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The Wildcat in Central-Northern italian peninsula: a biogeographical dilemma

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SUMMARY

Following standard procedures of chorologic monitoring specific for subregional and regional areas, the taxon was not found in the Apennine subregion between the Esino River (Province of Ancona) and Arroscia River (Provinces of Savona-Imperia). The biogeographical gap cannot ecologically be accounted for by those factors considered relevant for the species; i.e., bioclimate, spontaneous wood vegetation, populations of Arvicolid and Murids. Assessment of the conditions and previous modifications of the range and environment that we could «reconstruct», suggests that after the stress due to Glaciations the species, from south has not reached yet the central-northern part of the peninsula.

RIASSUNTO

Seguendo procedure standard di monitoraggio corologico, specifico per aree subregionali e regionali, il gatto selvatico europeo non risulta attualmente presente nella sub-regione peninsulare italiana tra il corso del Fiume Esino (Provincia di Ancona) e il corso del Torrente Arroscia (Province di Savona-Imperia). Il *gap* biogeografico non sembra ecologicamente motivato, relativamente a fattori ritenuti caratterizzanti l'ambiente di vita della specie. Ricerche di campo e ricognizioni bibliografiche, infatti, mostrano condizioni omogenee del bioclimate, della vegetazione legnosa spontanea, delle popolazioni di Arvicolidi e Muridi, tra l'area di assenza del felide e il suo attuale areale italiano accertato. L'analisi delle condizioni e delle modificazioni pregresse dell'areale e dell'ambiente, che è stato possibile «ricostruire», suggeriscono l'ipotesi che la specie sia scomparsa dall'area anzidetta in seguito allo *stress* prodotto dalle glaciazioni pleistoceniche. È possibile, quindi, che il gatto selvatico non abbia ancora raggiunto, dal meridione, la penisola centro-settentrionale, anche a causa di precoci modificazioni ambientali provocate dall'uomo. «Distanze» morfologiche e genetiche, misurate tra campioni di attuali popolazioni separate del felide, non contrastano tale ipotesi.

INTRODUCTION

The wildcat of the Old World, as it has been colourfully addressed by Haltenorth (1953), can be considered one of the most biologically successful

wild Carnivores (Clutton-Brock, 1981), when success is measured in terms of geographical and ecological size of the range.

Wild cat populations can be found in a wide strip of central-southern palearctic region, in a large part of African region, and of Oriental (Indian) region.

Among the three biogeographical-taxonomic groups whose phenotypes *silvestris*, *libyca* and *ornata* show clear differences, two have wild populations living in the Italian territory. These are *Felis silvestris silvestris* Schreber, 1777, the European wildcat, present in the Italian peninsula and in Sicily; *Felis silvestris libyca* cfr *sarda* Lataste, 1885, in Sardinia, the African wildcat; feral populations of domestic cat, *Felis silvestris catus* L., are present over the entire Italian territory.

Throughout its world range *Felis silvestris* depends, trophically, on populations of Arvicolids and Murids (e.g.: Piechoki, 1990; Ragni, 1981; Ragni *et al.*, 1987; Schauenberg, 1981). It is however capable to specialize, seasonally or permanently on Lagomorphs (e.g.: Aymerich, 1982; Corbett, 1979). In Mediterranean environment, i.e., Maremma Toscana, Sardinia, *Felis silvestris* can display a strong attitude to predation on Passeriformes and Galliformes (Ragni *et al.*, 1992 and unpublished observations). This behaviour is likely determined by local shortage or total absence of Arvicolids (Sforzi, 1990).

With respect to the vegetation of its habitat, the European wildcat appears ecologically bound to spontaneous wood caenosis of seasonal and/or evergreen broadleaves.

In Italy this felid results particularly bound to *Quercetum* and to *Fagetum*, with its numerous biogeographical and phytoclimatic variants (Ragni, 1981; Ragni *et al.*, 1987; Ragni *et al.*, 1992 c). These two wood formations represent a basic reference for the evaluation of the habitat suitability (Ragni, 1987).

The species, however, is capable to adapt to the extreme reduction of forest vegetation that results in the *garriga*, *landais* and steppe formations, i.e. in Sicily (Morabito, 1986; Ragni and Seminara, 1987; Ragni *et al.*, 1992 c), in Scotland (Scott *et al.*, 1992) or the Alpine vegetational landscape (Genero and Ragni, 1986; Ragni *et al.*, 1987).

Because of the enormous difficulties in the distinction and identification of the entities, it is possible to incur in a high percentage of erroneous diagnosis (Ragni 1992 a). Tracks, faeces, vocalizations and other indexes of its presence do not have absolute diagnostic strength.

Objective discrimination between wild and domestic phenotypes is only possible through direct morphological and biometrical assessment of characters of the coat colour and marking pattern in adults, of characters of the skull with permanent dentition, of metrical somatic and splanchnic characters in the *in carne* specimen with permanent dentition (Ragni, 1992 b).

Applying the above mentioned procedures, the almost 300 (n = 287) specimens directly examined from 1965 to 1992 and attributed to wildcat are distributed as follows (Fig. 1):

— peninsular sub-range, centered on Apennine mountain system and adjacent mountains, from Aspromonte (Province of Reggio Calabria, Calabria) to

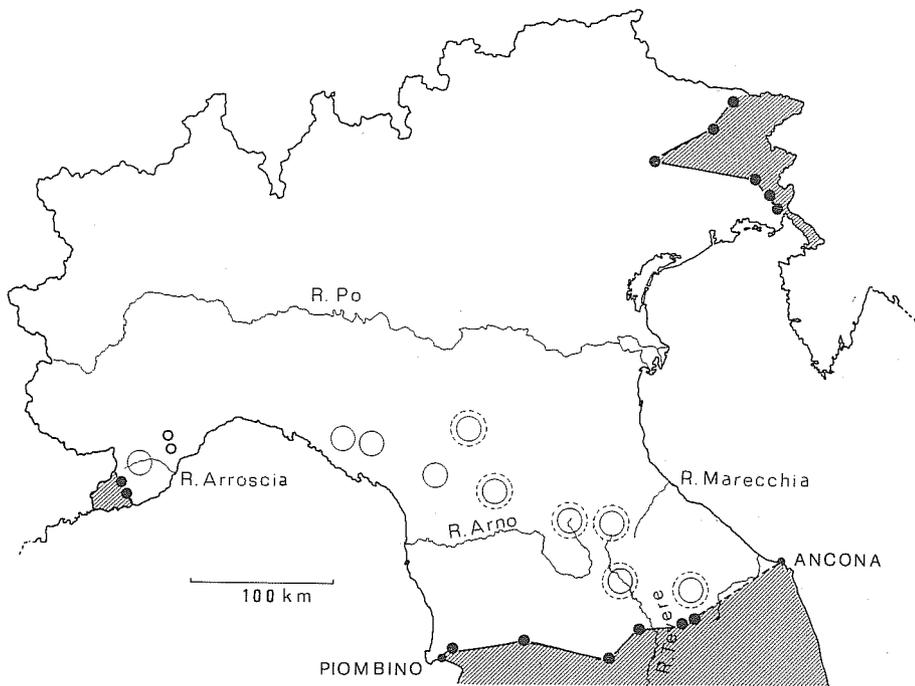


Fig. 1 - Borders of the present range of the European wildcat in the central-northern Italy. Dots: stands ascertained after 1960; small circles: stands ascertained in the 1900-15; medium circles: sample areas for the faunal-vegetational monitoring by transects; big, dashed circles: sub-regional study areas for the ascertainment of the wildcat presence.

- Appennino Umbro-Marchigiano, has its northern border in the geographical line: Riotorto (Piombino, Province of Livorno, Tuscany) - Belagaio (Provinces of Grosseto - Siena, Tuscany) - Mount Corona (Umbertide, Province of Perugia, Umbria) - Mount Maggio (Gualdo Tadino, Province of Perugia, Umbria) - Valleremita (Fabriano, Province of Ancona, Marche);
- northwestern sub-range, in the Ligurian Alps, has its eastern border in the stripe: - Calizzano - Toirano (1914, Province of Savona) and Molini di Triora - Pieve di Teco (1981, Province of Imperia); the northern border is represented by the Alpine watershed between Liguria and Piedmont; this range fragment appears isolated, as it is not continued in the French territory (Cheylan, 1979);
 - northeastern sub-range, corresponding to the Carsic-Alpine-Prealpine southeastern region. Its southwestern border is represented by Friuli Plain (Province of Udine, Friuli-Venezia Giulia) and Cansiglio (Provinces of Belluno-Treviso, Veneto). This range is connected with that of the numerous and prosperous Balkan populations (Krystufek, 1990).

Italian distribution of the wildcat shows therefore a discontinuity along the Apennine-Preapennine chain, which develops for 450 km north of the curious «Maginot line» Piombino-Ancona.

With respect to the above mentioned factors related to the habitat, the geographical and vegetational landscape of this chorologic gap does not show obvious discontinuity with the peninsular sub-range of the wildcat.

The following working hypothesis has thus been put forward. The reason why in the Italian peninsula *Felis silvestris silvestris* has not been found in the Apennine-Preapennine subregion between the Esino River (Province of Ancona) and Arroscia River (Provinces of Savona - Imperia) is due to inadequate search.

MATERIALS AND METHODS

To improve the efficacy of the search, from 1987 through 1992, 6 programs of sub-regional ascertainment have been carried out by the group «Gruppo *Felidae* Italia» in the following study areas (Fig. 1). Northern Umbro-Marchigiano Apennine, northern Umbria-Tuscany Tiber River basin (Alto Tevere Umbro-Aretino), Casentino Forest-Romagna slope, Casentino Forest-Tuscany slope, Acquerino Forest (Pistoia Apennine), Frignano (Modena Apennine).

A standard procedure consisting of two successive phases has been adopted to establish the presence of the wildcat in a given area, experimented for more than 20 years (Tab. 1): firstly, bibliographical search and inquiry by direct interview; field study, the second.

The procedure at regional level (geographical and/or administrative) is characterized by a first phase based on three distinct and independent sources of information with centralized distribution in the study area. The procedure at sub-regional level considers, during the same phase, 15-19 different and in principle independent sources, with homogeneous distribution and high density.

A sample of 36 complete programs of ascertainment carried out in 14 Italian regions (Tab. 2) in the Alpine, Apennine, Mediterranean continental, Mediterranean insular landscapes, from 1971 to 1992 has shown a highly significant direct correlation between the outcomes of the two phases, to a point that the outcome of the first phase has 86% chance to be confirmed by the outcome of the second phase.

To evaluate the presence of ecological factors characteristic of the habitat of the wildcat, 57 transects have been carried out for faunal (Mammals and Birds) and vegetational (spontaneous wood formations) survey with the naturalistic method, in 10 sample areas (Fig. 1): besides the previous 6, Garfagnana (Province of Lucca), Lunigiana (Province of Massa Carrara), La Spezia Apennine, Imperia Alps-Apennine.

For the evaluation of a fundamental ecological factor such as food supply, a bibliographical study has been carried out, which focused on Micromammals investigations done during the last 20 years in the Italian Apennine region, in

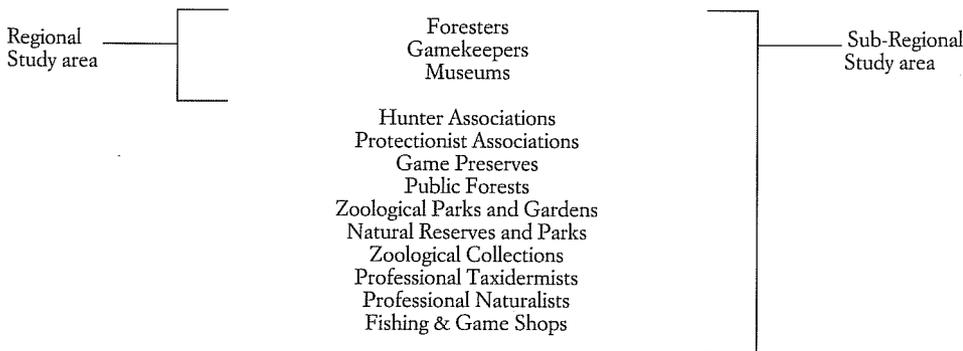
Table 1 - Standard two-phase procedure for the ascertainment of the presence of the wildcat in sub-regional study areas.

FIRST PHASE
BIBLIOGRAPHIC RECONNAISSANCE

Published data based on:

- remains before Etruscans and Greeks: **accepted**
- remains after Etruscans and Greeks, verifiable: **accepted**
- remains after Etruscans and Greeks, not verifiable: **not accepted**

INQUIRY BY DIRECT INTERVIEW



SECOND PHASE
FIELD STUDY

- Tracking on plastic terrain
Nocturnal transects by car and lamp
Observational sessions by means of play-back stimulations
Safe-trapping with living bait

areas where the presence of the wildcat is historically ascertained, as well as north of the critical line Piombino-Ancona.

The geographical distribution of the genus *Apodemus*, *Microtus*, *Arvicola*, *Clethrionomys* was determined by examining 79 places. The composition of Micromammal communities was determined by reviewing 38 studies based on the analysis of *Tyto alba* pellets, carried out in 19 places north of, and 19 places south of the line Piombino-Ancona. The latter were places where the presence of the wildcat was historically ascertained, the former were areas with adequate vegetational landscape.

Collections of Micromammals, obtained in the Pistoia Apennine by trapping (Authors), and *ad libitum* in the Modena Apennine (Bertarelli, *in litt.*) were also considered.

Table 2 - Outcomes of the application in sub-regional study areas of the procedure depicted in Tab. 1. (1): cases in which the first phase achieved positive results (presence of the wildcat) or negative results (absence of the wildcat); (2): cases in which the second phase confirmed the result of the first phase. Correlation coefficient between (1) and (2): $r = 0.973$ (d.f. = 12; $p < 0.001$); the result of the first phase is confirmed by that of the second one, with a probability $P = 0.86$.

N.	REGIONS	(1)	(2)
1	ALTO ADIGE	1	1
2	CALABRIA	1	1
3	EMILIA-R.	2	2
4	FRIULI-V.G.	3	3
5	LAZIO	3	3
6	LIGURIA	1	1
7	MARCHE	3	3
8	SARDEGNA	2	2
9	SICILIA	1	1
10	TOSCANA	8	6
11	TRENTINO	1	1
12	UMBRIA	8	7
13	VAL D'AOSTA	1	0
14	VENETO	1	1
TOT.		36	31

RESULTS

The results from the 6 programs of assessment of the presence of the wildcat in sub-regional areas, and from the 57 transects of faunal-vegetational survey in 10 sample areas, carried out in the sub-hypothesis study area, are as follow:

- no published scientific work, based on the identification of diagnosable specimen, maintains the presence of wildcat in recent times;
- 34 specimens (5 *in vivo*, 15 *in carne*, 6 *in pelle*; 8 skulls) considered by the collectors as *Felis silvestris silvestris*, all turned out to be domestic cats (*Felis silvestris catus*) Striped Tabbies, Short/Long-hair;
- no specimen of *Felis silvestris silvestris* kept in Italian museums and collections, both public and private, comes from the study area;
- the present phytoclimatic conditions, described by the composition of the spontaneous wood vegetation landscape, do not show significant differences with respect to the Italian range of the European wildcat. A relevant confirmation of the substantial bioclimatic and vegetational omogeneity of the Apennine-Preapennine region north and south of the line Piombino-Ancona is provided by Tomaselli *et al.* (1973), and Tomaselli (1973) (Fig. 2);
- the presence and the abundance indexes of potential competitors and wild predators (*Carnivora*, *Accipitriformes*, *Strigiformes*) do not show significant differences with respect to the Italian range of the species. Local reconnaissance observations (Acquerino, Frignano, and Casentino Forests) suggest however the possibility of an appreciable presence of domestic cat (*Felis silvestris catus*) and stone marten (*Martes foina*);
- direct persecution, destruction of preys, modification of the biotops and phytocoenosis carried out by man in recent times (XVIII-XIX centuries) do

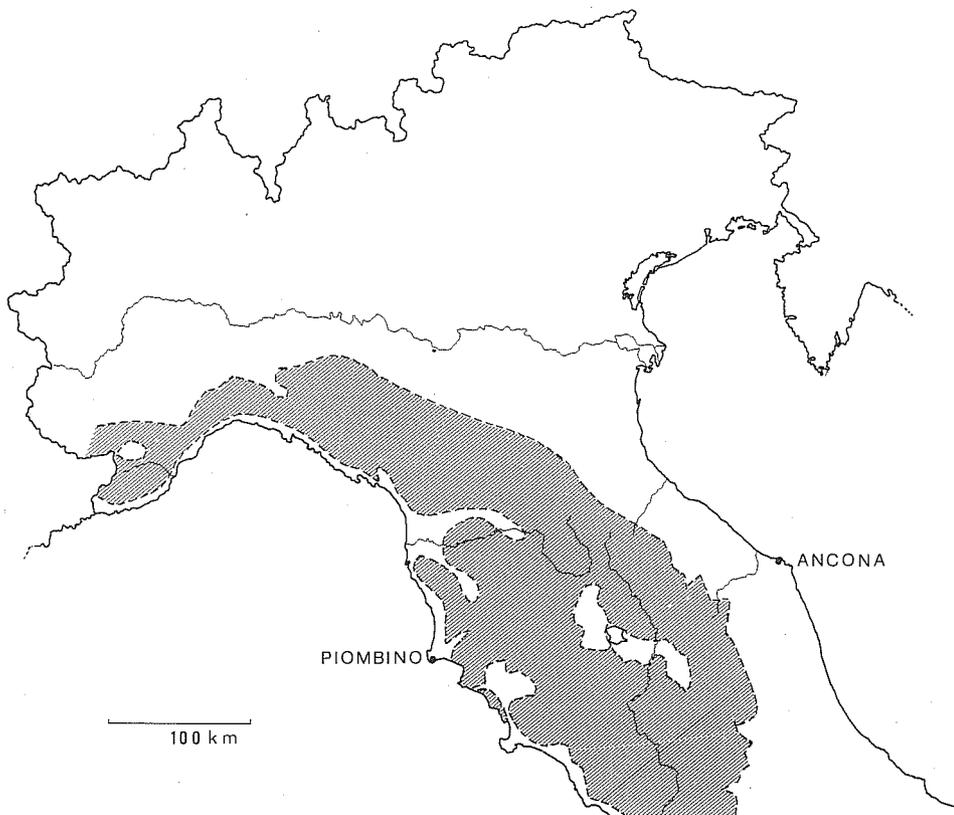


Fig. 2 - Present minimum distribution area, north and south of the line Piombino-Ancona, of the bioclimatic and vegetational conditions characterizing the wildcat habitat in the cis-Padana peninsular region.

not show significant differences with respect to the Italian range, when referred to the ecology of the species.

The lack of «significance» between the presence or abundance of the factors considered in the study area and in the Italian range of the species can be accounted for by the observation that in zones of the latter area the considered factor shows worse conditions (more limiting) than in the study area.

The considered Micromammals show an almost continuous distribution on the south, and within the area sub-hypothesis. On the other hand, well known are the ubiquitous *Apodemus* (Amori *et al.*, 1984), and the «omnipresent», real or potential, *Microtus* and *Clethrionomys* in Italy (Contoli, 1986). Moreover the presence and abundance of Arvicolidae and Muridae can be considered continuous not only in the Italian peninsula but from the Apennines to central Europe (Amori, *in verbis*).

The 19 samplings in the sub-hypothesis study area, and the 19 samplings in

the range of the wildcat show a percentage mean of Arvicolidae plus Muridae = 70.9 ± 4.4 the former and 70.06 ± 7.4 the latter.

The two means can be statistically attributed to the same population (Student's t-test = 0.2 with 36 d.f.).

The size of the group (Arvicolidae + Muridae) and the group (Insectivora + other Rodentia) in the specific samplings carried out to the north and south of the critical line Piombino-Ancona are illustrated:

	Arv. + Mur.	Others	Tot.
NORTH	4772	1564	6336
SOUTH	10201	3677	13878

The difference between the numbers observed and expected in the 19 northern stations is not significant:

	North-observed	North-expected	(O-E) ² /E
ARV. + MUR.	4772	4657.3	2.8
OTHERS	1564	1678.7	7.8
			$\chi^2 = 10.6$ (d.f. = 1)

In addition, of the 69 Rodentia trapped in the Pistoia Apennine, 84% are Arvicolidae (*Microtus* = 26%) and Muridae (*Apodemus* = 42%). Of the 767 specimens of Arvicolidae + Muridae found in Modena Apennine, belonging to 12 different species, 40.9% are Arvicolidae (*Microtus* = 30.52), 50.1% Muridae (*Apodemus* = 34.4%).

In the effort of reconstructing the remote history of the possible presence of the wildcat in the sub-hypothesis study area, a palaeontological and archaeozoological bibliographical survey has been done, in conjunction with a direct interview of several vertebrate palaeontologists and archaeozoologists. The results are as follow.

Before quaternary Glaciations, in the Villafranchian period, *Felis silvestris* inhabited the lands of Italian peninsula (e.g., Ficcarelli and Torre, 1975; Kurtén, 1965).

During pleistocenic Glaciations, in coastal and southern areas of the Italian peninsula, the wildcat is associated, among the species eaten by man, with powerful Carnivores:

- northern Tyrrhenian coast, near Toirano (Province of Savona), in the Würm, with glutton, bear, leopard, lynx, wolf and fox (Chiappella, 1953);
- Tyrrhenian coast, near Mommio (Province of Lucca), in the Musterian, with bear, wolf, fox, hyena, leopard, lion, lynx (Pitti and Tozzi, 1971);
- southern Adriatic coast, near Rignano Garganico (Province of Foggia), in the Würm, with hyena, leopard, fox, lion, wolf (Sala, 1978).

The domestic cat was a familiar animal for the populations of Etruria and

Magna Grecia, at least from the V century b.C. (e.g.: Bloch, 1984; Hamilton, 1896; Loxton, 1981; Weigel, 1961; Wink and Ketsch, 1973).

This domestic animal could not be but the cat domesticated, at least starting from the first millennium b.C., in the African and Asian regions of Mediterranean basin, from *Felis silvestris libyca* and its variable local populations (Clutton — Brock, 1981).

It is reasonable and cautious to assume that biological remains associated with human settlements and objects, not unambiguously attributable to *silvestris*, could belong to the domestic cat, if they can be dated after the ascertained Etruscan colonization in the central-northern Italy (IX century b.C.; Pallottino, 1983), and Greek colonization in the southern Italy (second half of the VIII century b.C.; D'Andria, 1983).

Of 41 archaeological sites in the cis-Padana area of the Emilia and Tuscany regions, which date back to the IX-V millennium b.C., Biagi *et al.* (1980) consider only 5 sites with faunal deposits. Two of these have remains attributable to *Felis silvestris*; both of them showed stratigraphic defilements (Provinces of Lucca and Bologna) with more recent fauna.

On reviewing Wilkens' scientific production related to the Mesolithic-Iron Age period in central-southern Italy (pers. comm.; *in litt.*; Wilkens, 1987), it appears:

- 1 - pre-Etruscan, postglacial peninsular deposits = 51
- 2 - (1) south of the line Piombino-Ancona = 39
- 3 - (1) north of the line Piombino-Ancona = 12
- 4 - (1) with *Felis silvestris* = 18 (Abundance Index, AI = 0.353)
- 5 - (4) south of the critical line = 17 (AI = 0.436)
- 6 - (4) north of the critical line = 1 (AI = 0.083)
- 7 - (6) expected in proportion to (5) = 5.2

From a bibliographical review carried out by P. Salerno on the Italian archaeological scientific production, which aims at finding pre-historic sites where *Felis silvestris* is present, the following results:

- 1 - sites from Mesolithic to Bronze Age = 25
- 2 - (1) south of the line Piombino-Ancona = 23 (one of this in the R. Esino valley; Tangiorgi, 1956)
- 3 - (1) north of the critical line = 2.

The two deposits (3) coincide with those mentioned above (Biagi *et al.*, 1980), with respect to which real possibilities of defilements from recent fauna exist.

From a bibliographical review on the Italian archaeological scientific production carried out by the Authors to find mesolithic-preetruscan sites with faunal deposits between the line Piombino-Ancona and the Po River, the following results:

- 1 - sites with faunal deposits = 13

2 - (1) with the presence of *Felis silvestris* = 4.

Two of (2) result to belong to the same site, Mount Pisano (Tozzi, pers. comm.). Two other sites show the already mentioned chance of defilement (Biagi *et al.*, 1980). In the last site Tozzi (pers. comm.) finds the presence of *Felis silvestris* «from Neolithic to VII-VI century b.C.», on the slope of Mount Pisano.

The situation in the Padana (= Po River basin)-Alpine region, north of the Po River, has been considered by means of two areas geographically contiguous: one Central-eastern (Sorbini and Durante Pasa, 1974) and the other Oriental (Bon *et al.*, 1991).

From a sample of 181 deposits with fauna from the Central-eastern region (more than 75% in the Provinces of Verona, Mantova, Vicenza and Brescia) the following results were obtained:

- 1 - Pleistocene deposits = 78
- 2 - Holocene deposits, before Iron Age = 103
- 3 - (1) with *Felis silvestris* = 1, AI = 0.013
- 4 - (2) with *Felis silvestris* = 8, AI = 0.078.

From a sample of 177 deposits with fauna from the Oriental region (Provinces of Tre Venezie and Alto Adige), it follows:

- 1 - Pleistocene deposits = 161
- 2 - Ancient Holocene deposits = 16
- 3 - (1) with *Felis silvestris* = 9, AI = 0.056
- 4 - (2) with *Felis silvestris* = 8, AI = 0.5

DISCUSSION AND CONCLUSIONS

The main conclusion of this study is that the working hypothesis is not verified. The recent and present presence of the *Felis silvestris silvestris* in the Italian peninsula can be excluded in the area between the line Piombino-Siena-Umbertide-Fabriano-Esino River and western Ligurian Apennines.

This chorologic gap does not appear to be accounted for by the ecological conditions of the area, considered to be characteristic of the habitat of the European wildcat. These conditions occur continuously both to the north and south of the critical line.

In the Mesolithic-Bronze Age period, the presence of *Felis silvestris* can be considered certain and consistent to the north of the Po River, and south of the line Piombino-Ancona.

During this period, in the sub-hypothesis area, the wildcat results present in:

- one foot-mountain site, on the coastal slope of Mount Pisano (Province of Pisa). 16 km away from the present coastline:

— one low-hill site at Monterado (Province of Ancona), in the valley of the Cesano River, 10 km away from the present coastline.

In the total sample ($n = 25$) of sites with fauna, the geographical density of the wildcat in the area, assessed by the abundance index, results to be $AI = 0.08$.

A sharp discontinuity with the conditions present to the south of the line Piombino-Ancona was observed. In this area the geographical density of the species is $AI = 0.436$. This corresponds to a frequency gradient north-south of 1:5.45.

A very similar pattern was also found in the Padana-Alpine region. The geographical density gradient between the Central-eastern region and the Oriental region, in the Holocene, is 1:6.4.

This similarity may indicate that during the pleistocenic Glaciations, in the Italian territory, divided by the large Padana vallum, the south has represented a refuge for the peninsular population, in the same way as the East did it for the Padana-Alpine population. In fact, with respect to Pleistocene, a low level of the geographical densities and of their gradient (1:4.3) was observed in the Central-eastern and Oriental trans-Padana areas. This phenomenon suggests the possibility that during the Glaciations a migration of the populations towards Dalmatia, has occurred through the low Carsic and Istrian threshold. The existence of a sharp gradient (1:6) between Pleistocene and Holocene in the Central-eastern area indicates a clear increase in the geographical density of the species, following the glacial stress.

However, the very high value of this gradient (1:8.93) in the Oriental area marks a preferential settlement and development of the species in the mild climate of Venete Prealps-Carso, and in the sunny Adige Valley.

This situation might also indicate the preclusion of a population flow from eastern refuges to the central-northern peninsula. The preclusion can be due to the relevant ecological barrier represented by the Po River Basin, present in the postglacial period.

The prosperous Padana-Alpine populations were subsequently exterminated, either directly or indirectly by the precocious and incessant development of human population.

Going back to the peninsular area between Esino River and Arroscia River, postglacial situation is compatible with the presence of rare, scattered and isolated, relictual micropopulations confined in coastal places on the Adriatic and Tyrrhenian Seas. These remnants, strongly exposed to extinction processes, were not able to form populations capable of surviving to our days.

The following lists some environmental factors and factors intrinsic of the species, which might have caused a severe reduction of populations during Glaciations, as well as represented ecological thresholds particularly difficult to overcome:

— an effect due to Glaciations, capable of markedly modifying the ranges, mai-

nly as result of driving «temperate» and «mediterranean» fauna towards south and towards coastal sites. For instance, steinbock to the Gargano (Sala, *in verbis*), lynx and wildcat to Elba and Palmaria islands (Kotsakis, Tozzi, *in verbis*);

- the wildcat is a species with productivity and population density usually low. Furthermore, it is stenoecious with respect to coniferous and herbaceous vegetation, and snowcover (e.g. Piechoki, 1991; Ragni, 1981);
- the species might have suffered the competition and predation by several, powerful Carnivores and by man. These became more and more severe due to the continuing population increase, particularly along the coasts and the south of the longest and narrowest Mediterranean peninsula;
- postglacial basins of rivers and lakes, as shown by the following lines: Tiber Valley, Chiana Valley, Arno Valley, and Reatino Lake, Clitorius Lake, Eugubino Lake can have made it very difficult to recolonize the northern peninsular territories. A similar role can have been played by the most part of the Po basin, by preventing or strongly restricting the movements towards the south of trans-Padana populations and of populations immigrated from the Balkan peninsula;
- starting from Etruscan colonization, domestic cat populations may have occupied the ecological niche and potential space for the wildcat in the central-northern peninsula. To the ecological effects of the colonization by the conspecific domestic, the effects due to genetic competition and, to a minor extent, transmission of viral infections which show, in wild populations, a virulence and mortality close to 100% (Ragni, 1992 b) can be added. Also the stone marten, widely euriecious carnivore, can have received a valid help from man in the expansion of its range and the development of its populations, since before the domestic cat it was commonly used as house rodents-killer (Hamilton, 1896).

Although daring, an alternative hypothesis, is that the absence of the wildcat in the Italian peninsula to the north of the line Piombino-Ancona is simply that it has not been able (yet?) to come back there.

This hypothesis involves the possibility of millennia of reciprocal genetic isolation for the three *Felis silvestris silvestris* populations presently residing in the Italian peninsular, north-eastern, north-western sub-ranges. It is therefore reasonable to expect the observed accumulation of morphological and/or genetic differences between the present populations, which would result from the lack of genetic flow and redistribution.

Ragni *et al.* (1987) indeed found constant and significant differences in the body and skull sizes, in the coat marking and colour patterns, between the north-eastern and the peninsular-Sicilian population samples. By measuring the genetic distance (Nei's D) between the Italian wildcat and domestic cat populations, Randi and Ragni (1991) obtained similar results.

As compared to the «outgroup» represented by the Sardinian *Felis silvestris libyca*, the north-eastern and Sicilian populations show very similar D-values

(0.0148 and 0.0167) which are both twice as big as that shown by the Apenninic population (0.0083).

A conclusive test of this hypothesis would be represented by a similar comparison with the relictual population of the Ligurian Alps.

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