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ITALIAN JACKALS 1984-2011: AN UPDATED REVIEW
(*CANIS AUREUS*: CARNIVORA, CANIDAE)

Riassunto. *Sciacalli italiani 1984-2011: sintesi aggiornata* (*Canis aureus*: *Carnivora*, *Canidae*).

Gli Autori presentano una revisione aggiornata delle conoscenze sullo sciacallo dorato in Italia. L'attuale distribuzione della specie nell'Italia nord-orientale copre le regioni Friuli Venezia Giulia, Veneto e parte della regione Trentino-Alto Adige, e sembra essere in rapida espansione. Gruppi riproduttivi di sciacalli dorati sono ampiamente dispersi sulle montagne del Friuli Venezia Giulia e del Veneto e sul Carso (province di Gorizia e Trieste). Le sporadiche presenze della specie in zone di pianura (province di Udine, Treviso e Venezia) sono principalmente legate a fenomeni di dispersione di maschi giovani e sub-adulti, ma in provincia di Udine è stato accertato anche un caso di riproduzione in agro-ecosistemi di pianura. In tutta l'area indagata la specie predilige quote basse o medie, selezionando ambienti boscati o fortemente modificati dall'intervento antropico, mostrando una discreta preferenza per ambienti umidi, letti fluviali e boschi riparati. I principali problemi per la specie in Italia sono sicuramente la mortalità stradale e gli abbattimenti accidentali nel corso dei prelievi di volpi.

Summary. The Authors make an updated review of the knowledge on the golden jackal in Italy. The present distribution of the species in the north-eastern part of the country encompasses the regions Friuli Venezia Giulia, Veneto and part of Trentino-Alto Adige, and seems to be in increasing expansion. Scattered reproductive groups of golden jackals are widely distributed on the mountains of Friuli Venezia Giulia and Veneto and on the Karst (provinces of Gorizia and Trieste). The sporadic presence of the species in the lowlands (provinces of Udine, Treviso and Venezia) is mostly related to the dispersion of young and sub-adult males, but there is also a case of lowland reproduction in the province of Udine. In the whole area the species prefers low to medium altitudes, particularly dwelling in wooded or human-dominated landscapes, with a certain preference for wet biotopes, riverbeds and riparian woods. The main conservation problems for the species in Italy are surely related to road mortality and to erroneous killings due to misidentifications during fox cullings.

INTRODUCTION

Canis aureus is a medium-sized wild dog widely distributed in Africa, Asia, the Arabian Peninsula and in central and south-eastern Europe (JHALA & MOHELMAN, 2008).

The European golden jackal (*C. a. moreoticus*) is surely the largest subspecies within this taxon, since the former Egyptian form (*C. a. lupaster*) is now regarded as a cryptic lineage of African wolf (FERGUSON, 1981; KNISPEN RUESSEN et al., 2011).

The European distribution of this species has been noticeably modified in the last sixty years, due to the increase of its Croatian and Bulgarian populations and to the natural trend to long-range dispersal rates of the species (KRYŠTUFEK & TVRTKOVIC, 1990; KRYŠTUFEK et al., 1997; ARNOLD et al., 2011).

In the 20th century the first pulsation of its range expansion toward the North Adriatic mainland dates back to the first years of the 50s, when some packs of golden jackals arrived in north-western and central Slovenia (BRELIH, 1955).

A second bigger pulsation began in the 80s and a third impressive expansion seems to have started at the beginning of the 21st century (LAPINI et al., 2009; KRYŠTUFEK, 2011).

The present situation is a consequence of the above-mentioned range pulsations, partic-

ularly due to the drastic reduction of the Balkan populations of wolves, culminated at the end of the first half of the 20th century (KRYŠTUFEK & TVRTKOVIC, 1990; KRYŠTUFEK et al., 1997).

The influences of the recent global climate change on this general picture are not clear yet, but they might be negligible, as the main factors involved in the modification of the species range seem clearly anthropogenic.

THE GOLDEN JACKAL IN ITALY

In spite of various old information (see SPAGNESI & DE MARINIS, 2002), there are no fossil records about the presence of *Canis aureus* in Italy, which therefore must be considered a recent invader of the country (LAPINI, 2003). The supposed jackal remains discovered in the Romanello Cave (Apulia), in fact, must be attributed to *Canis moschbachensis*, a wolf-like wild dog from Medium Pleistocene (T. Kotsakis, in litteris, 2010). Moreover, also the putative jackal fossil remains from the Mindel of Venosa (CALOI & PALOMBO, 1979) must be attributed to a wild dog more similar to a little wolf.

The species arrived in Italy from northern Istria probably in 1984 (LAPINI et al., 1993), while its reproduction in the eastern part of the country was first ascertained only in 1985, when two cubs were born in agricultural lowlands near Udine (LAPINI & PERCO, 1988, 1989; LAPINI, 1997).

The official inclusion of the species in the Italian faunal lists led to its legal protection, by the national law, “Legge n. 157/1992” (LAPINI, 2003; LAPINI et al., 2009).

Further data on the distribution of *Canis aureus* in Italy were then published in various papers (LAPINI et al., 1993), but the spatio-temporal distribution of the available records seems to indicate that in the 90s its Italian diffusion was declining (LAPINI, 2003) (fig. 1).

At the beginning of the 21st Century, on the contrary, a clear increase of the records indicates (fig. 1) a new phase of expansion, with the constitution of several reproductive households in the Julian (LAPINI et al., 2009) and Carnian Pre-Alps (LAPINI, 2009-2010, 2011; KRYŠTUFEK, 2011).

The present situation is clearly oriented toward an expansion to the west, with various reproductive groups widely dispersed in the regions Friuli Venezia Giulia (Karst of Gorizia and Trieste, Julian and Carnian Pre-Alps of the province of Udine) and Veneto (Alps and Pre-Alps of the province of Belluno).

Various presences of the species have been recorded also in the lowlands of Venezia and Treviso provinces (LAPINI et al., 1993, 2009; CAPPELLETTO & FASANO, 2010), and a first vagrant male was recently shot in the province of Bolzano (Alto Adige-Südtirol) (AUCKENTHALER & GERSTGRESSER L., 2009; LAPINI et al., 2009).

At present the latter record is the westernmost verified locality datum available for the overall European distribution of the species (LAPINI, 2009-2010; ARNOLD et al., 2011).

THE CURRENT SITUATION

The present situation of the species in north-eastern Italy is summarized in fig. 2.

In the interpretation of the distributive data, three quality levels (Q1, Q2, Q3) have been considered though their overall reliability was quite high in any case (fig. 3).

On the contrary, they had been considered as “ascertained reproductive groups” only those (1) whose reproductive status was supported by objective proofs, such as road-killed yearlings, photos of cubs or pictures of (at least) two-three specimens together (fig. 4), or those (2) that responded to our play-back stimulation with collective choruses.

In the latter cases, however, the reproductive status of the howling group had been only hypothesized, waiting for further confirmations (thin arrows in fig. 2).

Anyway, the 21st-century expansion of the species is rather evident (fig. 1), also if at present it is not possible to obtain a clear-cut picture of the exact number of reproductive groups present in north-eastern Italy.

This is due to some uncertainties in the interpretation of field data.

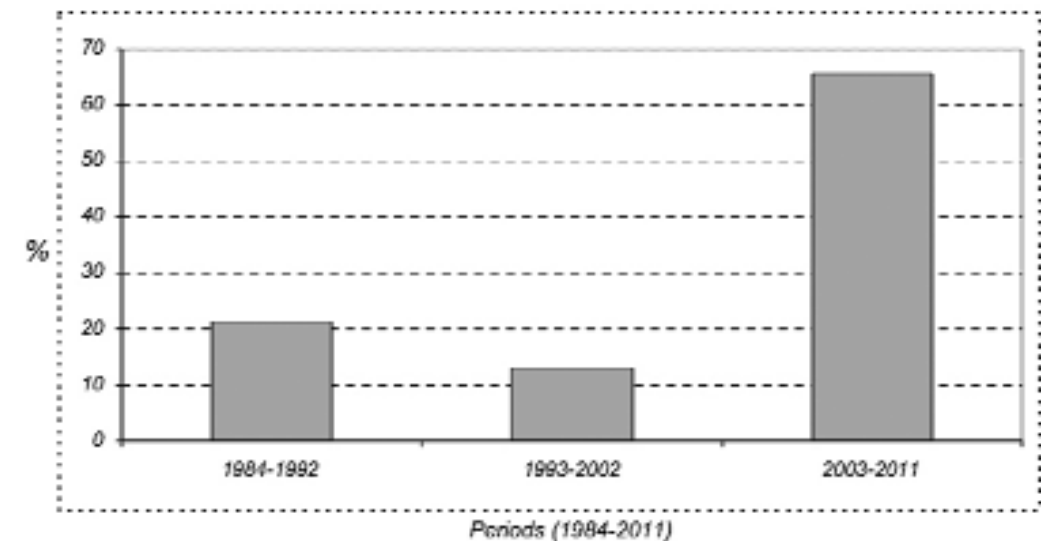


Fig. 1. Temporal distribution of the data on golden jackal in Italy from 1984 to February 10th, 2011. It is evident that the availability of information has noticeably increased in the 21st-century.

Fig. 1. Distribuzione temporale dei dati sullo sciacallo in Italia dal 1984 al 10 febbraio 2011. È possibile notare che la disponibilità di informazioni è notevolmente aumentata nel XXI secolo.

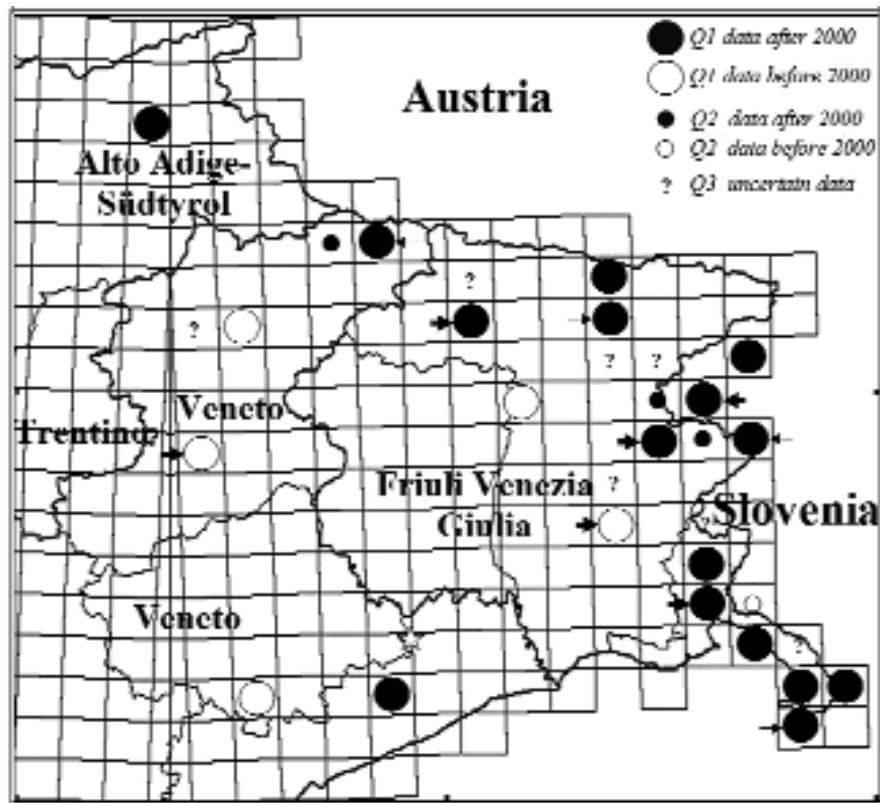


Fig. 2. UTM 10x10 km cartographic synthesis of the distribution of the golden jackal in Italy (from LAPINI, 2009-2010, modified and integrated with recent results). Q1: objective data (road kills and any other verifiable record); Q2: good but unverifiable records; Q3: particularly uncertain data. Thin arrows: reproductive groups located only by bio-acoustic techniques to date; Broad arrows: reproductive groups located by photo-trapping and/or road kills, most of which later confirmed also by bio-acoustic techniques; White star: release locality of a male golden jackal caught in the center of S. Donà di Piave (Venice) on April 30th, 2009 (LAPINI et al., 2009).

Fig. 2. Sintesi cartografica UTM 10x10 km della distribuzione dello sciacallo dorato in Italia (da LAPINI, 2009-2010, modificato ed integrato con dati ancor più recenti). Q1: dati oggettivi (investimenti stradali ed ogni altra informazione verificabile); Q2: dati buoni ma non verificabili; Q3: dati particolarmente incerti. Freccie sottili: gruppi riproduttivi finora localizzati soltanto con metodiche bio-acustiche; Freccie grosse: gruppi riproduttivi localizzati con fototrappolaggio o investimenti stradali, in gran parte dei casi successivamente confermati con metodiche bio-acustiche; Stella bianca: località dove è stato rilasciato il maschio catturato nel centro di San Donà di Piave (Venezia) il 30 aprile 2009 (LAPINI et al., 2009).

To date, the presence of a reproductive group was always ascertained with the contemporary combination of photo-trapping surveys (fig. 4), analysis of road-kills (particularly those of young females, fig. 5) and jackal-howling surveys performed with the standard methods defined by G. Giannatos in 2001 (GIANNATOS, 2004; GIANNATOS et al., 2005) (fig. 6), already applied in various other European situations (LANSKI et al., 2007; KROFEL, 2007, 2008, 2009; LAPINI et al., 2009).

The combination of these methods surely gathers the best results; however, for several groups of jackals it was not possible to combine all techniques and only bio-acoustic data could be obtained.

As already noted, the jackal-howling approach alone is not sufficient to support the reproductive status of a golden jackal group. The correct interpretation of jackal-howling results, in fact, is very difficult due to various reasons. First of all, it is almost impossible to evaluate the exact number of howling specimens. Moreover, various groups located only through play-backs had rapidly moved away, disappearing after few months. This was particularly evident for various groups located along the Italian-Slovenian borders (Karst and Southern Julian Pre-Alps) (LAPINI, 2009-2010).

At present, there are three to six reproductive groups of golden jackals in Friuli Venezia Giulia, with some uncertainties in number due to the problematic interpretation of the data from the Julian Pre-Alps. In this zone, indeed, it is rather complex to understand whether the records belong to one or to three different groups. It is very difficult to estimate their number also because at present there is no overall information about the habitat requirements of jackal groups in the alpine and sub-alpine environment. The species, indeed, shows a wide range of space-use patterns in relation to the local availability of anthropogenic resources (ROTEM et al., 2011).

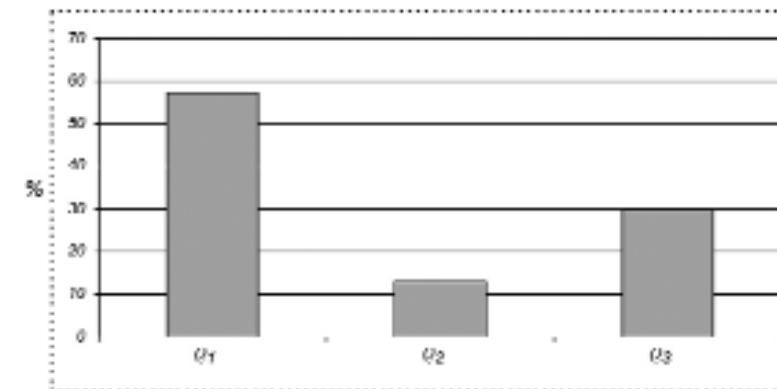


Fig. 3. Reliability of the data on golden jackal in Italy from 1984 to February 10th, 2011. Q1: objective data (roadkills and other verifiable records); Q2: good but unverifiable records; Q3: particularly uncertain data.

Fig. 3. Attendibilità dei dati sullo sciacallo dorato in Italia dal 1984 al 10 febbraio 2011. Q1: dati oggettivi (investimenti stradali ed ogni altra informazione verificabile); Q2: dati buoni ma non verificabili; Q3: dati particolarmente incerti.



Fig. 4. Photo-trapping results, most of which confirmed by means of bio-acoustic surveys (a, b). **a:** Reproductive group photo-trapped in the riverine woods along the River Tagliamento (Carnian Pre-Alps, province of Udine) in December 2010 (Photo D. Conte, Udine). **b:** Two golden jackals photo-trapped in the Polje of Doberdò, province of Gorizia, on March 1st, 2011 (Photo M. Zupan). The picture has been sampled from a short film recorded by an infra-red photo-trap. The eyes of the second specimen are indicated by an arrow. **c:** A lone (?) specimen photo-trapped in a karstic wood near San Dorligo della Valle-Dolina (Karst, province of Trieste) on May 28th, 2011 (Photo L. Kozlan, Trieste).

Fig. 4. Risultati da fototrappolaggio, per lo più confermati da verifiche bio-acustiche (a, b). **a:** Gruppo riproduttivo ripreso con fototrappole in boschi golenali del fiume Tagliamento (Prealpi Carniche, provincia di Udine) nel dicembre 2010 (foto D. Conte, Udine). **b:** Due sciacalli dorati ripresi da fototrappole nel Polje di Doberdò, provincia di Gorizia, il 1° marzo 2011 (foto M. Zupan). L'immagine è tratta da una breve ripresa video ad infrarossi registrata da una fototrappola. Gli occhi del secondo esemplare sono indicati da una freccia. **c:** Un esemplare solitario (?) ripreso con fototrappole in un bosco carsico vicino a San Dorligo della Valle-Dolina (Carso, provincia di Trieste) il 28 maggio 2011 (foto L. Kozlan, Trieste).



Fig. 5. Road kills. Young female (9.7 kg) road killed on a highway near Farra d'Isonzo (Gorizia) on February 10th, 2011 (Photo L. Lapini).

Fig. 5. Investimenti stradali. Giovane femmina (9,7 kg) investita su un raccordo autostradale nei pressi di Farra d'Isonzo (Gorizia) il 10 febbraio 2011 (Foto L. Lapini).



Fig 6. Bio-acoustic surveys. Left: material used in our bio-acoustic campaigns; right: bio-acoustic survey performed along the River Tagliamento (Carnian Pre-Alps, Udine province) (Photo L. Lapini).

Fig 6. Survey bio-acustiche. A sinistra: materiale utilizzato nelle nostre campagne di rilevamento bio-acustico; a destra: una verifica bio-acustica effettuata lungo il fiume Tagliamento (Prealpi Carniche, provincia di Udine) (Foto L. Lapini).

In Veneto there are one or two groups located in the mountains of the Belluno province, but also their number is still uncertain (fig. 2). The presence of some vagrant males in the lowlands of the Venezia and Treviso provinces seems related to these reproductive groups, as well as the vagrant male caught in Val Pusteria-Pustertal (Province of Bolzano).

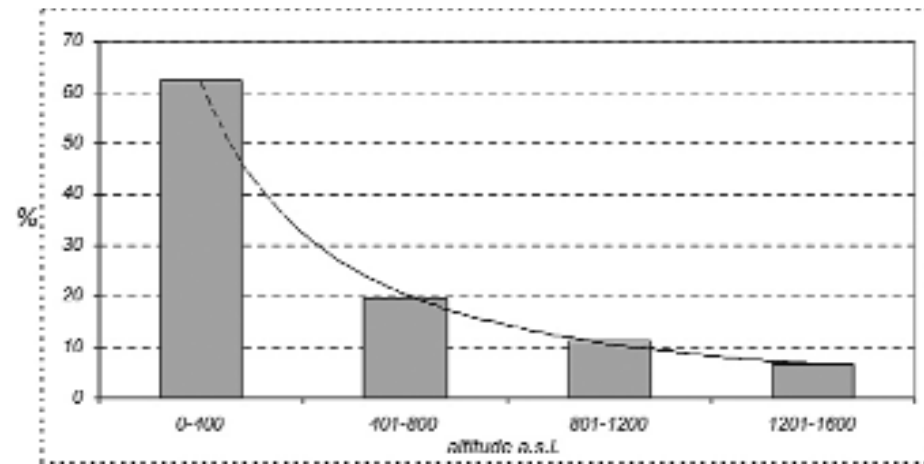


Fig. 7. Altitudinal preferences of the golden jackal in Italy from 1984 to February 10th, 2011.

Fig. 7. Preferenze altitudinali dello sciacallo dorato in Italia dal 1984 al 10 febbraio 2011.

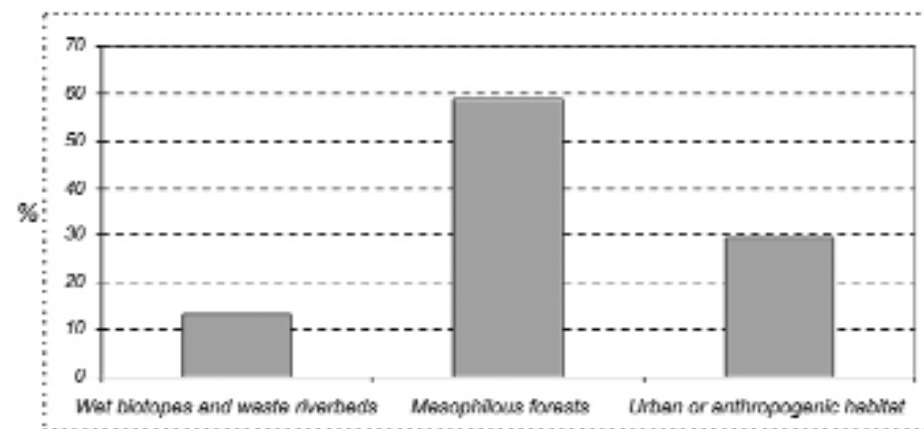


Fig. 8. Habitat selection of the golden jackal in Italy from 1984 to February 10th, 2011.

Fig. 8. Selezione dell'habitat operata dallo sciacallo dorato in Italia dal 1984 al 10 febbraio 2011.

PERSPECTIVES

The expansion of the golden jackal in north-eastern Italy is surely increasing.

An estimate of the current number of specimens in this zone is quite difficult, but so far it was possible to locate three to seven true or potential reproductive groups (15-35 specimens). Nevertheless, considering the elusive behaviour of the species, it is possible that the situation is largely underestimated.

In Italy the species selects low to medium altitude environments (fig. 7), with a clear-cut preference for various typologies of wooded mesophilous habitats (*Aceri-Tilietum*, *Fagetum*, *Abieti-Fagetum*, *Orno-Pinetum nigrae*, *Pinetum*, *Salicetum*) (figs. 8, 9). A high rate of presences in the surroundings of various human settlements was also observed (provinces of



Fig. 9. Habitats used by some reproductive groups of golden jackals in north-eastern Italy. 1: Riverbed of the Tagliamento River (Carnian Pre-Alps, Udine province) (photo L. Lapini). 2: *Aceri-Tilietum* mesophilous woods (Julian Pre-Alps, Udine prov.) (photo T. Fiorenza). 3: Agricultural lowland landscapes (Udine surroundings) (photo L. Lapini). 4: Karstic environment near the Polje of Doberdò (Gorizia province) (photo A. Scarpa).

Fig. 9. Habitat utilizzati da alcuni gruppi riproduttivi di sciacalli dorati nell'Italia nord-orientale. 1: Letto del fiume Tagliamento (Prealpi Carniche, provincia di Udine) (foto L. Lapini). 2: Boschi mesofili dell'*Aceri-Tilietum* (Prealpi Giulie, prov. di Udine) (foto T. Fiorenza). 3: Paesaggio agricolo di pianura (dintorni di Udine) (foto L. Lapini). 4: Ambiente carsico vicino al Polje di Doberdò (provincia di Gorizia) (foto A. Scarpa).

Udine, Gorizia, Trieste, Venezia and Treviso), as well as a clear preference for humid biotopes, riverbeds and riparian woods (fig. 8).

The main mortality causes of Italian golden jackals are related to road-killing and to mistakes during culling operations against foxes (fig. 10). In the period 1984-2011, in Italy at least 7 specimens (one young female, one reproductive female and five sub-adult males) were shot, but their true number is probably higher (LAPINI, 2009-2010).

A conservation plan for the species in Italy is urgently needed (see for example GINSBERG & MACDONALD, 1990; GIANNATOS, 2004), both for the above-mentioned human-related issues and for the problems that the cohabitation with the increasing population of wolves will create in the future.

The recent return of the wolves in north-eastern Italy (LAPINI et al., 2010), indeed, in the near future is expected to produce the conditions for an ecological segregation between the grey wolf and the golden jackal.

In a situation of true cohabitation between these species, in fact, *Canis lupus* will likely occupy the most secretive wooded eco-systems from the Alpine mountain chain, while *Canis aureus* will be relegated to more open lowland habitats. Within such environments the golden jackal prefers floodplains, swamps, wetlands, surroundings of human settlements and agro-ecosystems, riverbeds, estuaries and lagoons. These ecological scenarios are likely to exacerbate in the future the conflicts between jackals and various human activities.

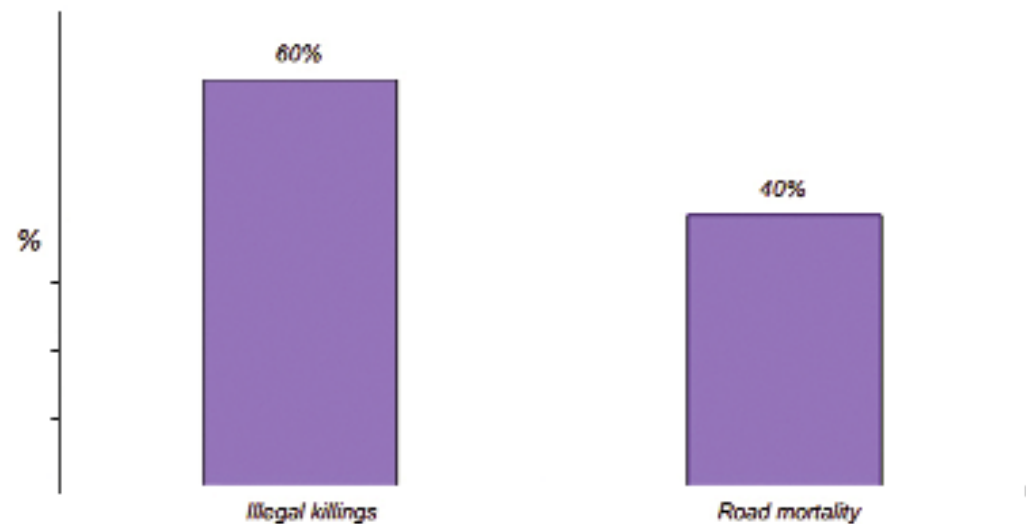


Fig. 10. Mortality of the golden jackal in Italy from 1984 to February 10th, 2011.

Fig. 10. Mortalità dello sciacallo dorato in Italia dal 1984 al 10 febbraio 2011.

The studies on this species in Italy, anyway, remain very poor, due to its secretive behaviour. In fact, this wild dog is so elusive that good, non-invasive distribution data can only be obtained by using the play-back method (GIANNATOS, 2004; GIANNATOS et al., 2005).

In north-eastern Italy, however, the so-called jackal-howling method makes it possible to obtain responses from reproductive groups of jackals only in 20% of the cases, also in areas where the presence of the jackals has been already demonstrated. This might be due to the fact that low densities usually reduce the elicibility of golden jackals (LAPINI et al., 2009).

In this conditions the best results were obtained with opportunistic methods (LAPINI et al., 2009), carrying out bio-acoustic campaigns in areas where the presence of jackals was previously indicated by sightings, road-kills, photographic records or howling spots reported by hunters, biologists or outdoor tourists.

On the basis of our field experiences, however, the importance of the play-back method in locating scattered reproductive groups of golden jackals is surely over-estimated, at least where they live at low population densities. On the contrary, it may be very useful in the monitoring of the relative density in areas where there are structured populations of golden jackals, organized in many neighbouring reproductive groups.

The jackal-howling technique must be surely considered a useful tool in the monitoring of Italian golden jackal populations, however, at the present low population levels, it should be applied only on the basis of other objective evidences, and integrated by other field methods (photo-trapping, field tracing, genetics, etc.).

A large-scale autumn survey on the golden jackal would be helpful in gathering new data for a more detailed evaluation of the resolution power of the jackal-howling techniques at the present Italian low population density. In late summer, indeed, the reproductive groups begin to be more vociferous, their responses being more frequent due to the high number of juveniles in the wild (G. Giannatos, in litteris, 2010).

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