

Non-natural mortality of the Iberian lynx in the fragmented population of Sierra de Gata (W Spain)

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González Oreja, J. A., 1998. Non-natural mortality of the Iberian lynx in the fragmented population of Sierra de Gata (W Spain). *Misc. Zool.*, 21.1: 31-35.

Non-natural mortality of the Iberian lynx in the fragmented population of Sierra de Gata (W Spain).— Human-related causes of mortality were studied in the Iberian lynx (*Lynx pardinus* Temminck, 1827) population located in Sierra de Gata (W Spain). By means of 233 interviews to residents in the study area, 50 cases of lynx mortality were documented, ranging from 0.6 lynxes/year from the 1950-59 decade to 2.3 lynxes/year between 1990 and 1995. Illegal hunting activities were the first two most important causes of non-natural mortality, with 54% of all lynxes killed by shooting, and 24% by trapping. Road accidents were the third most important cause, increasing from 8% in the 1980-89 decade to 29% in the 1990-95 period. The need for a regional conservation action plan for the species is stressed.

Key words: Iberian lynx, *Lynx pardinus*, Non-natural mortality, Sierra de Gata, Spain.

(*Rebut: 16 VII 97; Acceptació condicional: 23 II 98; Acc. definitiva: 21 IV 98*)

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Introduction

The Iberian lynx (*Lynx pardinus* Temminck, 1827) is the most endangered felid species in the world, and one of the most endangered carnivores in the Iberian Peninsula [see BELTRÁN et al. (1996) for its taxonomic status, and BLANCO & GONZÁLEZ (1992) and NOWELL & JACKSON (1996) for its conservation status]. Its former range was fragmented in the XXth century into nine large areas, and its population has been -and still is- threatened by human activities (RODRÍGUEZ & DELIBES, 1990) and human-caused mortality (FERRERAS et al., 1992). Legal protection of the species, achieved in 1967 in Portugal (PALMA, 1977) and in 1973 in Spain (RODRÍGUEZ & DELIBES, 1990), has had no impact on the rates of illegal harvesting.

In 1995, the lynx population in Sierra de Gata was fragmented into four small nuclei, with a minimum population estimated at 24-29 adult individuals (GONZÁLEZ OREJA & GONZÁLEZ VÁZQUEZ, 1996). The population is affected by multiple factors, all directly or indirectly related to human activities (GONZÁLEZ OREJA & GONZÁLEZ VÁZQUEZ, 1997).

To ensure the conservation of the Iberian lynx it is necessary to investigate both its natural history (RODRÍGUEZ & DELIBES, 1990) and its causes of death (DELIBES, 1996). This paper deals with the human-related causes of Iberian lynx mortality in Sierra de Gata.

Study area

Sierra de Gata is located in the Western Central Mountain Range of Spain, on the border between the Salamanca (north) and Cáceres (south) provinces. The main axis of the mountain range extends some 75 km, from the border with Portugal (west) to Sierra de Francia (east). The landscape underwent major changes during the XXth century following strong human intervention which included fires. Current vegetation forms are vast mediterranean shrublands, plus open forests, "dehesas", of holm oak (*Quercus ilex* subsp. *ballota*) and Pyrenean oak (*Quercus pyrenaica*). A great mountain surface is reforested with *Pinus pinaster* (see LADERO, 1987; RIVAS MARTÍNEZ et al., 1987; GONZÁLEZ OREJA & GONZÁLEZ VÁZQUEZ, 1997 for a full description).

Although the area is little developed and

human density is decreasing (fewer than 15 inhabitants/km²; EQUIPO ORTYGA, 1987), the mountain range is crossed by eight roads, from Las Mezas to Puerto del Castillo. Both small game (wild rabbit *Oryctolagus cuniculus* and red-legged partridge *Alectoris rufa*) and big game species (mainly red fox *Vulpes vulpes*, wild boar *Sus scrofa* and, to a lesser extent, roe deer *Capreolus capreolus*) are the target of traditional hunting activities, usually carried out in game reserves.

Methodology

Field work was carried out from June to September 1995, and again from August to November 1996, when verbal inquiries were carried out among possible informers (hunters, gamekeepers, naturalists, etc.) (GONZÁLEZ OREJA & GONZÁLEZ VÁZQUEZ (1996) for an assessment of the method employed. Special attention was paid to any data about lynx mortality. The cause and date of the death(s) were recorded, as well as the geographical site of occurrence.

Annual lynx mortality was calculated for 10-year periods (e.g. 1950-59, 1960-69, 1970-79 etc.), by dividing the number of deaths reported by ten. Given the protected status of the species, the informers were reluctant to provide potentially incriminating information. Results must therefore be interpreted as minimum values.

Results

From among two hundred and thirty-three interviews conducted, 14% (32) provided data about a total of 50 lynxes killed in the study area as a direct consequence of human activities, ranging from 0.6 lynxes/year in 1950-59 up to 2.3 lynxes/year in the 1990-95 period. The absolute order of importance of the known causes of mortality is: shooting (54%), illegal trapping (24%), road accident (10%) and kitten killing (6%). I do not know of any lynx killed by snares in the study area, though 6% of the cases were attributed to unknown causes (table 1).

The relative importance of these causes also varies over time (table 1). While shooting is the only cause of mortality observed in

Table 1. Non-natural causes of mortality of the Iberian lynx in Sierra de Gata (W Spain) showing the number of lynxes killed by each cause in each period of time. All data were gathered by means of 233 interviews to residents in the study area.

Mortalidad no natural del lince ibérico en Sierra de Gata (O España). Se muestra el número de linces muertos por cada causa y período considerado. Todos los datos se obtuvieron a partir de 233 entrevistas a residentes en el área de estudio.

	Causes of death					Total
	Shooting	Trapping	Kitten killings	Road accidents	Unknown	
1950-59	6					6
1960-69	4	2	3			9
1970-79	4	3			1	8
1980-89	7	5		1		13
1990-95	6	2		4	2	14
Total	27	12	3	5	3	50

all the periods, reaching about 50% after 1960, the proportion killed in road accidents increased from 7.7% in 1980-89 to 28.6% in the 1990-95 period.

At least on five occasions, two or more lynxes were killed within very close distances (less than 3 km apart) and dates (less than 5 years apart): Arropeones (two in 1962 or 1963), La Almenara (five in 1969), La Jañona (two in 1970 and two in 1981), Gata (three from 1978 to 1981) and Dios Padre (four between 1987 and 1992). In addition, four out of the five lynxes killed in vehicle accidents were in the Perales del Puerto mountain pass (C-526 road) and near the Santa Clara mountain pass.

Discussion

The main non-natural causes of Iberian lynx mortality in the present study area are directly related to human hunting activities. Illegal trapping and snaring account for more than half the lynxes killed in Spain, followed by shooting, while vehicle accidents are a minor cause (RODRÍGUEZ & DELIBES, 1990). In the Doñana area, human activities cause up to 75% of the annual mortality rate (FERRERAS et al., 1992). In Montes de Toledo

and Sierra Morena, more than half of the dead lynxes are victims of illegal rabbit traps, while only a few are killed by shooting (GARCÍA PEREA & GISBERT, 1986).

The situation is quite different in the Western Central Mountain Range. In both Sierra de Gata (this study) and the nearby Serra da Malcata in Portugal (PALMA, 1977; CASTRO, 1992; SARMENTO, pers. comm.) and Sierra de Francia in Spain (GRANDE DEL BRÍO, 1993), the majority of human-related lynx deaths are due to shooting, while trapping, probably as important as shooting during the sixties and the seventies (PALMA, 1977), has been exceeded by road accidents, currently the second most important cause.

In favourable conditions of food availability and habitat quality, the Iberian lynx overcome these losses, but not in small populations (RODRÍGUEZ & DELIBES, 1990). This may be the case in Sierra de Gata, a scenario where an assemblage of small populations inhabit a disturbed environment. Significant population losses occur several times in the different nuclei, suggesting a non-stable, probably declining population. What is more, a habitat selection index model for the nearby Serra da Malcata reveals that the area is largely unsuitable for the Iberian lynxes' ecological

needs, mainly because of their reproductive and trophic requirements (CASTRO, 1992). Due to the similarities between these two areas (CASTRO, 1994), this is also very likely the case in Sierra de Gata.

The method employed, interviews to residents, proves useful when trying to determine the causes of death of the small Iberian lynx population studied. However, it may have provided a biased (a lower) estimate of the real number of lynxes dying. Should this be true, current minimum annual mortality would be overestimated. Nevertheless, it is imperative to design a serious regional conservation action plan, including the right solutions to these and other problems (BELTRÁN et al., 1992). As shooting and trapping are the main non-natural causes of the Iberian lynx mortality in the Western Central Mountain Range, the positive effect on game species of Iberian lynx acting as a superpredator, i.e. controlling other predator populations (PALOMARES et al., 1995, 1996) should help to contribute to its conservation, generating a change of human attitudes about its ecological role.

Resumen

Mortalidad no natural del lince ibérico en la población fragmentada de Sierra de Gata (O España)

Se estudiaron las causas de mortalidad no natural de la población de lince ibérico localizada en Sierra de Gata (O España). Por medio de 233 entrevistas orales realizadas a residentes en el área de estudio (cazadores, guardas de caza, naturalistas, etc.), se obtuvo un total de 50 casos de lince muertos, con una mortalidad anual mínima comprendida entre 0,6 lince/año para la década de 1950-59 y 2,3 lince/año para el período 1990-95. Las actividades ilegales de caza fueron las dos principales causas de mortalidad no natural, pues el 54% de todos los lince muertos fueron abatidos a tiros, mientras que el 24% murió en cepos. Los accidentes en carreteras, localizados en el Puerto de Perales y el Puerto de Santa Clara, fueron la tercera causa más importante, incrementándose su importancia desde el 8% en el período 1980-89 al 29% en el período 1990-95 (tabla 1). Por lo menos en cinco ocasiones murieron dos o más lince

en áreas muy pequeñas (menos de 3 km) y en fechas muy próximas (menos de cinco años), lo que sugiere una población no estable, probablemente en declive.

Dado que esta situación es común a todo el Sistema Central Occidental, incluyendo la Sierra de Malcata y la Sierra de Francia, se puso de manifiesto la necesidad de un plan regional de conservación de la especie.

Acknowledgements

This article would not have been possible without the help of all the people I had the pleasure to meet during the field work in Sierra de Gata. Special thanks to Serafín Arevalo, José Gabriel (Gabi) González, Jesús Montero, José (Pepe) Moro, Carlos Pino, Jesús Serradilla and Juan Carlos Zamarreño. I also wish to thank Luis Barrios, Juan Carlos Blanco, Luis Castro, Miguel Delibes, Francisco Palomares and Pedro Sarmento, for valuable comments and references on Iberian lynx. I am also grateful to Miguel Delibes, Gabriela Francés, Santiago Pagola, Francisco Palomares and five anonymous referees for their helpful comments and reviewing the drafts of the manuscript. During the writing of this paper, the author received a post-graduate grant from the Basque Government (B.O.P.V. Feb. 28th, 1995)

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