BALKAN LYNX RECOVERY PROGRAMME

Best practices for handling lynx:

Guidelines for the Balkan Lynx Recovery Programme

Anja Molinari-Jobin[1], Andrej Gonev[2], Bledi Hoxha[3], Fatos Lajçi[4], Lisa Leschinski[5], Dime Melovski[2], Aleksandar Pavlov[2], Ilir Shyti[3], Aleksander Trajçe[3], Manuela von Arx[1]

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Affiliations:

[1] KORA, Talgutzentrum 5, 3063 Ittigen, Switzerland

[2] Macedonian Ecological Society, Arhimedova 5, 1000 Skopje, N.Macedonia

[3] Protection and Preservation of Natural Environment in Albania, Rr. Janos Huyadi, G.32. Ap.11, 1019, Tirana, Albania

[4] Environmentally Responsible Action (ERA), 30000 Pejë, Kosovë

[5] EuroNatur, Westendstraße 3, 78315 Radolfzell, Germany

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Introduction

Any handling of lynx must consider animal welfare a priority and respect all national and international legal requirements. The Balkan lynx (*Lynx lynx balcanicus*) is the most critically endangered subspecies of the Eurasian lynx, with its population estimated to be alarmingly low (Melovski et al., 2020). As such, the survival of every individual is of paramount importance to the overall conservation efforts. In handling these rare animals, utmost care must be taken to ensure their safety, as well as that of the people involved. However, handling lynx within the scope of the Balkan Lynx Recovery Programme (BLRP) does not only involve individuals from the Balkan lynx population but will also include lynx from other populations. This is due to planned reinforcement efforts, which require capturing, quarantining, and transporting lynx to bolster the existing population. These procedures are complex and require meticulous planning and execution to ensure the welfare of all animals involved. Incorporating lynx from other populations into the recovery process adds another layer of responsibility, as it necessitates compliance with both species-specific handling protocols and logistical considerations for translocation across regions.

Effective and humane handling protocols are essential to minimise stress and reduce the risk of injury or fatalities during conservation activities such as monitoring, keeping in quarantine and transporting of animals. There is a wealth of established best practices from handling lynx across Europe (Brandes, 2024; Kubala et al., 2018; Kvapil et al., 2024). Drawing from these proven methods, this document provides tailored guidelines to address the specific needs for the recovery of the Balkan lynx, with the goal of minimizing risks and ensuring the success of conservation interventions.

Captures

There is no absolutely safe capture. Each capture is stressful for the animal, may cause injuries and, in the worst case, even the death of an individual. The advantages of each capture therefore need to be balanced against the risks. The principles governing the capture of lynx are the prevention of injuries to animals and people.

Lynx are captured by means of box traps or foot snares (Fig. 1 and 2). **Box traps** are constructed in a way to minimise the risk of injury of animals caught. They should be smooth on the inside (e.g. made of plain wood or round logs) and dark when closed, but include holes for fresh air supply. The doors should be padded to avoid injuries when falling or closing. The length and size of the traps must be large enough that an animal is completely inside the trap when it releases the trigger. A small lockable window is left in both paddle doors for visual inspection. When captured, the lynx is narcotised through these windows with a blowpipe.

Fig 1. Box traps are used on trails to capture lynx, assuming that the lynx will use the easiest passage. *Photo*: B. Hoxha

Rules for managing box traps:

- One person is responsible for box traps throughout the whole capture season.
- If this person is not available, he/she is responsible to find a replacement.
- If no replacement can be found, the box trap needs to be blocked during the absence of the responsible person.
- The alarm system is programmed to send a control message upon a call request from the responsible person, projecting its status and battery level.
- At each visit, snow/ice/mud is removed from the surface, the fence around the trap is corrected if needed, and the functionality of the box trap, surveillance system and the alarm system is checked.
- In the presence of snow, a trail is made also on the opposite side of the box traps.
- The responsible person keeps an activity log (trap activation, date, time and species caught, date of checks, people who checked it and remarks on what was done) using a standard form.
- If available, each trap is lured with lynx urine, scats or with hay that stays for several weeks in the lynx cage in the zoo.

An alternative to box traps are **foot snares** for medium-sized carnivores. Soft catch traps or Belisle traps can be used, but for capturing lynx the use of the Swiss system is spreading. The Swiss foot

snare has been developed specifically for capturing lynx (Kubala & Breitenmoser-Würsten, 2024). They have been used successfully in Switzerland, Croatia, France, Germany, Italy, North Macedonia, Norway, and Slovenia for several decades. The snares are equipped with a spring in the bar that accelerates the pull effect of the wire, but also acts as a shock absorber and prevents foot/muscle damage.

Fig. 2. Snare traps set close to a lynx kill. *Photo*: D.Melovski

Snares are set around a lynx prey, as chances are high that the lynx will return during the night to feed if there is still meat left. As with box traps, special caution has to be taken with regard to the risk of capturing a (young) bear (see below). The trap should be inspected from a safe distance. Box traps and snares must be equipped with an alarm system (satellite, GSM or VHF) to alert the capture team. Camera trap surveillance is also recommended in order to be immediately informed of what triggered the trap. Especially when capturing with snares, the intervention should be really quick (less than 30 minutes to the site is recommended). Pop et al. (2018) and Kubala and Breitenmoser-Würsten (2024) provide further details about box traps, snares, their installation, capture procedures and team safety.

Rules for snare captures:

- Prior to the activation of the trap, tasks are distributed among the people present to ensure maximum efficiency during the handling procedure.
- The prey remains are tied to a tree or earth screw.
- Depending on the situation and the personnel available, it is decided beforehand whether the lynx will be immobilised with a net to inject the narcotics, or whether the use of a blowpipe or dart gun is more convenient.
- Traps are continuously monitored.
- The capture team waits at a suitable location close by but sufficiently distant to avoid disturbance.
- The narcotics are kept at body temperature.

All non-targeted animals caught in any of the traps have to be released immediately on site. Bycatches must be handled in a way to minimise the risk of harm and injuries and should be freed without immobilization whenever possible. Capture teams have to take special precaution when handling the capture of bears, wild boars etc without risk to people or animals. Noise, bright light and hasty movements are a stress factor for all animals caught and need to be restricted even if an animal is immobilised. If a bear is caught and not able to free itself, the capture team first needs to check the surroundings for the presence of other people and give warning. If the bear cannot safely be released from a distance it has to be tranquilised. Remember that there is no hurry, the safest option should be chosen, even if it takes longer. Bear spray is safer than a gun (Pop et al., 2018). If available, it is advisable to consult and involve Bear Intervention Teams to handle such cases.

Anaesthesia

Regarding physical capture, several anaesthesia protocols have been developed in Europe (Kubala & Breitenmoser-Würsten, 2024; Kvapil et al., 2024; Pop et al., 2018). The most suitable anaesthesia for the lynx is performed with a combination of sedatives and narcotics. Experience has shown that a mix of medetomidine and ketamine leads to a reliable, low-risk anaesthesia of lynx in all age groups. Medetomidine is a sedative and can be applied intravenously, intramuscularly or subcutaneously. The medetomidine preparation Domitor or equivalents (1 mg medetomidine hydrochloride / ml) have mostly been used. After intramuscular injection, medetomidine is rapidly absorbed. For Domitor it is stated that absorption in blood plasma after intramuscular injection is very similar to that after intravenous injection; the maximum plasma concentration was reached within 15–20 minutes and the elimination half-life was about 1.5 hours (Kubala et al., 2018).

Ketamine (Ketasol-100, 100 mg Ketamine / ml) is used to completely eliminate the awareness in addition to medetomidine. It is an anaesthetic (cyclohexane) with hypnotic properties that causes a functional and electrophysiological "dissociation" between the thalamus and the limbic system. It has a fast but relatively short effect (about 30–60 minutes, depending on dosage). Important potential side effects include an increase in blood pressure and heart rate, initial suppression of respiration and, if used alone, a high risk of convulsion. Ketamine can be injected intramuscularly, intravenously or subcutaneously. There is no antagonist for ketamine but this substance is characterised by a high therapeutic index. In case of overdose, the convulsions can be attenuated by the administration of diazepam (Valium) (Kubala et al., 2018).

Atipamezole is an α2-antagonist. This drug abolishes the sedative effect of α2-adrenergic agonists (medetomidine). It can be administered intramuscularly, intravenously or subcutaneously and is excreted through the urine. Both Antisedan or the generic drug Alzane can be used. It is stated that atipamezole exerts its effect 5–8 minutes after intramuscular administration, but that there are species-specific differences. High doses can cause increased heart rate (tachycardia), increased or decreased blood pressure, anxiety, shaking and cramping. If medetomidine has been injected in combination with a cyclohexane (ketamine, tiletamine), atipamezole should not be administered until at least 30–45 minutes after the last cyclohexane injection (i.e., after the cyclohexane drug has stopped working).

If an animal is trapped, the approach is made as soon as possible after capture and with as little disturbance as possible, i.e. quietly and with the minimum necessary number of persons. Drugs are administered by means of a blowpipe, dart gun or directly by hand with a syringe, depending on the type of capture. The dose used in Switzerland was identical for subadult and adult lynx of both sexes (but adjusted to juvenile lynx): 2.8 ml Domitor and 0.8 ml Ketasol-100 (Ryser et al., 2005). Kvapil et al. (2024) recommended a lower dose of medetomidine of 0.04–0.06 mg / kg, but in combination with butorphanol 0.05 mg / kg, with similar values of ketamine (3–5 mg / kg) in healthy lynx.

After the first injection, it is highly recommended to wait 20 minutes for the sedatives to take effect. If an approach / manipulation occurs too early, there is a great risk that the animal regains full consciousness. Consequently, the chemical immobilization of the animal will be more difficult and also associated with greater anaesthetic risks (Kubala et al., 2018). If no more reactions are detectable, including no reaction when touched in the insides of the ear, the animal is taken out of the trap and laid on its right side. The respiratory function is briefly checked before it is moved for further manipulation. Depending on the weather (hot/cold) the animal is placed on a flat sheltered place that is able to mitigate adverse conditions.

Lynx captured are checked for health issues (Molinari-Jobin et al. in prep.). Blood samples (and other genetic samples like saliva and hair/whisker) are taken for further genetic monitoring and disease diagnosis, and depending on the country of capture they are vaccinated against rabies. If lynx are captured for research purposes in the frame of the BLRP, they are fitted with a radio-

collar. If the animal is to be translocated, the collar will be fit at the end of quarantine, prior to transport to destination. For future identification during camera-trapping, photos of both flanks are taken with the legs spread out in a “walking” position (Fig. 3). Furthermore, the animal is weighed and body measurements taken. During the whole time of anaesthesia, the vital rates need to be controlled. Oxygen supply is mandatory (Kvapil et al., 2024). After all the necessary manipulations have been completed, the anaesthesia is antagonised as soon as possible. In a trouble-free catch the antagonist is given at least 60 minutes after the last injection of ketamine into the thigh muscle so that the animal is fully functional after waking up. See Kubala et al. (2018) for countermeasures in case of complications. If an animal which was meant to be translocated does not meet the selection criteria for translocation but is fit to live in the wild, it is released on spot, if possible with a radio-collar.

Responsibilities of the field team leader:

- Coordinate the action and give clear instructions to all people involved.
- Make sure that all field personnel know how to behave and which role each person has during the action.

Checklist:

- Tranquilise the animal.
- Conduct a clinical examination to evaluate the health status (see Brandes 2024, Molinari-Jobin et al. in prep. for details).
- Take blood samples for necessary blood tests – antibody titer against rabies, FIV, FeVL, parvovirosis and DNA extraction.
- Photograph the animal from both sides for future identification purposes.
- If applicable, make the vaccination against rabies at the capture site.
- If applicable, mark the animal with a microchip.
- Prophylactic treatment with ivermectin or doramectin and praziquantel is recommended for clinically healthy lynx for translocation (Brandes, 2024).
- If released on site: check the collar functionality (VHF signal, all magnets removed) and collar the lynx.
- Reset or deactivate the trap.

Fig. 3. Photos of both sides of the lynx are taken for future identification during camera trapping. Legs need to be spread out in “walking” position. *Photo*: Sebastian Kennerknecht

Transport

Even though transport is a stressful operation for the lynx, complications have seldom been reported. However, only fit animals are to be transported. Female lynx must not be transported if they are at 75% or more of their expected period of pregnancy. Lynx are transported when they are fully recovered from the narcosis. This allows them to regulate their vital functions themselves. Main complications come from stress, which may result in hyperthermia. The animal must be surveyed, but in a way to avoid additional stress.

To ensure maximum animal welfare, the transport (from the moment of loading the animal onto the authorised transport vehicle until it reaches the final destination) must be well-planned and prepared. Weather conditions, potential causes for delays (e.g. border waiting time, status of transport routes), legal obligations that may include live animal transport licenses, locations of fuel and repair services, etc. should be investigated and must be taken into account prior to the onset of transport (Kubala et al., 2018). The transport is handled smoothly, transport time is

minimised and the journey is interrupted only if absolutely necessary, with the availability of several drivers during longer transports (Kubala & Breitenmoser-Würsten, 2024).

During transport, animals must be protected against bad weather and extreme temperatures. The lynx is kept in as much darkness as possible (but note the air supply!). Overnight transports are the most suitable for long distances. The calmest and quietest environment possible is ensured. More generally, if an EU country is involved, the Regulation (EC) No 1/2005 (2005) on the protection of animals during transport and related operations applies.

The best option to transport a lynx is to use a transport box. For lynx, its size should be at least 90x60x50 cm (length, width, height) and must have appropriate ventilation. The transport box is constructed in a way to prevent tooth and claw injuries and is placed safely and fixed (Kubala & Breitenmoser-Würsten, 2024). For more information on the transport box see Kubala et al. (2018) and Pop et al. (2018). A two-door system has proven to be effective (Fig. 4). This provides the option to keep the animal concealed, for instance when loading and unloading, and providing access to more air as well as access to the animal for regular checks when in the car. If the transport lasts longer than eight hours, the transport box should be equipped with the possibility of providing water (Fig. 5). A healthy lynx does not need food during the transport.

Fig. 4. Transport box with double-door system. The inner door is made of metal bars, the outer door can be adjusted to necessity (complete darkness when down, better airflow when up). *Left photo*: A. Molinari-Jobin, *right photo*: E. Furlani

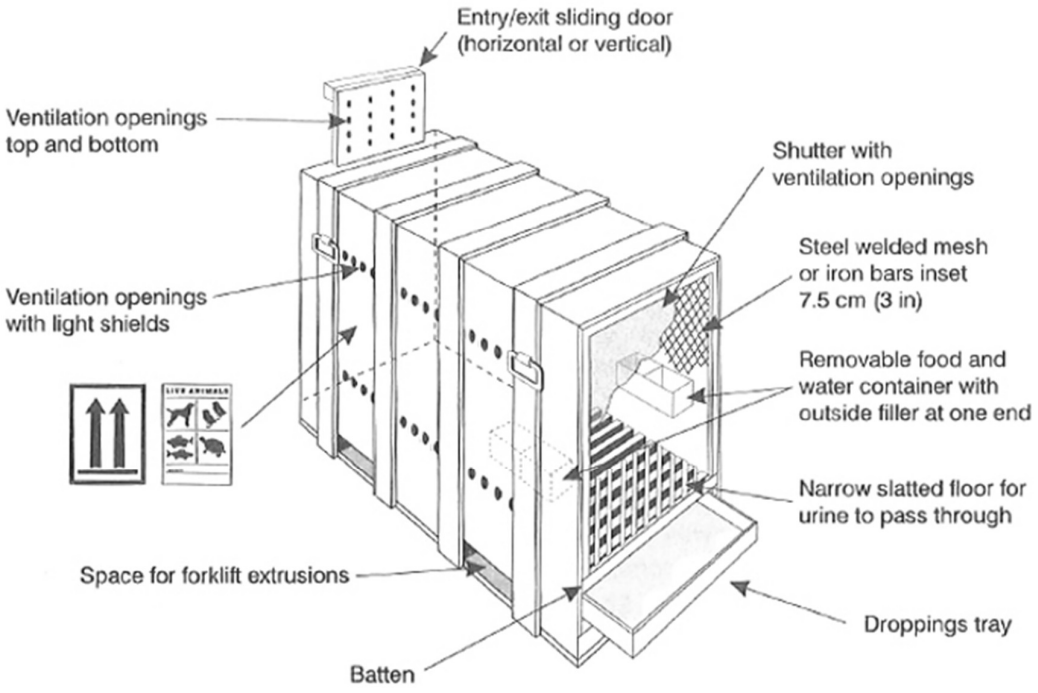

Fig. 5. Transport box for medium- to large-sized carnivores based on IATA rules. *Source*: IATA Live Animals Regulation, 39th Edition, October 2012, page 340.

The transport of the lynx from the capture site to the car may pose a challenge. It is always best to use a transport box, however, depending on the terrain this is not always possible. Over a short distance (less than 30 minutes), a lynx can be transported when immobilised. In case of very long-distance travels between quarantine and release site, the use of an aircraft should be evaluated.

Requirements for international transport of lynx

Balkan lynx range countries (with the exception of Kosovo) have signed the Convention on International Trade in Endangered Species (CITES) and must therefore follow the respective resolutions and decisions. In Articles III, IV, V and VII, the convention requires Management Authorities to be satisfied, before granting export permits, or re-export or travelling exhibition certificates, that specimens will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment. Therefore, the CITES GUIDELINES FOR THE NON-AIR TRANSPORT OF LIVE WILD ANIMALS AND PLANTS (2022) need to be followed. If the lynx is to cross a national border, CITES papers need to be provided. They are requested by the animal "keeper" (capture team, quarantine centre) in the country of origin to the local CITES authority before

transport. Although not strictly necessary, it is recommended to send the pdf of the documents to the CITES authority in the receiving country beforehand for check-up. The original document has to accompany the lynx during transport.

If a lynx is transported through a European union country, TRACES needs to be filled in. TRACES is the European Commission's online platform for animal and plant health certification required for the importation of animals, animal products, food and feed of non-animal origin and plants into the European Union, and the intra-EU trade and EU exports of animals and certain animal products. Representatives of businesses operating in the agri-food chain, sanitary and phytosanitary authorities, organic control bodies, border control posts, etc. from both EU and non-EU countries use TRACES for certification purposes and information exchange. The responsible veterinary authority of the receiving country needs to insert into the system the person who will receive the lynx. Before departure, the veterinarian of the quarantine centre fills in place of departure, animal identification and health status. Upon arrival at the destination, the veterinary authority at the destination needs to certify that the lynx has arrived and is healthy.

In European Union member states there is no obligation of a veterinarian to accompany the transport. If they do, they are allowed to possess and administer even those veterinary medicinal products not authorised in the host Member State to animals which are under the veterinarian's care in the necessary quantity not exceeding the amount required for the treatment prescribed by the veterinarian (Regulation (EU) 2019/6, 11. December 2018, art. 111). Documents which should accompany the lynx during transport are the health certificate, CITES, passport and notification that animals are wild, may be frightened, and can be dangerous (in English and local languages if necessary).

Veterinary requirements for lynx translocations

All national regulations regarding the capture and release of wild animals in the source and destination countries, as well as CITES regulations need to be followed. It is best practice to get in contact with the veterinary authority in the destination country well in advance of the planned translocation and agree exactly on what needs to be done at what time. If the transport passes through an EU country, we also recommend that the veterinary authority of Albania, Kosovo and/or North Macedonia gets familiar with TRACES.

The competent veterinarian of the source country will have to provide all the requested documentation.

Quarantine

Keeping wild animals in quarantine serves the purpose of avoiding any spread of diseases caused by movement of sick animals into a new environment. In general, animals are kept in quarantine in the country of origin, but there may be exceptions for lynx captured in countries where no adequate facility is available. Besides preventing the spread of diseases, quarantine can also be advantageous because 1) it allows to observe the animal in order to assure it is fit, 2) it allows the assessment of the suitability of its genetic profile, 3) it allows some flexibility for organising transport, and 4) it may "break" the homing behaviour, i.e. the return to the original home range (Kubala et al., 2018). Additionally, the quarantine can also serve for temporary care of orphaned or injured lynx.

The quarantine area must be separated from other departments where animals are kept and equipped in such a way that hygiene barriers prevent the spread of infectious agents. All surfaces (walls, floors, furnishings) in the quarantine area should be easy to clean and disinfected or replaced. Various infectious agents (viruses, parasite stages) can survive in the environment for long periods of time and, if not completely eliminated, can render enclosures unusable. Hence, each quarantine unit must be cleaned and disinfected after the departure of a lynx.

The quarantine stations are isolated both visually and acoustically from people and other animals. Unauthorised persons have no access. Walls and doors should be lined with smooth materials preventing the animals from biting or scratching in order to avoid serious teeth and claw injuries. Units are enriched with elevated parts as well as hiding possibilities and shelters for protection against sun and rain. Ideally, the lynx has access to two compartments with the possibility to confine the animal in one in order to clean the unit once a week from faeces and uneaten food (Brandes, 2024).

Contact with the lynx in quarantine should be kept to a minimum to avoid habituation and reduce stress. Fresh water needs to be provided daily and in a way that there is no need for the animal keeper to enter the unit. Preferably fresh cadavers of roe deer, red deer or chamois will be provided every 4–7 days considering also the rhythm of consumption of the carcass.

All areas must be visible and accessible for health checks (video surveillance preferred) and have access for blowpipe or dart gun for anaesthesia. During quarantine, the tranquilising action should be maintained at a minimum. But depending on test results of blood taken during first capture, second tests may be necessary requiring anaesthesia. If this is the case, lynx may already be radio-collared at this stage to avoid an extra anaesthesia before transport. If no exit anaesthesia is necessary, it is useful to have a system of capturing the lynx in a box trap from where it can easily be transferred to the transport box.

In general, a quarantine period of 30 days is recommended to cover diseases with a correspondingly long incubation period and prevalence. However, it may make sense – in order to

reduce the stress burden on the lynx – to limit the quarantine period to the time when all test results are available and no positive findings speak against a release into the intended area. This is especially true for wild-caught animals that are highly stressed by captivity (Brandes, 2024). The duration of the quarantine therefore depends on the following (Kubala et al., 2018):

- The success/results of the blood test (antibody titer against rabies, FIV, FeVL, parvovirosis, genetic profiling).
- Health and behaviour of the animal.
- The time when the rabies vaccine was given (if applicable).
- Obtaining all the legal documents/approval requested for international transport.

Capture of kittens

To monitor reproductive success, kittens are captured at an age of two to four (maximum five) weeks, ideally three weeks. At that age, kittens can be handled without anaesthesia. It is best practice to put kittens into a fabric bag when not manipulated, so they do not walk away (Fig. 6).

Manipulation:

- Weight
- Saliva for genetics (three samples per lynx)
- Hair for genetics
- Blood sample (if possible)
- Measure distance between genital openings and anus for sex identification
- Take photos of legs for potential future identification

After manipulation, the kittens are placed back into the den. The whole operation should not last longer than half an hour.

Fig. 6. Lynx kitten in a bag. *Photo*: E. Furlani / Progetto Lince Italia

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