

# Conservation of free-ranging Iberian lynx (*Lynx pardinus*) populations in Andalusia

## Conservación de las poblaciones silvestres de lince ibérico (*Lynx pardinus*) en Andalucía

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Photo: Andoni Candela

### RESUMEN

A finales del siglo XX se comprobó que el estado de conservación del lince ibérico era extremadamente crítico, cuando solo permanecían en la naturaleza alrededor de 150 individuos en dos poblaciones aisladas, Doñana y Sierra Morena oriental, ambas en Andalucía. La Junta de Andalucía, en colaboración con algunos socios, adoptó diferentes medidas de conservación que recibieron apoyo de la Unión Europea en forma de dos proyectos LIFE de conservación. Estos proyectos han sido esenciales para evitar la posible extinción de la especie en la naturaleza y para estabilizar ambas poblaciones silvestres. En la actualidad, los esfuerzos de la conservación *in situ* se están centrando en los siguientes objetivos: 1) Mantener y expandir las dos poblaciones existentes; 2) Crear nuevos núcleos poblacionales –siguiendo los criterios de la IUCN para las reintroducciones; 3) Maximizar la variabilidad genética mediante la “conexión genética” de ambas poblaciones; 4) Continuar promoviendo el apoyo local, nacional e internacional para garantizar la recuperación de esta especie gravemente amenazada. Hoy, la población de Sierra Morena continúa creciendo anualmente (tanto numéricamente como en superficie). De hecho, el número de individuos adultos (más de un año de edad) se ha incrementado desde los 38 registrados en 2001 hasta los 95 en 2008. La población de Doñana permanece estable, y se está llevando a cabo un programa de reforzamiento (principalmente genético, pero también demográfico). Los esfuerzos en la conservación *in situ* se están centrando también en la recuperación de nuevos núcleos poblacionales mediante programas de reintroducción. Los trabajos de preparación se están llevando a cabo desde 2005 y las primeras sueltas están programadas para el 2009.

### PALABRAS CLAVE

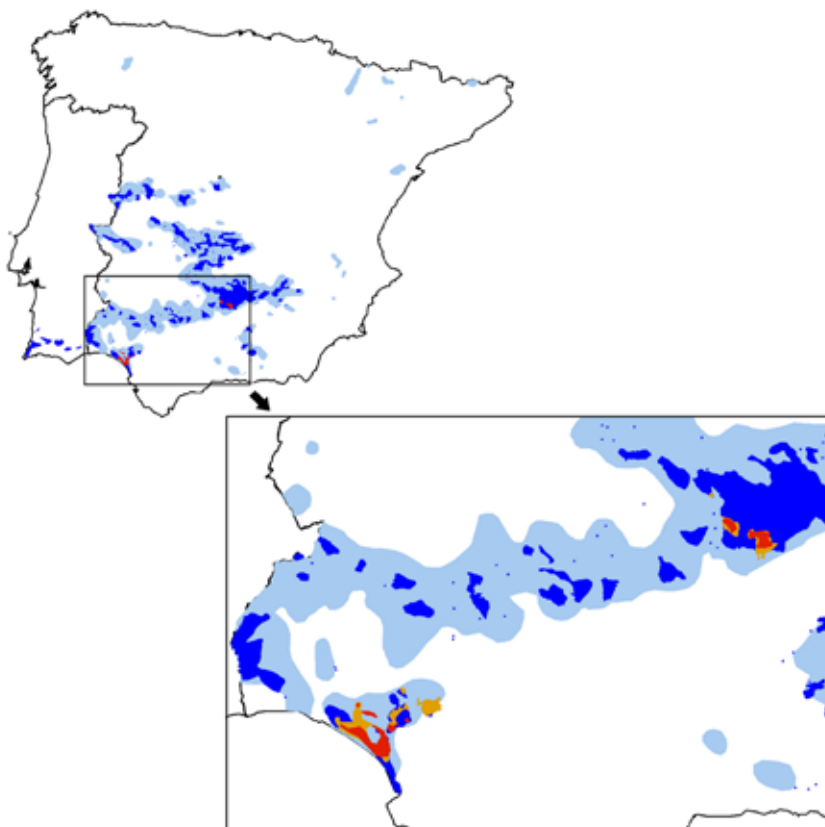
Recuperación, diversidad genética, refuerzo demográfico, reintroducción

## ABSTRACT

The conservation status of the Iberian lynx was found to be extremely critical by the end of the 20th Century, when only 150 individuals remained in the wild secluded into two isolated populations, Doñana and eastern Sierra Morena, both located in Andalusia. The Andalusian Government, together with a number of partners, adopted different conservation measures that received support from the European Union in the form of two LIFE–Nature conservation projects. These projects have proved essential to avoid the potential extinction of the Iberian lynx in the wild and to stabilize both free–ranging populations. Presently, *in situ* conservation efforts are focused on the following objectives: 1) Maintaining and expanding the two existing populations; 2) Recovering extinct population nuclei –following IUCN reintroduction criteria; 3) Maximizing genetic diversity by “genetically connecting” the two existing populations; 4) Continuing to promote local, national and international support to ensure the recovery of this highly endangered species. Nowadays, the Sierra Morena population continues to grow –both numerically and in surface area– at an annual basis. In fact, the number of lynxes has increased from 38 adults (individuals of more than one–year–of–age) registered in 2001 to 95 in 2008. The Doñana population remains stable and a translocation programme, with the ultimate goal of genetic and demographic reinforcement, is currently taking place. Also, *in situ* efforts are presently focused on the recovery of historical population nuclei through reintroduction programmes. Preparation works are being carried out since 2005 and the first releases are scheduled to begin in 2009.

## KEYWORDS

Recovery, genetic diversity, demographic reinforcement, reintroduction



**FIGURE 1. IBERIAN LYNX DISTRIBUTION RANGE IN THE 60's (ONLY SPAIN; PALE BLUE) (RODRÍGUEZ & DELIBES, 1990), IN THE EARLY 90's (DARK BLUE) (RODRÍGUEZ & DELIBES, 1990; CASTRO & PALMA, 1996), IN 2002 (RED) (GUZMÁN ET AL., 2004), AND IN 2008 (ORANGE) (LIFE PROJECT UNPUBLISHED DATA).**

**FIGURA 1. ÁREA DE DISTRIBUCIÓN DEL LINCE EN LOS AÑOS 60 (SÓLO EN ESPAÑA; AZUL PÁLIDO) (RODRÍGUEZ Y DELIBES, 1990), A PRINCIPIOS DE LOS 90 (AZUL OSCURO) (RODRÍGUEZ & DELIBES, 1990; CASTRO & PALMA, 1996) Y EN 2002 (ROJO) (GUZMÁN ET AL., 2004).**

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## INTRODUCTION

**T**he Iberian lynx (*Lynx pardinus*), a species endemic to the Iberian Peninsula (Ferrer & Negro, 2004), is currently endangered in Spain and virtually extinct in Portugal (Sarmiento et al., this book). It is considered the most endangered felid in the world, as it has been catalogued as “critically endangered” by the IUCN (2003). Legal protection for the Iberian lynx is granted by the Bern Convention, and the protection of its habitat, the Mediterranean scrubland, is considered a priority by the European Commission (Habitat Directive 92/43). Although it is known that the Iberian lynx inhabited throughout the Iberian Peninsula, its distribution area suffered a 98% decline during the second half of the last century (Rodríguez et al., 1992; Guzmán et al., 2004; Calzada et al., this book) and, by 2002, about 170 individuals remained, distributed into two isolated breeding populations: the Doñana Natural Space and its surrounding biosphere reserve, and the Andújar–Cardeña mountains in Eastern Sierra Morena, both in Andalusia (Guzmán et al., 2004; see Figure 1). The Iberian lynx is a specialized predator, with more than 90% of its diet comprised of wild rabbits (Gil-Sánchez et al., 2006; Palomares, this book “a”; Calvete, this book). Mediterranean scrubland areas represent the optimal habitat for this species (Palomares, 2001; Palomares, this book “a”). Current threats to the species include 1) scarcity of rabbits due to mixomatosis and rabbit haemorrhagic disease (RHD) (Calvete, this book); 2) habitat destruction, and 3) human-caused mortality (road kills, leghold traps, poaching, etc.) (Guzmán et al., 2004). Given this critical scenario, in early 2000 the Andalusian Regional Ministry of Environment began working on measures to avoid the Iberian lynx extinction. These included: 1) to attain an accurate knowledge of the actual distribution range of the species; 2) to carry out a monitoring programme of both rabbit and lynx populations; 3)

to sign collaborative agreements with land owners; 4) to recover rabbit populations; 5) to control non-natural causes of mortality; 6) to establish a captive population to help preserve current genetic diversity, and 7) to ensure support from the local people that inhabit near both wild populations. Initial results from this Andalusian programme allowed to determine what was the actual distribution range of the Iberian lynx and helped develop accurate population monitoring methods. By 2002, a more ambitious and participative LIFE–Nature conservation project was granted. The project, entitled “Recovery of the Iberian lynx populations in Andalusia” (LIFENAT 02/E/8609) lasted four years (2002–2006) and involved the participation of the Andalusian Regional Ministry of the Environment, the three main Andalusian hunter associations (*Asociación de Titulares de Cotos de Andalucía –ATECA–*, *Federación Andaluza de Caza –FAC–* and *Asociación de Productores de Caza –APROCA–*) and two conservation organizations (*Ecologistas en Acción Andalucía –EEA–* and *–CBD–Hábitat Foundation, belonging to the Spanish Environment Ministry*).

The main objectives of this project (which included both short– and medium–term conservation measures) were 1) to augment lynx population size; 2) to maximize the connection between isolated populations; 3) to promote habitat conservation and resources availability; 4) to improve public perception of the species; 5) to contribute to the maintenance of a genetic “pull” representative of the species; 6) to create an effective lynx population monitoring system, and 7) to decrease threats for the lynx. Scientific oversight was provided by the Superior Council for Scientific Research (CSIC), Doñana’s Biological Station. The main goal of this LIFE project was to stop and revert the rate of decline that had been observed during the previous decades. This included avoiding potential losses in both populations (through controlling threats and stabilizing resources availability), while increasing their carrying capacity to allow an increase of the population size. These specific goals were successfully attained, since both population nuclei could be stabilized and Sierra Morena one began increasing (LIFE project, unpublished data). Such results helped establish the basis for requesting a second LIFE–Nature project. This project, entitled “Conservation and Reintroduction of the Iberian Lynx in Andalusia” (LIFENAT 06/E/209), was granted in 2006 and will be ongoing until 2011. This new LIFE project focuses on the following objectives: 1) Maintaining and expanding the two existing populations; 2) Recovering extinct population nuclei –following IUCN reintroduction criteria–; 3) Maximizing genetic diversity by “genetically connecting” the two existing populations; 4) Continuing to promote local, national and international support to ensure the recovery of this highly endangered species. The project counts with the participation of the Andalusian Regional Ministries of Environment, Public Works and Agriculture, the Extremadura Regional Ministry of Environment, the three main Andalusian hunter associations (ATECA, FAC and APROCA) and four conservation organizations (EEA, CBD–Hábitat Foundation, the Spanish Society for the Conservation and Study of Mammals (SECEM), and World Wildlife Fund (WWF)/Spain). The project was structured based on the “Recovery Strategy for the Iberian Lynx”, presented in the II International Seminar on the Conservation of the Iberian Lynx, which was held in Córdoba in December 2004 (Olszanska & Breitenmoser, 2004). Presently, we are into the third year of this LIFE project and preliminary results indicate that the Sierra Morena population continues to increase, and also Doñana is beginning to do it, as it is currently being genetically and demographically enhanced via translocations of selected Sierra Morena individuals. In addition, firsts releases of the reintroduction of the species into areas of historical occupancy is scheduled to take place at the end of 2009.

## **MATERIALS AND METHODS**

### **STARTING POINT**

During 2001–2002, the actual distribution range of the Iberian lynx was studied in Andalusia. Transects searching for lynx signs (mainly scats and tracks) were performed in 366 5x5 km UTM squares, covering the known distribution area in 1988 (Rodríguez & Delibes, 1990). Lynx scats were confirmed by molecular methods (J.A. Godoy, unpublished data). Only 55 out of the 366 squares were positive, corresponding with the two previously identified nuclei: Doñana and the Andújar–Cardeña mountains, in the Sierra Morena range. About 80% of the distribution area was composed of private hunting lands. Afterwards, a quantification of rabbit abundance was performed through the lynx distribution area by means of transects. Rabbit abundance ranged between 0,6 and 4 rabbits/ha.



**FIGURE 2.**  
**(A).** FAUNA UNDERPASS  
PLACED IN A ROAD OF  
DOÑANA AREA.  
**(B).** CONSTRUCTION OF  
SPEED BUMPS IN A ROAD OF  
DOÑANA AREA.

**FIGURA 2.**  
**(A).** PASO DE FAUNA  
EN UNA CARRETERA  
DE DOÑANA. **(B).**  
CONSTRUCCIÓN DE  
RESALTOS EN UNA  
CARRETERA DE DOÑANA.

### AGREEMENTS WITH LANDOWNERS

The establishment of agreements with land owners and with hunter societies allowed the conservation projects to perform management measures throughout the lynx distribution. A total of 125,088 Has have currently being protected via collaborative agreements with landowners: 106,359 Has signed with the Andalusian Regional Ministry of the Environment, 13,729 Has with CBD-Habitat Foundation, and 5,000 Has with WWF-Spain. In addition, the Iberian lynx presently occupies 60,000 Has of public lands.



**FIGURE 3.** WELL COVERED  
WITH A METALLIC NET  
PROTECTED FROM THE  
ENTRANCE OF IBERIAN LYNXES.  
DROWNING IN WELLS WAS  
DETECTED AS A RELEVANT  
CAUSE OF MORTALITY DURING  
THE 90'S.

**FIGURA 3.** POZO CUBIERTO  
CON UNA MALLA METÁLICA  
PARA EVITAR LA CAÍDA DE  
LINCES. EL AHOGAMIENTO  
EN POZOS SE DETECTÓ COMO  
UNA CAUSA RELEVANTE DE  
MORTALIDAD DURANTE LOS  
AÑOS 90.

### CONSERVATION STRATEGY

Both Iberian lynx LIFE conservation projects have been based on a general strategy focused on:

- **Stabilization of existing territories:** This has been carried out focusing on the following points: 1) stabilising and increasing availability of resources through habitat improvement, and 2) decreasing actual threats for the lynx. Habitat improvement management is focused on getting optimal vegetation structure both for rabbits and lynxes (Palomares, 2001). It is mainly based on the improvement of meadows (small scrub clearances and cereal plantations) and increasing shelters for rabbits (artificial burrows, hiding areas, etc). Also, reduction of hunting pressure on rabbits is being carried out in critical areas. Rabbit releases are being performed in areas where rabbit abundance is under 1 rabbit/Ha in autumn, which is considered the minimum necessary to sustain Iberian lynx territories (Palomares, 2001). Rabbit releases are mainly being conducted using enclosures of about 5 Has with a predator exclusion fence (that is permeable to lynxes but not to other carnivores), although soft releases in the field without enclosure have also been performed. The last tool to increase rabbit availability is the establishment of supplementary feeding stations, aiming at maintaining specific lynxes in a determined area. These stations are baited with domestic rabbits and allow managing the population in case of potential rabbit populations crashes.

- **Decreasing causes of mortality.** Threats affecting Iberian lynx are mostly human-caused, although other causes can also affect the specie's population dynamic. The main human-related threats affecting Iberian lynx include poaching, road kills and drowning in wells (Rodríguez & Delibes 1992; Guzmán et al., 2004), whereas the main natural threat includes mortality due infectious diseases (Meli et al., 2009; López et al., this book; Meli et al., this book). Several measures have been implemented to control these threats. Specific surveillance against illegal hunting methods is being carried out by LIFE project staff in areas of lynx occurrence. Also, control of road kills, mainly in the Doñana population, is one of the most important issues being addressed through the current LIFE project. Part of this control is being addressed by the construction of wildlife underpasses and



**FIGURE 4. OPTIMAL AREAS (IN RED) FOR IBERIAN LYNX REINTRODUCTION IN ANDALUSIA. AREAS HAVE BEEN SELECTED BY THE MULTI-CRITERIA ANALYSIS BASED ON HABITAT, THREATS, RESOURCES AVAILABILITY, HISTORICAL DISTRIBUTION AND PROTECTION DEGREE. IN BLUE, CURRENT DISTRIBUTION RANGE.**

**FIGURA 4. ÁREAS ÓPTIMAS (EN ROJO) PARA LA REINTRODUCCIÓN DEL LINCE IBÉRICO EN ÁNDALUCÍA. LAS ÁREAS SE HAN SELECCIONADO POR UN ANÁLISIS MULTI-CRITERIO EN FUNCIÓN DEL HÁBITAT, AMENAZAS, DISPONIBILIDAD DE RECURSOS, DISTRIBUCIÓN HISTÓRICA Y GRADO DE PROTECCIÓN. EN AZUL, ÁREA ACTUAL DE DISTRIBUCIÓN.**



ecoducts (Figure 2), placing wildlife exclusion fences on problem roads, installing dissuasive road night lights (catadioptrics), advertising road signals and speed bumps for traffic, etc. Moreover, specific brochures and booklets have been developed to increase awareness among drivers in the Doñana area. In addition, to address the problem of lynxes drowning in wells, all known wells in areas of lynx occupancy have been covered with metallic nets (Figure 3). Finally, to control the risk of infectious diseases (López et al., this book; Meli et al., this book) a surveillance programme is being carried out throughout both Iberian lynx populations. This programme includes thorough health screenings of all handled animals (Martínez et al., this book), and also an indirect surveillance through scat analysis.

- **Settlement of new territories:** This is performed by increasing carrying capacity and decreasing threats for the lynx. The recovery of new territories has been made using territory recovery units (TRUs) as the main methodology. TRUs are composed of different habitat improvement measures performed in about 500 Ha (mean surface area of an Iberian lynx home range). Wild rabbit releases were included in TRUs only when rabbit abundance is under 1 rabbit/Ha.
- **“Compression” of occupied areas:** This strategy works under the same premises of the abovementioned ones; i.e., by increasing carrying capacity it is possible to reduce home range surfaces, which in turn will allow a higher number of individuals to inhabit a specific area.
- **Public awareness campaigns:** These campaigns have been taking place at a regular basis since 2002, and they are developed by all partners that participate in the conservation of this species. The incorporation of the hunter societies to the communication group has been one of the most effective ways to gain access to the hunter’s opinion and support. Conservation associations have also been important to bring national and local awareness regarding the situation of the species.
- **Reintroduction:** This entails a medium- to long-term aspect of the conservation strategy. The first macro-habitat analysis for the suitability of areas for potential Iberian lynx reintroduction in Andalusia was performed in 1999 (F. Palomares, unpublished data). This habitat model become the basis for further work, although resource availability was not considered in it. Given that this factor is thought to be the most important one to take into account when developing a reintroduction strategy, a more exhaustive work was needed. Initial work towards Iberian lynx reintroduction began under the first LIFE conservation project, in 2002, and it has always being based on the IUCN guidelines for reintroduction (IUCN, 1998). The detection of potential reintroduction areas in Andalusia was performed by a multi-criteria analysis (MCA). The MCA is a decision-making tool developed for complex problems that follows a logical, well-structured, decision-making process where multiple criteria are involved. The steps followed in this analysis were: 1) the identification of factors

determining the suitability of areas that could host Iberian lynx; 2) compilation of information on everyone of the identified factors; 3) integration of all information in a Geographical Information System (GIS), and 4) evaluation of the resulting models. The identified factors that were important in determining lynx presence included habitat features (vegetation structure, altitude and slope), resource availability: (rabbit abundance and drinking points availability) and threats (proximity to urban nuclei and to communication routes). Afterwards, a Weighted Linear Combination (WLC) analysis was performed (Barredo, 1996). With this method, the suitability of a pixel is obtained as the sum of partial suitability values of every factor in that area. The final potentiality map for Andalusia (Figure 4) took also into account the historical distribution of the species and the degree of protection degree of each area. The result was the identification of three optimal nuclei where to carry out initial Iberian lynx reintroductions in Andalusia: Guarrizas Valley, Guadalmellato Valley and Hornachuelos Natural Park. Once this map was generated, all three areas were analysed in a fine-scale comparison through hierarchical analysis of 35 variables grouped into seven groups: 1) Social attitude; 2) Possibility of integration in the current metapopulation; 3) Carrying capacity; 4) Habitat structure; 5) Possibilities of expansion to other a-priori suitable areas; 6) Illegal persecution pressure and 7) other threats. Among the three selected areas, the Guadalmellato Valley area was selected as the best one and, thus, the first reintroduction –scheduled for late 2009– will take place at this specific site. Ever since after signing agreements with the owners, habitat management measures are already being made in the area.

#### LYNX AND RABBIT MONITORING PROGRAMMES

A monitoring programme of both rabbits and lynxes is being carried out by the Andalusian Regional Ministry of the Environment since 2001. Rabbit abundance is continuously monitored – via transects and latrine censuses– in areas with lynx presence. A disease surveillance programme (focusing mostly on RHD) is also carried out every year during critical time-periods. Iberian lynx monitoring is carried out by means of photo-trapping, radiotelemetry, direct observations and search for lynx signs (tracks, scats, etc.). Evaluation of actions undertaken at the population scale has been performed using information on inter-annual rabbit latrine survey in 2.5 km UTM squares, since its surface (625 Ha) is about the size of a breeding female home range (Ferrerías et al., 1997; Palomares, 2001). In Sierra Morena, treated squares have been compared to control ones (without management actions).

#### GENETIC AND DEMOGRAPHIC REINFORCEMENT VIA TRANSLOCATION OF SELECTED INDIVIDUALS

The low effective size has, in fact, reduced the genetic diversity of both Iberian lynx wild populations and, data shows that genetic drift has taken place in Doñana and Sierra Morena (Godoy et al., this book). In addition, Doñana's genetic diversity is 30% lower than that of Sierra Morena (Godoy et al., this book). The most effective way to increase genetic diversity in the Doñana Iberian lynx population is via translocations of individuals from Sierra Morena (Palomares, this book "b"; Godoy et al., this book). To date, two individuals from Sierra Morena have been released in Doñana, one in 2008 and the second one in 2009. Both were soft-released, being kept between 2–4 weeks in large (3–8 Has) acclimatization pens placed within the most protected environs of the Doñana area. Translocations will continue to take place until at least four individuals from Sierra Morena will settle in Doñana.

### RESULTS

#### CONSERVATION STRATEGY

- **Stabilization and compression of territories, and settlement of new ones:** When comparing treated squares (squares where TRUs have been performed into) with control ones, the former increase overall rabbit abundance in 6 years, has been about 100%, whereas untreated squares have not shown significant differences in rabbit abundance during the same period of time. The most effective conservation measures have been the supplementary feeding stations and the rabbit release enclosures. Yet, the most important aspect that affects rabbit population dynamics in our study area has been the RHD (Figure 5; see Calvete, this book). In Doñana, rabbit abundance has slightly increased since 2002, although the effect of the carried out actions is not clearly related to this increase. Due to landscape features, the evaluation of actions over the rabbit population, however, is much more difficult to be performed in Doñana than in Sierra Morena. A TRU has been considered successful when the rabbit increase has allowed the settlement and reproduction of an adult female, while we have considered them partially successful if settlement has been recorded but without reproduction. Most TRUs both in Sierra Morena

Individual	Year	Age	Population	Individual	Year	Age	Population
Aura	2002	<1	DON	Candiles *	2006	<1	SMO
Saliega	2002	<1	SMO	Caña	2006	<1	SMO
Garfio	2003	3	SMO	Cardo	2006	<1	SMO
Cromo *	2003	<1	SMO	Ceniza	2006	<1	SMO
Fran *	2003	1	SMO	Córdoba	2006	<1	SMO
Jub	2003	3	SMO	Coscoja	2006	<1	SMO
Adelfa	2004	<1	SMO	Cuco	2006	<1	SMO
Alhucemas	2004	<1	SMO	Al-Andalus	2007	3	SMO
Aliaga	2004	<1	SMO	Alfonso *	2008	10>	SMO
Almoradux	2004	<1	DON	Azuel *	2008	Unkn.	SMO
Artemisa *	2004	<1	SMO	Calabacín *	2008	2	SMO
Arcex	2005	1	SMO	Cascabel	2008	2	SMO
Beta	2005	<1	SMO	Charqueña	2008	2	SMO
Biznaga	2005	<1	SMO	Era	2008	<1	SMO
Boj	2005	<1	DON	Esparto	2008	<1	SMO
Azahar *	2006	2	SMO	Espina	2008	<1	DON
Bandolero	2006	1	SMO	Estela II	2008	<1	DON
Barraca *	2006	1	SMO	Damán II	2009	2	SMO

TABLE 1. IBERIAN LYNX INDIVIDUALS EXTRACTED FROM THE FIELD BY THE LIFE CONSERVATION PROJECT TO BE INCORPORATED AS FOUNDERS OF THE *EX SITU* CONSERVATION PROGRAMME (\* = INDIVIDUALS CONSIDERED TO HAVE LIMITED POTENTIAL FOR SURVIVAL IN THE WILD AT THE TIME OF CAPTURE).

TABLA 1. EJEMPLARES DE LINCE IBÉRICO EXTRAÍDOS DE LA NATURALEZA POR EL PROYECTO LIFE PARA SER INCORPORADOS AL PROGRAMA DE CONSERVACIÓN *EX SITU* DEL LINCE IBÉRICO (\*=INDIVIDUOS EXTRAÍDOS POR TENER UN BAJO POTENCIAL DE SUPERVIVENCIA EN LA NATURALEZA EN EL MOMENTO DE CAPTURA).

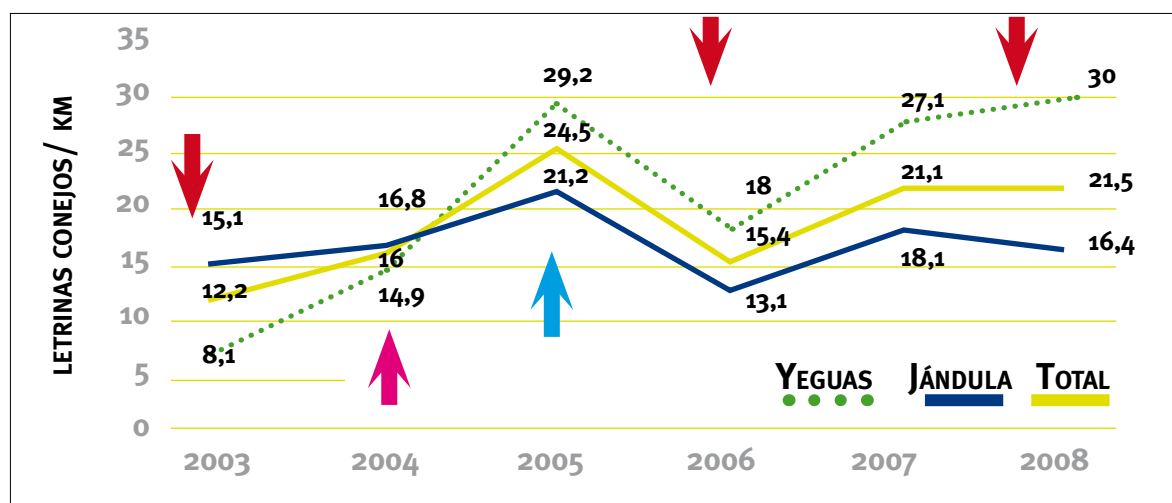
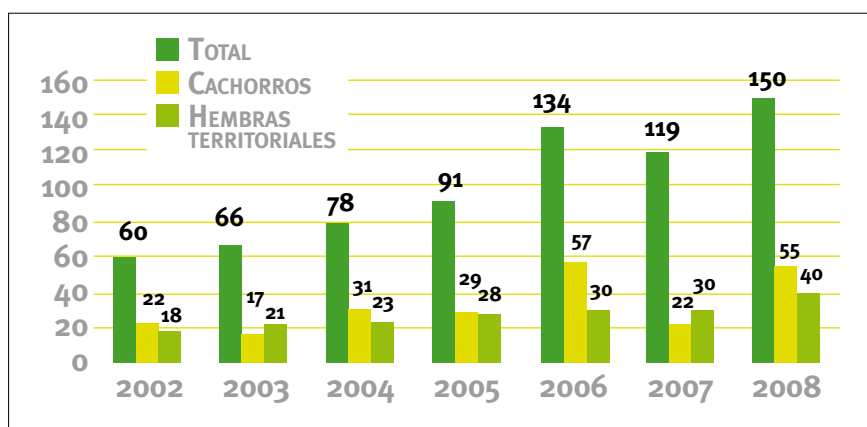


FIGURE 5. EVOLUTION OF THE RABBIT RELATIVE ABUNDANCE IN 2.5 KM UTM SQUARES IN THE IBERIAN LYNX OCCUPANCY AREA (N = 28 SQUARES). THE PINK ARROW MARKS THE BEGINNING OF THE SUPPLEMENTARY FEEDING PROGRAMME IN THE THREE CORRESPONDING SQUARES. THE BLUE ARROW MARKS THE BEGINNING OF THE LIFE PROJECT ACTIVITIES. RED ARROWS MARK RABBIT HAEMORRHAGIC DISEASE OUTBREAKS.

FIGURA 5. EVOLUCIÓN DE LA ABUNDANCIA RELATIVA DE CONEJOS EN UNIDADES UTM EN CUADROS DE 2,5 KM EN EL ÁREA DE DISTRIBUCIÓN DEL LINCE (N = 28 CUADROS). LA FLECHA ROSA MARCA EL INICIO DEL PROGRAMA DE ALIMENTACIÓN SUPLEMENTARIA EN LOS TRES CUADROS CORRESPONDIENTES. LA FLECHA AZUL MARCA EL INICIO DE LAS ACTUACIONES DEL LIFE. LAS FLECHAS ROJAS MARCAN LAS EPIZOOTIAS DE LA ENFERMEDAD HEMORRÁGICA DEL CONEJO.

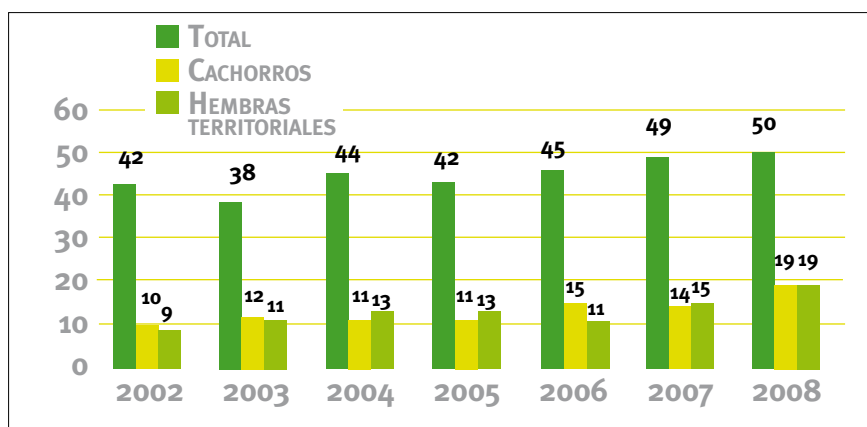


and in Doñana have been considered successful. In Sierra Morena, eight out of the 13 established TRUs can be considered successful and two partially successful. A total of 12 new Iberian lynx territories have been established in Sierra Morena since 2001, where the population has increased from 38 adults (considering animals over 1 year-of-age; n=60 individuals including young-of-the year) in 2002 to 95 adults (n=150 individuals including young-of-the year) in 2008 (Figure 6). In Doñana, nine new female Iberian lynx territories have been established since 2002, although the effect of the habitat management units is difficult to determine. The number of individuals in the Doñana population has remained stable at approximately 31–32 adults, yet the number of territorial females has



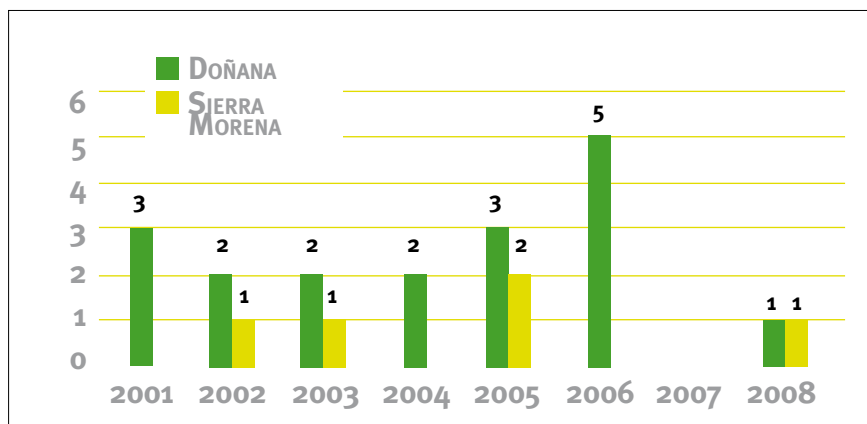
**FIGURE 6. EVOLUTION OF THE IBERIAN LYNX POPULATION IN SIERRA MORENA BETWEEN 2002 AND 2008: ESTIMATED TOTAL NUMBER OF INDIVIDUALS, CUBS AND TERRITORIAL FEMALES.**

FIGURE 6. EVOLUCIÓN DE LA POBLACIÓN DE SIERRA MORENA ENTRE 2002 Y 2008: NÚMERO TOTAL DE INDIVIDUOS ESTIMADOS, CACHORROS Y HEMBRAS TERRITORIALES.



**FIGURE 7. EVOLUTION OF THE IBERIAN LYNX POPULATION IN DOÑANA BETWEEN 2002 AND 2008: ESTIMATED TOTAL NUMBER OF INDIVIDUALS, CUBS, AND TERRITORIAL FEMALES.**

FIGURA 7. EVOLUCIÓN DE LA POBLACIÓN DE DOÑANA ENTRE 2002 Y 2008: NÚMERO TOTAL DE INDIVIDUOS ESTIMADOS, CACHORROS Y HEMBRAS TERRITORIALES.



**FIGURE 8. ROAD MORTALITY IN THE IBERIAN LYNX POPULATIONS BETWEEN 2001 AND 2008. DARK GREEN BARS REPRESENTS THE DOÑANA POPULATION AND LIGHT GREEN BARS THE SIERRA MORENA POPULATION.**

FIGURA 8. MORTALIDAD EN CARRETERA EN LAS POBLACIONES DE LINCE IBÉRICO ENTRE 2001 Y 2008. LAS BARRAS VERDES OSCURAS REPRESENTAN A LA POBLACIÓN DE DOÑANA Y LAS VERDES CLARAS A LA POBLACIÓN DE SIERRA MORENA.

increased from 10 to 19 between 2002 and 2008 (Figure 7), while the total number of males has decreased. This is largely due to the loss of males after the 2007 Feline leukaemia (FeLV) outbreak in the Coto del Rey nuclei (López et al., 2009; Meli et al., 2009; López et al., this book; Meli et al., this book).

- **Decreasing causes of mortality:** Measures to control road mortality seem to be working efficiently up to now. Although road kills increased during 2003–2006, they have decreased during 2006–2009 (Figure 8; Martínez et al., this book). Control of illegal hunting methods has helped decrease the number of leghold traps and snares to almost zero. In 2008, the epidemiological surveillance programme allowed to detect the first case of poisoning in an Iberian lynx. Fortunately, the perpetrator could be identified and he is currently down by law. The epidemiological surveillance programme is also working effectively. Thanks to this programme, which is led by staff of the Andalusian Government, the *Ex situ* Conservation Programme and the University Zürich, an outbreak of feline leukemia virus that occurred in Doñana population in 2007 could be rapidly detected and controlled (López et al., 2009; Meli et al., 2009; López et al., this book; Meli et al., this book).

- **Public awareness campaigns:** The outreach campaigns have made the population aware of the situation of the Iberian lynx and supportive of the proposed reintroduction in this area. Altogether, outreach efforts have largely focused on the most critical groups: hunters, farmers, local populations of Doñana, Sierra Morena and the proposed release site, and children. As part of these communication efforts, the LIFE conservation project publishes a monthly bulletin and maintains an updated webpage ([www.lifelince.org](http://www.lifelince.org)). Public information is proving to be a very effective tool for local awareness and support.

- **Reintroduction:** Habitat management measures are presently being carried out in the Guadalquivir Valley, where the first Iberian lynx reintroduction is scheduled to take place. Six wild-born individuals will be released during the second half of 2009. The selected method includes a soft-release technique in on-site acclimatization enclosures of approximately 4 Ha each. Most landowners in the area have already signed collaborative agreements with the Andalusian Regional Ministry of the Environment within the frame of the Iberian lynx LIFE–Nature conservation project.

## GENETIC AND DEMOGRAPHIC REINFORCEMENT

The genetic and demographic reinforcement performed in Doñana via translocations of Sierra Morena males is still incipient. The first translocated individual was released in Doñana National Park in January 2008. It was a three-year-old male named “Baya” that belonged to the Cardeña subpopulation (Ruiz et al., this book). It was released in Coto del Rey subpopulation, (a high rabbit density place) where there were three adult females and no adult males due to the FeLV outbreak that took place in 2007 (see López et al., 2009). Baya immediately settled in the area and copulated with the three territorial females. All three became pregnant and gave birth to a total of eight young, of which three were still alive by the end of 2008 (for details see text box by Ruiz et al., in Palomares, this book). The introduction of Sierra Morena genes into the Doñana population is considered essential for the long-term genetic health of this wild population (Godoy et al., this book). In January 2009, “Caribú”, a three-year-old male that originated from the Andújar subpopulation, was soft-released in Doñana’s Biological Reserve, one of the best protected areas within the National Park. This place is a low-density rabbit area where one adult female and one adult male inhabit. In contrast with the first experience, this male has not shown any interest on attempting to settle within the vicinity of the release site, and it is currently dispersing northwards out of the Doñana population in a moving considered as “homing behaviour”. Experiences with other lynx species (unpublished data) point out the possibility that this individual returns to the Doñana population by itself after several months.

## SAFEGUARDING GENETIC DIVERSITY IN CAPTIVITY

Both LIFE conservation projects have helped provide all the Iberian lynx founders that presently conform the Iberian Lynx Conservation Breeding Programme (Vargas et al., this book). Since 2002, 36 individuals have been brought into captivity (6 from Doñana and 30 from Sierra Morena; Table 1). From these, 24 lynxes were specifically extracted



Photo: Andoni Candela

for the captive breeding programme, whereas the other 10 lynxes were brought into captivity because they had problems that compromised their survival in the wild. The extraction rate was based on a model developed in order to avoid potential impacts on the population dynamics of this species (Palomares et al., 2002).

## DISCUSSION

The conservation strategy developed for the Iberian lynx in Andalusia seems to be advancing in the right way. The Sierra Morena population has experienced a substantial increase since 2001, when active conservation measures began to be implemented. The number of lynxes in this population has increased at a much higher rate than the surface area they are occupying; i.e., territories are being “compacted” and there seems to be current evidence of population saturation in Sierra Morena (LIFE project, unpub. data). The productivity is following an every-other-year cycle, probably due to the stratification of one-year-old individuals inside the population that hinder the survival of cubs born the following year. Moreover, about 70% of the juveniles are lost within their first year of life, and there have been several recorded cases of intraspecific aggression, which seems to be one of the major causes of this loss. Moreover, juveniles are currently settling in areas with very low rabbit densities or with very poor habitat structure. Population expansion seems difficult due to lack of resources in all areas surrounding the current distribution area. Nevertheless, there are suitable areas for the establishment of Iberian lynx within 15–45 km from the current Andújar–Cardeña population. In fact, all available information points towards asserting that the rapidly growing Yeguas River subpopulation has motivated the foundation of a new population nucleus in Southern Castille–La Mancha Community, 15 km away from the Andalusian Sierra Morena population (Castille–La Mancha Government, unpublished data). Iberian lynx conservation efforts in Doñana have promoted the establishment of an important number of new territories outside the National Park during the period 2001–2009, which have made up for the dramatic loss of territories suffered inside the National Park between 2001–2003. The key to this change of trend outside the National Park has been the awareness of the local population and the decrease in road mortality. The number of territorial females (19) and wildborn cubs (24) recorded in Doñana in 2008 have been the maximum ever recorded in this population. We believe that all



Photo: Miguel Ángel Simón

the abovementioned measures have prevented the extinction of this small population. However, more active management measures are needed to ensure the long-term conservation of this population.

Reintroductions are considered to be key in moving forward towards the recovery of the endangered Iberian lynx. Once the protection and effective conservation of the currently existing populations are granted, the next step is the establishment of new free-ranging lynx populations in areas of historical occupancy (see Calzada et al., this book). The Iberian lynx is critically endangered, and can only be recovered through hard work and solid partnerships between national and international stakeholders. The effort of politicians, biologists, scientists, veterinarians, hunters, and the whole society is sorely needed to help recover the lynx populations that roamed in the past throughout the Mediterranean forests and scrublands of the Iberian Peninsula.

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