riproduzione degli animali (in questo caso essi sono sovrapposti ai tondi più grandi); le ellissi punteggiate localizzano la presunta area di influenza di gruppi territoriali nel periodo 2003-2009; asterischi (*) indicano la posizione di alcuni punti di stimolazione acustica tradizionalmente utilizzati dagli sciacalli nello stesso periodo.

It is also particularly important to increase the field efforts using jackal-howling surveys coupled with photo-trapping to gather further information on the localisation of the Italian and Slovenian jackal family-groups. Hair-traps should be used together with photo-trapping, to obtain genetic samples that will allow to characterize all the jackals of these zones by bio-molecular techniques. In these trans-national zones a similar strategy had been already used for the brown bear, gathering interesting data about number and sex of the bears living on these mountain-chains (see FATTORI & ZANETTI [2009] and SKRBIŠEK et al., 2008 for a trans-national synthesis of these activities).

In this early phase of the colonisation, however, the public awareness about the species and its identification seems to be of primary importance both to increase the knowledge on jackals distribution and to promote their conservation in the whole High-Adriatic Hinterland. This front-line public-directed activity is crucial to avoid mistakes during fox hunting (see LAPINI, 2003 and KROFEL & POTOČNIK, 2008), which is the main problem for the conservation of the golden jackal in the whole High Adriatic Hinterland.

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References

- ANONYMOUS, 1992 - Se okrog Gropade res klati mali volk? *Primorski Dnevnik*, 11 August 1992.
ANONYMOUS, 2009 - Wolf in Kärnten genetisch bestätigt. *Kora-news on line*, last access: 5 05 2009 (<http://www.kora.ch/news/archiv/20090504.htm>).

- BAUER K., 2002 - Goldschakal *Canis aureus* Linnaeus, 1758. In: SPITZENBERGER F. (Ed.), 2001. Die Säugetierfauna Österreichs. Bundesministerium für land- und Forstwirtschaft Umwelt und Wasserwirtschaft publ., Graz: 564-568.
- BRELIH S., 1955 - Sakali (*Canis aureus* L.) na ozemlju Slovenije. *Biol. Vestn.*, 4:56-58.
- DELLA PIETÀ C., 1998 - Immigrazioni: ecco il primo sciacallo italiano. *Airone*, 204 (Aprile 1998): 18
- DEMETER A., 1984 - Recent records of rare or non-resident large carnivores in Hungary. *Vertebrata Hungarica*, 22: 69-71.
- DEMETER A. & SPASSOV N., 1993 - *Canis aureus* Linnaeus, 1758-Schakal, Goldschakal. In: STUBBE M. & KRAPP F. (curatori), 1993- Handbuch der Säugetiere Europas. Raubsäuger (Teil I). *Aula-Verlag*, Wiesbaden: 107-138.
- FATTORI U. & ZANETTI M., (eds.) without date [2009] - Grandi carnivori ed ungulati nell'area confinaria italo-slovena. Stato di conservazione. Progetto Interreg "Gestione sostenibile transfrontaliera delle risorse faunistiche". Direzione centrale risorse agricole, naturali e forestali della Regione Autonoma Friuli Venezia Giulia - Ufficio Studi Faunistici publ., Gorizia.
- FILACORDA S., 2006 - Esperienze nel Friuli-Venezia Giulia: lo stato degli studi su Orso, Lince, Lupo, Gatto selvatico, Cane procione, Sciacallo dorato. In: GASPARO D. & BORZIELLO G. (Eds.), 2006 - Sentieri ritrovati. Il ritorno dei grandi animali sulle Alpi orientali. Atti del Convegno del 20 Giugno 2006, Tolmezzo. *Club Alpino Italiano, Comitato Scientifico Generale publ.*, Treviso: 21-28.
- FOSSA I., 1988 - Pesci, Anfibi, Rettili, Uccelli e Mammiferi del Bellunese. *Tip. Piave publ.*, Belluno.
- GIANNATOS G., 2004 - Population status and Conservation Action Plan for the golden jackal (*Canis aureus*) in Greece. *WWF Athens*: 1-47.
- GIANNATOS G., MARINOS Y., MARAGOU P. & CATSADORAKIS G., 2005 - The status of the golden jackal (*Canis aureus*) in Greece. *Belgian Journal of Zoology*, 135: 145-149.
- HERZIG-STRASCHIL, B. (2008) - Short note: First breeding record of the golden jackal (*Canis aureus* Linnaeus, 1758, Canidae) in Austria. *Ann. Naturhist. Mus. Wien*, 109 B: 73-76.
- HOI-LEITNER M. & KRAUS E., 1989 - Der Goldschakal, *Canis aureus* (Linnaeus, 1758), in Österreich (Mammalia austriaca 17). *Bonn. zool. Beitr.*, 40(3/4):197-204.
- KROFEL M., 2007 - Golden jackals (*Canis aureus* L.) on the Pelješac Peninsula (southern Dalmatia, Croatia). *Natura Croatica*, Zagreb, 16(3): 201-204.
- KROFEL M., 2008a - Sakali v Sloveniji. *Lovec*, XCI. Letnik, št. 1/2008.
- KROFEL M., 2008b - Survey of golden jackals (*Canis aureus* L.) in northern Dalmatia, Croatia: preliminary results. *Natura Croatica*, Zagreb, 17(4): 259-264.
- KROFEL M., 2009 - Confirmed presence of territorial groups of Golden Jackals (*Canis aureus*) in Slovenia. *Natura Sloveniae*, 11(1): 65-68
- KROFEL M. & POTOČNIK H., 2008 - First record of a golden jackal (*Canis aureus*) in the Savinja Valley (Northern Slovenia). *Natura Sloveniae*, 10(1): 57-62.
- KRYŠTUFEK B., 1991 - Sesalci Slovenije. *Prirodoslovni muzej Slovenije publ.*, Ljubljana.
- KRYŠTUFEK B., MURARIU D., KURTUNUR C., 1997 - Present distribution of the Golden Jackal *Canis aureus* in the Balkans and adjacent regions. *Mammal Review*, 27(2): 109-114.
- KRYŠTUFEK B. & TVRTKOVIC N., 1990 - Range expansion by dalmatian jackal population in the 20th century (*Canis aureus* Linnaeus, 1758). *Folia Zoologica*, 39(4):291-296.
- LANSKI J., HELTAI M., SZABO L. & FRANKHAUZER N., 2007 - [Examination of the golden jackal density in the south Transdanubian region]. *Natura Somogyiensis*, 10: 373-388, Kaspovar.
- LAPINI L., 1994 - Lo sciacallo dorato balcanico (*Canis aureus moreoticus* GEOFFROY, 1835) nel bellunese. *Unpublished report to the Environment-Fish and Wildlife Service of Belluno Province*, Belluno, IX.1994:1-3.
- LAPINI L., 2003 - *Canis aureus* (Linnaeus, 1758). In: BOITANI L., LOVARI S. & VIGNA TAGLIANTI A. (eds), 2003- Fauna d'Italia. Mammalia III. *Carnivora-Artiodactyla*. *Calderini publ.*, Bologna: 47-58.
- LAPINI L., DALL'ASTA A., DUBLO L., SPOTO M. & VERNIER E., 1996 - Materiali per una teriofauna dell'Italia nord-orientale (Mammalia, Friuli-Venezia Giulia). *Gortania-Atti Museo Friul. Storia Nat.*, 17(95): 149-248.
- LAPINI L. & PERCO FA., 1988 - Primi dati sullo sciacallo dorato (*Canis aureus* Linnaeus, 1758) in Italia (Mammalia, Carnivora, Canidae). *Atti del I Conv. Naz. dei Biologi della Selvaggina, Suppl. Ric. di Biol. della Selvaggina*, 14:627-628.
- LAPINI L. & PERCO FA., 1989 - Lo sciacallo dorato (*Canis aureus* L., 1758), specie nuova per la fauna italiana (Mammalia, Carnivora, Canidae). *Gortania-Atti Museo Friul. Storia Nat.*, 10(88):213-228.

- LAPINI L., PERCO FA. & BENUSSI E., 1993 - Nuovi dati sullo sciacallo dorato (*Canis aureus* L.,1758) in Italia (*Mammalia, Carnivora, Canidae*). *Gortania-Atti Museo Friul. Storia Nat.*, 14(92): 233-240.
- MILENKOVIC M., 1987 - [The distribution of the jackal *Canis aureus* Linnaeus 1758 (Mammalia, Canidae) in Yugoslavia.] *Proceedings on the Fauna of SR Serbia, IV, Serbian Academy of Sciences and Arts, The Section for Natural and Mathematical Sciences*, Beograd: 233-248.
- RALLO G. P., 1989 - Espansione recente dello sciacallo (*Canis aureus* L.,1758) in Jugoslavia ed in particolare nella Penisola Istriana e sua possibile presenza in territorio italiano. *Ateneo Veneto*, Venice, 26(1988):293-296.
- SKRBIŠEK T., JELENČIČ M., POTOČNIK H., TRONTELJ P. & KOS I., 2008 - Analiza medvedov odvzetih iz narave in genetsko-molekularne raziskave populacije medveda v Sloveniji. I. del. Varstvena genetika in ocena številčnosti medveda 2007. Final report. *Dept. for biology, Biotechnical faculty, University of Ljubljana*, Ljubljana, 1-79.
- SPAGNESI M. & DE MARINIS A. M. (eds.), 2002 - Mammiferi d'Italia. Quaderni di Conservazione della Natura, Numero 14 (con disegni di U. Catalano). *Ministero dell'Ambiente e della Tutela del Territorio-Direzione Conservazione della Natura & Istituto Nazionale per la Fauna Selvatica "Alessandro Ghigi" publ.*, Savignano sul Panaro, Modena: 1-308.
- SPASSOV N., 1989 - The position of jackals in the *Canis* genus and life-history of the golden jackal (*Canis aureus* L.) in Bulgaria and on the Balkans. *Historia naturalis bulgarica*, 1:44-56.

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Addendum: In summer 2009 the presence of the golden jackal was ascertained also in Val Pusteria-Pustertal (Bolzano-Bozen Province, Alto Adige-Süd Tirol, Italy) on the basis of sure biological samples. At present this valley is the Northernmost Italian site where the presence of the species has been ascertained. This indicates that the expansion of the jackal in North-Eastern Italy is still in progression, also reinforcing the impression that in the Dolomites its presence should be under-estimated.

A road-killed young female of golden jackal was collected on 10 December 2009 in the Municipality of Socchieve (Province of Udine). This sample, examined thanks to the courtesy of S. Filacorda (Udine University), constitutes a first confirmation of previous sightings for the same zone of Friulian Carnian Alps.