lynxconnect

Release Protocol for Iberian Lynx

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1.Introduction

The International Union for Conservation of Nature (IUCN) **defines translocation as** "the **intentional and mediated movement of wild individuals** from one part of their range to another" and **a reintroduction as "an attempt to establish a species in an area** which was once a part of its previous historical range". It is important to note that the IUCN definition of reintroduction does not mention the origin of the individuals (i.e. wild-caught or born in captivity).

Reintroduced animals go through a unique process in which they are transported from their natal habitat and placed in a completely unfamiliar landscape (Bell, 2014). Increasing the success rate of reintroduction programmes requires efficient post-release monitoring of reintroduced animals. (Nichols and Williams, 2006; Armstrong and Seddon, 2008). This monitoring will provide the necessary information for assessing the effectiveness of the whole reintroduction process, allowing progress to be reviewed at all stages so that targets are achieved through a cyclical process. (IUCN/SSC 2013).

Since the beginning of Iberian lynx releases in reintroduction areas in 2009, 302 individuals have been released until 2020. In addition, eight individuals have been released since 2007 in Doñana for genetic reinforcement of the population. The analysis of the performance of these releases has made it possible to evaluate key-aspects in the development of the reintroduction processes.

The current protocol is an update of the Iberian Lynx Release Protocol developed in the framework of the Life Iberlince project, which guided the releases carried out during that project. That first version of the protocol was drafted based on the experience of creating Guarrizas and Guadalmellato populations through reintroduction in 2009 and 2010. This protocol incorporates lessons learned from the beginning of the reintroductions to the present. Details of the most relevant results of the reintroductions will be presented in the corresponding sections of the protocol:

- Origin, selection, and preparation of the specimens
- Selection of the release method
- Location of releases
- Number of specimens to be released and release criteria

2. Origin, selection, and preparation of the specimens

Both wild and captive-bred specimens have adapted well to the areas where they have been released. The average survival rate of captive-bred animals within the first year after the release has been 71%, which is higher than the average survival rate of 45% reported for reintroduced captive-born felines (Jule et al 2008). In those populations where both translocated wild animals and animals from captivity have been released, the survival of the former has been higher (wild survival: 81% vs captives: 60%. Data from Guarrizas and Guadalmellato populations). These data are aligned with other reintroduction projects for other lynx species (Devineau, et al., 2011) and other carnivores (Mathews, et al., 2005) where wild-born lynxes have higher survival rates than captive-born lynxes.

These differences may not be important in the early stages of a reintroduction, when intraspecific competition is low due to low population pressure. However, this may be relevant in later stages of a reintroduction, when it is necessary to establish individuals into saturated populations with high competition for resources. In Guadalmellato the survival rate within the first year of captive-bred animals during the initial stage of the reintroduction (years 1-4) was 55%, while it dropped to 20% during stage 2 (years 5-8). Similarly, in Guarrizas, although the survival of captive-bred animals released during the first year did not vary between stages, there was a decline in lynx survival and settlement in the third year after the release, turning out in a much lower proportion of individuals released in stage 2 becoming established

in the population than those released in stage 1 (Survival in the third year for stage 1: 35% vs stage 2: 22%).

Therefore, the specimens for translocations can come from the captive breeding programme or can be wild specimens born in the wild.

The specimens to be released from the captive breeding programme shall have previously undergone a programme of adaptation to freedom in the breeding centres of origin (see protocol "Handling of Iberian Lynxes Born in Captivity for their Release into the Natural Environment"), as well as a health check (see Quarantine Protocol for the Inter-population Transfer of the Iberian Lynx, 2012).

Using wild-born lynxes to reinforce or establish new populations may have some advantages over using captive-bred animals. First, costs are significantly reduced, as well as the amount of work required, as no training or other interventions are needed. On the other hand, Iberian lynxes born in the wild have higher survival rates than lynxes born in captivity. Another advantage may be the fact that the number of lynxes available for translocation can be much higher than those from breeding centres (more than 300 cubs born in the wild in 2019 and more than 400 in 2020).

It is important to consider the characteristics of the donor population when translocating wild animals; the donor population must be sufficiently robust so that the removal of individuals has no negative effects on it. To assess this effect, it is necessary to obtain information on productivity, recruitment rate and juvenile mortality. In populations where juvenile mortality is high (e.g. caused by high densities and territory saturation), translocation of juveniles may be considered as a way to take advantage of animals that otherwise may be missed. From a genetic point of view, it must be ensured that translocated animals contribute to increase the heterozygosity rate of the recipient population. An upper limit, derived from demographic simulations, should be set for the number of animals that can be removed annually from each population.

A performance analysis of 65 translocations between populations had the following results (Garrote et al. 2019):

	It establishes %	It disperses %	Back to origin %
Individuals <1 year	75	25	0
Individuals 1-4 years	66	24	10
Individuals > 8 years	0	57	43
Dispersants	15.4	69.2	15.4
Non-dispersing juveniles	78.6	21.4	0
Territorial Individuals	61.1	11.1	27.8
Distance to origin <50 km*.	44.4	11.1	44.4
Distance to origin >50 km*	78.3	17.4	4.3
Soft release	81.3	6.3	12.4
Hard release	51.4	34.3	14.3

* Only territorial and non-dispersing juveniles

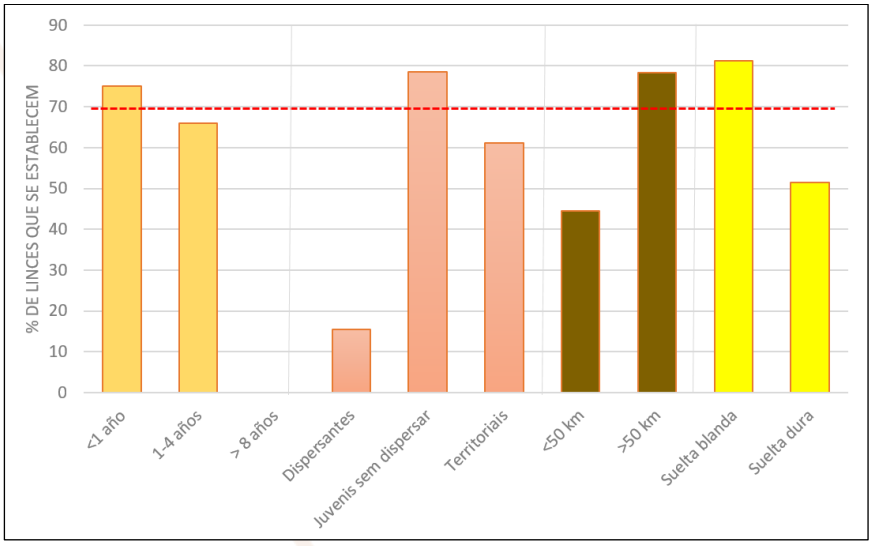

Figure 1. Percentage of translocated lynxes establishing in the release area.

The following recommendations for the release of translocated wild animals can be derived from those results:

- 9-12 months old non-dispersing individuals should be prioritised for translocations. It is feasible to translocate specimens aged 1-4 years. Translocation of specimens older than 4 years is not recommended. Never use senile individuals, older than 8 years (0% success)
- The recipient population should be as far away as possible from the origin to avoid philopatric behaviour
- Quarantine + adaptation period > 50 days

Other aspects to be considered are: 1) the health control procedure will be the same applied to those animals coming from the captive breeding programme (see protocol) and 2) the genetic requirements of both the individual and the recipient population, issues addressed in the genetic management protocol.

All released specimens must be tagged with radio-tracking collars.

3. Selection of the release method

There are two basic methods for releasing specimens in reintroduction programmes: direct release or "**hard release**" and release with a prior period of confinement to adjust the specimens to the area or "**soft release**" (Fritts *et al*., 1997).

3.1 Soft releases

The first releases in a new reintroduction area should be carried out by soft release in pre-adaptation enclosures in order to favour the survival of the specimens and guarantee their settlement, avoiding dispersal and return behaviours. Once there are territorial lynxes in the area hard releases will be carried out.

3.1.1 Suitability of the release areas and preparation of the pre-release facilities

The pre-adaptation enclosure should be built in a central zone of the selected reintroduction area, coinciding with squares with the maximum density of rabbits, with restricted human access, and whose owners support the reintroduction project (by official agreement). The orography should be

suitable for the construction of the infrastructure, as the construction budget depends on this factor. On the other hand, it is important that the selected area has a shrubs density enough to offer proper shelter to the released individuals while also allowing their sighting for correct monitoring and evaluation of their adaptation to their new living conditions. This way settlement is guaranteed, and dispersal of the released specimens is minimised.

The number of enclosures will depend on economic and logistical constraints and the number of lynxes to be reintroduced.

The size of the enclosures has changed over time and with the objectives initially set. The first enclosures were built in Guadalmellato. Three enclosures between 4 and 5 hectares were constructed, introducing one male and one female in each enclosure. They were wild-born, with reproductive potential, and were introduced into the enclosure during the mating season for the female to become pregnant and give birth into the enclosure. Lynxes could therefore remain in the enclosure for up to 6 months in the event of reproduction. This objective required large enclosure sizes. A similar process was replicated in Guarrizas. In the reintroductions carried out outside Andalusia, one-year-old captive animals were released, without the possibility of reproduction. The purpose of the enclosure was acclimatisation and to minimise the likelihood of philopatric dispersal movements. In these cases, the size of the enclosures ranged from 1.36 to 2 hectares. In these enclosures, up to three specimens were introduced at the same time. All enclosures fulfilled their role. Considering that captive animals came from enclosures of no more than 1,000 m^2, it is possible that smaller enclosures could be used without problem, but there is no field information on this issue.

<u>Characteristics of enclosures</u>

- It should be built in a location with good visibility from a nearby promontory in order to set up a monitoring station, or build a watchtower, to allow surveillance of the specimens.
- General enclosure of 4.5 m overall height and 3.85 m height in plan.
- 50 cm cantilever with an angle of 45 degrees built towards the inside of the enclosure, in order to prevent the escape of the lynxes
- The entire perimeter of the enclosure will be fixed to the floor, in order to prevent the lynxes from escaping by digging close to the perimeter
- It must have sliding doors for the release of the specimens
- Each enclosure will have 5 rows of electric fencing, 3 on the inside to prevent the lynxes from leaving and 2 on the outside to prevent access to the inside by other individuals or other species
- It must have sufficient vegetation or rock cover to allow for lynxes to hide and develop natural hunting strategies.

Inside, the pre-release enclosures must be equipped with:

- Water sources. Ideally located in a visible place from the external surveillance point for the control of the specimens
- Artificial hiding places as additional refuge for lynxes
- A supplementary food enclosure (SFE) located in a place visible from the surveillance point

The following table shows the units and characteristics of the enclosures used in the existing reintroduction areas:

Area	Enclosure	Size (ha)	Artificial vi-varia	Water sources	Artificial hiding	SFE
Vale do Guadiana	1	1,36	4	1 (Pond)	3	1
Matachel	1	1,5	2	3		1
Montes de Toledo	1	2	3	2		1
Guadalmellato	1	5	20	2	2	
	2	4	16	2	2	
	3	5,6	20	2	2	
Guarrizas	1	4,1	10	2	3	1
	2	3,9	10	2	2	1

There must always be wild rabbits inside the enclosure to allow lynxes to develop natural hunting behaviour. Rabbits must be placed into the enclosure with the highest health guarantees, being the origin of the rabbits primarily adjacent areas to the enclosure in order to avoid introducing external RHDV strains into the area.

Once lynxes are released outside the enclosure it is appropriate to provide them with domestic rabbits in the SFE until they are adapted to their new environmental conditions and so that the observer can verify their fitness. Within the first 3 days after the release there must be rabbits in the SFE, and thereafter rabbits will be supplied every 5 days as supplementary feeding and be able to observe the evolution of the released specimens.

3.1.2. Monitoring of specimens in the pre-release facilities

This confinement stage will enable special attention to be given to behaviour related to hunting, intraspecies interactions and to individual adaptation.

During their stay in the enclosure, daily tracking and monitoring should be carried out.

The main objective of this monitoring will be to check the physical and behavioural condition of the animal. For this purpose, it is suggested to carry out a visual check at least three times a day. It should be carried out through direct daily observation from fixed hiding places set up at 100 to 500 m, in order not to influence the behaviour of the reintroduced individuals. This control will be supported by the installation of camera-traps to take daily photographs of the animal. Other aspect to be considered is the control of those necessary ethological norms in nature which, to a certain extent, can ensure survival after release into the natural environment, such as hunting behaviour and interaction with other individuals (in the case of having been introduced into the enclosure together with another individual).

After the estimated pre-adaptation time, the final opening of the sliding doors installed in the enclosure will be carried out so that the animals can leave passively.

Should it be considered that some of the specimens have not adapted, they should be capture and resent to the breeding center or recovery center.

3.1.3. Summary of basic material and routine work requirements

Equipment:

- Fully equipped release enclosure
- Observation point close by
- Monitoring team equipped with binoculars and telescope
- Availability of domestic rabbits and wild rabbits
- Veterinary team on standby
- Capture cages and compression cages
- Camera traps

Work routine:

- Inspection of the perimeter fence to detect and correct any possible breaks
- Check the correct functioning of the electric fences, electrical insulators, battery, and system voltage
- Inspection of the Supplementary Feeding Enclosures and supply of rabbits, where necessary. Inspection of water sources
- Visual check of the physical condition of the animal three times a day

3.2. Hard releases

Once the first introduced individuals have been released and they have become established in the selected area, in subsequent years hard releases can be implemented, since it is believed that the presence of animals in the area reduces the possibility of dispersion and/or return behaviour. This method has the advantage of facilitating the handling of a larger number of specimens.

All specimens released after a health check must be radio-tagged.

4. Location of releases

All releases must be in areas previously assessed through the Protocol for the Selection of Reintroduction Areas. This ensures that the selected area is suitable for the settlement of the species. The mere presence of the species in an area may not be indicative of suitable conditions for the species. As the species increases its range in each new population, it may colonise areas of varying quality, eventually settling naturally in sub-optimal areas where there may be serious threats to the species. A clear example is found in the areas of lynx presence outside the limits of the Doñana National Park in the 1980s and 1990s, where most of the detected mortality cases were located, mainly caused by anthropogenic factors (Ferreras et al 1992). In these areas, the presence of the species was possible thanks to the dispersal of individuals born inside the National Park, which works as a source (Gaona et al 1998). These areas of high mortality operated as population sinks.

Releases should be primarily concentrated in the same population during the first years of reintroduction. The main objective for concentrate releases is to minimise the dispersive movements of individuals, thus reducing their probability of dying. It has also been shown that in those populations where reintroductions were concentrated, the number of individuals grew more quickly during the first years of reintroduction. Those populations reached the Life Iberlince objective of achieving the settlement of 5 breeding females before other populations where the releases were carried out in different areas (Garrote 2019). Similar conclusions have been reached in previous projects for the reintroduction of other Lynx species (Wilson 2018).

5. Number of specimens to be released and release criteria

The number of specimens will be conditioned by the availability based on the production in the breeding centres, as well as the number of individuals to be translocated. The more animals released, the greater the likelihood of a successful reintroduction (Wilson 2018).

5.1 Release criteria (numerical Vs genetic)

Numerical/demographic releases

Numerical/demographic releases aim to enhance exponential population growth by providing a stock of individuals that allows higher recruitment than mortality. According to the data obtained in the different reintroduction areas, this will be a stage that should last at least 5 years or until the target of 15 breeding females is reached. This may vary depending on the conditions and progression of each area. Therefore, demographic modelling of each population will be necessary to know more precisely up to what point individuals should be released (See below).

Releases based on genetic criteria

Releases based on genetic criteria aim to increase the heterozygosity rate of the population. This will be done by releasing a small number of individuals, but with a known and appropriated genetic load to maximise the genetic variability of each population. Genetic-criteria releases should only be used after demographic release targets have been met.

To determine when to cease releases on numerical criteria, and start releases on genetic criteria, appropriate thresholds should be established based on demographic parameters. To this end, population-specific demographic models will be developed for each population, determining the point at which not releasing new individuals will not affect the achievement of the estimated carrying capacity for that population.

It is proposed to use a standardised and easy-to-use method for all populations, such as VORTEX

The information needed for each population to build these models is the following:

General species information

- Age range of dispersants
- Survival of dispersants
- Age of earliest reproduction (female/male)
- Maximum life expectancy
- Litters per year

Population-specific information

- Mortality rates of adults, juveniles, and offspring
- Number of breeding females
- Number of cubs per female
- Maximum litter size
- Percentage of females reproducing annually under low density/saturated population conditions
- Population structure (number of individuals of each age/years/sex ratio)

- Population carrying capacity
- Genetic data

It has been found that as new populations grow there is an increase in population pressure and greater intraspecific competition, leading to lower survival and settlement success of reintroduced individuals, also affecting various demographic parameters of each population. This has been detected in Guarrizas and Guadalmellato, for which a long-term data series of the evolution of their populations is available and where the survival and settlement of released specimens has been decreasing as the population has been growing (see details in the section Origin, selection and preparation of the specimens). The evolution of these parameters may condition the settlement success of released individuals, which may be a reason to stop releases before reaching the numerical target set by the results of the demographic model (Vortex). Criteria for stopping reintroductions shall be:

- Unacceptable mortality levels (over 50%)
- Proportional ratio of the contribution of the released individuals to wild production (e.g. when the number of released individuals is less than 10% of births). Detailed values in this regard will be obtained from the demographic model developed for each population.

Likewise, the increasing difficulty for the settlement of released specimens as the population evolves significantly affects releases with genetic criteria, since, by definition, these will occur when the population reaches a certain number of individuals, and therefore the difficulty of fixation will be higher. To date experience in this issue is limited, however, some interesting guidelines for future releases in saturated populations can be drawn from the Doñana genetic reinforcement experiences. Nine lynxes have been released in Doñana, four from the wild and five from captivity. At the time of writing this protocol, only two specimens, both wild males, have succeeded in reproducing, which is the ultimate goal of genetic releases. Both individuals settled when they were released in a "vacant territory" situation. This means that the death of a territorial male was used as an opportunity to release these breeding-age wild males in a newly vacated territory. In both cases the original territorial males died due to various causes, creating the opportunities for targeted releases into the vacant territories. The possibility of targeted removals of territorial individuals to create this "vacant territory" and facilitate the settlement of individuals with genetic value is considered. This last point can be delicate and may require courageous decisions that need to be properly explained to the public.

Therefore, and based on the above, and on the section "Origin, selection and preparation of the specimens", regarding the survival of wild vs. captive specimens and the successful settlement of translocated animals, the following recommendations are suggested to conduct releases with genetic criteria, or any type of release into saturated or near-saturated populations:

- Preferentially release wild specimens
- Use soft releases, in acclimatisation enclosure
- Release potentially breeding male individuals
- Select areas with vacant territories (opportunistic/extraction of territorial specimen)

In expanding populations, with low levels of intraspecific competition, the process of genetic reinforcement can be carried out with the same methodology as usual releases (captive breeding contribution).

The implementation of genetic reinforcement will require knowledge of the genetic of the population to be reinforced and of the individuals available to be released at that site, in order to select the one that brings the greatest diversity to the population. Genetic monitoring of population is addressed in the "genetic monitoring protocol”.

6. Social participation in releases

Social involvement in releases brings benefits to the reintroduction process and is therefore integrated here as a recommendation and as an integral part of the protocol. Public releases lend transparency to the reintroduction process, as well as openness and trust on the part of the project teams. The releases can be used to organise outreach activities. It is also a good opportunity for the public to ask questions in a casual atmosphere and meet the monitoring teams that will be working in the area, the project team.

Information about the animals, their origin, the Iberian nature of the process and other technical details must be provided in the releases, framing the medium- to long-term reintroduction process and its population objectives.

Basic rules of conduct should be communicated at the release site that also ensure respect for the animal and the moment: keeping quiet, moderate gestures, reasonable distance to the transport box.

The media should be included in this public assistance, also considering their particular needs for image capture, interviews etc.

7. Protocol review

This protocol will be reviewed and updated every 4 years. The next review of this protocol will take place in 2025.

8. Pending issues

This section lists the identified needs for improvement of some aspect of the protocol that could not be addressed in this update. It is recommended that they are rectified and incorporated in the next update of the protocol. The pending issues identified are as follows:

- Detailed analysis of factors affecting the success of hard-release releases

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