Sarmento, P., Cruz, J., Ferreira, C., Monterroso, P., Serra, R., Tarroso, P., and Negrões, N. (2009). Conservation status and Action Plan for the recovery of Iberian lynx populations in Portugal (Estado de conservación y Plan de Acción para las poblaciones de lince ibérico en Portugal). In Iberian Lynx *Ex Situ* Conservation: An Interdisciplinary Approach (Conservación *Ex Situ* del Lince Ibérico: Un Enfoque Multidisciplinar): 33-40. Vargas, A., Breitenmoser-Würsten, C., and Breitenmoser, U.(Eds.). Madrid: Fundación Biodiversidad in collaboration with: IUCN Cat Specialist Group.

Keywords: 8PT/action plan/captive breeding/conservation strategy/habitat restoration/Iberian lynx/in situ conservation/Lynx pardinus/rabbit recovery/recovery/reintroduction

Abstract: From the first half of the 20th century onwards, the Portuguese Iberian lynx population was distributed in three major nuclei: Sado Valley, Malcata and Contenda-Barrancos. In the following decades these areas were subjected to a process that culminated in the specie's considerable regression, probably as consequence of a major allocation of potential habitat to forestry and of prey scarcity as a result of viral diseases. The most recent survey, conducted from 2002 till 2004, revealed that the species is presently on the verge of extinction. Aware of the critical situation of the Iberian lynx in Portugal, the Institute of Nature Conservation and Biodiversity developed a Conservation Action Plan for the Iberian lynx in order to provide a consistent and effective approach to conserve the species in Portuguese territory. The on-going Action Plan is being applied in all Natura 2000 Sites, located in the lynx historical distribution that present suitable characteristics for the species potential presence or landscape features that can be optimised for lynx survival and that can be relevant for the species life-cycle. The goal of this Plan is to apply pre-release strategic reintroduction activities in order to make it possible, in the long-term, the reintroduction of Iberian lynx. Integrated in the plan, there are several ongoing conservation projects, which include habitat and prey restoration and the construction of a breeding centre that will be integrated within the overall Iberian Lynx *Ex situ* Conservation Programme.

Notes: Incl. Spanish abstract

Photo: Antonio Sabater

Conservation status and Action Plan for the recovery of Iberian lynx populations in Portugal

Estado de conservación y Plan de Acción para las poblaciones de lince ibérico en Portugal

Pedro Sarmento, Joana Cruz, Catarina Ferreira, Pedro Monterroso, Rodrigo Serra, Pedro tarroso and Nuno Negrões

Resumen

Durante la segunda mitad del siglo XX, la población portuguesa del lince ibérico se distribuía en tres núcleos principales: el Valle de Sado, Malcata y Contenda-Barrancos. A lo largo de las décadas siguientes, las poblaciones de lince sufrieron una regresión significativa en estas áreas, probablemente debido a las prácticas silvícolas en gran parte del hábitat disponible, así como a la escasez de conejos a consecuencia de la introducción de enfermedades víricas. Según el último censo de linces realizado entre los años 2002 y 2004, el lince actualmente se encuentra al borde de la extinción en Portugal. El Instituto para la Conservación de la Naturaleza y Biodiversidad, consciente de la situación crítica de esta especie en Portugal, adoptó un Plan de Acción para la Conservación del Lince Ibérico con el fin de disponer de un método coherente y eficaz para la conservación del lince en territorio portugués. Este Plan de Acción se está aplicando en todos los espacios de la Red Natura 2000 situados en el área de distribución histórica del lince y que, a su vez, ofrecen condiciones apropiadas para la presencia potencial de la especie. También se están teniendo en cuenta aquellos espacios con características que podrían ser optimizadas para la supervivencia del lince. El Plan tiene como objetivo realizar actividades estratégicas de preparación para la reintroducción, con el fin de posibilitar, a largo plazo, la reintroducción del lince ibérico en áreas de distribución histórica. El Plan integra varios proyectos de conservación que están actualmente en curso y que incluyen la regeneración del hábitat y la recuperación de las especies de presa, así como la construcción de un centro de cría que se integraría en el programa global de Conservación *Ex situ* del Lince Ibérico.

Palabras clave

Restauración de hábitat, conservación *in situ*, recuperación de conejos, reintroducción, cría en cautividad

Abstract
From the first half of the 20th century onwards, the Portuguese Iberian lynx population was distributed in three major nuclei: Sado Valley, Malcata and Contenda-Barrancos. In the following decades these areas were subjected to a process that culminated in the specie's considerable regression, probably as consequence of a major allocation of potential habitat to forestry and of prey scarcity as a result of viral diseases. The most recent survey, conducted from 2002 till 2004, revealed that the species is presently on the verge of extinction. Aware of the critical situation of the Iberian lynx in Portugal, the Institute of Nature Conservation and Biodiversity developed a Conservation Action Plan for the Iberian lynx in order to provide a consistent and effective approach to conserve the species in Portuguese territory. The on-going Action Plan is being applied in all Natura 2000 Sites, located in the lynx historical distribution that present suitable characteristics for the species potential presence or landscape features that can be optimised for lynx survival and that can be relevant for the species life-cycle. The goal of this Plan is to apply pre-release strategic reintroduction activities in order to make it possible, in the long-term, the reintroduction of Iberian lynx. Integrated in the plan, there are several ongoing conservation projects, which include habitat and prey restoration and the construction of a breeding centre that will be integrated within the overall Iberian Lynx *Ex situ* Conservation Programme.

Keywords
Habitat restoration, *in situ* conservation, rabbit recovery, reintroduction, captive breeding

Photo: José María Pérez de Ayala

Conservation status and Action Plan for the recovery of Iberian lynx populations in Portugal

Pedro Sarmento, Joana Cruz, Catarina Ferreira, Pedro Monterroso, Rodrigo Serra,
Pedro Tarroso and Nuno Negrões

Introduction

A recent national survey has brought to light the critical status of the Iberian lynx (*Lynx pardinus),* in Portugal (Sarmento et al., 2009). Field evidence showed that the species is currently in a pre-extinction stage and this scenario was re-enforced by a similar operation conducted in Spain (Guzmán et al., 2005). Consequently, the Iberian lynx was classified as a Critically Endangered species under IUCN criteria in the updated version of the Portuguese Red Book of Vertebrates and in the IUCN Red List of Threatened Species (Cabral et al., 2005; IUCN, 2007). The Iberian Lynx is a vulnerable species because of its dependence on only one prey, the rabbit *Oryctolagus cuniculus*, and its narrow habitat spectrum (Delibes et al., 2000; Calvete, this book; Calzada et al., this book). The decline in rabbit populations, caused by habitat changes and viral diseases, has had a direct impact on lynx numbers as well as high rates of non-natural mortality and habitat destruction (Ferreras et al., 1992; Guzmán et al., 2005). As a result of this process, currently lynxes are essentially constrained to two isolated populations (Doñana National Park and Cardeña-Andujár), both located in the Spanish Autonomic region of Andalusia (Guzmán et al., 2005; Calzada, this book). Potentially, dispersing animals could occasionally appear in Toledo, Guadalmez river, Central Sierra Morena and Sierra del Relumbrar y Alcaraz (Alda et al., 2008).

The current dramatic status of Iberian lynx populations, associated to its ecological importance were the basis for its classification as a top priority species for conservation in Portugal. This situation was the catalyzer for the establishment of a National Conservation Action Plan (Sarmento et al., 2005), which was legally approved in 2008 (Portuguese Government Issue 12697/2008, May 6th) and whose ultimate goal is to promote the specie's recovery and conservation in national territory through the restoration of historic population nuclei through reintroduction. In this paper, we discuss the recent evolution of lynx populations in Portugal and describe the on-going and proposed conservation measures conceived to reverse the specie's decline and assure its long-term conservation in the country.

Recent history – past and present situation

A recent geographic analysis of the distribution of museum specimens, "naturalised" lynxes, skins and photographs of hunted animals, using data from 1950 to the early 1990s, put into evidence the existence of

three potentially major historical nuclei: Sado Valley (currently Cabrela-Monfurado Natura 2000 Sites), Malcata and Moura-Barrancos (Sarmento et al., 2009; see Figure 1 for geographic locations). These nuclei probably constituted the Portuguese Iberian lynx core areas in the mid-20th century. It seems that these areas were subjected to a degradation process, as a consequence of a major allocation of potential habitat to forestry and of prey scarcity as a result of viral diseases that has led the Iberian lynx towards an extinction vortex since the 1960s. By the mid 1970s, Palma (unpublished data) performed the first Portuguese scientific study on the species ecology in Serra da Malcata and attempted to describe the lynx distribution range and density in the country. A national total population of 50 individuals was estimated, which, according to the author, were distributed through Serra da Malcata, Sado Valley and Algarve.

More recently, a national lynx status survey was undertaken from 1994 to 1997 (Ceia et al., unpublished data), under the coordination of the Institute of Nature Conservation (ICN, re-designated in 2007 as the Institute of Nature Conservation and Biodiversity, ICNB), following the same criteria and methodology of the 1988 lynx Spanish survey (Rodríguez and Delibes, 1990), which had been based on personal interviews and questionnaires. Five lynx populations were estimated, distributed throughout 2,400 km^2 and harbouring a total population of 40-53 individuals. Three out of the five identified areas (Serra da Malcata, Serra de São Mamede and Guadiana) corresponded to the western extensions of the Sierra de Gata, Sierra de San Pedro, and Western Sierra Morena Spanish populations, respectively (see Figure 1).

In the beginning of this decade a new census was conducted in an Iberian cale (Guzmán et al., 2005; Sarmento et al., 2009), using only reliable methods that could undoubtedly confirm the species occurrence. For Portugal, no evidences of the species presence were obtained and the study revealed that the Iberian lynx is presently in the verge of extinction. In recent years, reliable information is becoming rarer. The last scat confirmed by DNA analysis as being from lynx origin was collected in Moura-Barrancos in late 2001 (Santos-Reis, unpublished data), and from this date forward, no other reliable information was obtained regarding the occurrence of the Iberian lynx in Portugal. This scarcity of evidence together with low habitat suitability in most of the lynx's historical range, points to a catastrophic situation for the species in Portugal (Sarmento et al., 2009). Although we cannot confirm extinction, the scenario is highly pessimistic.

On-going and future conservation actions

Aware of the considerable difficulties pointed above, the ICNB, developed a Conservation Action Plan for the Iberian lynx (CAPIL) in order to provide a consistent and effective approach to conserve the species in Portuguese territory (Portuguese Government Issue nb. 12697/2008, May 6th). The goal of this Plan is to apply pre-release strategic reintroduction activities (IUCN/SSC, 1998) in order to make possible, in the long-term, the reintroduction of the species in Portugal, and thus, to assure its viability as a fundamental element of Mediterranean ecosystems. For achieving this goal it is necessary to establish a suitable connection between *ex situ* and *in situ* actions (Vargas et al., this book). The Action Plan is being applied in all the areas of Natura 2000 Network, located in the lynx historical range, which include suitable characteristics for the presence of the species or landscape features that can be optimised for lynx survival and that can be relevant for the species life-cycle (Figure 1). In this framework we include residence, dispersal and reproduction habitats as defined by Palomares, 2001.

In situ actions – the application of the Action Plan

Conservation measures will likely be implemented at three scales of decision-making: home-range level (micro-scale), population level (macro-scale) and ecological corridors, providing a broad direction for management activities by establishing objectives and guidelines. The following managements units will be designed in order to achieve conservation (Ruediger et al., 2000; Figure 1):

• **Micro-units for lynx management (MULs):** These micro-units are intended to provide the fundamental or smallest scale for evaluation and monitoring of the effects of management actions on lynx habitat and prey. The MULs should be considered as theoretical home-ranges that should incorporate all the habitat requirements for the completion of the Iberian lynx life cycle and should be managed as if the species was present, even in case of no detection.

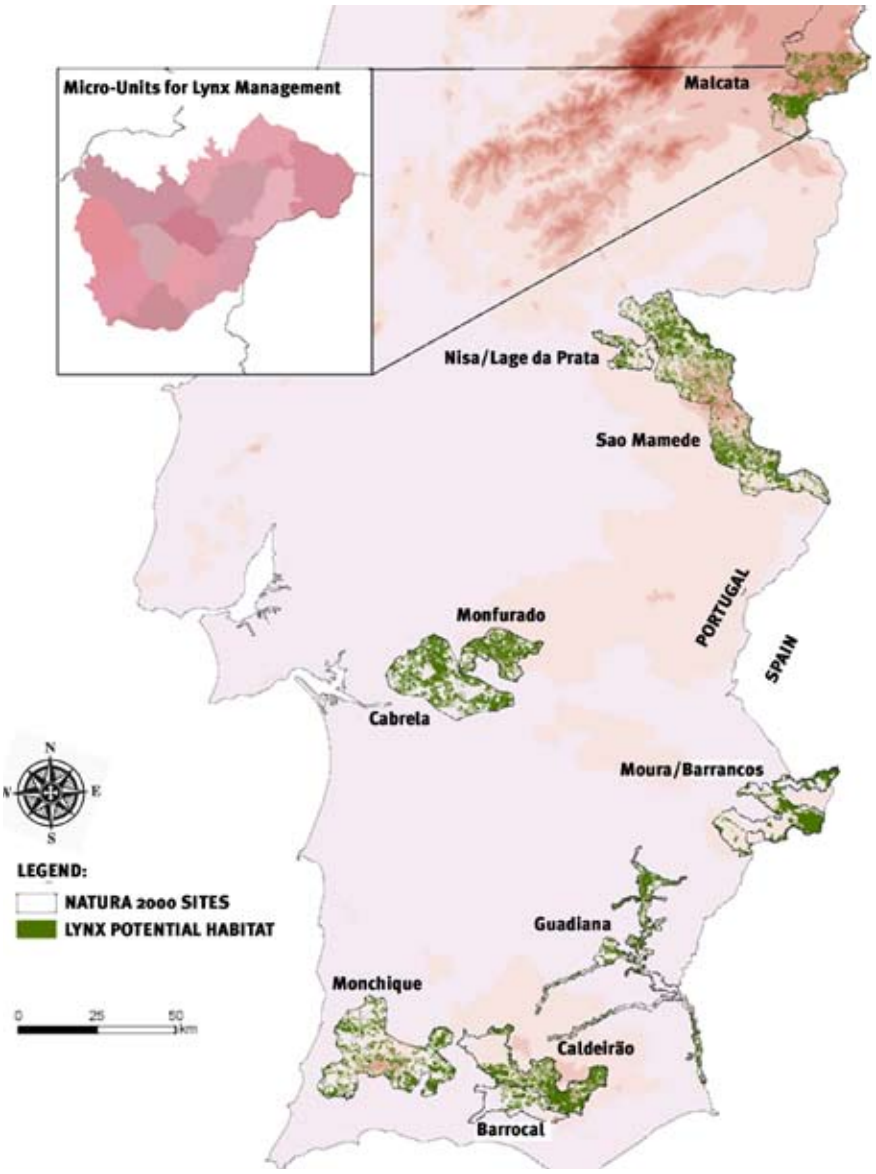

Figure 1 – Natura 2000 Sites selected for the application of the Portuguese Iberian Lynx Conservation Action Plan and examples of lynx management units for the Malcata area.

Figura 1 – Espacios Natura 2000 seleccionados para la aplicación del Plan de Acción para la Conservación del Lince Ibérico en Portugal y ejemplos de unidades de manejo del lince en el área de Malcata.

• **Macro-units for lynx management (MALs):** Action and programme planning should not be only focused at the home-range level (MULs). The landscape patterns of significant areas that correspond to potential populations should be taken into account. In this context, several MULs corresponding to theoretical populations will constitute a Macro-unit for lynx management (MALs).

• **Ecological corridors:** Dispersal is a key issue for lynx survival, since the meta-population equilibrium could only be achieved when the genetic flow between populations is maintained. Thus, the presence of linear landscape elements that warrants survivorship and movement is critical in terms of conservation.

The CAPIL actions were integrated in the Natura 2000 Network Management Plan, which will be the basic tool for conserving the habitats and species of European importance in Portugal. For the establishment of

A HABITAT TYPE	MANAGEMENT GUIDELINES
Denning habitat	Identify priority areas for land acquisition or warrant
	Recover potential areas of Mediterranean scrubland
	Promote programmes for controlling feral cats and dogs
	Promote forestry practices compatible with lynx conservation
	Establish economic incentives
	Promote sustainable rabbit hunting
	Enforce the vigilance towards illegal hunting
	Co-ordinate the decision-making process for infrastructure edification with lynx conservation
Foraging habitat	Identify priority areas for land acquisition or warrant
	Promote crop fields for rabbits
	Conduct rabbit restocking operations
	Evaluate the impact of rabbit diseases
	Promote sustainable rabbit hunting
	Enforce the vigilance towards illegal hunting
	Co-ordinate the decision-making process for infrastructure edification with lynx conservation
Corridors	Identify priority areas for land acquisition or warrant
	Stop the physical remove of scrubland vegetation and riparian habitats
	Promote sustainable rabbit hunting
	Enforce the vigilance towards illegal hunting
	Co-ordinate the decision-making process for infrastructure edification with lynx conservation

Table 1 – Natura 2000 major management guidelines for Iberian lynx conservation according to the different types of habitats.

Tabla 1 – Principales directrices de manejo de la Red Natura 2000 para la conservación del lince ibérico según el tipo de hábitat.

these measures, we mapped lynx potential habitat for all Natura 2000 Sites that had been classified with lynx presence (Figure 1). Using this data, management guidelines were defined for each habitat category according to its importance for lynx conservation (Portuguese Ministerial Council Resolution nb. 115-A/2008, July 21st; Table 1). These guidelines are being applied since 2005 for evaluating human activities that can directly or indirectly influence future lynx conservation. Currently is on-going a national evaluation on the effects of management guidelines on the conservation of natural habitats and species of European Community interest within the Natura 2000 Network areas.

On-going *in situ* conservation actions

Three major conservation projects are currently on-going:

• Habitat recovery in Serra da Malcata. Until 2007, most of the *in situ* conservation actions carried out in Portugal have concentrated in Serra da Malcata Nature Reserve where, since 1997, a continuous programme, financed by the LIFE Programme (LIFEB4-3200/99/006423) and by FEDER, for habitat and prey restoring is on-going. The main actions of this project include preventing the degradation of the Mediterranean forest, restoring land-use practices that favour rabbit presence (creation of pastures and shelters) and rabbit restocking. Several years after the systematic application of these measures it was possible to increase lynx carrying capacity at the Reserve and, as a consequence, to establish a reintroduction plan following IUCN guidelines (IUCN/SSC, 1998).

• LPN/FFI Life Project. In 2006, the League for Nature Protection (LPN), a Portuguese Non-Governmental Agency, in association with Flora and Fauna International (FFI), engaged in an EU LIFE project for the conservation of Iberian lynx in the area of Moura-Barrancos Natura 2000 Site (PTCON0053), called "Habitat recovery for the Iberian lynx in the Moura-Barrancos Natura 2000 Site" (LIFE06/NAT/P/000191). The main purpose of this project is to increase habitat suitability for lynx through the establishment of medium to long-term management agreements with

landowners and hunting reserves in order to make a rational use of natural resources and to explore game species in a sustainable way compatible with lynx conservation (for further details please go to http://www.lpn.pt).

• Odelouca dam mitigation actions. Following the assessment of water resources in the Algarve (South Portugal), the Portuguese Government has applied for financial support to the European Union for the building of a dam in the Odelouca region, a Natura 2000 Site (PTCON00037) and part of the historical range of the Iberian lynx. The package of environmental compensatory measures presented to the EU includes several actions, being habitat recovery, rehabilitation and viability analysis activities for Iberian lynx and rabbit, conversion of monocultures into Mediterranean bush, valorisation of ecological corridors between habitat patches, and the construction of a captive breeding centre for the Iberian lynx as the most relevant.

Future actions

Future *in situ* conservation actions will include a feasibility analysis for reintroduction in potentially areas, located in the south-east of Portugal, several regional projects, financed by EU funds, for habitat management and prey increasing and the establishment of a national systematic monitoring system for rabbit populations. The first measure is crucial for the success of the Action Plan since it is of critical importance that the best possible sites and release methods are utilized. The study will be conducted in three phases: 1) construction of a landscape-scale statistical model; 2) construction of a large-scale statistic model, and 3) development of a metapopulation model. Following this action, several regional projects for habitat and prey conservation will be applied in order to maintain or augment potential sites for lynx colonization.

Ex situ conservation

Portugal is represented in the Iberian Lynx Captive Breeding Team (CCCLI) through the ICNB since 2001. Based on the Spanish *Ex situ* Conservation Action Plan (Vargas et al., 2005, 2008), the ICNB has applied its global aims and objectives and developed its own *Ex situ* Conservation Plan (Serra et al., 2005), which, among other measures, foresees the construction of a captive breeding facility within the Iberian network of breeding centres and under the technical and scientific guidance of the CCCLI (Vargas et al., this book). The construction of the breeding centre in Silves (Algarve, Southern Portugal) is currently taking place and will be able to maintain up to 16 breeders coming from the captive breeding programme as of mid-2009.

Conclusions

The dramatic decline of the Iberian lynx and the critical status of its free-ranging populations in Portugal are now acknowledged by both scientific and political groups nationwide. Nevertheless, it is assured that the recovery of the Iberian lynx populations will be a considerable challenge with a high degree of uncertainty in both Iberian countries. In order to achieve the goal of restoring the species in Portugal and Spain it is necessary to apply a daring plan that will involve inter-agency and international collaboration; therefore, on-going actions involve several teams that are co-ordinately conducting a multidisciplinary approach towards Iberian lynx recovery. All the same, all agents involved in this laborious task need to be aware that, even with unlimited resources and in ideal conditions, the future of the Iberian lynx in the Iberian Peninsula is still uncertain, and only a professional attitude, coupled with social and political support, can prevent the vanishing of this majestic cat species.

Acknowledgments

Authors which to thank all field collaborators during Iberian lynx surveys in 2002, which provided most of field data available, and to Catarina Eira for the revision of the manuscript.

References

Alda F, Inogés J, Alcaraz L, Oria J, Aranda A, Doadrio I.,2008. Looking for the Iberian lynx in central Spain: a needle in a haystack? Animal Conservation 11:297-305.

Calzada, J., González, L.M., Guzmán, J.N., Heredia, B., 2009. A new strategy for the conservation of the Iberian lynx, in: Vargas, A., Breitenmoser, C., Breitenmoser, U. (Eds.), Iberian Lynx *Ex situ* Conservation: An Interdisciplinary Approach. Fundación Biodiversidad, Madrid, Spain.

Calvete, C., 2009. Status and trends of rabbit populations, in: Vargas, A., Breitenmoser, C., Breitenmoser, U. (Eds.), Iberian Lynx *Ex situ* Conservation: An Interdisciplinary Approach. Fundación Biodiversidad, Madrid, Spain.

Cabral, M.J., Almeida, J., Almeida, P.R., Dellinger, T., Ferrand de Almeida, N., Oliveira, M.E, Palmeirim, J.M., Queiroz, A.I., Rogado, L., Santos-Reis, M., 2005. Livro Vermelho dos Vertebrados de Portugal. Instituto da Conservação da Natureza/Assírio e Alvim, Lisboa, Portugal.

Delibes, M., Rodríguez, A., Ferreras, P., 2000. Action Plan for the conservation of the Iberian lynx *(Lynx pardinus)* in Europe. WWF – Mediterranean program.

Ferreras, P., Aldama, J.J., Beltrán, J.F. Delibes, M., 1992. Rates and causes of mortality in a fragmented population of Iberian lynx *(Felis pardinus)*. Biological Conservation 61, 197-202.

Guzmán, J.N., García, F., Garrote, G., Ayala, R., Iglesias, C., 2005. El lince ibérico *(Lynx pardinus)* en España y Portugal. Censo-diagnóstico de sus poblaciones. Dirección General para la Biodiversidad. Madrid.

IUCN/Species Survival Commission, 1998. IUCN guidelines for reintroductions. IUCN, Gland, Switzerland and Cambridge, UK.

IUCN, 2007. IUCN Red List of threatened species. Available at http://www.iucnredlist.org. Accessed September 1st 2008.

Palomares, F., 2001. Vegetation structure and prey abundance requirements of the Iberian lynx: implications for the design of reserves and corridors. Journal of Applied Ecology 38, 9-18.

Rodríguez, A., Delibes, M., 1990. El lince ibérico *(Lynx pardinus)* en España. Distribución y problemas de conservación. Colección Técnica. ICONA, Madrid.

Ruediger, B., Claar, J., Gniadek, S., Holt, B., Lewis, L., Mighton, S., Naney, B., Patton, G., Rinaldi, T., Trick, J., Vandehey, A., Wahl, F., Warren, N., Wenger, D. and Williamson, A., 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USI National Park Service. Missoula, MT.

Sarmento, P., Cruz, J., Monterroso, P., Tarroso, P., Ferreira, C., Negrões, N., 2005. Iberian lynx conservation in Portugal: dilemmas and solutions. Wildlife Biology in Practice 1(2), 156-162.

Sarmento, P., Cruz, J., Monterroso, P., Tarroso, P., Ferreira, C., Negrões, N., Eira, C., 2009. Status survey of the critically endangered Iberian lynx (*Lynx pardinus)* in Portugal. European Journal of Wildlife Research (2009). Doi: 10.1007/s10344-008-0240-5.

Serra, R., Sarmento, P., Baeta, R., Simão, C., Abreu, T. 2005. Portuguese Iberian Lynx *Ex situ* Conservation Plan. Instituto para a Conservação da Natureza e Biodiversidade (ICNB), Lisbon. http://lynx.uio.no/lynx/ibelynxco/20_il-compendium/home/index_en.htm.

Vargas, A., Martínez, F., Bergara, J., Klink, L., Rodríguez, J., Simón Mata, M. A., Aymerich, M., 2005. Programa de Conservación *Ex situ* del Lince Ibérico. Junta de Andalucía, Consejería de Medio Ambiente.

Vargas, A., Sánchez, I., Rivas, A., Martínez, F., Godoy, J.A., Roldan, E., Serra, R., Pérez, M.J., Simón, M.A., Delibes, M. and Aymerich, M., 2008. Update on the Iberian lynx *Ex situ* Conservation Programme. Cat News49: 25.

Vargas, A., Sánchez, I., Martínez, F., Rivas, A., Godoy, J.A., Roldan, E., Simón, M.A., Serra, R., Pérez, M.J., Sliwa, A., Delibes, M., Aymerich, M., Breitenmoser, U., 2009. Interdisciplinary Methods in the Iberian lynx *(Lynx pardinus)* Conservation Breeding Programme, in: Vargas, A., Breitenmoser, C., Breitenmoser, U. (Eds.), Iberian Lynx *Ex situ* Conservation: An Interdisciplinary Approach. Fundación Biodiversidad, Madrid, Spain.