WILDLIFE RESCUE IN NEPAL

A Field Guide to Veterinarian and Wildlife Technicians

Department of National Parks and Wildlife Conservation
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Foreword

Wildlife Rescue Centres in Nepal are established to support orphaned, injured, problematic, sick, or displaced wild animals. In recent years, wildlife rescue centres have significantly improved in terms of treatment and rehabilitation facilities, employing trained wildlife technicians and providing essential resources for their sustenance. Article 15 (Ga) of the National Parks and Wildlife Conservation Act, 2029 BS (5th Amendment, 2076 BS), emphasizes that individuals, institutions, or local bodies can operate wildlife rescue centres to promote animal welfare and mitigate the issues of human-wildlife conflict.

This Wildlife Rescue Field Guide provides general guidelines to assist wildlife technicians in making informed and systematic decisions during rescue operations. This document compiles essential knowledge and practical experiences specific to Nepal's wildlife conservation. Rescue operations involving highly risky animals such as tigers, leopards, sloth bears, Himalayan black bears, and rhinos require the involvement of highly trained and experienced personnel. These operations are equipped with darting gear, sedative drugs, and specialized transport facilities. In case of other less risky animals such as snake, reptile, bird, and deer have been rescued using basic techniques, knowledge, and limited equipment. Active participation from local communities, biologists, and local leaders has proven effective in rescuing these animals. Critical components of a successful rescue include quick species identification, an understanding of animal behavior, knowledge of proper rescue techniques, and awareness of community responses. I hope this document helps to bridge the knowledge gap for veterinarians, technicians, and field personnel involved in wildlife rescue operations, helping them carry out their work safely and effectively.

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Director General

Chapter-1

Background

Wildlife rescue and rehabilitation is considered a modern practice, however, people have been helping animals in distress through informal and undocumented means for thousands of years. From a global perspective, the emergence of professionalism and standardisation in these domains is a relatively recent development, tracing back to the latter part of the 20th century, when it is now being closely tied to wider environmental and conservation movements (https://www.resqct.org/resq-blog/ethicswildlife). Wildlife rescue and rehabilitation involves procedures for rescuing wild animals in distress using effective handling methods, necessary care, treatment, feeding, weaning and preparing for release into their natural habitats. The field personnel require to have knowledge of capture and treatment including thorough understanding of an animal's physiological, behavioural, and ecological requirements.

The rigorous efforts of Nepal Government, local communities and conservation organizations on protection of biodiversity and combat poaching has led to the restoration of wildlife habitats resulting into an increase in the number of endangered species. These efforts have been regarded as successful for increasing the number of rare and endangered species such as Asian elephants, Royal Bengal Tiger, Snow Leopard, The Greater One-horned Rhinoceros, Common Leopard, Clouded Leopard, Asiatic Wild Buffalo, Gaur, Black buck, Himalayan Black Bear and Sloth Bear, and two species of crocodiles, some reptilians such as snake, and many bird species.

With the success achieved in the conservation of wildlife, conflicts between humans and wildlife are increasing primarily because of sharing of natural habitats and resources by both the entities of the ecosystem. The extent of conflicts is heightened in the buffer area of the protected areas of corresponding national parks and wildlife reserves and adjacent divisional forest areas in various parts of the country. The conflict situation is more dominated by species such as Asiatic elephants. Elephants have intrinsic long-range foraging behaviour and travel long distances seasonally to foster their life cycle and

have become one of the major conflicts causing species whereas tigers, leopards, rhinos and others have limited home ranges and thus the problem is also localised. The utmost concern whatever the species is, it is the loss of life and properties due to invading wildlife into either the shared habitats or directly into the community areas.

Maintaining harmony between various species of wildlife and community peoples for coexistence is of primary concern today. This is in fore front of the government programmes and has continuously addressed by developing human wildlife friendly policies, deterring wildlife through artificial barricades, improving wildlife habitats, educating local peoples, promoting the skills for coexistence, distributing compensations and safe capture and rescue of the offending wildlife for minimising both human and wildlife casualties.

Capture, rescue and rehabilitation are the key strategies to save the wildlife involved in the conflict areas and to minimise their adverse effect on normal socio-cultural integrity and functions. Many wildlife species such as elephants, rhinos, large felids, hyaenas, bears and crocodiles are very hazardous to people as they can harm peoples through traumatic attacks. Many other species such as antelopes, deer, wild boars, porcupines, wild buffaloes and monkeys are mostly concerned for crop damage.

In conclusion, it is the public responsibility to relieve the sufferings of both wild animal species as well as the sufferings of local communities due to the presence of wild animal species in their surroundings. Wildlife capture, rescue and rehabilitation is one of the recently adapted everlasting plans to ensure the safety of both human and wildlife. Wildlife escaped or displaced from protected areas or national forests whatever is the situation, if rescued promptly, the potential damage to public life and properties as well as retaliatory actions towards escaped wildlife can be reduced, and the perception towards wildlife in the local community could become positive. Such rescue and rehabilitation activities have been carried out by protected areas with the technical assistance of NTNC field offices, rather promising budget allocation for capacity development and purchasing of equipment for wildlife rescue and rehabilitation by a number of forest institutions signifies a positive trend and enhanced stewardship towards wild animals and affected peoples. Prompt and strengthened rescue operations and establishment of wildlife rescue and rehabilitation centres in human wildlife conflict prone areas shall definitively contribute to the reduction of human-wildlife conflict all over Nepal. The newer wildlife rescue and rehabilitation centres established in the national parks and wildlife reserves shall play a crucial role to provide essential services to care for and rehabilitate injured, sick, or orphaned wild animals. Wildlife rehabilitation centres serve as hospitals and specialised recovery facilities for injured, sick, or orphaned animals, offering them a chance at recovery and eventual release back into their natural habitats providing second life contributing overall health of local ecosystem. An organised wildlife rescue centre can also offer public outreach programmes and enhance public awareness and understanding of ecological role of each species and protecting ecosystem processes in the local area. However, the process involves the availability of well-trained manpower, specialised equipment, drugs and cages for wildlife capture and transportation, raising of orphan wildlife and financial resources to deliver the services promptly. Sufficient funds need to be allocated to acquire newer animal capture and handling technological tools and skill development for field rescue personnel to handle the rescue of all species of wild animals including mammals, reptiles and birds, this simplified field guide has been prepared for helping field personnel engaged in problem wildlife captures, care, transportation and rehabilitations.

Chapter-2

Knowledge Essentials for Wildlife Rescue Team

2.1 Knowledge Essentials

A dedicated 'Wildlife Rescue Team (WRT)' sometimes referred to as 'Rapid Response Team'(RRT) is established for every protected area including its buffer Zone. The Division Forest Offices (DFOs) at districts or areas with high potential of human wildlife conflicts also establishes a similar team for the capture and rescue of wildlife that are involved in conflicts. This ensures the protection and rescue of injured, orphaned or displaced wildlife in DFO's command area. In general, WRT may comprise veterinary officers, wildlife officers, forest officers, rangers, veterinary technicians, wildlife technicians, game scouts, armed forest guards, Nepal Army,, Nepal Police or other security agencies, wildlife rescue experts, rescue facilitators, representatives

Rescued wildlife transfering into rescue centre in Banke National Park.

of the wildlife welfare agencies, and closest Wildlife Rescue Centres (WRC) and community leaders as far as concerned. The mobilisation of this team ensures protection, capture, rescue or direct the animal to its natural habitat. The team is equipped with field gears and equipment for rescue activities at the field level and shall communicate with the base office for food, transportation and shelters for rescued animals.

The members of WRT/RRT should possess a number of basic skills regarding species identification, tracking and acting for rescue efforts as per topography and habitat type, species, behaviour and response of the local communities.

Wildlife rescue and rehabilitation is mostly a tedious work when concerned with dangerous animals but may be regarded as simple task if the animals are not dangerous to rescuers and local people. The process first involves the safety of the rescue team members, safety of local audiences if present and the safety of the wildlife in distress in a sequential order. Occasionally even a layman may rescue a wildlife such as a pangolin, baby reptiles and birds, very young deer fawns or even very sick rhino calves. Otherwise, raged animals including tiger, leopard, jackals, foxes, rhinos, hyenas, and others warrants the involvement of highly experienced members with a good knowledge of behaviour and skill of animal handling. Injury to some animals and occasional mortality due to trauma or capture myopathy may happen during rescue operations as an unfortunate outcome in some cases (Tripathi et al. 2003). Sometimes number of individuals and urban or suburban setting is more valuable for consideration while rescuing wild animals whereas some landscapes and ethnic community and their influences to larger population may affect the safety of both concerned wildlife and rescue team members. All these interactions are influenced by current events of human injuries, death, or property damage from an aggressive wildlife species such as tiger, leopards or mugger crocodiles.

Members of the rescue team frequently need to be knowledgeable in a number of different topics which are briefly explained below:

2.1.1 Species Identification

Identifying the species is the first and foremost step for proper planning for a safe and effective rescue of wildlife. Major wildlife species like tigers, leopards, and rhinos are often recognised and reported by local people. However, verification of species, age and sex by a team of wildlife conservation officers, veterinarian, rangers, wildlife technicians, game scouts, biologists,

researchers, tourist guides, and experienced elephant staff (*mahouts*) is necessary. A practical knowledge of key characteristics of felids (cat species) such as size of the body structures and size, pug marks, stripes, teeth and jaws, eyes, etc may be useful to differentiate species and its age status with other similar species. Identifying small feline species such as jungle cats, civets, and common leopards, as well as the six deer species (swamp deer, sambar, chital, barking deer, hog deer, and musk deer), can be confusing unless visual observation of the individuals is done. There have been instances where blue bulls were mistakenly reported as deer species.

2.1.2 Species-specific Behaviour

The natural defence and combat system of every group of wildlife species against any of the threats is varied greatly. The members of wildlife rescue team must be aware species behaviour while capturing. Animal handler must be aware that many herbivores can bite very commonly, use antler and horns and even can kick quickly; tigers, leopards, civet cats and bear species can bite through sharp canine teeth or can use claws to cause injury while primates are also able to bite and kicks. Reptiles such as crocodiles have powerful claws and jaws with multiple teeth and snakes have fangs and poisons whereas birds of prey, owls, and some other birds can injure handlers through beak and sharp talons. Snakes can lift anterior one third of its body glide force fully its anterior portion and bite in self-defence. Rescue team must have also had an idea of maternal instinct toward the young. For example, an injured rhino and also felines can react vigorously and attack rescuers if proper safety measures are not taken while rescuing baby animal. Normally trained elephants are used and security personnels are mobilised in case to deter the mother rhinos reacting to their young calf being rescued or handled by the rescuer team.

2.1.3 Estimation of Age and Body Weight of the Animal

The knowledge of the standard body weight of a particular species of wild animal is important to calculate drug doses and size and strength of transport cages. A standard on age estimation with body characteristics is often used while calculating the drug doses.

2.1.4 Landscapes, Exit ways and Forest Composition of the Rescue Site

The rescue team must be aware of the landscape including roadways, passages, and other routes in the rescue area, so that area for the rescue operation can be determined considering animal and field team safety, accessibility to transport and other logistic arrangement. Such information is crucial as the operation team has to locate the animal for darting. Certain animals such as elephants and tigers may charge the darter after being hit by the dart. The ponds, shallow rivers and existence of good-sized trees to climb in case of emergency should also be taken into account, with extra caution required when the operation is being held during the night-time.

2.1.5 Skill of Site Selection for Positioning Traps/Darter

The wildlife technicians or veterinarians must be skilled in identifying suitable locations on a site where the wildlife to be rescued. This is essential for installing nets, traps, other required accessories or positioning the technician with dart gun and tranquillisers for capturing the animals. The selection of the location depends on the behaviour of the animal such as whether it is nocturnal or diurnal, living in groups or whether it is possible to be tracked through its movement patterns. Very often the best location may be selected by careful onsite investigation. Generally, a *machan* (watch tower) has to be constructed near the placement of bait animals if long hours have to be waited to for the target animal. Occasionally, leopards hiding inside a house in the rural areas must be darted by opening the portion of the roof (in case of Thach/tile roof) for tranquilising the animal. For darting a wild elephant causing conflict in village, strong shelter should be identified. Importantly, the terrain of the capture location, public sentiments and safety concerns may dictate the positioning of traps or firing site for the darting procedures.

2.1.6 Commanding Mahouts

As far as possible, the best *mahouts* and decent elephants should be chosen to recruit in a wildlife rescue work. *Mahouts* having long experience on wildlife rescues and good knowledge of local topography are preferable. Many captive elephants may get afraid or often runaway with members of rescue team on the back when raged tigers jump or roar at the time of search inside the bushes. The *Mahouts* must have firm commanding capability over his elephant as well as a good quality to communicate and understand the local circumstances at the field. Incidents, particularly while rescuing a problematic tiger, may have occurred fleeing the site by dropping its passengers. Similarly, when injured calf rhinos are rescued for the treatment of injuries, the chase of mother rhino is specifically commanded by *Mahouts* and their respective trained elephants.

2.1.7 Skill of Coordination and Communication

2.1.7.1 Coordination Skill

Rescue of wild animals in the current scenario requires proper coordination and cooperation between people from different backgrounds and different agencies. Different approaches and management techniques are required for different species of animals. It is one of the most challenging and difficult tasks to rescue a wild animal and is equally tough to rehabilitate the rescued animals. Restraining wild animals is also a difficult job, so both physical and chemical restraining methods are used.

2.1.7.2 Tolerance Skill

While rescuing the problematic animals from the community or human settlement, it is lengthy, and time taken as rescue team has to manage logistic and safety as well as social crowd. Additionally, public sentiment towards animal may also cause the process lengthy. In such situation, the trust of the people upon the action is lost and many start to chatter against the rescue team's expertise and skill. At such moment, the team members must have greater tolerability of such charges against them.

2.2 Member of Wildlife Rescue Team

Wildlife Rescue Team should be a fully organised team with expertise and equipment in saving wildlife that are sick, orphaned, injured, displaced or confiscated within the range. These teams are mostly assigned to take care and protection of fauna as well as flora in protected areas, buffer zones and Division Forest Office areas who would have authority to act the special power on the legal basis of National Parks and Wildlife Conservation Act 2029 BS. The team members must comprise of multidisciplinary experts with knowledge and experience of legal provisions, rescue planning, wildlife capture and handling, and rehabilitation. The team is led by corresponding protected area staff or Division Forest Officials. The team should be equipped with financial resources, modern drugs, tools and techniques necessary for efficient capture, rescue, treatment and management of the rescued wild animals. A brief idea of human resources and skills required for the rescue operation is described below:

2.2.1 Conservation Officers/ Divisional Forest Officers

This includes Conservation Officers from the respective protected area or Forest Officers from the respective Division Forest Offices or experienced Officers from closest wildlife rescue centres or rangers designated by them for a particular wildlife rescue. Their duty is to lead the wildlife rescue mission and coordinate with security officials, representatives of local government, members of buffer zone user groups and community forest user groups.

2.2.2 Veterinary Officers and Technicians

The involvement of well trained and experienced veterinarian and veterinary technicians is mandatory in the wildlife rescue team. Duty of the veterinarian and veterinary technicians is top select appropriate tranquillising drugs, calculate drug dosages and safely prepare darts. They should evaluate the health status of the animal after darting, collect samples, administer appropriate treatment and antidotes and monitor safe transport. Physical examination of rescued wildlife such as heart rate, body temperature, respiration rate should be carried out by veterinarian and emergency drugs should be administered if required.

2.2.3 Wildlife Technicians

Wildlife technicians are needed in the rescue team whose duty should be locating animals through wildlife signs, tracks and food prints. Wildlife technicians should be well aware of wildlife behaviour and thus guide field team about potential threats to team from the rescuing animal. In case of tiger or leopard rescue events, the team fix the vit cloth around a probable site (white cloth as psychological barrier to tigers) in order to restrict the animal from escaping and to be rescued safely. Experienced wildlife technician shots the tranquilliser darts from appropriate safe locations such as from trees, from vehicles, from machan or from elephant back. They approach the darted animal, immobilise and apply radio transmitters, or assist in cooling or heating of the immobilised animal. The technical team takes quick action for the transportation of tranquillised animals to a safe transport crate, then to the transport vehicle. In case the traps are decided for captures, wildlife technicians decide appropriate location and fix the traps and monitors the area on a scheduled time with safety measures. Similarly, they also place the camera trap in conflict site if required to monitor the status of wildlife especially for large felids to assess the body condition and age. Game scouts, foresters, and forest guards also can play similar roles as wildlife technicians.

2.2.4 Mahouts

Mahouts mobilise the elephants to locate the animal to be rescued both before and after the darting. This is because elephants can navigate through challenging terrain that is inaccessible to vehicles. Mahouts guide their elephants through the forest. The

Rescue team preparing for the operation in Banke.

extensive knowledge of the mahouts on local territory may be used to find the offending wildlife and guide through for animal darting. The condition of the animal, age, sex, size and bodyweight, etc. can safely be evaluated from the back of the elephant

Wherever possible, Mahouts and their respective elephants have specific role on rescue of tigers, leopards, sloth bears and rhinos in the national parks and wildlife reserves. The elephants play very important role particularly to locate the animal before or after the darting.

2.2.5 Biologists/Zoologists

They play an important role in the identification of species, age and sex of the animal to be rescued. Their skill in tracking and locating the animals and post release monitoring and knowledge of species-specific behaviour, feeding preferences, etc. is crucial in rescue and rehabilitation of wildlife species.

2.2.6 Local Leaders

This includes representatives of the concerned municipal offices, member of buffer zone user group and chairpersons of the closest Community Forests, Law and order situation are very important for the safety of the rescue team, local people as well as for the safety of the animal which is expected to be maintained and regulated by these local leaders. Their role in enviable for having close contacts with local security agencies such as army posts (where applicable) and local police units. One must not forget to inform the local leaders before the rescue operations being held at a specified date and time. Local leaders have good knowledge on social dimension which will have profound effect on convincing them in case of conflicts. Local leaders in association with security personnels can control unnecessary gatherings which occur to watch, heckle, and photograph, and some to merely make an ugly display of machoism and false bravado during the wildlife capture and rescuing operations (Ahmed et al., 2021).

2.2.7 Security Personnels and Drivers

This includes a team of security personnels (Nepal Army/Nepal Police/Armed Forest Guards Municipal Police) that are responsible for creating safe environment while rescuing and transporting rescued animals.

2.2.8 Operation force- Crane, Drivers, Labors

For the transportation of the rescued animals, a crane, truck and other transportation means should be available. Well experienced, drives for these vehicles and loaders along with labours are crucial for the smooth operation of the rescue activity. They should follow the instruction provided by the team leader for speed, stops, etc., for frequent observations on the condition of the rescued animals.

Chapter-3

Understanding Circumstances and Situations for Wildlife Rescue

Human-Wildlife Conflict is increasing every day due to several factors including habitat loss, fragmentation, habitat shrinking, loss of habitat corridors, degradation of habitats and grasslands due to excessive resource extraction, human disturbances and grazing pressure by domestic animals. Nepal holds diverse distribution of wildlife species, which vary according to its distinct geographic regions in the Terai, the hills, and the Himalayas. Each of the geographic region has experienced some level of wildlife-related issues including fatal infections, diseases, injuries, poaching, and retaliatory killing. Some animals may fall on irrigation canals, but many animals may be caught on various traps set by poachers. While searching for food at night, certain species may temporarily take shelter near rural forests, residential dwellings, or livestock sheds. Young wild animals may sometimes stray from their mothers and/or natural habitats require rescue and rehabilitation. In each of the situations, human intervention may be required that include driving a stray animal back to the protected area/natural habitats, treating the sick or injured animals, husbandry care of the orphan and old animals, chemical restraining of animals. Similarly, the animals that are trapped are at high risk. Tiger, rhinos and elephants are known for fighting against each other for territorial defence or for establishing dominancy over its rivals or intruder animals and sustain traumatic injuries. The looser or aged animals specially tigers, rhinos and elephants are pushed to the poor habitats or on junctions of human settlements and forest where human activities are most common. Dominant male deer exhibit exceptionally aggressive behaviour during rutting period which is almost unknown even to the rescue team members.

Rescue interventions for capture, treatment or removal of a particular species of wildlife safely from the site involves the participation of a team of experts and intensive management. Physical fitness and sound mental alertness are mandatory among team members. Wild animal rescue usually happens in a non-ideal situation for handling drugs and animal. Depending on the jurisdiction, national park and forest officials must be on a team for

Tiger pugmark

Rescue team observing sign of problematic wildlife in Banke.

wild animal rescue operations in which one or more experienced veterinarian or veterinary technicians, wildlife technicians, biologist/zoologist/ sociologist, local community leaders and security personnels should be included (Ahmed et al., 2021). Necessary permissions must be taken from National Parks/Wildlife Reserves/or Division Forest Authorities as they are the main authorities for wildlife conservation, and hence their permissions and leading roles are mandatory to undertake and execute any rescue operation.

From the experiences of last few decades, it is evident that wild animals in Nepal sometimes spotted in the settlements may need rescue to allay the locals' fears of losing their lives and property. These conditions that animals require rescue are summarised here under:

3.1 Displacement from Habitat

The habitat of rhinos and tigers in Nepal is surrounded by human dominated landscapes, hence in many cases rhinoceros and tigers stray out to the human habitations and causing human-animal conflicts where rescue is inevitable to stop human casualties. Occasionally, tigers during their usual roaming activities through the stretches of different habitats along the narrow streams in a misty and foggy nights may reach areas of human settlements and often enter houses feeling a safe refuge. Additionally, some tigers while looking for appropriate habitats may settle down in a small strip of forest patches near human settlement and begin wandering the agricultural field and cattle sheds, creating safety concern for local peoples. Same situation may apply with many other species and in such circumstances a quick rescue of the animal saves both human and animal life. Such displaced animals can be directly rehabilitated after safe capture, rescue and medication, if required, to the similar and appropriate natural habitat. Particularly in the Monsoon period, many young rhinos are washed off by flood and sided near the villages, which then wanders around. Such rhinos must be rescued and rehabilitated in safe and natural habitats.

3.2 Traps and Snares

Poachers often use nooses made of ropes, wires, or brake cables set in forested areas to illegally capture wild animals. According to local residents, the likelihood of discovering wild creatures living in such traps is accidental. Delicate, single-strand wire snares are used for smaller animals like wild rabbits which often goes unnoticed whereas thicker and robust snares set to capture larger ones such as wild pigs and other herbivores like barking deer. As placed for small animals, but larger animals are also likely to be caught on the snares. The wire traps set illegally for herbivores at or near the edge of agriculture and forest land accidently traps leopards. Gharial crocodiles suffer from gillnet that is thrown along rivers often for fishing because it entangles on their long snouts, making it difficult for them to eat and eventually killing them. Occasionally leopards, tigers and Himalayan black bears are trapped on the lethal grip of such wire snares. A trapped wild animal tries and struggles to break free, which frequently leads to injuries, extreme stress. These animals should be carefully rescued because their struggling behaviour could weaken the ropes or wires, which could then break and attack the animal directly in response to the rescue team's provocative behaviour.

3.3 Escapes from Captivity

In certain cases, rescued animals may escape out of zoological gardens or wildlife rescue centres and spotted in unsuitable habitats or on the crowded streets of urban areas. Such emergencies can be solved by wildlife rescue operations. In a case when a dangerous animal escape, public safety, staff safety, animal safety and recapture should be the primary goals where the event is managed through absolute calm environment.

3.4 Rescue of Confiscated Wildlife

Nepal is frequently being used as a transit for the smuggling of live wild mammals, reptiles, and birds to other nations. There are number of examples that include confiscation of dancing bears for fun within the country; pangolins, and turtles captured and smuggled to Tibetan border from Nepal. Likewise, many internationally smuggled live wildlife specimens are confiscated and detained in Nepal; couple of times, common chimpanzees, and ring-tailed lemurs and some species of birds including falcons, owls, and macaws have been confiscated and rehabilitated in the local zoos. For implementing CITES regulations, these confiscated animals can be safely transferred to Wildlife Rescue Centres for their care and wellbeing until their repatriation to the country of origin.

Wild boar piglets rescued from illegal possession in Chitwan, 2024

3.5 Diseases and Injuries (Intraspecific Fighting)

Animals in the wild can suffer from many kinds of infectious and non-infectious diseases, including malnutrition, intoxications and physical injuries. Such animals, if noted, can be rescued, treated and rehabilitated back in the wild. Many incur severe injuries due to intraspecific competition over territory or for mating and die due to pain and haemorrhages, and due to physical inability to graze, hunt or defend predators. In such instances, mega animals are captured and treated in the field whereas most carnivores are rescued and transported to the wildlife rescue centres for medical treatment. Rhinos, tigers, and elephants have been mostly found injured because of territorial fights in their natural habitats and are treated and released.

3.6 Rescue of Straying Wildlife

Many wildlife species such as tigers, leopards, wild boars, rhinos, wild buffaloes and sometimes elephants in Nepal frequently stray around human settlements and farmlands. Some snake species may enter and even stay indoors or in the surrounding. Because of the presence of wild animals in human utility areas, the possibility of losses of life and property is increased which imposes some kind of fear and compromised safety and restricted movement among local peoples. Such circumstances also create retaliatory actions that hampers the survival of straying wildlife. In such situation, wildlife rescue and rehabilitation are the only way to safeguard the animal and minimise the adverse consequences.

3.7 Natural Disasters

Young rhino calves are often separated from their mother amidst floods in Chitwan and Bardia districts and there is a safe rescue and rehabilitation practice ongoing for decades. Additionally, 12 rhinos were washed away from Chitwan National Park, Nepal to Susta area and nearby village in Western Nawalparasi, Nepal and city of Bihar, India, which were successfully rescued by rescue team of Chitwan National Park (DNPWC, 2022). For a smooth rescue operation, Nepal government has already developed a transboundary rescue operation guideline for the greater one-horned rhinoceros (DNPWC 2022).

3.8 Mismothering

Failure of an animal to take maternal care of its young is referred as mismothering. Young wildlife immediately after birth or short period after parturition may be left by mother animals. Primiparous females are likely abandon their young after giving birth to their young. Such animals may be rescued and hand reared in the wildlife rescue centres for their survival. This has been noted in deer, rhino, leopard, fishing cat, jungle cat, and elephants in Nepal.

3.9 Fallen in Wells, Canals, Swamps or Trapped in Geological Faults

The intensity of such instances as wildlife falls into the canals and cannot come out of it is not very common. Occasionally leopards have been found fallen into the deep wells, and few rhino and elephant calves, deer species and Nilgai have been reported fallen into the irrigation canals. If unnoticed, these animals virtually die, but if the event is noted, attempts are made to fill the portion of the canal with soil to make them way out of the canal. At condition that the mother is around, captive elephants can be used to block them while rescuing the young ones out of the problematic area otherwise the rescued animal have to be reared in captivity- if the mother animal is already moved out of the area, then they have to be rescued and hand reared.

3.10 Automobile Accidents

Occasionally wildlife such as deer, rhino, leopard and tiger, hyaena are hit by vehilces on the highway passing through the national parks or corridor forests such as Barandabhar forest. In such cases the extent of injury is observed and if treatment is needed, they are rescued and kept in wildlife rescue centres until recovery.

3.11 Trapping in Food Packaging Materials/Gillnets

The careless dumping of processed food and its packaging materials in the wildlife habitats exerts a disastrous effect on wildlife and ecosystem. Wild animals sometimes get access to opened aluminium can or plastic packages with narrow inlet and their head stocked while attempting to excavate left over food (Newsome & Van Eeden, 2017). Eventually the event can kill the animal by inhibiting its sight and prohibiting ingestion of food. Such events require immediate rescue and removal of the object to save the animal but rarely reported. The accumulation of plastic material in the stomach of ruminants severely affect their health and performance. Deer species with prominent antlers while fighting each other entangles the antlers and require rescue for their survival. Occasionally migratory birds are trapped in fishhooks set on riverbanks to catch fishes and need rescue and rehabilitation. Very often, the gillnets used illegally by fishermen in Rapti River in Chitwan National Park have affected gharial crocodiles by entangling into the snout inhibiting ingestion of fishes and requiring assistance for its removal by rescue operation.

3.12 Aggressive Domestic Animal Species

The science of wildlife rescue techniques is sometimes useful to capture domestic animals which has gone feral or semi wild or rabid. Many instances in the past, buffalo and cattle bulls have been restrained by wildlife rescue team using chemical capture methods in Nepal relieving the fear of sustaining traumatic injuries for the concerned farmer communities and municipal authorities.

3.13 Understanding Local Socio- political Circumstances

Straying of tigers into a village, or tiger spotted incidents in any settlement areas attract a large number of people who often circumvent the tiger. As time passes, more people come to see the tiger and the crowd gets bigger. In the event of the inability of the authorities to manage the populace, the tiger is typically terminated due to human attacks and stress. A large crowd and noise can make the tiger nervous and scared and so may provoke the tiger to attack nearby people. The crowd may be so angry that it is impossible or unsafe for the immobilisation team to approach and deal with the tiger. In addition, the people situation may influence options for monitoring, moving, or releasing the tiger after it has been anesthetised (Lewis et al., 2012). So, it is wise to manage the crowd from the beginning of the incident, if possible and keep the crowd safer at distance from the tiger. Opportunistic groups may emerge and provoke the general mass to turn to violent activities.

Chapter-4

Wildlife Rescue Techniques

Vit cloth fixing in the buffer zone of Shuklaphanta National Park.

4.1 Introduction/Key Features

All wild animals have the potential to cause injury to people who handle them and/or are in close contact with them (Warrell, 2012). Large (weighing more than 15kg) or venomous wildlife species like snakes, medium to large felids, bears and crocodiles are most likely to cause injuries (CITES, 2021). All primates and carnivores over 3kg of weight is considered high risk due to their speed, dexterity or potential aggressive nature. Thus, the first concern when rescuing wild animals is the safety of rescue team members and people around the rescue area (DoF, 2017) in the meantime equal priority is given to the safety of the animal concerned. This is achieved by employing standard and advanced techniques, which safeguard both animal and the rescue team members. Therefore, species-specifc techniques and tools are necessary for rescuing wild animals. Also, all mammals, birds and reptiles pose a risk of transmitting zoonotic pathogens that can infect humans. Primates, bats, rodents and carnivores are mammals of particular concern. Thus, appropriate personal protective equipments (PPEs) must be used during handling of rescued or confiscated wild animals.

Wild animals can be captured employing physical and/or chemical methods. The selection of a procedure primarily depends on the species involved, size of the animal, number of animals to be managed, physiological and emotional status of the animal, length of the procedure and level of invasiveness, the environmental conditions, terrain/escape cover, availability of equipment, appropriateness and availability of drugs and most importantly the safety of the rescuers.

When discussing techniques used for wildlife rescue, two types of capture methods are practiced namely physical capture and chemical immobilisation.

Both the techniques can be employed with due care depending upon the species, size, behaviour, and health status of the animal. In cases where the captured animal is aggressive and difficult to handle due to its active behaviour, chemical immobilisation may be necessary to safely carry out extended clinical or management procedures.

4.1.1 Physical (Manual) Restraint Methods

In Nepal, the control of problem tigers, leopards, and other wild animals was traditionally carried out by trapping them using locally built traps. Unfortunately, the common fate of these animals after being captured was often death. Trapping and killing wild animals are inhumane and illegal in the current context. However, locally built traditional traps are still used to trap common leopards, if other methods fail, and later rehabilitated to suitable habitats. Physical restraint and handling can be practiced to captive wild animals and are useful in rescue centres and zoos. Very often animals can be transferred into squeeze cages by patiently encouraging them to enter a transport crate using food as enticement. Then animals can be squeezed and can be restrained for a brief period so that procedures such as clinical examination, sample collection, injection of drugs, or tagging, etc. can be carried out safely, minimising risk to both handler and the animal. However, this method is applicable to tamed and seriously sick animals and has several limitations. Physical methods are well suited for capturing small animals, birds and reptiles as these animals pose limitations to darting (have small darting surface on the body), are shy, maintain a large distance on approach and are often hidden in thickets/bushes. Physical restraint methods for free ranging wildlife captures are not considered applicable. However, foot hold traps for snow leopards have been used for trapping followed by chemical immobilisation and carried out the intended procedures. Baby mammals, different species of snakes and birds or terminally sick animals can be rescued by using this method.

Physical restraint methods include various systems and devices designed to facilitate the safe handling and control of wild animals. It is important to understand the individual animal's temperament and behaviour, strength and retrieval capabilities and the handler's safety when choosing a physical restraint procedure. The terrain and topography of the area must be understood thoroughly before a procedure is put into practice. An animal often attempts to escape when trapped, which can injure himself requiring a humane medical treatment immediately.

Physical restraint is easy to operate and do not pose much risk to the animals, it has several limitations and many times it is unachievable. Physical capture involves the use of devices such as catch poles, traps (foot hold and boxes), crush, bags, ropes, restraint board and nets, which restrict an animal such that it can be handled or chemically immobilised afterwards. Generally, nets are employed when a small group or herd of deer species (chital, swamp deer and hog deer) are to be captured at a time for research or rescue purposes. Nets (linear drive nets or drop nets) can be easily set in open areas and removed and is useful for species that cannot be approached easily. Taking out netted animals may often be quite stressful for certain species resulting in injuries. Blind folding of head with appropriate cloth or blankets may be beneficial to restrict vision and resulting excitement and stress to the captured animals. Animals entangled in fences or other types of wires or snares may be controlled and rescued using catch poles. A catch poles is a light weight, usually aluminium, sliding tube with a plastic- covered wire cable for the loop, and a cable locking system.

Trap cage can be placed for capturing common leopard, where traditional wooden trap cages are prepared by trapper which still are implemented in the division forest areas in mid hill region of Nepal. Leopard captured in these cages are transferred to the transport cage with or without chemical immobilisation. Sometimes if required for invasive intervention then leopard is immobilised.

4.1.2 Chemical Restraint Methods (Chemical Immobilisation)

Restraining animals through chemical immobilisation (popularly known as darting) is one of the most used techniques in wildlife rescue events of aggressive animals. Chemical immobilisation involves the use of sedatives and/or anaesthetic drugs to render an animal unconscious or docile enough to be safely handled prior to capture. In such cases, the immobilising drugs are delivered

Rescue team preparing chemical immobalisation in the buffer zone of Shuklaphanta National Park.

remotely. Chemical restraint is one of the most reliable methods for restraining wildlife when required, indicating it a valuable tool in wildlife conservation, research and management. Wild animals are likely to be intensely stressed during capture because they are not conditioned to human handling. Wildlife rescued in Nepal by this method includes large wild feline species (tiger and leopards (common, clouded and snow leopards)), large herbivores (rhinos, elephants, wild buffalo, gaur, sambar deer, swamp deer, and blue bull), and small herbivores (chital, hog deer, barking deer and musk deer). The rescue of Himalayan black bear and Rhesus macaques are among other species. This method requires highly skilled and experienced personnel particularly for the selection and safe handling of sedative drugs, preparation of darts and use of remote drug delivery equipment such as dart rifles, blow pipes, jab sticks, etc. It requires a high skill and basic technical knowledge of handling darting equipment, tranquilliser medicine and tranquillised animals. Problem tigers, common leopards, sloth and Himalayan black bears, rhinos, etc. have been rescued well in Nepal using chemical methods. The rescue of offending strayed, displaced, injured or sick wildlife by these methods have been extremely useful to reduce human-wildlife conflicts and losses of such animals due to retaliatory killing. This technique is regarded as the safest technique to rescue for wildlife and handlers but are employed mostly at or near the national parks, wildlife reserves and their buffer zones. But recently, the scope of wildlife rescue work using this technique have been attempted to expand to division forest areas through purchase of tranquillising rifles, drugs and other necessary things as well as providing extensive training on wildlife handling to concerned staff.

Chemical immobilisation involves the use of drugs to restrict animals' movements by inducing a state of insensibility and preventing deliberate and coherent mobility. The technique is well suited for medium and large sized animals. It allows the capture of selected individuals and enables selection of the time of capture, the equipment is easy to carry, and it causes minimum disturbance to the animals.

4.1.2.1 Remote Delivery System Equipment and Handling

Various brands of remote drug delivery system equipment have been produced by manufactures, with constant modification enhancing the efficiency and availability. Long range dart rifles manufactured by Palmer Chemical and Equipment, Inc. Douglasville,

Georgia, U.S.A. have been the most widely used dart rifle in Nepal. However, its use is limited now because of difficulties in importing 0.22 power loads, explosives (also known as cap chur charges) and other accessories. This system uses 0.22 blank charges for propelling the metal dart syringe filled with tranquilliser drugs and cap chur charge fitted within the rear part of the metal dart syringe. Upon impact with the animal, the charge detonates and release gas, which then pushes the plunger forward and inject the tranquilliser through the needle into the animal. 0.22 calibre blanks are available in a variety of strengths. Charge strengths are coded by different colours, usually brown, green, yellow, or red, with red being the most powerful. Darts propelled with either yellow or red charges are capable of causing significant injury or death of an animal. Cap-Chur charges also come into three capacities i.e. for 1-3ml, for 410ml and for 15-20ml drug volume; they are also coded yellow (1-3ml), orange (4-10ml), and red (15-20ml) to avoid confusions (Kreeger, 1997). This type of dart gun is very robust and durable; however, the use is being limited due to lack of supplies of accessories and need of rigorous practice for the handling procedures. Additionally, other demerits include the projection of the syringes in high speed, which has a very high impact on animal and causes muscle damages and thus is not recommended for use on small animals.

Dan injects, Tel-inject and several other brands of dart rifles are widely used today, all designed to deliver darts with high accuracy and minimal impact force, making them suitable for wildlife capture and veterinary procedures. Most modern dart rifles utilise compressed air or CO_2 mechanisms to propel darts with controlled force, minimising tissue damage upon impact. Many rifles allow users to adjust the power depending on the distance and size of the target animal, ensuring appropriate drug delivery. Dan-inject and Tel-inject dart rifles are currently in use in Nepal. Understanding of mechanism of action of the modern rifles and plastic dart syringes and frequent target practice and safe dart filling makes the technicians perfect in darting and using such equipment.

In wildlife rescue operations, darts can be fired either from trees, top of the houses, machans, elephant back, vehicles as per the location of wild animals.

All the accessories (Annex 1) including plastic dart syringes and needles are brand specific and may or may not be compatible to the corresponding dart rifles. Animals unable to react or caged may be darted with specific blow pipe equipment or Jab sticks.

4.1.2.2 Care and Handling of Tranquilliser Equipment

Extensive practice is required to perfectly operate tranquilliser rifles (dart gun) during wildlife rescue events. Attaching the CO_2 cylinder or foot pump to provide desired pressure in the barrel, changing the barrel, aiming and estimating the distance between darter and the animal, target site on the animal, and pressing the trigger are key components for practicing. The operator should be very careful while loading the gun with drug filled dart syringes. It is wise to put on safety mode until the aim for darting is achieved. It is wise to depute a member of the rescue team to observe to the target to know whether the target is met or missed out as most of the wildlife species run away to bushes after the dart is inject the animal. In case, the chance is missed, the operator should take out the dart syringe from the barrel and depressurise the dart so that it is safe to handle.

All the dart equipment must store in a lockable cabinet after completion of the rescue task.

4.2 Handling of Drugs and Preparation of Darts

The handling of drugs to capture wild animals requires training and experience. Drugs used in wildlife capture are generally mixture of one or more potent drugs and they are of higher concentrations as compared to the drugs used in domestic animals. This is just to overcome the limitation of space in the dart syringes and propulsion capacity of the darting equipment. Opioid drugs used to capture mega animals such as elephant, rhino, etc. are dangerous if proper safety is not followed. Thus, the instruction of manufacturer must be followed strictly. Human antidote must be in hand and there should be a trained person to administer the antidote in case of emergencies.

The drug dosages provided in this field guide is mostly referred from a book entitled "Hand Book of Wildlife Chemical Immobilisation" (Kreeger & Arnemo, 2012). The more recent information is extracted from articles published in scientific journals and current practices in Nepal.

- Drug handling and dart preparation is generally done in the plain and vantage points. An appropriate place without bushes, vines, dry leaves, etc. should be selected.
- Selection of fresh dart syringes is also important. Pushing the plunger forward and backward a couple of times with the help of syringe and connector is recommended to check movability. The appropriate dart needle should be selected, and the needle must be carefully checked for air passage through the side port, ensuring that the port is properly blocked using the plastic sleeve. The syringe should be pressurised to check the retention of the air pressure within the rear chamber and subsequently depressurised using a de-venting pin.
- PPE such as nitrile gloves, face shields, face masks, etc. should be worn by those who prepare the darts. Ask your rescue member to stay away from the preparation site.
- Human antidote and syringe for administration be kept tidy at the site, and a clearly written emergency action plan to manage the human exposure to drugs or capture-related injuries will be valuable.
- A bottle of clean water must be made ready for washing, if in case the potent drugs are spilled on the body.
- A person should be allotted to watch the drug handling and dart filling process to monitor accidental spilling or punctures by needles.
- It is important to never pressurise the drug bottles with air, and avoid using large-bore needles for drawing drug solution; instead, only use 21-G needles or higher .
- Care should be taken to observe the direction of the wind to avoid spillover drops from contacting the face, and caution must be exercised while recapping used needles to prevent finger pricks.1ml plastic disposable syringes are preferred for handling M-99 and alike drugs.
- If two drugs need to be used, each drug should be drawn with separate syringes.
- Fill the drugs into the anterior chamber of the plastic dart syringe carefully so that it does not overflow. The remaining space can be filled with distilled water.
- Fit the prepared needle and tighten it. Pressurise the dart with the help of 20ml air syringe after covering front part of the syringe with 'safety cap'. Syringe Safety Caps are plastic, closed end, poly nylon tubes placed over the medicine chamber of the dart syringe while it is being pressurised. If a silicone sleeve leaks, the safety cap prevents the liquid drug from being discharged onto the user of the syringe or other individuals in the near vicinity of the syringes while it is being pressurised. Check the presence of pressure in rear chamber with de-venting pin. Attach the stabiliser.
- Load the prepared dart syringe into the chamber of the dart equipment and push the trigger button to safety mode.
- Dispose-off used medical syringes safely (collecting in an empty mineral water bottle and close with lid or burning or burying under the soil).
- All unused prepared darts must be depressurised immediately after unloading from the dart projectors for safety.

4.3 Care and Handling of Immobilised Animals

After the dart has hit the target, a quite environment should be maintained. The exact time of the dart impact must be noted and communication among team members should be carried out using sign language. In the case of fast-moving target such as tiger and leopard, the direction of the movement should be closely monitored, by the person positioned on the treetops. If available, trained elephants and their mahouts can be deployed to move forward from sides to block the animal's forward movement. Signs of anaesthesia induction would be observed in slow pace, staggering gait, loss of balance and finally recumbency. The level of consciousness is accessed by poking from a safe distance with long poles or throwing pieces of wood over the darted animal.

The tranquilised animal should be approached with caution generally from the back of the animal and reflexes (sense to touch by patting the body, palpebral reflex, relaxation of the tail, protrusion of the penis, etc.) are checked to ensure the animal is completely insensible. Then the obstacles around the animals (such as bushes, grasses, vines, etc.) should be cleared quickly

to prepare the place save for working. The eyes must be covered with cotton cloth (preferably dark) and the auditory canal needs blocked with cotton plugs. The dart syringe should be removed and the wound needs cleaned and treated. Vital signs (such as rectal temperature, heart rate and respiration) must be monitored often using thermometer, stethoscope and by observation of chest movements or placing hand on respiratory opening respectively. Quickly, body measurements and body weight (if possible) should be taken and the status of hydration, traumatic injuries and wounds need examined and treated and samples (blood, hairs, swabs, urine, faeces) should be collected to get the other information about animal. Hyperthermia should be treated through splashing cold water over the body of the animal whereas the posture is corrected natural to the species. Ruminants should be positioned on sternal recumbencies to lower bloating. Veterinarians or technicians should access the level of anaesthesia and top up the sedative drugs if necessary.

Immediately, the transport medium such as stretcher, platform, sledge, etc. should be placed close to the animal, and the animal positioned on the medium should be lifted and carried to the transport crate. Carefully, the animal should put inside the transport crate and doors need locked, but the vital signs and posture should be constantly monitored.

An antidote (if available) should be injected parenterally. Highly reactive animals such as blue bulls, wild buffalo, and swamp deer must be injected with short term sedative to facilitate transport and to reduce excitement and self-inflicted injuries. The amount of antidote to be injected should be calculated as per the biochemical standard, practices and experiences. The animal is left in quite environment for smooth recovery. The transport crate should be covered with cloth so that the recovering animal in the crate feel safe and thus reduce the immediate stress, excitement and injuries.

The crated wildlife may be transported to the rehabilitation site for release or to the wildlife rescue centres for further treatments, relaxation and housing depending upon the species and their physical and mental conditions.

Transporting immobalised tiger from the buffer zone of Shuklaphanta National Park.

One or more group of peoples may resist the movement of the vehicle demanding a look or touch to the animal or compensation for the losses due to a particular wildlife species. Local social workers must be able to convince these crowds as a captured wildlife should not be halted for longer.

All the equipment and accessories brought in the field for rescue operation should be thoroughly checked and gathered, and while moving captured animal to the destination, communicating with rescue centre authorities for preparing necessary arrangements for space and food for rescued animal is a critical component.

4.4 Management of Rescued Animals When Dead

Wildlife that are extremely weak, dehydrated or severely injured from intraspecific fighting, or suffering from disease may die during immobilisation, or they may already be in the terminal stages diseases. Sometimes even healthy animals may die during immobilisation procedures due to adverse drug reactions or idiosyncratic responses to certain drugs or regurgitation of ingesta into the lungs leading to choking. Inadequate knowledge to estimate the body weight and faulty calculation of drug dosages may result in death due to overdosing. Any way the animals that die during or following capture should be necropsied to reveal the cause of death. This will be helpful to correct the mistakes, if any, for future operations.

The Department of National Parks and Wildlife Conservation has set procedures for wildlife deaths during wildlife rescue events through approval of "Wildlife Rescue and Rescue Centre Management Procedures, 2073". In case of deaths of wildlife during rescue, the arrangements in the Article 13 of the procedure should be followed that states a post-mortem examination is carried out, and a detailed report with photographs is prepared, recorded, and sent to the concerned offices, in case of death of wild animals during rescue, transportation, while being at the rescue centre, or during treatment,. The carcass is disposed off using deep burial method within the office premises.

4.5 Drug Combinations and Doses

The use of peripherally acting neuromuscular blocker drugs, which block the transmission of impulses and paralyses the muscles has been discontinued in wildlife captures due to its narrow safety margin, lack of antidotes and many other disadvantages. Instead, safer centrally acting drugs that affect the central nervous system are now extensively used for wildlife capture and rescue operations. Wildlife capture drugs generally employ a combination of anaesthetics and tranquillisers to decrease the effective dose rates and consequently to lower the drug volume to be administered remotely through the dart projectors.

The most commonly employed drugs for wildlife capture in Nepal are ketamine (dissociative anaesthetic agent) and xylazine, meditomidine/azaperone (tranquillisers/sedatives) used signally or in combination. Use of tranquillisers only is not safe because sedated animals can be easily aroused with minimal stimulation and the animals are capable to attack the attendants. Tranquillisers have good CNS depressant, muscle relaxant and analgesic properties and for most tranquilliser agents, the antidotes (yohimbine, atipamezole and tolazoline) are available.

Opioids/Narcotic drugs are used for the immobilisation of free ranging wild animals, especially the mega-herbivores such as elephant, rhino and gaur but are contraindicated in felines. These drugs are primarily morphine and its derivatives and produce immobilisation through CNS depression. They are extremely potent and hence are capable of immobilising huge animals with a relatively small dosages, however, utmost care is needed while handling them as they are very toxic to humans. The most commonly used drug of this category is Etorphine HCl (M 99) in combination with acepromazine or azaperone. The antidotes (diprenorphine HCl, naltrexone and naloxone) are available for reversing the narcotic effect.

4.5.1 Major Animals

Key features and details of drug use for major animals tranquilising are described below:

i. Tiger *(Panthera tigris)*

Tigers are gentle and shy animals normally inhabiting core and mystical forest areas. However, the aged, injured or incapable of hunting occasionally inhabit the forest fringes where local peoples frequently visit for the collection of forest products that results to human-tiger interaction leading to conflicts. Young tigers who are trying to establish their territory are frequently driven to the outside of the forest by the dominant individuals, which are already occupying the preferred forest habitats. There have been some instances where tigers missing their way at night and taking refuge in school buildings, cattle sheds or even inside human homes for safety. Numerous cases of accidental human predation by tigers have been recorded in Parsa, Bara, Makawanpur, Chitwan, Nawalparasi, Banke, Bardia, Kailali and Kanchanpur districts of Nepal. Such tigers habituated in killing humans or livestock return to their kills within a few hours of time if not chased by villagers in the beginning. The technicians must be aware of this behaviour and plan for darting accordingly.

Vit cloth (White cloth) setting for rescue of a tiger in Jagatpur, buffer zone of Chitwan National Park.

Depending upon the circumstances, tigers can be rescued by employing a chemical method called darting. Physical capture methods should be strictly avoided because some unusual events have been observed in Nepal in the past leading to dangerous and unpredictable outcomes. If available, a Standard Operating Procedure to deal with straying of tigers in human dominated landscapes should be followed.

A problem tiger rescued from a sugarcane field in Triveni area, buffer zone of Chitwan National Park.

The steps are described below:

- Designate a wildlife rescue team with relevant members (as mentioned above), elephants, and allocate a rescue vehicle for transportation of team, transport crate and Vit cloth and dart equipment and capture drugs. The crate should be made up of strong metal or woods with sliding doors on both end and take it to the capture site.
- Communicate and coordinate with all the stakeholders- army, police, local administration, social leaders, forest authority, etc.
- Determine the sex and status of the animal by pugmark studies or by camera trapping in the kill site.
- If it is hard to see a tiger in the daytime, manage a bait animal most often buffalo calves for the tiger baiting.
- Examine the nature of the forest area for forest or grassland type, ponds or rivers or houses close by.
- Set the vit-cloth with the help of trained elephants surrounding the baited tiger. Generally, after killing the bait animal, the tiger drags the carcass to close by bushes as a safety for hiding and eating. Hence, depending upon the size of the area and the length of vit cloth available, the tiger location is encircled with vit cloth in the funnel shape whereas on the narrow end of the funnel, tiger darter is deployed in a safe tree for darting. The process of setting of vit cloth should be well known to the wildlife technicians. It must be very quietly accomplished along with the proper mobilisation of trained elephants inside the vit and the vit positioner outside of the vit cloth.
- Select young wildlife technicians with good tree climbing abilities and place them on safe tree heights on most probable sites that a darted tiger may move in the safe direction. Use trained elephants to transfer them from place to place as a safety measure. Warn them not to climb down on their own before notifying the concerned tiger is completely slept as well as after ensuring there are no other tigers within the encircled area.
- Prepare the darts with calculated drug doses and handover to the wildlife technician with experiences of tiger darting.
- When the darter is ready on a safe tree, trained elephants along with rescue team members on their back are moved in a gentle manner towards tip of the circle. The darter whistles after a successful dart hit, someone makes note of the time, and everybody remain silent for 10-15 minutes to shorten the induction period on the tiger as well as not trigger the tiger run to go far away.

Wildlife technicians inspecting a tranquillised tiger for rescue in Madi, buffer zone of Chitwan National Park.

- Examine the status of the darted tiger preferably from the back of the elephant. When assured appropriately tranquillised, approach from behind after checking the reactions of darted tiger using a long pole or pieces of wood throwing upon him.
- The darted tiger is positioned on lateral position, the ears are plugged with cotton and the eyes are protected by a cloth cover. Vital signs are monitored, recorded and samples (blood, hair, tissues, etc.) collected or radio collar fitted for monitoring after release.
- Injuries are treated (antiseptic dressing, injections of long-acting antibiotics, anti-inflammatory etc.). Hyperthermia is controlled by swabbing cold water on head, inside of the fore and hind legs, and belly.
- Then, the tiger is transported to the cage on an appropriate stretcher and enclosed securely within the crate. Then the antidote is injected preferably intravenously otherwise intramuscularly (generally ½ intravenous and ½ intramuscular preferred) and wait for the revival of the animal from the effect of the tranquilising drugs used.
- The crate is loaded into a vehicle and transported to pre-determined site for release or to a wildlife rescue centre for further treatment.

Detail of drug choices for tiger captures

- Weight: 100-160 kg (f), 140-300 kg (m)
- Recommended drug: 3 mg/kg ketamine plus 0.07 mg/kg medetomidine.
- Supplemental drug: 1.5 mg/kg ketamine. Antagonist: 0.35 mg/kg atipamezole (1/2 IV and ½ IM)
- *Alternative drugs*: xylazine @ 1 mg/kg and ketamine hydrochloride at a dose rate of 3 mg/kg respectively (Tripathi et al., 2003; Allwin et al., 2018). Antagonist: yohimbine @0. 125 mg/kg i. v. or atipamezole @ 10:1 ratio of xylazine to atipamezole i. m. or. i. v.
- 4 mg/kg tiletamine-zolazepam (Tilazole/Zoletil); 11 mg/kg ketamine plus 0.8 mg/kg xylazine; antagonist with 0.125 mg/kg yohimbine i.v. The addition of 0.1 mg/kg midazolam to any of the above combinations may help to reduce convulsions.
- Xylazine 200 mg and ketamine hydrochloride 400 mg mixture plus 1.2 mg atropine sulphate total dose (Nath et al., 2007).

ii. Snow Leopard *(Panthera uncia)*

Snow leopards in their high-altitude habitats are involving cattle and sheep predation and may be entrapped in foot snares or traditional traps. Unusually, a snow leopard was encountered in a bamboo bunch at Charghare (altitude ~150 m) of Urlabari area of Morang district in January 2024 (2080/10/9) and rescued by darting team.

- Weight: 25– 45 kg
- Recommended drug: 3 mg/kg ketamine and 0.08 mg/kg medetomidine
- Supplemental drug: 2 mg/kg ketamine
- Antagonist: 0.4 mg/kg atipamezole, ½ i. m. ½ i. v.
- Alternative drug: 4 mg/kg tiletamine zolazepam
- 10 mg/kg ketamine plus 2.2 mg/kg xylazine
- Tiletamine zolazepam (Zoletil /Tilazole®) @ 2 mg/kg body weight and medetomidine @ 0.02 mg/kg body weight (Johansson et al., 2013). Snow leopards are trapped in foot snares first and then chemically immobilised.
- A field researcher reported using approximately 2 mg/kg tiletamine-zolazepam plus 0.02 mg/kg medetomidine with good success. He added 5 ml of 1 mg/ml medetomidine to a vial of tiletamine-zolazepam and administered a fixed dose of 0.8 ml of this mixture to all leopards.

iii. Clouded Leopard *(Pardofelis nebulosa)*

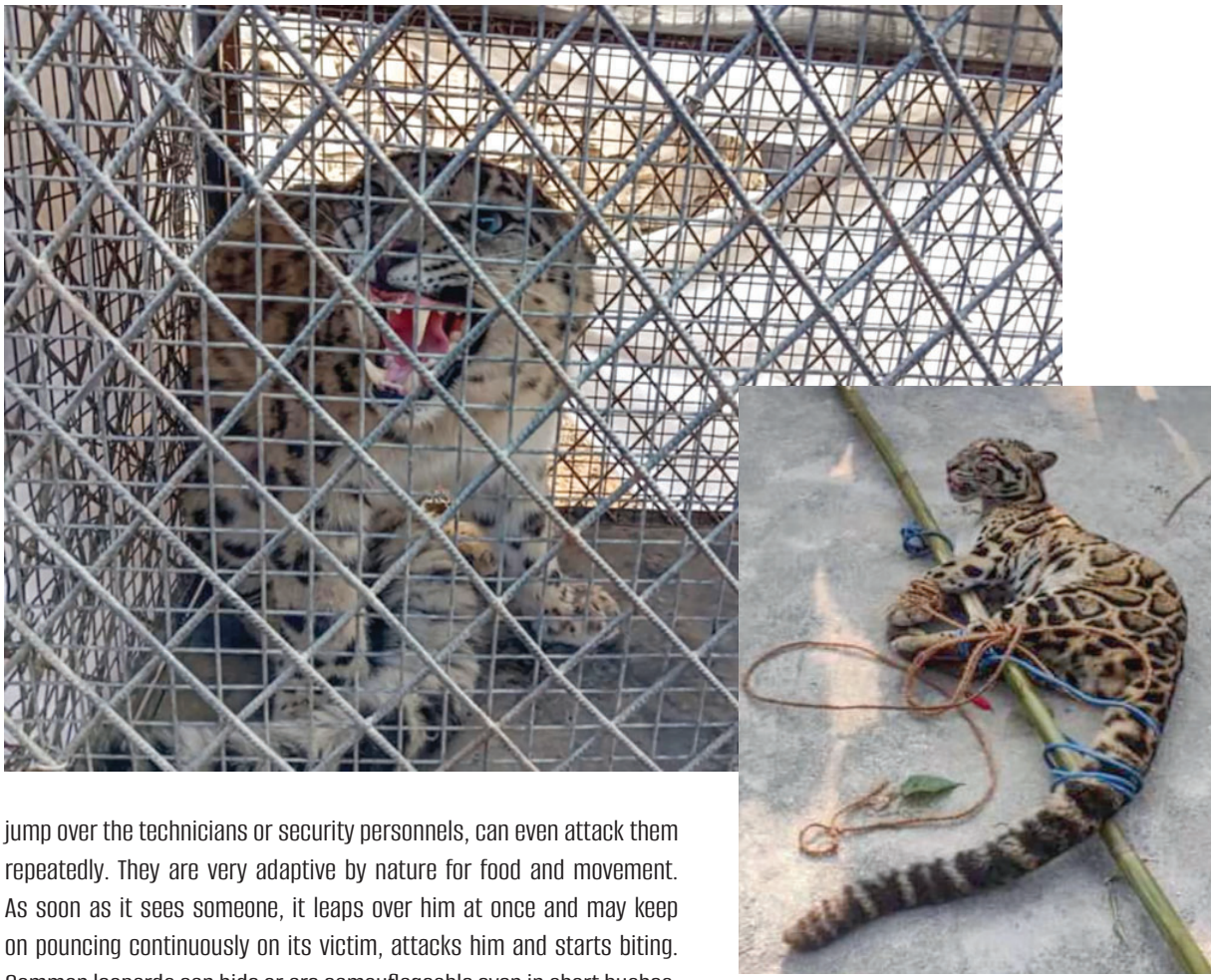
Clouded leopard (*Pardofelis nebulosa*) a medium-sized wild cat can be distinguished by distinctive dark markings on its body, including blotches, clouds, and black-edged ellipses as well as occasional black spot, relatively short legs and long tail. The species has been rescued from Jhapa and Udaypur district in Nepal. The conflict between this cat and humans is not much explored but when this animal is seen by peoples they tend to approach and capture the individual due to its strange phenotypic characters, gait and uncommonness. Clouded leopards are opportunistic as other cat species enters human settlement for easy prey.

- Weight: 10-20 kg
- Recommended drug: 3 mg/kg ketamine plus 0.08 mg/kg medetomidine. Supplemental drug: 2 mg/kg ketamine. Antagonist: 0.4 mg/kg atipamezole; give 1/2 dose IV, 1/2 IM. *Alternative drugs:* 4 mg/kg tiletamine-zolazepam (Zoletil / Tilazole®)
- Supplemental drug: 5 mg/kg ketamine
- 10 mg/kg ketamine plus 2.2 mg/kg xylazine
- Xylazine @ 1 mg/kg body weight and Ketamine hydrochloride @5 mg/kg body weight (Ali et al., 2016).
- Alternative drug: 20 mg/kg ketamine and 2 mg/kg xylazine, antagonise by atipamezole @ of 10:1 xylazine atipamezole ratio.

iv. Common Leopard *(Panthera pardus)*

Common leopards are quite commonly encountered animals for rescue and rehabilitation in Nepal as they are preferred to be around the human premises in search of food or habitat thereby creating havoc in the public. Such situations need to be quickly attended by capture of strayed animal using the chemical methods. Rescue of common leopards is quite common but rare for clouded leopards and snow leopards. Leopard often enter the cattle sheds (goat, sheep, poultry) or even houses for search of food animals. Additionally, they are most extensively trapped or killed by poachers and very often confiscated by police or forest authorities while trafficking their parts. On recent days, many leopards show signs of convulsions, seizures or blindness and many villagers' approaches and take control of them. All this is the signs of Canine distemper infections. Canine distemper had been reported in conflicting leopard in different part of Nepal (Sadaula et al. 2024)

Chemical immobilisation of common leopards must be carried out very cautiously as this species is not afraid of peoples and can



jump over the technicians or security personnels, can even attack them repeatedly. They are very adaptive by nature for food and movement. As soon as it sees someone, it leaps over him at once and may keep on pouncing continuously on its victim, attacks him and starts biting. Common leopards can hide or are camouflageable even in short bushes.

A displaced Clouded leopard rescued by local peoples in Buddhashanti 1, Jhapa district (Source: Ramesh Siwakoti, Mardi News, 2077 Poush 14)

- Weight: 50-80 kg
- Recommended drug: 3 mg/kg ketamine plus 0.07 mg/ kg medetomidine. Supplemental drug: 2 mg/kg ketamine. Antagonist @ 0.35 mg/kg atipamezole; 1/2 IV, & 1/2 IM. *Alternative drugs*: 6.6 mg/kg tiletamine-zolazepam (Tilazole /Zoletil®).
- Xylazine@ 1.5 mg/kg and ketamine @ 5 mg/kg. Antidote -yohimbine HCl @ 0.14–0.17 mg/ kg body weight (Deka, et al., 2012).

v. Jungle Cat (*Felis chaus*)

Padded foot-hold and box traps can be used to capture jungle cats. Iron mesh custom- built box traps (40 x 40 x 120 cm, width, height, and length). To minimise the time between capture and immobilisation, very-high-frequency transmitters can be attached that emits a signal after the trap is disturbed. Constant monitoring of the trap transmitter signals is required. The trapped animals can be tranquillised with a mixture of xylazine and ketamine in a ratio of 1:3 per kg body weight.

- Weight: 4-16 kg
- Recommended drug: 5 mg/kg tiletamine-zolazepam
- Supplemental drug: 5 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 2.5 mg/kg ketamine plus 0.1 mg/kg medetomidine; antagonise with 0.5 mg/kg atipamezole
- Ketamine @ 6–9 mg/kg and medetomidine @ 0.05–0.08 mg/kg (Tellaeche et al., 2020).
- Medetomidine @ 0.04 mg/kg combined with ketamine at 3 mg/kg /kg. Antagonise with atipamezole@ 0.2 mg/kg i. m. or tiletamine-zolazepam @ 6.8–10.8 mg

vi. Red Panda (*Ailurus fulgens*)

Red pandas have been rescued frequently in Eastern Nepal. A red panda may wander into human settlements where stray dogs and vehicular movements are likely to injure them. Red Panda may be found injured or sick near their habitats or at agricultural fields of farmers and require rescue and treatment. Animals found may be dehydrated, or they may have sustained some traumatic injuries which follows pain and stress. Such animals need proper veterinary care and treatment. Safe manual handling may be done in case of dull animals but may require tranquilisation in case of active and healthy animals. Animals requiring health checkup may be sedated with safe tranquillisers. Rescued red panda have been fed on 200 ml of milk, 20 ml of honey, 1 banana, 200 g of apple, 1 raw egg 4 kg of bamboo leaves, and plenty of drinking water daily (Ahmad et al., 2021; Mohan, Rai, and Dey, 2021)

- Body weight: 3-6 kg
- Recommended drug: 5 mg/kg tiletamine -zolazepam
- Supplemental drug: 5 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 4 mg/kg ketamine plus 0.1 mg/kg medetomidine; antagonise with 0.5 mg/kg atipamezole
- 10 mg/kg ketamine plus 2 mg/kg xylazine
- Xylazine and ketamine @2-5 mg/kg body weight each (Mohan, Rai and Dey, 2021)
- Ketamine and xylazine combination @ 10 mg/kg b. w. and 0.4 mg/ kg b. wt. respectively and can be safely revived with intramuscular injection of yohimbine HCl @ 0.4 mg/kg b. w. (Ahmed et al., 2021).

vii. Stripped hyena (*Hyaena hyaena*)

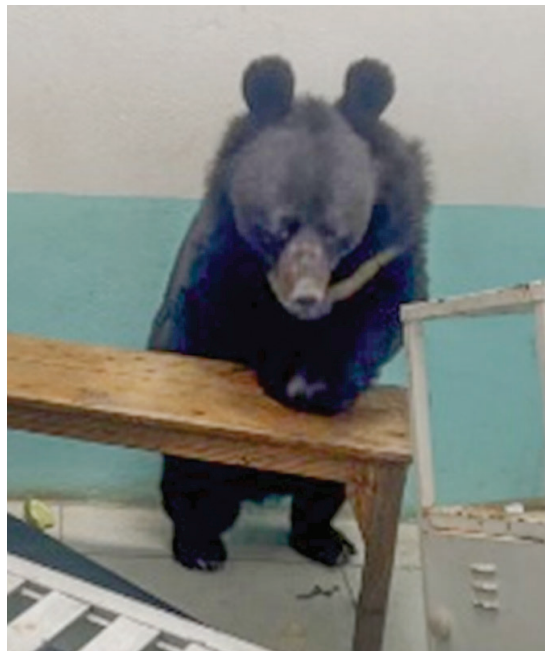
Sick hyaenas in Nepal may be found exhibiting lethargy and weakness in or near its habitats in agricultural fields, or lying on the side of roads due to collision by motors, or fallen in wells or surface water tanks as a result of disease or in confrontation with depredation of domestic goats in human dominated landscapes. Such animals need rescue and treatment. Several hyaenas die in the conflict, however few animals need rescue and rehabilitation (Bhandari and Bhusal, 2017)

- Weight: 25-55 kg
- Recommended drug: 6.5 mg/kg tiletamine -zolazepam
- Supplemental drug: 3 mg/kg ketamine
- Antagonist: None
- *Alternative drugs:* 10 mg/kg ketamine plus 1 mg/kg xylazine; antagonise with 0.11 mg/kg yohimbine
- Ketamine@ 2.5 mg/kg and medetomidine @ 0.035 mg/kg and reversed with 0.18 mg/kg atipamezole (Mehmood et al., 2021, Saeidi & Kheradmand, 2024).
- Ketamine@ 8 mg/kg and xylazine @ 0.7 mg/kg (Saeidi & Kheradmand, 2024).
- Butorphanol @0.2 mg/kg) plus medetomidine @ 0.02 mg/kg plus midazolam @ 0.2 mg/kg (Saeidi & Kheradmand, 2024)

viii. Himalayan Black bear (*Ursus thibetanus*)

Himalayan black bears live in forests close to human settlements in the mid hill area of Nepal, thus they constantly conflict with humans. It has been rescued from human hospital premises and rehabilitated in eastern Nepal (March 4, 2022, Kathmandu Post). These bears are injured and at extreme circumstances are killed particularly when the later kill domestic animals or attack humans. There are instances that Himalayan black bear was trapped in lethal snares and had to be tranquillised, freed from a metal snare, transported to zoo, treated and rehabilitated. Abandoned baby bear cubs can be handled manually and hand reared.

- Body weight: 65-90 kg (f), 110-150 kg (m)
- Recommended drug: 8 mg/kg tiletamine -zolazepam
- Supplemental drug: 4 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 1.5 mg tiletamine zolazepam plus 0.03 mg/kg detomidine; antagonise with 0.12 mg/kg atipamezole
- Medetomidine @0.04 mg/kg and zolazepam-tiletamine @ 2 mg/kg (Jeong et al., 2017), revived with 0.15–0.225 mg/kg of Atipamezole



A Himalayan black bear inside a human hospital (Taplejung district). Source: Ananda Gautam/TKP, The Kathmandu Post. March 4, 2022.

ix. Sloth bear (*Melurus ursinus*)

Every year, many cases of human-bear conflicts are reported in its distribution range mostly in Chitwan National Park and its buffer zones. However, sloth bear rescue has been a rare event in Nepal other than rescuing a couple of trained dancing bears (Rangila, a 19-year-old male and Sridevi, a 17-year-old female in 2017) from Sunsari district and a single bear (Dhudaru) in 2019 from Siraha district of Nepal. Sloth bear cubs may be found abandoned in the forests and may require hand rearing and rehabilitation. An adult sloth bear creating fear and danger to local peoples was rescued from rural settings of Birgunj town in 2017 and one adult successfully immobilised and treated in Bhimpur area of Chitwan National Park in 2020. Adult and sub adults require chemical immobilisation for capture, transport and rehabilitation in the natural habitat

- Weight: 55-145 kg
- Recommended drug: 6 mg/kg tiletamine -zolazepam
- Supplemental drug: 2 mg/kg ketamine
- Antagonist: None
- *Alternative drugs:* 7.5 mg/kg ketamine plus 2 mg/kg xylazine; antagonise with 0.125 mg/kg yohimbine
- Ketamine@ 2.5 mg/kg and medetomidine @ 0.035 mg/kg and reversed with 0.18 mg/kg atipamezole (Mehmood et al., 2021, Saeidi & Kheradmand, 2024).
- Ketamine@ 8 mg/kg and xylazine @ 0.7 mg/kg (Saeidi & Kheradmand, 2024).
- Butorphanol @0.2 mg/kg) plus medetomidine @ 0.02 mg/kg plus midazolam @ 0.2 mg/kg (Saeidi & Kheradmand, 2024).
- Ketamine hydrochloride and xylazine hydrochloride @ 5 mg per kg body weight and 2.0 mg per kg body weight, respectively (Veeraselvam et al., 2014)

One year old sloth bear rescued from Siraha district (Source: Diwakar Pyakurel, Onlinekhabar.com, 2077 Baisakh 5)

x. The Greater One-horned Rhino (*Rhinoceros unicornis*)

Rhinoceros calves have been frequently rescued and rehabilitated in Nepal and India. Rhino calves are frequently separated from their mother due to severe river flooding, particularly in the Rapti and Narayani rivers in Nepal. Some calves are orphaned due to poaching of their mother. Frequently, tigers unsuccessfully attempt to kill rhino calves; in the process, the calves are injured severely and suffer bleeding, febrile and are unable to follow the mother animal and abandoned. Similarly, few calves during estrous period of the mother rhino, a dominant male rhino follows the female rhino, and the calves are thrown away by the bull rhino as a nuisance resulting them injured and traumatised. Such injured calves are rescued, treated and rehabilitated in Chitwan, Bardia and Shuklaphanta National Parks. Occasionally, rhino calves are found fallen in ditches, canals, etc. which require safe rescue and treatment depending upon the duration of fall, starvation and injuries. A young rhino calf may be abandoned due to a severe illness of its mother or subsequent death requiring rescue and rehabilitation for its survival.

Severely injured or debilitated rhino calves under 1-5 months of age can be manually handled and transported to wildlife rescue centres entangling into strong nets or putting them into a strong wooden box. But some calf needs to be tranquillised using etorphine (M 99) and Acepromazine (ACP) for safe capture, handling and transport. Necessary veterinary care is provided, and the rescued rhinos react vigorously in the rescue centre for almost one week to the attendants but later they can recognise care takers and behave more friendly. Adult rhinos that are fired or speared, entangled in traps and nets may be treated and released in the field despite rescuing and transportation.

The rhino calves can be hand-raised for about 1-1.5 year through a single-handed caretaker. While rescuing the injured/ abandoned rhino calves in the field, one must be careful to observe the presence of its mother in the near territory. A small vocal signal can incite the mother rhino to run to the calf and hamper the rescue work. Trained captive elephants are useful to block the mother rhinos reaching calves under rescue operation. Adult rhinos inflict serious injuries due to intraspecific fights and such animals are darted and treated and monitored in the field as transporting them to the rescue centre is very cumbersome.

Care taking of rescued rhino calf in Chitwan National Park

There are several records of rescue of strayed rhinos in Chitwan National Park and its buffer zone areas. Also, rhinos that were swept to India by severe floods during 2017 were rescued and rehabilitated in Chitwan National Park (DNPWC, 2022). Rescue of adult rhinos require proper preparation and involves use of proper crates, sledges and bulldozer machines for dragging.

- Weight: 1,600-2,200 kg, calves 200-500 kg
- Recommended drug: 2.25 mg etorphine plus 10 mg Acepromazine (ACP) (Adult female) and 3 mg Etorphine plus 12 mg ACP (Adult male), Sub adult – 2 mg Etorphine plus 8 mg ACP and Young – 1 mg Etorphine plus 4 mg ACP
- Supplemental drug: 2 mg etorphine
- Antagonist: 4 mg diprenorphine per mg etorphine given
- *Alternative drugs:* 3.8 mg etorphine plus 14 mg detomidine plus 400 mg ketamine; antagonise with 300 mg naltrexone
- 0.4-1 mg of etorphine in combination with 5-10 mg of ACP and 200-500 mg of ketamine can be employed for the capture and transportation of young rhino calves (Gairhe, 2011).
- 1-3 mg etorphine/ animal plus 5-10 mg of acepromazine depending upon the size of the animal. 0.5-1 mg etorphine may be topped intravenously in case the rescue operation is not accomplished quickly (DNPWC, 2022).
- 4.9 mg etorphine hydrochloride and 10 mg of acepromazine maleate. Antagonise with 6.5 mg i.v. into the ear vein (Ahmed, 2021).

xi. Elephant (*Elephas maximus*)

Young elephant calf once abandoned by the herd in the forest, and some adult male elephant while being problematic in the villages and fragmented forests need rescued. Such calves may be trapped in metallic snares set by poacher for killing small Suidae or herbivores sometimes. The snare encircles the leg and tightens firmly every day and can soon cut bone deep, exposing the calf to infection and death. Such snared elephants require prompt tranquilisation and transport to a wildlife rescue centre. The calves fallen into the canals or ditches can be rescued manually, if still aggressive M 99 is the preferred drug for tranquilisation and the location of the elephant herd have to be accessed first for safety of the rescue team members.

Frequently adult captive elephants particularly tuskers have to be tranquillised for a brief period to control the aggressive behaviour during musth. They are darted with xylazine or sometimes with trilaphon® injection and monitored until self-recovery. Trained domestic elephants in musth can also be chemically restrained with a combination of xylazine and ketamine hydrochloride @ 400 and 300 mg respectively (Ahmed et al., 2017) and only with 700 mg of xylazine hydrochloride (Ahmed et al. 2019).

- Weight: 2,300-3,700 kg (f), 3,700-4,500 (m) kg
- Recommended drug: 0.003 mg/kg etorphine
- Supplemental drug: 2 mg etorphine, as needed to maintain immobilisation
- Antagonist: 2 mg diprenorphine per mg etorphine given
- *Alternative drugs:* 1 ml Large Animal Immobilon® per 1,000 kg BW; antagonise with equal volume of diprenorphine
- Comments: Xylazine (0.1 mg/kg) or medetomidine (0.005 mg/kg) are capable of producing profound sedation. Xylazine sedation can be reversed with i.v. injection @ of 1 mg atipamezole for each 10 mg of xylazine given. Immobilised elephants suffer fewer respiratory problems when in lateral, as opposed to sternal, recumbency. Body temperature ranges from 96.3-99.5°F), but may decline during immobilisation to 95.5 °F.

xii. Wild Water buffalo (*Bubalus arnee*)

Wild water buffaloes locally known as "Arna" exist naturally only in Koshi Tappu Wildlife Reserve in Nepal. Hence, rescue events may have to be carried out in the peripheral area of the reserve. There are past experiences that adult wild buffaloes were trapped in strong parachute nets illegally set for other animals at the fringe of forest and villages and had to be freed by chemical immobilisation procedures. Also, occasionally, sharp arrows projected by locals to Arna invading cropland have to be immobilised for arrow removal and treatment.

Wild buffalo entangled in strong parachute net in Koshi Tappu Wildlife Reserve..

- Weight: 700-1,200 kg
- Recommended drug: 0.03 mg/kg etorphine plus 0.2 mg/kg xylazine
- Supplemental drug: If animal is not down in 20 minutes, repeat full dose
- Antagonist: 0.5 mg/kg diprenorphine plus 0.05 mg/kg yohimbine
- Comments: Although effective, the etorphine-xylazine doses may still result in long induction times (> 20 min).
- Wild buffaloes were captured using etorphine (4-6 mg /animal) and xylazine (50 -60 mg/animal) for an animal ranging 400- 500 kg body weight in 2073 B. S. Haloperidol was used to sedate the animals in the transport.

xiii. Gaur (*Bos gaurus*)

Gaur herd are extremely shy by nature and mostly stay away of human settlements. Gaur prefers to live in herd, however many times they stray out from their herd and get trapped inhuman habitat which is one of the important causes of man-animal conflicts. However, dominant bulls rarely wander to sugarcane fields near their habitat (Chure range) and create conflict with people. Records of human injuries due to Gaur bulls are available in the buffer zone of Parsa National Park and rescue of a couple of Gaur calves were reported from Sunsari, Morang and Jhapa and Chitwan districts in the past (DNPWC, 2020).

- Weight: 650-1,000 kg
- Recommended drug: 0.0075 mg/kg carfentanil plus 0.1 mg/kg xylazine
- Supplemental drug: 0.0075 mg/kg carfentanil
- Antagonist: 0.75 mg/kg naltrexone 0.1 mg/kg yohimbine

Alternative drugs:

- M 99 (etorphine HCl 9.8 mg/ml) @ 0.013 mg/kg and azaperone (40 mg/ml) @0.16 mg/kg (6.86 mg etorphine and 80 mg azaperone for a 500 kg body weight). Revival with diprenorphine (M 50-50) 1.5 ml (Ali et al., 2024,)
- Anesthetic combination of xylazine hydrochloride and ketamine hydrochloride @ 0.1 and 0.08 mg/kg respectively for a 1200 kg male Gaur (Ahmed and Ahmed, 2022)
- 1 mg/kg xylazine; antagonise with 0.125 mg/kg yohimbine (calm animals)
- Xylazine at @ 0.1 mg/kg body weight and ketamine hydrochloride @ 2.5 mg/kg body weight (William et al., 2011)

xiv. Nilgai (*Boselaphus tragocamelus*)

The nilgai, also called the blue bull, inhabit areas with short bushes and flat grasslands of terai protected areas of Nepal. They are prone to invade vegetable gardens in rural settings and sometimes require capture and transportation. Occasionally, orphan calves need rearing which do not necessitate immobilisation but when grown to adult, they react vigorously and hence the best way to transfer them to the wilder habitat is the use of immobilising drugs. Preferred drug is the M 99 but an intravenous injection of haloperidol before administering M 50-50, help to keep calmness during transportation.

One of the major complications during blue bull capture is mortality or morbidity due to capture myopathy, which may appear within hours, days or months after the operation. This is a result of the stress and struggle experienced by the animals during the capture. Capture myopathy can be reduced by avoiding predisposing factors and minimising unnecessary physical handling during mass capture operations (MoFECC, 2023).

- Weight: 170-240 kg
- Recommended Drug: 4 mg carfentanil (males); 3 mg carfentanil (females) Supplemental drug: If animal is not down in 20 min, repeat full dose. Antagonist: 100 mg naltrexone or naloxone per mg carfentanil given.
- *Alternative drugs:* 6 mg etorphine; antagonise with 2 mg diprenorphine per mg etorphine given.
- Xylazine @ 1 mg/kg and ketamine @ 0.5 mg/kg. Antagonist: Yohimbine @ 0.15 mg/kg (Sarma et al., 1997).
- Haloperidol (20 mg i. v.) reduces excitement during transportation, but must be injected at the time of administration of opioid antidotes.
- Comments: Prone to excessive running during induction with opioids; monitor for hyperthermia.

xv. Chittal/Spotted Deer (Axis Deer, *Axis axis*)

Axis deer (*Axis axis*) are nervous and excitable animals, and chemical immobilisation of this species has been associated with a high percentage of complications and fatalities. Xylazine can be injected to facilitate handling and to reduce stress and struggling in the captured animals. Atipamezole can be employed to reverse the xylazine-induced sedative effects (Sontakke et al., 2007).

These animals are in possession of many individuals and need rescue. They are very often injured by stray dogs and need rescue and treatment.

- Weight: 40-110 kg
- Recommended drug: 3.5 mg/kg ketamine plus 0.1 mg/kg medetomidine
- Supplemental drug: 2 mg/kg ketamine
- Antagonist: 0.5 mg/kg atipamezole
- *Alternative drugs:* 4 mg/kg ketamine plus 4 mg/kg xylazine; antagonise with 0.125 mg/kg yohimbine
- 0.004 mg/kg carfentanil plus 0.125 mg/kg xylazine; antagonise with 0.4 mg/ kg naltrexone plus 0.125 mg/kg yohimbine
- 2.6 mg/kg tiletamine-zolazepam
- 1.7 ml Large Animal Immobilon® plus 30 mg xylazine; antagonise with 2 mg diprenorphine per mg etorphine given plus 0.125 mg/kg yohimbine
- 3 mg fentanyl plus 24 mg azaperone plus 30 mg xylazine (i.e., Fentaz® plus xylazine); antagonise with 10 mg naloxone per mg fentanyl given plus 2 mg per kg tolazoline
- 3 mg per kg xylazine (calm animals only); antagonise with 0.2 mg per kg yohimbine
- Comments: lower doses of ketamine xylazine can be used in captive axis deer.
- Xylazine @ of 0.5 mg of /kg and ketamine @ of 2.5 mg /kg in males and xylazine @ of 1 mg /kg and ketamine @ of 1.5 mg of /kg in females. Antagonise with yohimbine @ of 0.1 to 0.3 mg/kg body weight (Sontakke et al., 2007).

xvi. Ratuwa/Barking Deer (*Muntiacus vaginalis*)

Barking deer injured by dogs is frequently rescued or they have to be rescued from illegal keeping. Fawns are frequently collected by villagers unaware of the hiding of fawns by mother deer in bushes. Injured animals may have to be chemically immobilised for treatment purposes. Males have elongated 2–4 cm (0.79–1.57 inch long), slightly curved upper canine teeth projected downwards of which carefulness is required not to be injured while handling them. They also fight among them with these teeth and inflict serious injuries.

- Weight: 14-28 kg
- Recommended drug: 3.3 mg/kg ketamine plus 3.3 mg/kg xylazine
- Supplemental drug: 2 mg/kg ketamine
- Antagonist: 0.125 mg/kg yohimbine
- *Alternative drugs:* 0.007 mg/kg carfentanil plus 0.05 mg/kg xylazine; antagonise with 0.7 mg/kg naltrexone plus 0.125 mg/kg yohimbine

A rescued Barking deer at Koshi Tappu Wildlife Reserve. Note the sharp upper canine tooth protruding downward from the upper jaw.

xvii. Rhesus Monkey (*Macaca mulatta*)

Among the three species primates available in Nepal, the Rhesus monkey is one of the risky species which frequently bites visitors in an around temple areas. Such monkeys are captured and rehabilitated to a safe habitat. Monkeys can be trapped in box traps; however, they are clever and easily avoid the subsequent traps.

- Weight: 9-12 kg
- Recommended drug: 6 mg/kg ketamine plus 0.09 mg/kg medetomidine. Supplemental drug: 3 mg/kg ketamine
- Supplemental drug: 3mg/kg ketamine
- Antagonist: 0.45 mg/kg atipamezole
- *Alternative drugs:* 2.5 mg/kg ketamine plus 2 mg/kg xylazine; 6.6 mg/kg tiletamine-zolazepam; 22 mg/kg ketamine
- Atropine sulphate @ of 0.04 mg/kg and ketamine @ 10 mg/kg body weight; xylazine @ of 1 mg/kg and ketamine @ of 5 mg/kg body weight (Kanu at al., 2018)

4.5.2 Other Animals

Body weight and details of drug use recommended for other animals tranquilising are described below:

i. European Lynx (*Felis lynx*)

- Weight: 8-38 kg
- Recommended drug: 5 mg/kg ketamine plus 0.2 mg/kg medetomidine
- Supplemental drug: 2.5 mg/kg ketamine
- Antagonist: 1 mg/kg atipamezole
- *Alternative drugs:* 5 mg/kg tiletamine-zolazepam 10 mg kg ketamine plus 1.5 mg/kg xylazine
- Comments: The ketamine-medetomidine dose can be reduced by 50% for captive lynx. Arnemo et al. (1999) used 5 mg/kg ketamine plus 0.08 mg/kg medetomidine on lynx kittens (4-5 weeks old).

ii. Leopard Cat *(Prionailurus bengalensis)*

Leopard cats are frequently submitted to the wildlife rescue centres by public either in injured condition or at too young state. The immobilisation of this species is often not required; however, the drug dosages are referred based upon research on the sub species such as Sunda leopard cats.

- Weight: 2-5 kg
- Recommended drugs: 25 mg/kg ketamine plus 2 mg/kg xylazine
- Supplemental drug: 12 mg/kg ketamine
- Antagonist: none
- 8 mg/kg of Zoletil with supplemental dose of 3 mg/kg ketamine (Fernando et al., 2013)

iii. Fishing Cat *(Prionailurus viverrinus)*

- Weight: 7.7-14 kg
- Recommended drug: 4.4 mg/kg tiletamine-zolazepam
- Supplemental drug: 4.4 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 22 mg/kg ketamine
- 0.5 mg/kg xylazine and intravenous tiletamine–zolazepam @ 1.5 mg/kg (Sussadee et al., 2017)
- Tiletamine - zolazepam @ 4 mg/kg and xylazine @ 0.3 mg/kg (Klakhaeng et al., 2024)

iv. Dhole/Asiatic Wild dog (*Cuon alpinus*)

- Weight: 15-24 kg
- Recommended drug: 8 mg/kg tiletamine-zolazepam
- Supplemental drug: 4 mg/kg ketamine
- *Alternative drugs:* 5 mg/kg ketamine plus 0.04 mg/kg medetomidine; antagonise with 0.2 mg/kg atipamezole
- 20 mg/kg ketamine plus 0.2 mg/kg acepromazine
- 20 mg/kg ketamine plus 1 mg/kg xylazine
- The average body weight of Dholes range between 10-15 kg and they can be immobilised with 6–8 mg/kg of ketamine and 0.7–1.14 mg/kg of xylazine which can be antagonised with 0125 mg/kg of yohimbine intravenously (Muliya et al., 2016).

v.Tibetian Wolf (*Canis lupus*)

- Body weight: 27- 60 kg; 23.1±5.8 kg (Sarwar et *al*., 2021)
- Recommended drug: 10 mg/kg tiletamine -zolazepam
- Supplemental drug: 5 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 10 mg/kg ketamine plus 2 mg/kg xylazine; antagonise with 0.15 mg/kg yohimbine
- 4 mg/kg ketamine plus 0.08 mg/kg medetomine; antagonise with 0.4 mg/kg atipamezole
- 4.92 ± 0.52 mg/kg ketamine and 2.08 ± 0.29 mg/kg xylazine; antagonise with yohimbine @ 0.125 mg/kg body weight (Talukdar & Rania, 2023)
- Tiletamine- zolazepam @ 5-6 mg/kg (Sarwar et *al*., 2021).
- Xylazine @1.25 mg/kg and ketamine @ 2-3 mg/kg body weight (Sarwar et *al*., 2021).

The Tibetan Wolf (*Canis lupus*) can be immobilised using ketamine and xylazine mixture at a dose rates of 4.92 ± 0.52 mg/kg body weight and 2.08 ± 0.29 mg/kg body weight for ketamine and xylazine respectively. Drug induction can be achieved at 4.4 ± 1.1 minutes with animal coming into sternal recumbency by 5.6 ± 1.5 minutes. Duration of anaesthesia last 35.25 ± 6.07 minutes. Yohimbine can be administered for reversal at the dosage of 0.125 mg/kg body weight provided reversal effect with animal standing by 15.5 ± 4.2 minutes.

vi. Large Indian Civet (*Viverra zibetha*)

- Weight: 5-11 kg
- Recommended drug: 4.4 mg/kg tiletamine-zolazepam
- Supplemental drug: 4.4 mg/kg ketamine
- Antagonist: None

vii. Small Indian Civet (*Viverricula indica*)

- Weight: 2-4 kg
- Recommended drug: 4.4 mg/kg tiletamine-zolazepam
- Supplemental drug: 4.4 mg/kg ketamine
- Antagonist: None

viii. Masked Palm Civet (*Paguma larvata*)

- Weight: 3.6-5 kg
- Recommended drug: 4 mg/kg tiletamine-zolazepam
- Supplemental drug: 4 mg/kg ketamine
- Antagonist: None

xi. Asian Palm Civet (*Paradoxurus hermaphroditus*)

- Weight: 1.5-4.5 kg
- Recommended drug: 5 mg/kg tiletamine-zolazepam
- Supplemental drug: 5 mg/kg ketamine
- Antagonist: None

x. Red Fox (*Vulpes vulpes*)

- Weight: 4.1-4.5 (f), 4.5–5.4 (m) kg
- Recommended drug: 2 mg/kg ketamine plus 0.08 mg/kg medetomidine
- Supplemental drug: 2 mg/kg ketamine
- Antagonist: 0.4 mg/kg atipamezole
- *Alternative drugs:* 0.07 mg/kg medetomidine plus 0.8 mg/kg midazolam; antagonise with 0.35 mg/kg atipamezole
- 10 mg/kg tiletamine-zolazepam
- 2 mg/kg tiletamine-zolazepam plus 0.04 mg/kg medetomidine; antagonise with 0.2 mg/kg atipamezole
- 20 mg/kg ketamine plus 0.2 mg/kg acepromazine
- 20 mg/kg ketamine plus 1 mg/kg xylazine, antagonise with 0.15 mg/kg yohimbine
- 25 mg/kg ketamine plus 1 mg/kg midazolam
- 0.15 mg/kg medetomidine; antagonise with 0.4 mg/kg atipamezole (trapped animals only)
- Comments: If using xylazine, wait at least 45 min after last ketamine injection before administering yohimbine.

xi. Golden Jackal (*Canis aureus*)

- Weight: 7-15 kg
- Recommended drug: 2 mg/kg ketamine plus 0.11 mg/kg medetomidine
- Supplemental drug: 1 mg/kg ketamine
- Antagonist: 0.5 mg/kg atipamezole
- *Alternative drugs:* 0.09 mg/kg medetomidine plus 0.5 mg/kg midazolam: antagonise with 0.45 mg/kg atipamezole
- 10 mg/kg tiletamine-zolazepam
- 8 mg/kg ketamine plus 0.5 mg/kg xylazine
- 20 mg/kg ketamine plus 0.2 mg/kg acepromazine

xii. Yellow Throated Marten (*Martes flavigula*)

- Weight: 2-3 kg
- Recommended drug: 30 mg/kg ketamine plus 1 mg/kg xylazine
- Supplemental drug: 15 mg/kg ketamine
- Antagonist: None published

xiii. Blackbuck (*Antilope cervicapra*)

- Weight: 32-43 kg
- Recommended drug: 6 mg/kg tiletamine-zolazepam
- Supplemental drug: 3 mg/kg ketamine
- Antagonist: None

Alternative drugs:

- 1.5 mg carfentanil; antagonise with 1 mg/kg naltrexone
- 2 mg/kg ketamine plus 0.25 mg/kg medetomidine; antagonise with 1 mg/kg atipamezole
- 4 mg/kg ketamine plus 0.25 mg/kg xylazine; antagonise with 2 mg/kg tolazoline (Sontakke et al., 2009).
- 2.3 ml Large Animal Immobilon® plus 10 mg xylazine; antagonise with 2 mg diprenorphine per mg etorphine given plus 0.125 mg/kg yohimbine

xiv. Chauka/Chausinga/Four-horned antelope (*Tetracerus quadricornis*)

- Weight: 17-21 kg
- Recommended drug: 15 mg/kg ketamine
- Supplemental drug: 8 mg/kg ketamine
- Antagonist: none

xv. Swamp deer/Barasinga (*Rucervus duvacelli*)

- Weight: 172-181 kg
- Recommended drug: 2.1 mg carfentanil
- Supplemental drug: If animal is not down in 20 min, repeat full dose
- Antagonist: 1 mg/kg naltrexone
- *Alternative drugs:* 0.015 mg/kg etorphine plus 0.5 mg/kg xylazine; antagonise with 0.03 mg/kg diprenorphine plus 0.125 mg/kg yohimbine; 1 mg etorphine plus 100 mg ketamine plus 100 mg xylazine; antagonise with 2 mg diprenorphine plus 0.125 mg/kg yohimbine
- An intravenous injection of 5-10 mg of haloperidol help to calm the animals after capture in nets (ShNP, 2016)

xvi. Sambar Deer (*Cervus unicolor*)

- Weight: 109-260 kg
- Recommended drug: 2.1 mg carfentanil plus 30 mg xylazine (males); 1.2 mg carfentanil plus 15 mg xylazine (females)
- Supplemental drug: If animal is not down in 15 min, repeat full dose Antagonist: 1 mg/kg naltrexone plus 0.125 mg/kg yohimbine
- *Alternative drugs:* 0.7 ml Large Animal Immobilon® plus 30 mg xylazine; antagonise with 2 mg diprenorphine per mg etorphine given plus 0.125 mg/ kg yohimbine
- 6.6 mg/kg tiletamine-zolazepam
- 10 mg fentanyl plus 80 mg azaperone plus 100 mg xylazine (i.e., Fentaz® plus xylazine); antagonise with 0.2 mg/kg naloxone plus 2 mg/kg tolazoline

xvii. Laguna/Hog Deer (*Axis porcinus*)

- Weight: 27-110 kg
- Recommended drug: 0.45 mg carfentanil
- Supplemental drug: If animal is not down in 20 min, repeat full dose Antagonist: 1 mg/kg naltrexone
- *Alternative drugs:* 1.5 mg/kg ketamine plus 0.05 mg/kg medetomidine: antagonise with 0.25 mg/kg atipamezole
- 4 mg/kg xylazine; antagonise with 0.2 mg/kg yohimbine (calm deer only)

xviii. Himalayan Musk Deer (*Moschus chrysogaster*)

- Weight: 7-17 kg
- Recommended drug: 4.5 mg/kg ketamine plus 1.5 mg/kg xylazine
- Supplemental drug: 2.5 mg/kg ketamine
- Antagonist: 0.125 mg/kg yohimbine

xix. Himalayan Tahr (*Hemitragus jemlahicus*)

- Weight: 50-100 kg
- Recommended drug: 1.5 mg/kg ketamine plus 0.1 mg/kg medetomidine Supplemental drug: 1.5 mg/kg ketamine
- Antagonist: 0.45 mg/kg atipamezole; give 1/2 dose IV, 1/2 IM
- *Alternative drugs:* 0.01 mg/kg carfentanil plus 0.1 mg/kg xylazine; antagonise with 1 mg/kg naltrexone plus 0.125 mg/kg yohimbine
- 0.8 ml Large Animal Immobilon® plus 10 mg xylazine; antagonise with mg diprenorphine per mg etorphine given
- 4.4 mg/kg tiletamine-zolazepam
- 3 mg/kg ketamine plus 2 mg/kg xylazine; antagonise with 0.2 ml. atipamezole

xx. Wild Boar (*Sus scrofa*)

In order to reduce the stress and safety risks for both humans and animals, chemical immobilisation is the preferred method of restraint.

- Weight: 91 to 136 kg
- Recommended drug: medetomidine @0.15 mg/kg) + ketamine @5 mg/kg); medetomidine @ 0.1 mg/kg + ketamine @5.0 mg/kg) + butorphanol (0.2 mg/kg) (Morelli et al., 2021)
- Antagonist: 4 mg of atipamezole per mg of medetomidine

Alternative drugs:

- Tiletamine- Zolazepam @ 8 mg/kg (Fournier et. al., 1995)

xxi. Indian Hanuman Langur/Dhedu (*Semnopithecus entellus*)

- Weight: 10-23.6 kg
- Recommended drug: 3.3 mg/kg tiletamine-zolazepam
- Supplemental drug: 3.3 mg/kg ketamine
- Antagonist: none
- *Alternative drugs:* 5 mg/kg ketamine
- Atropine sulphate @ 0.04 mg/kg and xylazine hydrochloride @ 1 mg/kg and ketamine hydrochloride @ 10 mg/kg (Kamalakar et al., 2023)
- 1 mg/kg xylazine and 2.5 mg/kg ketamine revival with yohimbine @ 0.125 mg/kg (Majie et al., 2014).

xxii. Assamese Monkey (*Macaca assamensis*)

- Weight: 18 kg (m), 13 kg (f)
- Recommended drug: Xylazine @ 0.46 mg/kg & ketamine @ 8.64 mg/kg (NTNC, 2011).

4.6 Transportation of Rescued Wildlife

Transportation of rescued animals must be done with due care because the restraint, capture, confinement, loading, unloading and the transportation process induces a high level of stress. Safe, humane, ethical and professional protocols for transportation may be followed when available. Animals must be transported in a well-ventilated and strong safe box that do not injure the animal as well as prevents any possibility of escape. The shortest route for the destination should be taken and the speed should be gentle. The animals must be monitored frequently for temperature, humidity, watering and feeding.

A movable metal cage for rescuing leopards in Shivapuri Nagarjun National Park. Note : vertical doors at both end of the cage and wheels

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Annexes: Equipment and Supply Checklist for Wildlife Rescue Operations

S. No.	Material/Equipment	Remarks
1.	Dart guns with accessories (Adapters, .22-caliber blanks, CO_2 or compressed air, 0.22 charges (brown, green, yellow, red), cap chur charges, cleaning rod and pushing rod (to remove stuck or unused darts from the barrel)	
2.	Dart syringes, needle and plungers, tail pieces, connectors, silicone lubricant (for dart plungers)	
3.	Dart needle sleeves or caps, 20 ml syringes for air, safety cover, range of medical syringes, nitrile gloves	
4.	Transport crate, sledge, planks, stretchers, vit cloth, ear plugs, water jerry can, shovel, crowbars, spade, hammer, pliers, knife, ropes and nails, PPE, etc.	
5.	Tranquilliser drugs for animals, and antidotes and emergency drugs for both the animal and humans	
6.	Veterinary equipment, e. g. thermometer, stethoscope, pulse oximeter with rectal probe, blood collection tubes, gloves, masks, sanitisers, soap, etc.	
7.	Water bottles or jerry cans	
8.	Black cloth for covering crate	

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