Guidelines for the Rescue, Rehabilitation, Release and Post-Release Monitoring of Andean bears

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This publication is dedicated to my beloved wife Dolores Insuasti and my sons Andres and Francisco, for all their support over the years. – Armando Castellanos – principal author.
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PROLOGUE

Mammalian fauna in Ecuador is characterized by its considerable diversity, with over 400 registered species to date. Of these species few stand out, due to their magnitude and prominence, and are accordingly classified as emblematic or flagship. The Andean Spectacled Bear belongs to this group, and exists in paramo and cloud forest habitats. The ecological importance of the Andean bear is well acknowledged, making it difficult to understand why it is extensively hunted and pursued to such an extent that it is at the point of becoming endangered with extinction.

The present geographical distribution of Andean bears is determined by a variety of factors, both natural and anthropic. Human intervention within bear habitat for settlement formation and agricultural expansion is progressively encroaching into more remote areas, leading to a greater overlap between the bears’ and the human domain. The outcome of this is a conflict between bears and humans, resulting in an ever-increasing number of bears being hunted or taken from their natural environment as pets. The rescue and reintroduction of Andean bears into more remote, untouched areas of forest and paramo is often the only alternative to ensure they survive the effects of human intervention.

Though techniques of animal reintroduction have evolved greatly over the past few decades, reintroduction programs still pose many difficulties and often incur high costs, yet most of all they necessitate the participation and leadership of specialized personnel. In Ecuador, the principal author, Armando Castellanos, is a biologist that has dedicated a huge portion of his life to the study of mountain tapirs and Andean bears. Associated with the Institute of Biological Sciences of the Polytechnic School (University), Armando has worked towards the conservation of Andean bears in Ecuador since the 1990s, to the point where he is now recognized as the foremost authority with regards to this species.

Herewith is the second edition of the “Guidelines for the Rehabilitation, Release and Post Release Monitoring of the Andean Bear”. The manuscript is divided into two segments. The first segment is compiled with detailed information on the biology and ecology of the species, relating extensively to the personal experiences of the three authors. The second segment contains systematic step by step reintroduction guidelines describing key strategies for the many components involved in reintroduction programs such as alimentation, enclosure design, release site selection, and post release monitoring. This guide is a detailed and informative, yet easy to read piece, containing various illustrations that complement the didactic material compiled using the authors’ vast experience of working with Andean bears.

Quito, 31 January 2015
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INTRODUCTION

Wildlife rehabilitation and reintroduction programs are becoming increasingly common in developing countries. Despite these countries generally possessing large natural areas in which to reintroduce animals back into the wild, such initiatives are not exempt from facing the same controversies and disputes encountered by rehab and reintroduction programs in Europe and North America. The first Andean bear (Tremarctos ornatus) reintroduction program was conducted in Ecuador in 1995 in accordance with International Union for Conservation of Nature (IUCN) reintroduction guidelines. Since these pioneering attempts many subsequent programs have followed, with each individual experience leading to a greater understanding of the parameters and procedures required to ensure successful Andean bear rehabilitation and reintroduction programs.

This guide is the result of experiences gained and lessons learned during the past 20 years of Andean Bear rehabilitation, release and post-release monitoring in which 21 Andean bears (11 females and 10 males) of different ages have been released back into their native habitat in Ecuador. Its content is also a result of extensive wild Andean Bear research carried out through the capture and monitoring of 23 wild bears, and during the captive management of over 70 individuals in rescue centers and zoos. These collective activities have facilitated the compilation of a vast amount of information and data that have enabled the development of detailed rehabilitation and reintroduction protocols. The following guidelines not only detail techniques with which to provide rescued Andean Bears a second chance at freedom, they also provide the basis for specific and tangible conservation and protection of the species through the reinforcement of native bear populations. Additionally, this guide provides useful information and techniques that can be used in captive management of Andean bears in zoos and sanctuaries, such as dietary recommendations, habitat enrichment, breeding programs, and geriatric bear care.

The main objective of this document is to contribute and share essential knowledge and experience with the aim of motivating and guiding the development of further Andean Bear reintroduction programs in Ecuador and other South American nations. Captive management and reintroduction programs are unquestionably important tools in preventing the extinction of this species and should be implemented within a framework that equally considers both population recovery and habitat protection and restoration. We hope the experiences and results shared in this document can support and encourage biologists from other South American countries where the species exists towards the initiation of new Andean Bear reintroduction programs. Similarly, it is important to note that these initiatives must respond to the particular characteristics of each region and be based on the regional in situ ecological and biological knowledge of Andean Bear populations.
CHAPTER I: ANDEAN BEAR BIOLOGY AND ECOLOGY

SCIENTIFIC NAME: *Tremarctos ornatus* (F. Cuvier, 1825)
FAMILY: Ursidae
ORDER: Carnivora
CLASS: Mammalia

Common and Vernacular Names: Jukumari, ucumari, iznachi, manaba, oso negro, oso real, tomasito, oso de anteojos, oso frontino, el salvaje, juco, ucucu, uco, uca, mashiramo, puca mate, yanapuma, yuramateo, oso achupayero, oso ganadero.

SPECIES DESCRIPTION

The Andean bear is the only South American Ursid, and is the second largest land animal on the continent after the tapir (*Tapirus* spp.) It is the only extant species of the Tremarctinae family of short faced bears. Despite being a large mammal species, little is understood about its biology or ecology due to its remote, inhospitable habitat, low population densities and elusive nature.

As all other bear species, Andean bear use plantigrade locomotion. They are of intermediate size in comparison to all other living genera of the Ursidae family. There are no recognized subspecies of *T. ornatus*.

The species exhibits a solid and robust build with a relatively short and muscular neck, and comparatively short, wide legs in relation to body size. Each limb has five fingers possessing strong, sharp, curved and laterally flattened non-retractable claws that help this animal to climb trees, among other things. The forelimbs are much longer and more muscular than the hindlimbs. The tail is rudimentary and is hidden in the fur of the bear’s posterior.

Andean bears have rounded heads with small round ears, and a shorter muzzle than the other seven Ursid species. They have long, thick and predominantly black or dark brown fur, except around the muzzle, which is tawny or brown, often with white or cream patches around the eyes that sometimes extend to the jaw, throat and chest (Fig. 1). Most bears have distinctive facial markings that are similar to human fingerprints and can be used for
individual identification, although it is not uncommon to find specimens with totally black faces (Fig 2). A level of populational diversity of facial markings has been noted between Andean bear populations throughout its range.

Species specific features that distinguish Andean bears from other bear species include: i) a smaller skull especially in the facial region; ii) a more pronounced masseteric crest; iii) an extended zygomatico-mandibularis muscle; iv) a humeral epicondular foramen situated above the internal epicondyle; v) 13 pairs of ribs (one less than all other Ursids).

In contrast, Andean bears share the same dental formula other ursids with 42 teeth (incisors 3/3, canines 1/1, premolars 4/4 and molars 2/3), with the fourth premolar and molar teeth specifically adapted for chewing and grinding fibrous vegetation. The mandibular structure of Andean bears corresponds to the species’ omnivorous diet, with a combination of bladed canines and enlarged molar teeth.

**BODY LENGTH AND WEIGHT**

The following morphological information is based on data collected from 60 wild and captive Andean bears (n = 60) in Ecuador.

**Male bears:**

- Total length (from tip of nose to end of tail): 1.37 - 1.88m
- Weight: 130 - 200 Kg

**Female bears:**

- Total length: 1.30 - 1.48m
- Weight: 35 - 70Kg

A significant difference was observed between the weights of captive and wild individuals, with wild bears generally having a lower body mass than captive bears. This is caused by the higher activity levels required and seasonal food shortages in the wild environment. A degree of individual body mass variation was observed between wild adult bears, which are potentially influenced by climate and food availability, as well as genotypic variation. Adult bears exhibit significant sexual dimorphism, concurrent with other Ursid species. Our data shows male bears to have a body mass two to three times greater than that of their female
counterparts, with lifestyle also heterogeneous between the sexes. Further morphological data from other South American countries would reinforce our base data, and all captive bear facilities and wild bear research programs are encouraged to share data to gain a comprehensive understanding of Andean bear phenology throughout its range.

LIFE EXPECTANCY

Andean Bear life expectancy in the wild has not been established though we estimate bears in the wild rarely live longer than 20 years due to the combined stresses of foraging and competition. In captivity they may live as long as 40 years.

HEMATOLOGY

Hematological and serum biochemical values are important baseline parameters with which the health status of captive and wild animals can be evaluated. During wild bear studies and captive bear management, hematological data from 49 Andean bears was collated and analyzed. This has provided an insight into normal blood chemistry values for the species whilst indicating intraspecific similarities and significant differences caused by gender, age, diet, body mass and lifestyle. It has also enabled comparative studies using the hematology and serum biochemistry values of other ursids.

Andean bears appear to demonstrate significantly higher levels of serum triglycerides in comparison to other bear species. This could be indicative of a physiological mechanism to cope with the periodic starvation that occurs at times of year when there is a shortage of certain foodstuffs. Andean bears exhibit similarly low levels of blood urea nitrogen and alkaline phosphatase to those of the Giant Panda, which is likely to be a reflection of their predominantly vegetarian diet.

Hematological differences can be observed between captive and wild bears, with wild bears having a significantly lower mean cellular hemoglobin concentration, indicating periodic anaemia in wild bears caused by seasonal food shortages. Male bears have significantly higher blood protein levels than females, which is likely a direct correlation to sexual dimorphism and the larger body size of male bears. Adult bears have elevated hemoglobin, hematocrit and cholesterol levels in comparison to juveniles, yet lower levels of alkaline phosphatase.

More extensive hematological analysis is required to provide conclusive reference range values in order to better understand the effects of lifestyle, nutrition, disease, and environment upon hematological and serum biochemical values. Whilst further information is being compiled, the baseline data available provide useful reference values that can be consulted when analyzing rehabilitated bears’ hematological characteristics (Appendix I).
GENETICS

The Andean bear has 52 nuclear chromosomes (compared to the 74 chromosomes of the six ursine bears and 42 of the Giant Panda) and evolutionarily is one of the oldest of the extant bear species. Population genetics studies show that bears in Venezuela, Colombia, Ecuador and Peru have low levels of genetic diversity (Heterozygosity ($H$) = 0.40, total population). Genetic diversity levels reported for Ecuadorian bear populations oscillate between 0.4 and 0.5. These levels are low when compared to population genetic diversity levels reported for other species of bears.

DISTRIBUTION AND HABITAT USE

The Andean Bear is endemic to the Tropical Andes bioregion, and inhabits the majority of the Andean mountain range from western Venezuela through Colombia, Ecuador, Peru, Bolivia, and into northwestern Argentina (Fig. 3). Due to its adaptive plasticity, the species has adapted to live in a variety of habitats and occupy a wide range of altitudes between 250-4750 meters above sea level (masl). Ecosystems inhabited by Andean bears include páramo and puna high grasslands, and a variety of forest habitats including upper montane, subtropical, tropical and dry forests, and even shrubby coastal deserts. Food availability drives habitat selection and Andean bears often exhibit seasonal displacements between ecosystems, associated with fruiting cycles. Other factors that influence Andean bear habitat use include human presence, water availability, exposure, altitude, slope, aspect and steepness.

DISTRIBUTION IN ECUADOR

Andean bear presence in Ecuador is focused predominantly around the Andean mountain belt. Populations exist in both the western and eastern foothills, inhabiting the Choco bioregion to the west and the upper Amazon basin to the east. Andean bears in Ecuador
have a wide altitudinal range existing between 700 and 4300 masl. Habitats used by Andean bears in Ecuador include páramo high grasslands, montane, subtropical and semideciduous forests, though the bears’ preferred habitat is subtropical cloud forest with an altitudinal range of between 2000 and 2800 masl.

**ANDEAN BEAR BEHAVIOR**

Due to its shy and elusive nature, information on wild Andean bear behavior is scarce. Most behavioral data has been collected from local people and in the captive environment, though a small amount of data has been obtained from small-scale studies on wild and reintroduced individuals. Andean bears in the wild prefer to avoid interactions with humans at all costs, and on detecting any signs of danger they generally flee or climb the nearest tree in order to avoid confrontation (Fig. 4). To escape conflict, it has been observed that Andean Bears are able to jump from heights of up to 8m without suffering any apparent fracture, contusion or wound. Andean bears are believed to be aggressive only when threatened, hurt or with cubs. The only evidence of attacks on humans has been a result of severe provocation through injury caused by gunshots, whilst defending their prey from angry farmers, or due to incompetent mishandling in captivity.

Andean bears are largely solitary, interacting with conspecifics only to form mating pairs and in areas with unusually high concentrations of seasonal food resources. There are many reports of several bears eating in the same cornfield, feasting together on carrion and perched on the same tree eating fruits or berries. Large gatherings of males have also been observed competing for females in heat. Apparently, related animals could tolerate each other and form small temporary groups while exploiting an abundant food resource, as have been seen in other bear species.

Andean Bears are mainly terrestrial, but are partially arboreal in nature. They are agile climbers, and are able to climb not only trees but also vertical rock walls (Fig. 5). They are very good swimmers, and have been observed swimming across large lakes. As is characteristic of all ursids, Andean Bears have a highly developed olfactory sense and moderate levels of hearing and vision. They are able to stand and even walk short distances on their hindlimbs,

![Figure 4: © Philippe Henry. Andean bear effortlessly climbing a tree](image)

![Figure 5: © Robyn Appleton. Mother and cub scaling a vertical rock wall in search of food](image)
predominantly using this behavior to sense food resources and danger through olfactory cues.

Due to the relatively constant annual temperatures associated with life in a subtropical environment, Andean bears do not hibernate.

**ACTIVITY PATTERNS**

Throughout their range Andean bears exhibit predominantly diurnal activity. This is substantiated by our intensive radio telemetry studies in the Intag cloud forest region of northwest Ecuador, where we observed significant diurnal activity (4921 readings), with collared bears being most active between 0600h and 1830h. Activity decreased considerably between sunset and sunrise, and the bears were least active between 0200h and 0500h. From our results it is evident that Andean Bears do not undergo long periods of deep sleep, thus they require short naps during the day generally between the hours of 10H00 and 15H00.

**HOME RANGE, HABITAT USE AND MOVEMENT PATTERNS**

As well as being sexually dimorphic, Andean bear home range, habitat use and movement patterns contrast significantly between the sexes. Through our radio telemetry research on wild bears in Intag we estimated the average home ranges of Andean Bears using various calculation methods. We identified a significant sexual disparity in territory use between males and females. Using the 100% minimum convex polygon method we calculated an average home range of approximately 150km² for male bears (n = 3) and 34 km² for females (n = 5). Extensive home range overlap exists between Andean bears, particularly between males and females. Male ranges do overlap significantly however and territorial dominance between individuals appears to be absent.

Large territorial displacements realized by male bears are motivated largely by the pursuit of females and food. Males are able to travel up to 18.75 km per day when moving between core areas. In fragmented habitats, they often use forested ravines and existing ridgeline trails to migrate between forest patches that can be separated by up to 5km. Identification and protection of these forested ravines and ridgeline trails used as corridors by male bears is vital in order to maintain the genetic diversity of Andean Bear populations throughout their range. Female Andean bears have much smaller home ranges than males, and tend to concentrate their movements around relatively small areas where food is abundant. However, in areas where corn plantations exist adjacent to bear habitat, females are known to travel longer distances to obtain readily available and nutritious sustenance, and have been observed to travel approximately 6km in a day.
NESTING BEHAVIOR

Andean bears commonly build "ground nests" on the forest floor consisting of round piles of vegetation that are normally associated with feeding sites or migration trails. These ground nests are commonly found under the roots of large trees or leaning against rock walls and are mainly used for nocturnal resting. Andean bears also assemble platforms high in the tree canopy (Fig. 6) using branches, leaves and vines. Treetop platforms have been found measuring up to 6m long, and are known to be used recurrently over considerable periods of time for multiple purposes including resting, feeding, detecting food sources, and as lookout points when depredating on crops or livestock. It has also been observed in some cases that Andean bears use treetop platforms for prolonged resting and sleep.

In the páramo, bears have also been observed to build nests strategically on rock faces in order to sense potential danger in areas of regular human activity (Fig. 7). We recently uncovered such a nest near to the popular fishing destination of Sucus Lake. The nest was ideally placed to detect approaching humans, and was covered in excrement piles from at least four different individuals. This underlined the nest’s strategic importance and the unlikelihood of it being a maternal nest due to the presence of excrement at the nest site.

DIET AND FEEDING BEHAVIOR

Andean bears have a very varied diet, which contrasts depending on geographical region, food availability and seasonality. They are predominantly frugivorous/folivorous omnivores, though they are opportunistic in their alimentary selection, eating a wide range of plant, fungi and animal foodstuffs. Due to their perennial availability, the most commonly consumed plants in several cloud forest regions such as Intag and Cosanga in Ecuador are Suro bamboo (*Chusquea* spp.), bromeliads (*Guzmania* spp., *Greiga* spp.), palm hearts (Arecaceae), heliconias (Heliconiaceae), and prayer plants (*Calathea* spp.) Andean Bears are excellent climbers of trees, where they feed on a variety of fruits and seeds, which have different maturation cycles that often provoke large displacements of habitat in search of ripened
specimens. The main cloud forest fruits consumed by Andean Bears are higuero wild figs (*Ficus* spp.), wild avocados (*Nectandra* spp., *Ocotea* spp.) and myrtle (*Myrcianthes* spp.), among many others (Appendix VI). In the paramo ecosystem, Andean bears feed principally on puya bromeliads (*Puya* spp.), frailejones (*Espeletia pycnophylla* ssp. *angelensis*) and blueberries (*Vaccinium* spp.). In the wild, animal protein is obtained by foraging for worms, insects and larvae; harvesting the eggs of various bird species; scavenging for carrion including cannibalistically; and hunting for rodents, birds, rabbits, deer and mountain tapirs (*Tapirus pinchaque*: Fig. 8). An interesting behavior displayed by Andean bears is the use of latrines in which they defecate repeatedly in the same place (Fig. 9).

More and more frequently, Andean Bears have begun to enter into the ironically named ‘human domain’ in search of nourishment due to the widespread deforestation of their natural habitat by humans. The main non-native food sources exploited by Andean Bears are corn (*Zea mays*), granadilla (*Passiflora ligularis*), banana (*Musa* spp), sugar cane (*Saccharum officinarum*) and tree tomato (*Solanum betaceum*). There are also sporadic reports in Colombia and Ecuador of Andean bears fishing for rainbow trout (*Oncorhyncus mykiss*) especially in artificially stocked lakes and fish farms. Worryingly, attacks on domestic livestock are becoming more frequent. The emergence in bear depredation of human crops and livestock is causing an escalating conflict between bears and humans. Radical measures must be taken immediately in order to decelerate a problem that, without intervention, will threaten the species with extinction in years to come.

**REPRODUCTION**

Little is understood regarding the reproductive and maternal behavior of wild Andean bears due to the species’ elusive nature and the sheer inaccessibility of its terrain. Most of the information collated on Andean bear reproduction has been obtained from captive animals, though data on wild bears is increasing thanks to research carried out in the Chaparri region.
of Peru and recent discoveries here in Ecuador. In captivity, Andean Bear females reach sexual maturity at around four years of age, while in the wild it is thought to be about two to three years. In zoos, courtship and reproductive behavior lasts between one and five days, and involves non-aggressive fighting, frolicking and reciprocal high-pitched grumbles. In the wild Andean bears are polygamous, with males possessing multiple mates throughout their extensive home ranges. Courtship behavior of wild Andean Bears is largely unknown, though females have been observed with assemblages of up to four disputing males stalking their trail. Gestation periods observed in captivity vary between 160 and 255 days. In cloud forest habitat, it is likely that births coincide with the ripening season of nutritionally important fruits and more recently with the maturation of the maize crop.

The species exhibits embryonic diapause as a reproductive strategy in which the fertilized egg remains in a state of dormancy within the uterus for a period of time before implanting into the uterine wall to continue its development. This makes it very difficult to detect pregnancy during the early stages. In some cases embryonic resorption has been reported in captivity.

Captive born cubs measure approximately 18 cm and weigh between 300 to 500g at birth. They open their eyes around 42 days and at around three months of age are ambulatory and are able to follow their mother. Females give birth to one or two cubs (in rare cases up to four) in a previously prepared nest in either cavities in rock faces (Fig. 10), or under huge rocks or tree roots. Wild Andean bear maternal behavior is largely unknown, though mother and cub(s) are believed to abandon the nest after approximately nine to twelve weeks, and cubs have been observed to accompany their mother for well over a year before separation. In the Intag region, collared female bears have been observed with the same cub(s) over time periods of up to 13 months, indicating that the maternal period considerably exceeds this time period. Further studies on maternal behavior in different habitats are vital in order to better understand the essential needs of nesting and nurturing Andean bear mothers, thus enabling specifically focused habitat protection in key denning sites.

At the Andean Bear Foundation, we have recently uncovered and researched Andean bear maternal dens in cloud forest and paramo habitat for the first time in the history of the species. This research has provided many important insights into wild Andean bear nesting behavior. To follow are descriptions of the two distinct Andean bear dens found in cloud forest and paramo habitat.

![Figure 10: Andean bear maternal den in rock cavity in cloud forest](image)
Andean bear den in cloud forest habitat

The den had been purposely constructed by a pregnant female using branches and dry leaves from the surrounding trees in preparation for birth. The whole nest arrangement was approximately 2m long and 1m wide, with the sheltered hollow inside measuring approximately 1.5m long x 0.80m wide and 0.50m deep (Fig. 10). The dryness and age of the branches suggested that the nesting site had been used in previous years highlighting the importance of protecting known denning sites. The posterior half of the nest consisted of a small, natural rock cave located on a narrow ledge with ferns hanging vertically from the rock face above. The anterior section of the nest had been constructed on a ledge of soil, rock and moss measuring around 10m long and 3.5m wide, with a series of deeper cavities off to one side. The immediate surroundings of the den were clean with practically no feces or strong odors, indicating that precautionary steps are taken to eliminate the risk of attracting predators with olfactory cues.

Andean bear den in paramo habitat

During the writing of these guidelines, we have also uncovered the first Andean bear den in páramo habitat (Fig. 11). Due to the extreme climatic conditions of the páramo habitat, the female bear had carefully selected the dry face of a large rocky outcrop to position her nest. The nest had a slightly smaller surface area than the one found in the cloud forest environment, measuring 1m long by 0.7m wide. The smaller size was presumably for increased heat retention, with the nest excavated half a meter deep into thick vegetation to increase insulation and shield the nest from strong cold winds. The nest had two entrances; a principal access route and an exit route that was concealed to one side of the nest. The female had constructed the nest in a similar form to the nest of the Northern mountain cacique (Cacicus leucoramphus) in order to effectively block wind while retaining heat, thus ensuring that the expectant cub would be well sheltered from the elements. The primary component of the nest was fuchsia (Fuchsia spp) which, along with some other vegetation, appeared to have been raked from within an area of several square meters surrounding the nest. Again, the surrounding area of the nest was clean, indicating precautionary measures are taken to eliminate the risk of attracting predators.

CONSPECIFIC COMMUNICATION

Vocal communication in Andean bears is rare and mainly occurs between mother and cub during the period of parental care. Other recorded incidents were generally induced during mate and resource competition, or associated with stereotypic behaviors in captivity. During our work with bears in rehabilitation and in the wild, we have identified seven different calls used by Andean Bears for communicating with conspecifics. To follow is a description of
each of these different calls with phonetic characterizations where possible using the human intonation:

**Table 1: Vocalizations of Andean bears and their designated purposes.**

<table>
<thead>
<tr>
<th>Vocal description</th>
<th>Phonetic Description</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purring</td>
<td>Kuurrr , Kuurrr</td>
<td>A call expressed when curious or scared</td>
</tr>
<tr>
<td>Tutting</td>
<td>Tuutucttu</td>
<td>This call is characteristic response of bears that have been discovered in the treetops, and is a sign of a female bear communicating with her cub(s)</td>
</tr>
<tr>
<td>Shrieks and bellows</td>
<td></td>
<td>Demonstrative noises exerted by males when disputing over food or a female on heat</td>
</tr>
<tr>
<td>Short gasps</td>
<td>Gguff , Gguff</td>
<td>Initiatory call when attacking another bear or a response to being abruptly startled</td>
</tr>
<tr>
<td>Grumbling</td>
<td>Eggmmmm</td>
<td>Responsive call of peril when cornered, generally in the treetops</td>
</tr>
<tr>
<td>Anxious moaning</td>
<td>MMrnnMMrnn</td>
<td>A stress induced noise and behavior only heard from captive bears in zoos and occasionally from bears that have been in prolonged rehabilitation. This noise is accompanied by a form of masturbation in which the bear rubs himself vigorously against another part of his body, another bear or on a stationary object</td>
</tr>
<tr>
<td>Bleating</td>
<td>Gmrr , gmrr , gmrr</td>
<td>A noise of contentment made by bear cubs during suckling and motherly care</td>
</tr>
<tr>
<td>Incessant whining</td>
<td></td>
<td>Call made by cubs when calling for their mother for protection or milk</td>
</tr>
</tbody>
</table>

**MARKING BEHAVIOR.**

Andean bears exercise various methods of indirect communication in the wild. The main such communication method involves rubbing against specific tree species to strip epiphytic moss and bark, followed by claw marking, scent marking, and the deposition of hormonal secretions. The principal purpose of this behavior is generally to announce ones presence to potential mates. Despite the apparent lack of territorial behavior between Andean bears, claw and scent marking also appears to be a way of determining dominance and position in the social dominance hierarchical system.

**ROLE IN THE ECOSYSTEM**
Andean Bears play a crucial role in maintaining the dynamic and structure of the ecosystems in which they inhabit. They are effective seed dispersers for a variety of plant species, promoting the regeneration of the forests through their everyday activities. Not only are they proficient seed dispersers, but due to their semi-arboreal nature, Andean bears commonly break off large tree branches to open up clearings, allowing the development of seedlings that are germinating in the understory. In the secondary cloud forests of Intag, Ecuador, the Andean bear exhibits a behavior of ripping bark off pioneer tree species such as cedrillo (*Brunellia* spp. Fig. 12), inflicting the decay, death and premature fall of these trees. As a consequence, large clearings are formed that benefit the development of slow growing and emergent tree species, ultimately aiding the dynamics and diversity of the forest.

Research has revealed that Andean bears in the wild prune various types of vegetation including edible palms and bromeliads. This encourages the regrowth of replacement buds, leaves and flowers of these plants, maintaining them in prime condition. Due to the many ways in which Andean bears clear, prune and germinate the forests, they are often referred to the gardeners of the cloud forest environment in Ecuador. The ecological role of Andean bears is not just limited to maintaining the forests and paramos. They also play a vital role in regulating the hydrological cycle, as a secondary effect of their natural behavior in these ecosystems. Through their horticultural behaviors, Andean bears increase the density of epiphytic plants in the cloud forest, which in turn enhances the effect of evapotranspiration and the level of effective rainfall that is permeated into streams and rivers.

**THREATS AND CONSERVATION STATUS**

Due to its low reproductive rate and lengthy period of parental care, Andean bears are highly susceptible to the effects of human intervention on their habitat. Andean bear habitat is being lost and fragmented at an unprecedented rate with the expansion of agricultural frontiers throughout the Andes and as a result, extinction risk is expected to increase faster than that of any other ursid species. Numerous Andean bears are killed in human–bear conflicts resulting from agricultural land conversion and poaching continues to be a major conservation issue for the species. Consequently, Andean bear populations are declining throughout their entire range and there are believed to be no more than 20,000 individuals left in the wild, with an estimated population of less than 3,000 in Ecuador. The Andean bear is classified on the IUCN Red List as vulnerable (VU) across its entire range, and
endangered (EN) in Ecuador in the Red Book of Mammals of Ecuador. It is also included in Appendix I of the Convention on the International Trade of Endangered Species (CITES).

CHAPTER II: ANDEAN BEAR REINTRODUCTION PROGRAMS

Unfortunately, it is becoming more common that Andean bear cubs are in need of rescuing due to escalating human-bear conflicts and habitat loss. Reintroduction programs are tangible alternatives to euthanasia or perpetual captivity for bears that meet the stringent criteria demanded for a potential return to the wild. Andean bear rehabilitation and reintroduction encompasses a complex series of processes that must be implemented with the utmost of meticulousness to ensure that the best interests of the bears are continuously prioritized. At the Andean Bear Foundation, we have reintroduced 21 bears and as such, we provide the following recommendations for the consideration of fellow biologists that have similar ambitions of reintroducing Andean bears into the wild.

PROJECT PLANNING - ESSENTIAL PRE-PROJECT CONSIDERATIONS

In any new initiative, coherent and comprehensive planning is a key factor in determining ultimate success or failure. There are a number of considerations that need to be carefully deliberated prior to the inception of an animal reintroduction program.

FINANCES, FUNDRAISING AND LOGISTICS

In order to function in a successful and systematic manner, all animal rehabilitation and release programs demand a stable and secure financial status, a well thought out and logistically sound strategy and a suitable infrastructure. It is essential to have such funds and forward planning in place prior to the implementation of any such ventures.

Program funding, especially with regards to new initiatives, is often the most difficult obstacle to overcome. Such funding should be sought imaginatively using a multi-dimensional approach considering localized fundraising schemes, social network campaigns and grant applications. It is advisable to carefully select fund providers that specifically target projects and geographical areas similar to the one you work in and, where possible, it would be ideal to contract somebody with previous grant writing experience.

PROJECT TEAM

A dependable and enthusiastic team is fundamental in ensuring successful execution of the many tasks involved in rehabilitation and release initiatives. Project leaders must be
recognized in their field, and the presence of at least one veterinarian with wildlife handling experience is imperative.

The team should consist of a multidisciplinary balance of veterinarians, biologists, animal caregivers and field assistants with the necessary skills to oversee the various aspects of the program. The team will be comprised of both skilled professionals and devoted volunteers which will be determined depending on the scale of the project and the resources available.

Additional experts, such as botanists and environmental educators, may be required to perform habitat assessments of release sites and to increase the localized knowledge and respect towards the target species in areas adjacent to release sites.

Team capacity evaluation prior to the outset of the program is essential in order to address where training is needed, and thorough training should be provided to all staff members in relevant practices in order to avoid potential harm to both personnel and animals.

It is recommendable to elect a board of advisors from outside the project team in order to provide an impartial evaluation on all aspects of the program from an unbiased perspective. Regular team meetings are important in order to share ideas, to maintain a common focus and to foster a healthy team spirit.

**LICENSING ACQUISITION AND GOVERNMENTAL REQUIREMENTS**

Regardless of the country you find yourself in, in order to carry out any hands on work with wild animals there are a number of legal and governmental requirements you must fulfil. Rehabilitation facilities focused on rearing and releasing bears must be licensed and endorsed by the relevant governmental entities responsible for managing wildlife. Though license requirements will vary from country to country, detailed action plans are often an essential prerequisite for obtaining such licenses. Action plans will need to describe all procedures to be carried out throughout the duration of the program including rescue, tranquilization, drug administration, transportation, handling, collection of biological materials and reintroduction.

License acquisition and action plan approval is often a long, drawn out process and information should be requested from the relevant governing body (often called the Ministry of Environment or its direct translation) long before planning your project start date.

The importance of forward planning cannot be overemphasized when it comes to rescuing, rehabilitating and reintroducing animals back into the wild. It is helpful for all staff members to have a clear picture of how everything will be done, who will do what and when. The more prepared the project and its staff are, the more likelihood there is of it managing pressure situations and achieving its desired ultimate objectives.
COMMUNITY PARTICIPATION

It is highly recommended that bears are reintroduced into areas sufficiently large and distant from populated areas to avoid the potential of them encountering humans. However, this is not always possible. In such cases where there is no option but to release bears in relative proximity to human settlements, one of the key elements of a successful reintroduction program is a healthy relationship with surrounding communities. Community participation is an integral project component that can easily be overlooked in the planning phase, leading to reintroduction failure. The communities surrounding a bear release site, rehabilitation facility or wild bear research initiative should be consulted prior to location selection, and it is advisable that their opinion is scrupulously taken into consideration. Though community agreement, backing and support is vital, the involvement of local people as park rangers, project assistants, and educators is also strongly advised in order to create regional ambassadors that can teach conservation values to neighboring communities.

BEAR RESCUE CONSIDERATIONS

There are a variety of circumstances that one could be presented with during a rescue mission. It is important to adhere to a carefully formulated protocol as much as the situation allows, whilst being flexible and prepared for every potential incident that may arise.

RESCUE PROTOCOL

Rescue missions should be accompanied by recognized government officials or authorities in order to prevent any threat or harm to rescuers or animals. When handling bear cubs, it is advised that personnel wear bite resistant gloves to avoid potential injury. Cubs under three months can be managed and transported in the lap of rescuers without anesthesia. Should they appear nervous or aggressive, a fetch pole (Fig. 13) should be used to transfer them to a transport kennel in order to reduce stress (Fig. 14). Bear cubs may be bottle fed during transport following the guidelines described in the bear cub diet section (Chapter IV, page 43).

Rescued juvenile and adult bears must be transported in a transport container as described in the subsequent section (page 26). Depending on the temperament of the bears and the logistical difficulties experienced at the rescue site, it is often
necessary to anesthetize bears using the guidelines described in the ‘Immobilization’ section (page 29). In cases where bears are transported without anesthetic they can be provided with solid foodstuffs such as fruits or sugar cane.

Time is of the essence during rescue missions, and it is essential to transport the rescued bear(s) to a veterinary clinic with controlled urgency to ensure the bear arrives not just speedily, but also safely. For veterinary care procedures during transport, see page 28.

INTENSIVE VETERINARY CARE- NURSING BEARS BACK TO HEALTH

Often, rescued animals are in poor physical condition, and their health status can be critical. A full medical check up must be performed on arrival at the veterinary clinic and a detailed medical history archive should be initiated (Appendices III and IV), with all observations and necessary treatment being documented. Rescued individuals may need constant veterinary attention, and it can take weeks to nurse them back to full health. It is vital that they show a clean bill of health before being considered for a rehabilitation program. Should rescued bears enter a rehabilitation program, their medical record must continue up until the release date in order to keep track of medical history throughout rehabilitation.

SELECTION OF BEARS FOR REHABILITATION PROGRAMS

Bears are rescued in a variety of circumstances, at different stages of their development, and with diverse physical and mental conditions. After every rescue mission, a difficult decision has to be made regarding the fate of each rescued individual. At the Andean Bear Foundation, we aim to provide as many bears as possible with the opportunity to be free again. Unfortunately, due to financial and spatial restrictions, we are not always able to accept all bears that are eligible onto rehabilitation programs. In such cases it is important to direct funds towards individuals that stand a superior chance of being successfully rehabilitated, and hence have a better opportunity of surviving and procreating on a return back into the wild. Younger, less habituated and more ‘wild’ bears should be selectively chosen for rehabilitation programs in such instances.

Once a bear is back to full health following its rescue, a thorough physical examination is carried out in order to determine its suitability to enter a rehabilitation program. Bears that are either ineligible for reintroduction or those that cannot be taken on due to financial and/or spatial constraints should be relocated to a sanctuary or zoological institution.
To enter a rehabilitation program, bears should possess the following characteristics:

- Absence of permanent physical disabilities or injuries
- Aged no more than 10 years in order to focus reintroduction efforts on individuals that will have a greater reproductive capacity.
- Fur, claws and teeth in perfect condition.
- Normal blood chemistry, hematology and serology, and a lack of hemoparasites. Should bears display blood chemistry values outside the reference range for the species (Appendix 1), specific tests for hemoparasites such as Leptospira, Brucellosis etc. must be performed. Should tests show positive, treatment must be administered during rehabilitation in order to avoid the spread of the disease and the contamination of the native bear population upon release. Some common diseases suffered by Andean bears and details of their treatment can be found in Appendix 2.

QUARANTINE AND INITIAL ADAPTATION

Bears that have been selected for rehabilitation must undergo a period of quarantine and observation that lasts between 30 and 45 days to ensure no illnesses or diseases have emerged. The quarantine period also gives bears the opportunity to acclimatize to their new surroundings at the rehabilitation facility. During the quarantine period, all necessary treatment must be provided by a qualified wildlife vet, and duplicate hematology, blood chemistry and coprological testing should be performed in order to definitively ascertain that the animal is healthy. Following a successful isolation phase, the rehabilitation process may begin immediately. Should an individual show a serious or terminal illness or deformity during quarantine, it is rejected from the rehabilitation program and transported to a sanctuary or zoo.

TRANSPORT OF CUBS AND ADULT BEARS

From the initial rescuing of bears, through their transporting to rehabilitation facilities, and finally on their journey to freedom during the release mission, transportation is an omnipresent component of bear reintroduction programs. It is also a delicate and hazardous process,
especially when immobilization is necessary, and therefore must be treated with extreme care and respect. There are a number of considerations to take into account when transporting bears, and each and every detail is vital to ensure a safe and smooth passage to its final destination.

**DESIGN AND CONSTRUCTION OF TRANSPORT CONTAINER**

Transport containers for Andean bears are normally made of metal, though wood may also be used for smaller individuals. Dimensions should vary according to bear size, but should allow them to turn completely freely. Container height should enable the bear to stand with its head extended and length should allow the bear lie face down without touching the sides.

Transport containers we have successfully used for adult bears are 2 x 1 x 1m steel boxes (Fig 15), similar to Iznachi traps, minus the trap mechanisms such as pulleys, nylon cord, fasteners and sliding rails. See ‘Iznachi Trap Design’ section. (Page 71). It is important that four handles are added to the design of transport containers, one in each corner to facilitate transport (Fig. 15).

**TRANSPORT CONSIDERATIONS**

Where immobilization is necessary, bears are fasted for 24 hours prior to being transported in order to facilitate anesthesia (for rescue missions this may not be possible). They are only provided water to maintain hydration levels. Bears that have not been previously transported and/or are calm-natured may be persuaded to enter transport containers using food items. Should this be successful, they may be transported without using anesthetics and may be proportioned foodstuffs during transport, taking into consideration transport time. On the other hand, bears of a nervous disposition must be tranquilized, with anesthesia being limited to a maximum period of five hours. If the journey to the release site/rehabilitation center takes longer than five hours, it is advisable to allow the bear to wake up and monitor its progress until the final destination has been reached. When transporting immobilized bears, it is important to wait between four to six hours or until the animal is completely awake and alert before supplying food.

If multiple animals are transported at the same time, getting them into transport containers becomes more difficult due to the mutual stress experienced by the animals. In such situations it is preferable to immobilize the bears one at a time starting with the most nervous individual. Once they are in their respective containers a decision should be made, depending on the temperament of each individual, of whether to keep them sedated or not.
During transportation it is important to minimize the stress and discomfort of the bears. Dry native vegetation, grass or sawdust may be scattered on the floor of the container to enable the bear to lie comfortably. When transporting bears relatively long distances in warm conditions, it is important to keep them cool and hydrated. The most effective way of doing this is by intermittently spraying them down with water. Adequate air circulation is supplied to the container via small air vents in the roof.

Should bears be transported by air, the container should be built under the regulations and standards set forth in the September 2003 IATA (International Air Traffic Association) Regulations (Crate # 73):

**VETERINARY CARE DURING TRANSPORTATION**

When transporting bears without immobilization, it is important to monitor them every 30 minutes, with necessary action taken should health status appear to be deficient. However, when transporting immobilized bears, the following steps should be taken subsequent to anesthesia in order to perform a safe and stress-free translocation:

i) Confirm the bears’ unconsciousness by gently touching its ears with the tip of the blowpipe or unloaded tranquilizer gun (Fig. 16)

ii) In the absence of the ear twitching reflex reaction, the bear can be approached. Should the bear react, it must be left a further few minutes before testing the reflex again, and if deemed necessary further anesthetic should be administered.

iii) Carefully remove the dart. Wipe away excess blood, disinfect the wound using antiseptics, and spray repellent around the wound to deter flies and parasites.

iv) Check the condition of the eyes, ensuring they are clear and moist, and free of dirt and abrasions. Should the eyes be dry and/or dirty, apply saline solution. During the anesthetic period, it is important to cover the eyes with a blindfold of some sort, in order to reduce stress and prevent damage to the cornea and retina. Apply neutral eye gel (Vetergenta ®) between the eyelids.

v) Carefully transfer the bear to the transport container. Should the bear need to be carried a long distance to the container, it is advisable to use a two person hammock or a stretcher in order to facilitate transport and minimize bear stress. Gently place the animal in the container, positioning it in the lateral decubitus position and alternating sides every hour during transport.

vi) Throughout the duration of anesthesia, avoid loud noises and sudden movements. Immobilized animals must be monitored continuously and vital signs should be checked every five minutes, including the winking reflex, mucous membrane color and capillary refill time.
vii) In order to prevent infections that may be caused during animal handling and anesthetic induction, it is advisable to inject intramuscularly a wide spectrum antibiotic and an ADE vitamin complex.

**IMMOBILIZATION**

Veterinary care of animals during transportation and medical examination should always be overseen by a vet with experience in wildlife immobilization as there are numerous complications and difficulties that may arise that demand specialized attention. This section is merely a basic guide to help direct wildlife vets and assistants based on our personal experiences. There are comprehensive animal anesthesia guides that should also be referred to in order to gain more extensive information on the processes involved.

There are a number of situations in which Andean bears will require immobilizing for transport, medical examination or treatment. The immobilization method employed should depend on circumstance and environment. From short distances (< 2m), jab sticks may be used for administering tranquilizing agents. Equally, blow pipes are effective from short distances, though their efficiency decreases from distances of over 5m. In situations where it is not possible to approach closely to a bear, tranquilizing guns are the only option available.

For the immobilization of Andean bears, it is recommended to administer intramuscularly a combination of Ketamine (3-8 mg/kg, Ketamine 50 ®) and Xylazine (2 mg/kg, Xylazine HCl). Ketamine is a relatively economical, quick acting tranquilizer with a wide margin of safety that induces a state of analgesia and anesthesia. To reverse the effects of this anesthetic, Yohimbine (0.1-0.25 mg/kg) is administered intravenously in order to accelerate the rate of recovery. Alternatively, a combination of equal parts of Tiletamine and Zolazepam may be employed in a dose of 3-5 mg/kg. For prolonged anesthesia using both of the above combinations, immobilization can be maintained with additional doses of Ketamine.

**SAMPLING UNDER ANESTHETIC**

Due to the lack of hematological, genetic and epidemiological data on Andean bears, it is important to take samples at every opportunity. Having a bear under anesthetic for transport or medical examination provides us with the perfect opportunity to improve the comprehension of little understood
aspects of Andean bear physiology. Should conditions and circumstances allow for samples to be taken without risking the bears’ well-being, samples should be taken as soon as it is completely immobilized. To follow are explanations of sampling methods for a variety of analyses:

**Blood sampling:** Blood samples of Andean bears are best taken from the femoral artery (Fig. 17). The area is prepared and disinfected before blood extraction is performed with a sterile syringe and needle. Extracted blood is transferred into two labeled and color coded vacutainer tubes, one with anticoagulant and one without. The tube with anticoagulant needs to be slowly inverted 10 times in order to carefully blend the blood and anticoagulant together. The tube without anticoagulant needs to be maintained vertical and still for a minimum of 20 minutes to stimulate rapid coagulation and serum separation. Both tubes need to be refrigerated immediately (freezer boxes are useful tools when sampling in the field) and taken to a laboratory within 24 hours for analysis.

**Hair sampling:** It is important to collect at least 10 clean, coarse hairs complete with follicle, ideally from the base of the tail. Contact must be avoided to prevent the sample becoming contaminated. Hair samples should be preserved in unwaxed paper envelopes, labelled carefully and placed inside non-breathable containers with a silica dessicant, then taken to the lab for genetic analysis.

**Skin sampling:** Skin samples are only taken should the bear have a superficial injury. Skin cells are scraped from the wound using a sterile scalpel blade and the sample is preserved in a test tube. Skin samples should be around 1cm² and conserved in 10% formaldehyde in order to perform a biopsy.

**Urine sampling:** Urine collection for sampling can only be performed if the bear urinates involuntarily as a result of muscle relaxation induced by the anesthetic. Urine should be collected in a secure and sterile container and kept refrigerated during transport until laboratory analysis is possible.

**Fecal sampling:** Feces are taken where possible directly from the rectum using a sterile examination glove. The sample is divided into two, under sterile conditions, with half being preserved in 10% formaldehyde solution and half placed into a sterile container. Both samples must be immediately refrigerated and taken to a laboratory for analysis.

**Biopsies:** In cases of swollen ganglia, biopsies can be taken using the following instructions: Prepare and disinfect the sample area. Hold the swollen ganglion using forefinger and thumb. Using the other hand, pierce into the center of the ganglion with a two inch #16 needle and extract a tissue sample. Preserve the sample in a sterile test tube and send to a laboratory for analysis.

**Ectoparasites:** Ticks and mites should be removed from the body carefully as it is critical that the buccal apparatus (hypostoma) remains intact to enable microscopic identification.
Ticks can be transported live in an aerated but secure container, with vegetable matter to maintain moisture until they have been identified in the laboratory. When it is necessary to store ticks for long periods of time, they should be preserved in 70% alcohol. It is recommendable to remove microscopic ectoparasites such as lice and fleas using a lice comb. These parasites should be preserved in 70% alcohol for subsequent microscopic analysis.

**Note:** Where possible, it is advisable for specimen analyses to be performed at the same laboratory to ensure uniform standardization, repeatability and comparison of results for an individual, and between individuals.

**EMERGENCIES**

During anesthesia an element of risk always exists and contingency plans must be carefully planned in case emergency situations arise. All necessary drugs and equipment must be incorporated into the transport inventory in order to efficiently deal with any emergencies that may transpire. A veterinary doctor with wildlife handling experience is an essential team member in animal transport procedures to ensure the life of the animal is not unnecessarily compromised.

There are an endless number of emergency situations that may arise during immobilization. To follow are just some of the potential types of emergency situations we have encountered, with brief descriptions of how they can be successfully managed.

**Hyperthermia:** If body temperature exceeds 40ºC, it is essential that measures are taken to regulate it. A method of decreasing bear body temperature back to within its normal range is to moisten areas of the body that are efficient in evaporative cooling, such as the inner thighs, armpits and abdomen. It is important that cool (not cold) water is used, and that a water sprayer is always on hand during transit.

**Cardio-respiratory arrest:** In cases of cardio-respiratory arrest, it is crucial that a vet with extensive experience in emergencies under anesthetic is present. An endotracheal tube must be inserted immediately to establish and maintain a patent airway. Intravenous therapy must be performed for vital fluid replacement and a dosage of 0.5mg/kg Doxopram® must be intravenously administered.

**Vomiting and excessive salivation:** In the event of vomiting and excessive salivation place the bears head in the ventral decubitus position in order to permit fluid drainage, thus preventing suffocation caused by fluid entering the lungs.

**Sudden and unexpected revival:** It is crucial to be permanently aware of a bear’s vital signs whilst it is under anesthetic. A supplementary dose of ketamine must be pre-prepared, and
on observation of the slightest sign of movement, it must be administered intramuscularly in order to prolong immobilization.

CHAPTER III: REHABILITATION FACILITIES

Ideally, bear rehabilitation centers should have the capability to cater for a wide range of bears of different sizes and ages, therefore installations should consist of a variety of enclosures for infant, yearling, juvenile and adult bears, as well as a quarantine facility. Obviously many rehabilitation programs don’t have the necessary finances for multiple enclosures, though they should have a minimum of facilities for infants, yearlings and adults. Size recommendations for bear enclosures in South America are not available therefore rehabilitators are advised to follow the minimum enclosure sizes recommended for Ursids by the U.S. National Wildlife Rehabilitators Association (NWRA).

SITE CONSIDERATIONS

Rehabilitation facilities designed for raising and releasing Andean bears can either be constructed within or adjacent to national or privately protected areas where bears will be released, or in an ideal logistical location far from the release area. Depending on the individual circumstances of each reintroduction program, there are pros and cons for both options.

FACILITIES NEAR RELEASE SITES

For facilities built near release sites, it is often more difficult to transport building materials, food, and the bears themselves before and during rehabilitation. However, once the facility is constructed and the bears are in position, they are able to acclimate and adapt to post-release conditions throughout the rehabilitation process. Additionally, natural bear foodstuffs present in the release area will be readily available for enrichment purposes. Though there are many logistical challenges to be overcome with this option, the benefit of buffering the initial release shock by providing release site conditions throughout the rehabilitation phase should increase release success potential.

FACILITIES FAR FROM RELEASE SITES

Due to the financial constraints of many rehabilitation programs, options are limited as to where and how rehabilitation facilities can be constructed. Often facilities have to be constructed far away from release areas and close to town. There are many logistical benefits created by being in close proximity to town. Easy access facilitates construction
work, bear transport, personnel coordination, veterinary procedures and the delivery of bear food and supplies. Contrastingly, release site conditions are not approximated, making pre-release acclimatization difficult. As such it is advisable that all new facilities are built in areas sharing a similar altitudinal range and climate to potential release sites.

Release missions embarked upon overland from distant rehabilitation facilities have previously proved stressful. Due to the inaccessibility of release sites and the poor condition of rural dirt tracks, overland expeditions take time. This increases the level of risk being put on bears’ well being and can even put their life in jeopardy due to prolonged anesthesia. Though overland release missions can be carried out if there is no alternative, they should be extremely carefully planned with detailed contingency protocols in position. Where possible, the use of helicopters to transport bears to their release site should be favored in such circumstances to minimize bear stress and the risk of mortality.

**REHABILITATION FACILITY RECOMMENDATIONS**

There are many fundamental elements that are essential to providing a safe, hygienic and stress-free environment for Andean bears during rehabilitation. It is advised that all Andean bear rehabilitation facilities consider the following guidelines:

- All rehabilitation facilities must be isolated from human disturbance regardless of their location.
- Where possible, rehabilitation facilities should have vehicular access to transport caretakers, construction materials, food, veterinary supplies, and to facilitate emergencies.
- The slope of the enclosure site must exceed 15 degrees in order to maintain good soil drainage and prevent flooding and swamping.
- The enclosure must not be exposed to flooding from rivers and/or areas of landslide risk.
- The enclosure must have access to a nearby water supply.
- There must be no trails, roads, or public throughways in close proximity to the rehabilitation enclosure.
- There must be nearby facilities and accommodations for researchers and caregivers.
- The entrances and perimeter fence of the facility must possess clear signs stating that entrance is prohibited to all unauthorized personnel under all circumstances.
VITAL COMPONENTS OF A REHABILITATION ENCLOSURE

All bear rehabilitation facilities must possess the following essential features, which should be complemented by the various habitat enrichment tools and strategies described in the following section.

Feeding and drinking vessels:

Each rehabilitation enclosure must have at least one feeder per animal, which can be made of concrete or any other rustic and strong material (Fig. 18), and must be firmly fixed in place to withstand the pressures exerted by bears during feeding. Fresh water must be permanently available to bears via drinking bowls, hose pipes and pools (see below).

Sheltered area:

Though Andean bears are well adapted to living in humid environments, it is important that captive bears are provided with a dry refuge in which it may find shelter, just as wild bears may seek out shelter at the base of a tree or a small cave in times of heavy rain. Consequently, rehabilitation enclosures should always have at least one sheltered area that consists of a roofed, enclosed and elevated platform with a combined area large enough to give all bears the option of keeping dry in times of heavy rain.

Pool:

All adult rehabilitation enclosures must possess a water feature that has a surface area of at least 4 m² (Fig. 19). The pool should progressively reach a maximum depth of 1m to ensure safety for juvenile and adult bears.
HABITAT ENRICHMENT

Though it is recognized that bears will instinctively respond to their environment on reinsertion and behave accordingly in order to survive and procreate, it is important to minimize the potential for bears to develop stereotypical behaviors and to provide all the necessary cues during rehabilitation to stimulate natural behaviors.

Enclosure enrichment is an essential part of the rehabilitation process. Where the rehabilitation enclosure is situated in areas adjacent to the release site, habitat enrichment is much easier to achieve. In rehabilitation facilities that are far from the release site, and near to towns, more care needs to be taken in mimicking the natural environment of the release area.

There are many key components to a rehabilitation program that should be implemented in order to stimulate natural behaviors and consequently stand bears in good stead on their return to the wild. The following structures and strategies are fundamental in prompting bears to exhibit natural behaviors during rehabilitation:

Climbing Structures and Platforms:

In the wild Andean bears spend a large proportion of their time in the canopy, and climbing is an integral part of their foraging behavior. During rehabilitation it is important to provide Andean bears with ample opportunity to practice their climbing skills, therefore it is vital to include a network of climbing structures within the enclosure. Andean bears frequently use treetop platforms in the wild, and as such a high platform should also be incorporated into enclosures.

Denning Structures:

As well as providing bears with a sheltered area in the enclosure, a type of ground denning structure is an ideal enrichment tool for rest and shelter, especially for female bears that use dens for birthing.

Marking stimuli:

A combination of trees, trunks and posts should exist within the rehabilitation enclosure in order to encourage typical scratching and marking behaviors used in the wild for conspecific communication and to maintain healthy claws.

Figure 20: © Alandy Torres. Juvenile Andean bears playing in an artificially made swing
Native vegetation:

The main priority of a rehabilitation enclosure is to mimic the bears' natural environment. With this in mind, ideally facilities should be located in an area that possesses flora congruent to that which exists at the proposed release site. In cases where this is not possible, it is important to introduce vegetation that exists at the release site into the enclosure on a weekly basis so bears can gradually familiarize.

Playthings:

To reduce the potential for bears displaying stereotypic behaviors, it is advisable to provide them with additional stimulatory cues using toys and playthings. Where possible it is preferable to construct playthings using natural materials. Swings or hammocks are ideal examples, and can be made using natural materials such as hemp, bamboo, wood, fique, or alternatively using non-natural ropes and large tires. They should be securely attached to the outer enclosure structure to prevent accidents (Fig. 20). Piles of logs and branches, both large and small also provide recreational value for bears in rehabilitation. Other artificial playthings such as balls and wooden boxes may also be used to keep bears entertained.

Social enrichment:

Though Andean bears are predominantly solitary animals, they undoubtedly encounter conspecifics in the wild on a regular basis. In order to prepare rehabilitating bears, especially orphans that may never have encountered other bears before, it is beneficial to house two or more bears together in order to encourage social behaviors and conspecific recognition. Having conspecific companions may also divert the bears’ attention away from rehabilitators and hence could reduce the likelihood of habituation.

Feeding Enrichment Strategies:

Andean bears are permanently challenged to search for food resources in the wild, and the majority of their time is spent foraging and scavenging for food. As such it is important that they do not become accustomed to ‘easy meals’ in rehabilitation. There are many strategies that can be used to force Andean bears to search for their food during rehabilitation that will stimulate their senses, and stand them in good stead for the challenges that await them in the wild. Food items can be positioned in different parts of the enclosure, hidden or buried to motivate bears into using their olfactory sense to locate food items. Additionally, native foodstuffs should be introduced such as palms, bromeliads, *Chusquea* bamboo, branches from fruiting trees, and a variety of animal protein sources. Feeding enrichment using native foodstuffs is covered in Chapter IV ‘Alimentation Strategies During Rehabilitation’ (Page 43).
DESIGN AND CONSTRUCTION OF REHABILITATION ENCLOSURES FOR ADULT BEARS

Due to the excessive strength, high intelligence and curious nature of Andean bears, security is paramount when considering the design and construction of rehabilitation enclosures. They must be constructed using heavy-duty materials, and constantly revised and maintained to prevent any potential for escape.

Project budgets will likely vary, though there are a number of minimum requirements that should be upheld. The perimeter walls of Andean bear enclosures must be especially durable, ideally consisting of overlapping galvanized mesh walls that are firmly attached to 3m vertical heavy gauge metal posts, and fixed into solid concrete foundations. The roof should be enclosed to prevent the possibility of escape or alternatively, walls should at least possess inward facing extensions at a 45° angle to prevent bears scaling the walls. Electric fencing around the perimeter of the upper wall may also be used as an escape deterrent.

All metal components of the structure must be welded firmly together or fixed securely with heavy duty staples or tie wire to form a fully enclosed structure. The flooring of all enclosures must consist of entirely natural material, such as rocks, logs, grass and dirt.

After experimenting with different styles and sized of enclosures under strict financial constraints, we have formulated designs for idyllic economical rehabilitation enclosures in cloud forest and páramo environments for adult bears. When managing abundant financial resources, it would be beneficial to build larger enclosures. However, most potential rehabilitation initiatives are likely to face financial difficulties therefore we thought it appropriate to share the design specifications of our enclosures for adult bears and cubs alike.

REHABILITATION ENCLOSURE DESIGN IN CLOUD FOREST ENVIRONMENT

In cloud forest environments rehabilitation enclosures should focus heavily on arboreal enrichment, incorporating as many components of a natural forest habitat as possible. It is important to consider Andean bear behavioral needs in a cloud forest environment as well as safety and welfare requisites during enclosure design. Consequently, we construct rehabilitation facilities suitable for two juvenile or adult bears as follows:
i) **Primary Chamber:** 12m x 6m x 3m (l x w x h)

This is the principal section of the enclosure where bears will spend the majority of their time during rehabilitation (Fig. 21). Accordingly, this section will contain the majority of enrichment tools including a sheltered denning structure, a small pool constantly supplied with fresh water, several scaffold structures to simulate a treetop environment, small accessible feeding platforms (Fig. 22) and various above ground resting places. Branches and rocks of different sizes are placed on the ground to simulate the forest floor litter and to prevent the formation of sludge (Fig. 23). Additionally, slender trees of the same species that bears use in the wild for marking are fixed in the primary chamber, and replaced when necessary to encourage individuals to use marking, rubbing and bark stripping behaviors. On occasion wild bear droppings will be deposited on the enclosure floor to stimulate responses to olfactory cues in the wild, and to foster intraspecific curiosity.

Within the primary chamber there should be an existing tree which the enclosure has been constructed around, or alternatively a 6m tall tree (can be artificially made out of concrete) may be introduced and erected spanning the combined height of the primary and superior chambers (see below). The tree structure must be thick enough to allow the animals to climb (>20cm DBH), and should possess side branches and an artificially constructed platform (Fig. 24).

The primary chamber may be divided into two interconnecting 6m x 3m sub-sections to enable intervention in emergency situations of aggression between individuals. There must be two distinct entrances to the main chamber, situated in opposite corners to facilitate
safe cleaning, maintenance and enrichment. Entrances should be accessed through auxiliary chambers (see below) to ensure safety and eliminate the risk of escape.

The enclosure should possess a roofed area that covers half of the main chamber to provide the bears a choice of being under shelter or out in the open. The roof can be made of zinc sheets, complemented by leaves and branches of native flora to provide shade and protection from rain. Two opposite walls should have small windows for observational studies using cameras and video cameras.

**ii) Superior Chamber: 3m x 3m x 3m (l x w x h)**

Due to the bears semi-arboreal nature, it is important to incorporate an elevated section within the enclosure. This should be a vertical extension of the main compartment and should measure approximately 3m³. The superior chamber appendage provides a 6m vertical expanse within the enclosure and includes a tree structure with which the bears are able to enhance their climbing agility and strength. Within this elevated chamber, one or two wooden platforms measuring 2.80 long by 0.80m wide should be constructed for resting, sleeping and behavioral stimulation. Raised platforms should always have sheltering walls, generally made of wood to protect against wind and rain (Fig. 25). The superior chamber must also be fixed with zinc metal roofing sheets to protect the animals from sun and rain, and should possess one small observation window.

**iii) Auxiliary Chambers: 3m x 3m x 3m (l x w x h)**

Auxiliary chambers are vital components to any rehabilitation enclosure, enabling secure entry using their double door mechanism. They also provide a temporary holding chamber in which to move bears before entering the main chamber for cleaning and maintenance purposes. Due to their small size, they are very useful during animal immobilization and treatment. Two auxiliary chambers should be situated at opposite ends of the main enclosure to ensure that either compartment of the main chamber can be accessed or isolated at any given time.

The rehabilitation enclosure should preferably be painted green. The paint should not contain lead in its components to prevent contamination and / or poisoning.
REHABILITATION ENCLOSURE DESIGN IN PÁRAMO ENVIRONMENT

Bears rehabilitated in páramo environments should always be reintroduced in the paramo ecosystem. Consequently, rehabilitation enclosures in paramo don’t need to concentrate on arboreal enrichment to the same extent that sub-tropical enclosures do. However, bears released in paramo will likely encounter cloud forest habitat at some point after their release, therefore the inclusion of some climbing structures is advisable. Páramo enclosures should simulate the natural environment as much as possible, therefore extra enrichment cues should be introduced to complement the natural flora already housed within the enclosure. We construct rehabilitation facilities suitable for two juvenile or adult bears as follows:

i) **Primary Chamber**: 24m x 12m x 3m (l x w x h)

Due to this type of enclosure being in the paramo environment, there is an absence of sizeable woody plants, and hence no need for a superior chamber (Fig. 26). Contrastingly, paramo rehabilitation enclosures should have a larger surface area (24m x 12m) to provide extra terrestrial capacity. A lower concentration of climbing structures is required, though some scaffolding and a raised platform should be implemented. Alternatively, the introduction of edible shrubs and plants native to the paramo ecosystem, such as puya bromeliads and blueberries, should be prioritized. Paramo rehabilitation enclosures should possess a small pool stocked with water conveyed by hose from a reliable source, and a small dug-out cave dug in which bears can rest. Should there be no potential for a dug-out cave, the space under the platform (Fig. 27) or alternatively thick plastic or metal barrels may be used. Straw or dry vegetation should be placed inside artificial caves to increase comfort and warmth. The primary chamber should have two entry...
doors located at opposite corners of the enclosure, which are connected to auxiliary chambers.

ii) **Auxiliary Chambers**: 3 m x 3 m x 3 m (l x w x h)

These compartments, measuring 3m³ are connected to the two main entrance doors to the enclosure that are situated on opposite ends of the main chamber (Fig. 26). The adaptations and uses for this type of enclosure are described in the above section.

**DESIGN AND CONSTRUCTION OF REHABILITATION ENCLOSURES FOR BEAR CUBS**

Bear cubs of diverse age and size are accepted onto rehabilitation programs, demanding customized care depending on their individual needs. Bear cub rehabilitation enclosures should possess small scale features that resemble those described in adult enclosure design (Fig. 28).

Bears up to the age of two months need round the clock attention and can be adequately accommodated in a wicker or reed basket that mimics the maternal nest (Fig. 29). At this stage of development cubs should be kept indoors, at a temperature exceeding 10°C. From the age of two months, Andean bear cubs need adequate space, safe playthings and nontoxic apparatuses with which to learn basic skills. Enclosures for bears of between two and four months should measure at least 2m long x 3m wide x 2 high and should be constructed using chain link wire mesh walls, a dry wooden base and a zinc sheet roof. In cold environments, the enclosure walls should be protected from the wind by removable plastic sheeting in order to maintain a satisfactory enclosure temperature. Cubs will need enrichment tools to satisfy their curiosity and nurture their development including; a maternal nest.
made of straw and dry vegetation; a climbing frame made of branches and logs; small-scale playthings such as balls, swings, and hammocks.

Juvenile bears can be directly transferred to adult bear enclosures or alternatively juvenile bears may be constructed of an intermediate size between those for infants and those for adult bears.

**CONDUCT OF PERSONNEL DURING REHABILITATION PROGRAMS**

The conduct of rehabbers within bear rehabilitation facilities worldwide is diverse. Though the extent to which habituation affects the potential for post-release success is unknown, at the Andean Bear Foundation, we prefer take a more conservative approach. We have one main caretaker that is responsible for daily feeding and enclosure cleaning tasks. Other workers (biologists, vets, maintenance workers) occasionally approach the enclosure, though contact is minimal and conversation is limited to minimize imprinting.

**REHABILITATION ENCLOSURE MAINTENANCE**

Andean bear rehabilitation enclosures are highly susceptible to rapid deterioration due to the humid environment they in which they are commonly situated. This problem is escalated by the curious, powerful and energetic animals which they house.

It is vitally important to regularly and thoroughly check the state of the enclosure’s outer structure, welded joints, doors, locks, and roof panels. In the event of a fault in any of these structures, reparations must be carried out immediately in order to prevent any possibility of escape or injury. Enrichment structures such as platforms, pools, climbing frames and water pipes should also be checked regularly, and such structures should be fixed or replaced to meet the bear’s rehabilitation requirements safely and effectively. During reparations, the bears will be temporarily housed in the adjoining management cages (auxiliary chambers) in order to avoid accidents and injuries to both bears and technicians.

**HYGIENE AND WASTE MANAGEMENT**

Waste food and excrement should be removed from the rehabilitation enclosure on a daily basis, at which time the bears will be temporarily held in the adjoining auxiliary chambers. There may be varying governmental regulations on waste management and hygiene control in different countries and regions which should be consulted and considered when designing rehabilitation infrastructure. In Ecuador, there are no clearly defined
governmental guidelines on hygiene and waste management, though we advise constructing septic tanks for waste deposition at least 50m from the rehabilitation facilities, with every deposition being covered with a layer of earth and leaves for efficient and safe bioregulation.

Simultaneous to the daily waste removal, the bears’ water pool should be emptied, scrubbed and filled with clean water to minimize the probability of it retaining water borne diseases, and to ensure the bears have constant access to a fresh, clean water source.

The leaves and branches covering the ground surface of the enclosure should be changed every six weeks, and more frequently in the rainy season.

Cleaning utensils such as brooms and scourers should ideally be disinfected after each use and maintained in the utmost sanitary conditions to avoid any transmission of disease or contaminants to bears in rehabilitation.

A storage unit for foodstuffs should be implemented into the rehabilitation facility infrastructure to ensure that bear food is kept fresh and in sanitary conditions. All food should be washed before it is provided to the bears.

CHAPTER IV: ALIMENTATION STRATEGIES DURING REHABILITATION

During rehabilitation, diet is one of the most important components in successfully taking rescued bears through the rehabilitation process from infants to adults. The progression of the bears’ diet throughout their development should be meticulously thought out and scheduled in stages in order to maintain a healthy bear body mass index (BMI), and to prepare them for a return to the wild by gradually introducing them to wild bear foodstuffs. To follow are guidelines of how we have successfully nourished bears in preparation for release in Ecuador.

BEAR CUB DIET

It is not uncommon that orphaned bear cubs are inserted into rehabilitation programs from the age of between six weeks and three months old. Often these cubs come into our care as a result of their mothers being killed by hunters and farmers.
indiscriminately looking for retribution for damages inflicted upon their crops or cattle herd. In such instances, the cubs are either left for dead or taken in as pets or to sell in the illegal trade of wild animals. Such incidents are often either reported to us or to the Ecuadorian Ministry of Environment, and a rescue mission ensues.

In the first few months of their existence, Andean bear cubs are very dependent upon their mother, and rely enormously on her nutritious, calorific milk for growth. When lactating cubs are separated from their mothers under whatever circumstances, their lives are at high risk due to the absence of this specialized sustenance. Lactating infant bear cubs that enter rehabilitation programs must be cared for around the clock and a formula to substitute bear milk must be derived and formulated. Rehabilitators working with different bear species around the world have distinct, species specific formulas and methods of feeding infant bear cubs. The following formula has proved successful for us in feeding Andean bear cubs here in Ecuador.

- 900ml soy milk
- 100ml apple blended in boiled water
- 2 large spoonfuls of bees honey

This formula delivers high calorific sustenance whilst providing a good balance of nutrients and vitamins. Soy milk is an ideal high calorie ingredient that, unlike other formula bases we have experimented with, doesn’t provoke stomach upsets or produce diharrea symptoms. A fixed routine in the feeding and handling process is important for the bears in order to habitualize them to a set time schedule, with one dedicated caregiver elected to provide all the intensive care needed in the bears’ first few months (Fig. 30). This provides cubs with a vital sense of security and is a crucial first step towards preparing them for life in the wild.

Up until the age of two months, the formula is provided every two hours around the clock at a ratio of approximately 20% body weight. Between two and three months, formula can be provided every three to four hours and the quantity may be tapered off to around 15% body weight per serving.

Between three and four months old, Andean bear cubs receive the same lactate formula with the addition of 30g of corn flour, Cerelac® or an alternative cereal concentrate. Feeding frequency is reduced to every four to five hours. Wild bears generally begin to ingest their first solid foodstuffs at around the age of 3 months, whilst continuing to suckle their mothers’ milk. Consequently, during rehabilitation programs, Andean bear cubs between three and four months of age are gradually familiarized with small amounts of fruit and vegetable.
Between four and six months of age, bears should continue with the same milk substitute formula, which is reduced to three feedings a day whilst one serving of solid foodstuffs per day is supplemented to the daily diet. A variety of fruits and vegetables such as puréed bananas and papayas, diced avocado and watermelon, and grated apples and carrots amounting to a serving of 350g is mixed with 5 spoonfuls of multi-cereal powder such as Cerelac ®.

From six to eight months old, bears will have a much reduced need for the milk substitute formula, and hence should be fed solid foodstuffs three times a day with milk formula only accompanying the afternoon feed. Bears are fed the same fruit and vegetable mixture as previously, though larger quantities of a much more varied assortment can be provided including corn husks and sugar cane, and a variety of fruits and vegetables with the exception of citric fruits. Solid food should now be presented in large chunks and occasionally scattered and hidden in order to provide behavioural enrichment in preparation for the wild. To add a protein source to the diet, small invertebrates and dry dog food should be provided. At this point it is logical to introduce wild bear foodstuffs to their diet including palm hearts, bromeliad hearts and Chusquea bamboo, young bears should continue to be provided with milk formula in order to satisfy their innate urge to suckle.

At the age of 8 months, Andean bears no longer need to suckle and thus at this time our bears in rehabilitation are weaned onto an entirely solid diet. Between this time and the time of release back into the wild, rehabilitated bears are fed a combination of both natural and non-natural foodstuffs, with the ratio of natural foodstuffs provided gradually increasing as the release date approaches.

**NON-NATURAL ALIMENTATION**

During rehabilitation, it is necessary to feed Andean bears with non-natural foodstuffs due to the unfeasibility of alimenting them purely with native bear food. The percentage of non-natural food is proportionally reduced in concordance with a simultaneous increment in the percentage of natural foodstuffs in the rehabilitation diet. Despite natural foodstuffs increasing in quantity as rehabilitation progresses, non-natural elements will remain part of the bears’ diet right up until the release date.

Between the age of 8 months and the bears’ release they will be fed non-natural foodstuffs twice a day, with a variety of natural foodstuffs provided only in the morning feed. Rehabbers working with other bear species worldwide have many different nutritional protocols that work successfully with their target species. Though more extensive wild and captive Andean bear nutritional studies may prove useful in further developing rehab protocols, we have found an approximate daily consumption of 8% body weight to be
successful in maintaining rehabilitating a healthy bear body mass index. In the initial diet, 7% body weight is allocated to a non natural food mix complemented by 1% body mass allocated to natural foodstuffs, and an additional animal protein source twice a week.

When preparing bear food, we find it effective to mix ingredients together without pulverizing fruit chunks so bears become accustomed to a solid diet whilst maintaining healthy teeth and gums. The fruit content of the recipe will alter depending on the localized fruit maturation and harvesting cycles. Cereal quantity and type may be rotated depending on the bear’s periodic requirements. To rapidly augment bear weight, the quantity of cereal or grain cake can be elevated at a ratio of 3:1, whilst adding molasses or honey, assorted nuts, nutritionary supplements such as Ensure®, and vitamin complexes in gel form to the mix.

Taking into consideration wild bear diet composition and the alimentary needs of captive bears, we have formulated a balanced solid diet known as ‘chapo’ that is used as a basic formula with which to initiate the rehabilitation diet. This formula is modified and supplemented with more wild foodstuffs as the bear progresses through rehabilitation.

To follow are the daily quantities of each consisting ingredient of ‘chapo’ based on a 60kg bear:

3kg mixed fruits (bananas, papayas and seasonal staples)
500g guava
340g oats (assorted cereals)
260g wheatgerm (grain cake or palm kernels)
30g mineralized salt
10g powdered vitamin complex.

The information compiled from wild Andean bear studies has helped to fine-tune bear diet during rehabilitation programs to resemble the components and quantities consumed by wild bears, making the transition from captivity to wild less stressful on the digestive system. As such, rehab diets should ideally incorporate a nutritional balance similar to that of wild Andean bears.

As a result of our wild bear studies in different regions of Ecuador, we estimate fibrous plant carbohydrate to make up approximately 75% of wild Andean bear diet in the cloud forest ecosystem, principally in the form of bamboo, bromeliads and palm hearts. These plants also provide an important source of vegetable protein which is important due to the scarcity of animal protein in wild bear diet. The remaining 25% of the cloud forest diet is predominantly made up of wild fruits, with a very small and arbitrary percentage allocated to animal protein. In the páramo, carbohydrate consumption may reach as much as 90% of wild bear diet in the form of Puya bromeliads and Espeletia frailejones.

Though animal protein sources aren’t a large part of wild Andean bear diet, they are a vital nutrient for muscle growth and repair. The consumption of animal protein, as with all other Andean bear foodstuffs, is opportunistic. As such, wild consumption percentages are inconsistent due to the irregularity of its availability. For ease of diet management during rehabilitation, animal protein is quantified in the diet, with an animal protein source incorporated into the diet twice a week that makes up an additional 2-3% of bear body weight (on top of the original 8% body weight daily consumption). Animal protein sources can be mixed and rotate between different meats (occasionally with bones and hairs/feathers), eggs and dry dog food.
Immediately prior to the release date, it is essential that bears are carrying a bit of extra weight, without being obese, in order to aid them in the first days/weeks after release. During this time they will undoubtedly lose weight due to the stresses of the drastic change imposed upon them which could consequently lead to illness and even death. Having extra fat deposits during those critical first days will help buffer the impact of release shock.

**NATURAL ALIMENTATION**

Prior to release, it is important to familiarize bears with native foodstuffs that are present at the release site (Appendix VI). Localized bear diet in release areas is determined through studying the native population and also by consulting local farmers on the subject. Native bear foodstuffs will supplement the non-natural diet at a ratio of 1% of total body mass, being provided in increasing quantities as the release date approaches.

Often, particularly with bears born in captivity or those rescued as cubs, we have observed an inability to recognize the nutritional value of native food items commonly consumed by wild bears. In such instances, it may be necessary to use coaxing techniques in order to encourage bears to identify them as a food source. Over the years we have devised specific methods of motivating bears to eat a variety of native foodstuffs that are foreign to them. To follow are specific guidelines describing techniques that encourage Andean bears to recognize and exploit native foodstuffs in their natural form:

**PLANTS AND FRUITS**

Although Andean bears are opportunistic omnivores, they predominantly eat plant matter. As such, a large portion of the natural alimentation in their rehabilitation diet should consist of a variety of the natural plants and fruits they will encounter on their return to the wild.

**Poaceae (Chusquea spp.)**

*Chusquea* (Suro) is a species of evergreen bamboo native to South America. Taxonomically it is part of the Poaceae family of grasses that includes corn, wheat, rice and sugarcane. *Chusquea* bamboo comprises a high percentage of Andean bear diet in many cloud forest regions of Ecuador. Consequently it is an important food item to introduce during
the rehabilitation process, though it is seldom immediately recognized as a source of nutrition. Due to the similarities between *Chusquea* bamboo and sugarcane, bears that don’t recognize *Chusquea* as a food item are introduced to sugarcane as an intermediary learning step. The process is as follows...

i) Initially bears are fed sections of peeled sugar cane

ii) Subsequently they are introduced to unpeeled fragments of sugar cane until they learn to remove the tough external layer in order to uncover the succulent center.

iii) Once they have learned to peel sugar cane, the next step involves providing the bears with a combination of small fragments of peeled sugar cane (unripe) and *Chusquea* bamboo. The sugar cane should be unripe so that it has a low sugar content which will promote bamboo ingestion. The progressive acceptance of bamboo enables it to be served in increased proportions whilst reducing the sugar cane content of the bear’s diet.

iv) The next step is to present the bears solely with fragments of peeled bamboo until such time that they consume it without additional stimulus.

v) Once the bears have dominated step iv, small orifices are cut into entire *Chusquea* bamboo stalks into which dog biscuits, molasses or honey are inserted in order to promote stalk tearing. The loaded bamboo stalks are subsequently planted in the ground inside the rehabilitation enclosure to motivate the bears into ripping open the implanted stalks, and eventually recognizing the juicy bamboo center (Fig. 33).

vi) Finally whole bamboo stalks are planted within the rehab enclosure in the absence of all other foodstuffs in order to compel the bears into eating the bamboo in its natural state.

**Bromeliaceae (Guzmania spp. Greigia spp. Puya spp.)**

Bromeliaceae is a family of monocot flowering plants native to the tropical and sub tropical Americas. They form a significant part of wild Andean bear diet in both paramo and cloud forest ecosystems, providing an important source of carbohydrate and fiber. Both epiphytic and terrestrial bromeliads are consumed by Andean bears and it is important to provide them with various types during rehabilitation. Bromeliads are slowly introduced into bear cub diet as follows...
i) Initially, bears are manually given the extracted soft core of the plant to familiarize it with them as a nutritious and appetizing staple.

ii) Once they have the taste for the soft core, whole terrestrial bromeliads are embedded in the ground, as they would be found in the wild. Eventually bears recognize the plant as food, subsequently uprooting them and tearing them open to get to the nutritious centre (Fig. 34).

iii) Arboreal, epiphytic bromeliads are attached high up on the trees, walls and roof within the rehabilitation enclosure to provide behavioral enrichment by promoting wild bromeliad harvesting behaviors. Following initial recognition of arboreal bromeliads, rehabilitated bears rapidly discover how to collect and tear them open for consumption.

Areceae (non-spiny), Heliconeaceae, Cyclantaceae and Marantaceae

Edible palms, heliconias, cyclanthas and prayer plants are flowering monocots that possess soft shoots and serve as vital Andean bear food items in the cloud forest ecosystem, providing an excellent source of protein, carbohydrate and fiber.

i) As with bromeliads, bears are manually fed the extracted soft heart of these plants in order for them to recognize them as nutritious food items.

ii) Once bears have accepted the soft heart, they are then introduced to the apical segment of the plant, which envelops the soft heart in its retaining layers. The apical sheath is pierced several times to enable the passage of olfactory cues without disfiguring the outer layer. The bears recognize the palm heart as food using their olfactory sense, and learn to destroy the outer layers to get to the edible center.

iii) Subsequently, small palms are planted in the interior of the rehabilitation enclosure, for the bears to learn to manipulate them in a state close to the natural form in which they exist in the wild (see figure X).

Spiny Areceaeae (spiny palms)
Andean bears also consume spiny Arecales palms in the cloud forest environment. During rehabilitation it is important to also introduce them to the spiny species to facilitate recognition on return to the wild. The procedure of coaxing bears into eating spiny Arecales palms is exactly the same as that for non-spiny palms described above, with two exceptions which are:

a) The spines are removed from the apical segment of the plant in part ii

b) Following this there is an extra step, introducing bears to the isolated and pierced apical segment with spines before repeating step iii as described above.


Wild fruits are an essential component of Andean bear diet. Fruiting trees and shrubs in cloud forest and paramo environments are seasonal, and fructification cycles have a huge impact on bear foraging behavior. During the rehabilitation process, wild fruits that are available at different times of year should be provided to ensure bears are familiar with olfactory cues that on detection will provoke them to forage once back in the wild.

i) Wild fruits and berries that are present in the release area are gathered from the forest, where possible taking large branches full of fruits.

ii) The gathered fruits and berries are presented to the bears, and are also hung on trees, ropes, poles and mesh within the enclosure to promote foraging behavior (Figure 35).

**ANIMAL PROTEIN**

It is important to consider the omnivorous and opportunistic feeding habits of wild bears when forming rehabilitation diet protocols. During rehabilitation, bears should be introduced to a variety of sources of animal protein, not only to supplement their dietary needs, but also to familiarize them with meat as a food source. Bears should be presented with various forms of animal protein from small invertebrates to small mammals, using species with similar behavioral patterns to those they will encounter in the wild. Animal protein sources such as worms, crickets, larvae, chickens, rabbits and trout, should be
farmed *in situ* where possible or obtained from neighboring ranches. Small quantities of wild invertebrates may be taken from the wild, adhering to the code of conduct for ethical invertebrate collection.

**Larvae**

i) To familiarize bears with larvae, they are initially fed to them directly.

ii) Farmed larval colonies are introduced to the enclosure and hidden for bears to search them out and devour them. Alternatively larval colonies can be located and their nests ethically removed from wild niches (e.g. branches, stems, sods of earth), and subsequently concealed inside the rehab enclosure.

**Worms**

i) As with larvae, worms are offered directly to the bears for initial recognition (see figure X).

ii) Following this, farmed worms are deposited into blocks of humid earth and entered into the enclosure to be discovered and exposed by the bears for consumption.

**Insects**

i) Insects are farmed, bought and to a lesser extent collected and presented to the bears.

ii) Dead insects are initially provided until bears recognize them easily (at which point they are given live specimens). They are placed in distinct areas of the enclosure for the bears to perceive, pursue and finally consume.

**Eggs**

In the wild, bears occasionally seek out wild bird nests and take their eggs. This behavior may be stimulated during rehabilitation by introducing bears to eggs and nest structures within the rehabilitation enclosure.

i) Initially, bears are presented with salmonella treated farm eggs (hen or quail), that can be fed directly or served with the ‘chapo’ mixture.

ii) Vacant bird nests found in the vicinity of the rehabilitation enclosure or artificially made nests can be loaded with quail eggs and attached on the branches of the ‘artificial tree’ or platform within the enclosure.
iii) Should rehabbers have knowledge on the native bird species in the area, nests from non-endangered bird species’ commonly found in the release area may be introduced into the rehabilitation enclosure once or twice in the final weeks of the rehabilitation process.

Mammals and birds

Andean bears typically scavenge on carrion and hunt small mammals (Fig. 36) and birds in the wild. As such it is important to encourage bears to harness these skills during rehabilitation.

i) To foster natural predatory and carrionous behavior during rehabilitation, tested and hygiene registered hunks of beef and chicken, still with skin and feathers attached, are positioned in different parts of the enclosure. Occasionally, bears refuse to accept beef and chicken as an animal protein source, and in such cases it is recommended not to keep insisting, however most bears instinctively recognize meat as a valuable food source.

ii) The next step is to place whole dead animals, such as rabbits, chickens and guinea pigs inside the rehabilitation enclosure. In cases that these animals are not eaten immediately, they should be left to decompose as many bears prefer to eat putrid flesh.

iii) Once the bears are used to eating small domestic mammals, samples of native wild carrion, such as deer, tapir or rabbit, are taken from the release site, and introduced into the rehab enclosure.

iv) In order to stimulate and develop Andean bear natural hunting instinct during rehabilitation, live chickens, rabbits and guinea pigs may occasionally be introduced to the rehabilitation enclosure to enable the bears progressively refine their hunting skills.
v) Once bears have mastered the skill of pursuing and eating live domestic animals, wild rabbits (that are commonly eaten by wild bears, are non-endangered and abundant) may be trapped and placed in the rehabilitation enclosure. It is essential that bears are familiarized with the smells and sights of animals they will encounter in the wild, and build up a skill-set with which to hunt them subsequent to their reinsertion (Figure 37).

**Fish**

There have been a number of reports of Andean bears feeding on rainbow trout from artificially stocked highland lakes and streams in Ecuador and Colombia. During rehabilitation, specimens of trout and tilapia can be introduced into the enclosure pool, in order to stimulate fishing behavior that may prove an asset on return to the wild (Fig. 38).

**CHAPTER V: RELEASE CONSIDERATIONS**

The release procedure is one of the most critical components of bear reintroduction programs and as such there are several contributing factors that demand careful consideration. Once a bear has been deemed ‘ready’ for a return to the wild, the most favorable release method is ascertained, a suitable release site is chosen and the necessary permits have been obtained, a release mission can be planned.

**DETERMINING THE SUITABILITY OF BEARS FOR RELEASE**

Prior to release, it is essential to evaluate a bear’s physical and behavioral characteristics to determine their suitability for release. The following criteria must be met for bears to be ascertained as ready for release:

- Optimal physical condition and health status. Bears must be large and robust, yet not obese. Their BMI and biometrics should be compared to the wild Andean bear data available, and body and pelage condition are assessed. Bears must possess...
no injuries or physical deformities. Teeth and claws must continue to be in perfect condition, with no missing or fractured teeth.

- Bears must show sufficient size and agility to defend themselves from potential predators such as the puma (Puma concolor) and the jaguar (Pantera onca). Though wild Andean bears are not threatened by such predators, recently released, captive bred sub-adult bears are potentially vulnerable to predation. For this reason, it is recommended that bears are at least 18 months old at the time of release.

- It is fundamental that bears are thoroughly examined by an experienced veterinarian to ensure that the bear is carrying no diseases or endo/ectoparasites that it could transmit to the native population or other species that inhabit the release area. Bears must have an immaculate bill of health, and possess hematological values within species reference ranges to be accepted for release. In the case that bears need deparasitation, the dosage of administered antiparasitics will be gradually decreased on approximation of the release date in order for the bears to build up a resistance to any potential diseases present in the release area.

- Bears must show sufficient aptitude to manipulate and feed on the majority of native foodstuffs they are provided during the rehabilitation process, especially plants with a high fibre content such as *Chusquea* bamboo, bromeliads, palms and heliconias (Appendix VI).

- Bears must not exhibit pronounced habituation to caretakers. They must show alertness to the slightest movement or sound, and should be preferably timid and cautious of human presence*.

Each of the above criteria should be assessed by giving the bear an aptitude rating out of 20, and the combined score is then calculated. Bears with a rating of ≥80% are deemed ready for release, and bears that score ≤79% need further rehabilitation or are rejected from the reintroduction program.

* Though the majority of rehabilitation programs try to avoid contact between humans and bears to prevent imprinting, bears are extremely intelligent animals and due to their sensitive olfactory sense, we believe they never cease to recognize humans. Nevertheless, we have observed that on return to their natural habitat, instinct kicks in and bears generally become suspicious and disinterested in human contact.

**EXCLUSION CRITERIA**

- Aged animals
- Lactating females
• Females with cubs

• Pregnant females (determine presence and stage of pregnancy using ultrasound).

RELEASE TYPES

There are two recognized types of release that are used when reintroducing bears back into the wild.

HARD RELEASE

This release type is the one we always use in Andean bear reintroductions, where the bear is transported to the release site and released without any form of post-release support. This type of release is applied under the supposition that the rehabilitation process was successful. It is strongly suggested to use this type of release when reintroducing Andean bears. Ideally, hard released bears should be liberated in remote areas, and the mode of transport employed must be determined in accordance with the logistical considerations of each release mission.

SOFT RELEASE

This release type involves acclimatizing the bears in an enclosure at the release site and the post-release provisioning of foodstuffs near the holding enclosure. This release type enables bears to adapt gradually to their new environment.

In Ecuador, soft release methods have only been employed when one or more released Andean bears return to the rehabilitation enclosure, rehabilitator lodgings, or houses (Fig. 39) in the vicinity of the release site after an unsuccessful hard release.

RELEASE SITE SELECTION

This is one of the most important objectives of a reintroduction initiative, and can often be the make or break factor in defining its success or failure. The purpose is to evaluate the viability of various potential release areas, ultimately selecting the most beneficial for the
reintroduction at hand. Several factors must be carefully considered during release site selection.

HABITAT ASSESSMENT

- This process involves visiting potential release areas at different times of the year to evaluate their suitability. Additionally, maps, aerial photographs and satellite images of the release site and its adjacent areas should be meticulously analyzed to gain a more comprehensive view of the scope, vegetation and topography of the entire area. Any existing habitat studies on proposed release sites should be consulted to aid the habitat assessment process. In determining the suitability of inaccessible release sites, pre-release reconnaissance missions from the air are necessary to analyze aspects of the terrain not possible to detect from the ground.

- Release sites must be situated well within the relevant System of National Protected Areas or within private protected areas or reserves. They must be large enough to support a viable bear population, whilst also containing an abundance of native Andean bear foodstuffs such as bromeliads, *Chusquea* bamboo and fruiting trees amongst other staples. It is important that such assessments are carried out at different times of year in the build-up to release in order to determine the annual availability of fruits and berries and to ensure there is no seasonal shortage of food or water. It is important to determine, as much as possible, the dynamics and demographics of the native population in order to determine the potential effects that may be caused by introducing another individual.

- Due to recently released bears being unfamiliar with their new surroundings, they are extremely vulnerable within the first days after release. It is imperative that the release location is in the immediate vicinity of an abundant food source. Supplemental food may be left beside the bear for post-anesthesia consumption when deemed necessary. The timing of release missions is also important and it may be beneficial to coordinate them in accordance with native food seasonality where perennial foodstuffs (bromeliads, *Chusquea* bamboo) are less common.

POTENTIAL CONFLICT

- No matter what lengths are taken during rehabilitation to restrict human contact with bears, a certain level of habituation will always emerge. One of the ways to minimize any potentially detrimental post-release effects that can stem from human habituation is to release bears into areas distant from human settlements. In most South American countries we have the luxury of possessing large, yet untouched regions that are of benefit to the success potential of wildlife reintroduction.
programs. Through our wild Andean bear telemetry studies, we have estimated average home range data for both male and female bears (150km² and 35km² respectively). Where possible, these area values should be used as a minimum indicator as to the size of potential release sites with no human intervention within their perimeter. So far this model has proved successful in our reintroduction programs in Ecuador though further home range studies throughout the species’ range are encouraged.

- In cases where there is no alternative but to release bears in areas adjacent to populated areas, it is important to study the potential for conflict during release site selection in order to evaluate all threats that may jeopardize release success. Bears that are released in areas of inadequate natural food are likely to search for other means of nutrition, which may result in conflict with humans. The presence of livestock and agricultural land use in areas adjacent to bear release sites must be evaluated. It is strongly advised to release bears sufficiently distant from livestock and crop plantations in order to minimize potential post-release conflicts. A cultural study of the populations surrounding the release area may be necessary in order to determine the risk of conflict repercussions.

**GENETIC AND HEALTH ASSESSMENT**

- In contrast to other bear species, the genetic diversity of Andean bears is relatively low (Global HE = 0.3-0.6; Ruiz-Garcia et al. 2005). Consequently, there is a low risk of genetic contamination through reinsertion of this species. In cases where the rehabilitated bears’ provenance is known, it is deemed acceptable to release bears within relative proximity without DNA testing. Nevertheless there is a great need for further population genetics studies throughout the species’ range.

- All bear reintroduction programs must ensure that no diseases or parasites are passed on to the recipient population. A full veterinary examination of both ectoparasites and endoparasites must be performed with all necessary treatment given to eradicate the potential of disease transmission

**RELEASE PERMIT ACQUISITION**

- All bear releases, regardless of whether they are proposed to take place on private or government administered land, require special permit acquisition. This often entails the submission of detailed protocols to prove the bear is fit to return to the wild, and that a suitable release site and date has been proposed. The requisites for a release permit will vary between governmental institutions and will need to be requested prior to planning a release mission. Once the permit has been granted, a release date will be confirmed.
PREDATION AND COMPETITION

• Wild adult Andean bears have no natural predators within their range with the exception of humans. They share parts of their range with large carnivores such as the jaguar and the puma, but due to the bears’ size, strength and agility they are not perceived as prey items. However, there is potential for an attack from such large predators on young sub-adult bears and for this reason, this protocol suggests that Andean bears are released with a minimum age of 18 months, by which point we believe they are big enough to defend themselves.

• Though there has been no conclusive evidence of released bears experiencing mortality due to direct competition with native conspecifics for resources, it is a factor that should be analyzed carefully. To counteract the risk of competition, bears should be released in areas of abundant food and low existing population densities.

POTENTIAL FOR POST-RELEASE MONITORING

• It is important to consider that the evaluation of release success is a fundamental part of any reintroduction program in providing impetus to either continue the good work or to amend strategies or in unsuccessful cases to suspend operations. For this, we must consider the logistical challenges that are faced in releasing animals in such remote and inaccessible environments. Though the main priority is to ensure considerable distance exists between release sites and human settlements, feasibility of post-release monitoring and potential retrieval missions in emergency situations must be taken into account. Often our bears are released using helicopters and their post-release monitoring is only realistically possible using light aircraft. Where possible during release site selection, a compromise should be found that maintains sufficient distance from settlements whilst facilitating monitoring through the existence of nearby trails and roads. Bears released with radio collars should be released in reasonably accessible yet remote areas, in order to facilitate post release monitoring. Satellite and GPS collars are a potential solution to monitoring challenges faced in inaccessible regions, though this significantly elevates project costs and must be addressed in the planning and fundraising phase.

MARKING OF INDIVIDUALS

It is essential to quantify release success through the post release marking and monitoring of reinserted individuals. With Andean bears we have previously marked reintroduced bears with VHF (very high frequency) radio (Fig. 40), GPS or satellite collars in order to determine
survival rates and movements. It is occasionally possible to assess the degree of post-release environmental adaptation and behavioral patterns, though this involves a difficult (and often fortuitous) process of tracking and observing released bears. Marking reintroduced individuals enables rehabilitators to evaluate and improve rehabilitation and reintroduction protocols in order to maximize the success potential of future releases; hence it is regarded as a fundamental component of reintroduction initiatives.

Prior to the deploying of radio, GPS or satellite collars on Andean bears nearing the conclusion of their rehabilitation period, apparatuses should be exhaustively tested to ensure well-defined signals are received in the distinct habitats present in the release area. It is important to test the level of signal emission from various points around the release site bearing in mind the effect of both slope and vegetative cover. Testing procedures should be performed at least two months prior to collar deployment, and are a major component in determining a suitable release site.

When fitting the collar, it is imperative to leave a space of 2-3cm between the collar and the animals’ neck in order to accommodate for potential growth of released sub-adult bears, or for seasonal body mass fluctuations triggered by native food seasonality. The space cannot be too big due to the potential weight loss resulting from initial release stress. Finally, the collar must be tested by pulling it up in the cranial direction to ensure it cannot be discarded by the bear. It should be physically impossible for the collar to pass the bears’ lower mandible.

To avoid tranquilizing bears more than is necessary, collars should be deployed either during transportation to the rehabilitation enclosure or on the day of the release mission. With sub-adult bears, stretchable polycotton fasteners are fitted to the collar to enable it to expand with the growth of the individual. These polycotton fasteners have a lifespan of approximately one year. When collaring adult bears that are to be tracked for over a one year period, it is advisable to fit collars with galvanized wire fasteners (Fig. 41). Wire of a diameter of 1.5mm will gradually rust causing
the collar to fall off after a period of approximately three years, whilst using wire of a 2mm diameter will lead to the collar falling off after approximately five years.

To prevent the wire from troubling or harming the bear, the ends should be wrapped in aluminium foil tape (Fig. 40). Collars with external antennae should be avoided, as they are likely to be destroyed during typical marking behavior. Collars should be of a light color, to aid sighting and easy identification of reintroduced bears by trackers and people living near the release site, enabling them to report sightings or damages inflicted by project bears. The use of expanding collars on juvenile bears is not recommended due to their fragile unreliability enabling easy removal.

CHAPTER VI: RELEASE MISSION CONSIDERATIONS

There are a number of determining factors that will influence the success or failure of a release mission. It is vital that everything is organized and prepared meticulously, taking into consideration the unique circumstances of each individual case. To follow is a description of all the factors that need considering when releasing bears back into the wild.

TIMING OF RELEASE

It is advantageous to study the seasonal food availability within the release area before deciding on a release date in order to determine the best time of year for release. However, many Andean bear foodstuffs are perennial so if it is determined that there is an abundance of such foodstuffs in the release area, bears may be released at any time of year. In the upper páramo ecosystem it is preferable to release bears during the dry season due to the severe weather conditions experienced in the wet season.

Preferably, Andean bears should be released in the morning, to give them enough time to wake up from the anesthetic and have plenty of time to become accustomed to their new environment before nightfall.

RELEASE MISSION METHODS

Depending on the location of the rehabilitation enclosure, there are three alternative release mission methods that we use.
REHABILITATION ENCLOSURE AT RELEASE SITE

In instances in which the enclosure is at the release site, one experienced member of staff proceeds to open the door of the enclosure, allowing the bear to leave of his own accord (Fig. 42). The rest of the field team present should maintain a distance of 30m from the door, situating themselves behind the enclosure without making a movement or sound once the bear has exited. The team should wait at the release site until the bear disappears out of sight before departing the area.

REHABILITATION ENCLOSURE IN THE SAME REGION AS RELEASE SITE.

In cases where the rehabilitation enclosure is situated close to the release area, bears must be immobilized following the guidelines described in the ‘Immobilization’ section (page 29). To transport bears over short distances in areas where there are no roads, a type of hammock specially designed to fit comfortably on horseback is assembled using PVC tubes, soft padding and cords of nylon (Fig. 43). Despite the proximity of the release site, when releasing large male bears, a helicopter may be necessary as they are too heavy to be transported on horseback.

REHABILITATION ENCLOSURE FAR AWAY FROM RELEASE SITE

In such situations, the most advisable method of transport is by helicopter, though depending on the locations of the rehab centre and the release site, a combination of road and horseback transport may be considered should there be a thorough contingency plan in place, and the total transport time does not exceed five hours. During transport the bears are sedated following the procedures described on page 29.
TRANSPORTING BEARS BY HELICOPTER

Undoubtedly the optimal strategy for releasing bears into remote regions is by helicopter (Fig. 44). Using helicopters significantly reduces transport time, and hence the stress imposed upon the bears and the release team. Even when the rehab enclosure is situated relatively close to the release site, helicopter should be the preferred mode of transporting male bears, as they are generally too heavy to be transported on horseback. The large territorial requirements of male bears also advocate the use of helicopters to transport them to remote areas, thus avoiding potential human-bear conflicts.

It is important to solicit the utilization of helicopters many months prior to the release date. Should you be planning to use military aircraft, it is highly advisable to request the Super Puma or the MI-8 model. In the weeks approaching the designated release date, reconnaissance missions should be performed with the purpose of finding suitable landing sites and, if necessary, to construct temporary heliports.

Although various bears may be available for release at one particular time, it is advised that they are released one by one, due to the effect of excess weight on flying capability and aircraft control, and the logistical parameters involved with having multiple bears sedated at once in a high stress environment. Transport containers are not used during helicopter release, both to facilitate embarkation and disembarkation procedures, and
to reduce the weight imposed upon the aircraft. Disembarkation is executed using a hammock specially fabricated using heavy-duty material and 2.5m x 1.5m in length (Fig. 45). It is important that there are sufficient trained personnel present to minimize risk and to bear the weight of the transported individual.

MEDIA INVOLVEMENT AND CONDUCT

In the event that the release mission is reported by the media, photographers and reporters must be strictly briefed prior to the outset of the operation. They must keep a sensible distance from the action, and it must be made clear that the ultimate priority is to safely sedate, transport and release the bears. Their presence cannot interfere with proceedings and there is absolutely no possibility of changes in camera angle, repeating scenes or pauses in the process at any time during the release mission. Should their presence be affecting the work of the release team, reporters must be immediately told to withdraw from the scene.

CHAPTER VII: POST-RELEASE ACTIVITIES

Now that the bear is back in its natural habitat, it may appear that the hard work stops here. However, there are a number of post-release follow-up activities that are important in monitoring the progress of released bears, dealing with problem situations and educating communities surrounding release sites.

POST RELEASE MONITORING

An essential component in evaluating release success is the post-release monitoring of Andean bears using radio or satellite telemetry methods. Though it is almost impossible to determine whether reintroduced bears demonstrate behavioral deficiencies, the main objective of monitoring is to determine whether released bears have survived and adapted successfully to their new environment (Fig. 46). Simultaneously, ecological and behavioral studies should be carried out on

Figure 46: © Patricio Meza. Reintroduced female Andean bear photographed 2 years post-release with a cub
released animals in order to ascertain whether they have integrated successfully into the wild population, and become active breeders. The first three months of any release are critical and as such, monitoring will be continuous during this time.

RADIO TELEMETRY MONITORING

Radio is an excellent type of signal to use when tracking animals because radio waves can transmit information rapidly and for long distances. If released bears are fitted with standard radio collars, each individual should ideally be tracked for eight hours per day during daylight hours. Andean bears don't move significantly at night, therefore it is only necessary to record their nocturnal activity patterns where possible, and no actual tracking is required. The frequency of tracking expeditions will depend on the number of bears released and the amount of time passed since the release date.

Terrestrial radiotelemetry expeditions should begin at least two weeks after release to ensure bears don’t encounter human odors or tracks. This is a vital procedure in minimizing the potential of bears following human olfactory cues that may result in conflict situations.

Tracking teams should be composed of a minimum of three people. It is important that there are always at least two people tracking at one time for safety reasons. A rotating schedule of seven day blocks should be organized with two team members on tracking duties each seven days, at which time one would be replaced by the third team member. The cycle will continue as such to ensure that there are always two people tracking at any given time and that all team members have a week long resting period after every two weeks tracking.

Radio collars can emit signals over distances of up to 20km in a straight line without obstructions. However, signal is easily blocked by mountain ridges, vegetation and rocks and bears may remain undetected from just a few hundred metres away. As such, it is advisable to track bears using ridgeline trails in order to minimize obstructions and maximize the potential of locating reintroduced bears.

GPS TELEMETRY MONITORING

If there are sufficient funds available, bears may be monitored using GPS telemetry collars. Information is retrieved from these collars remotely via UHF or wireless signals (Fig. 47),
though one must be within 5km of the collar without obstructions for successful data transmission. In the first three months after release it is important to gain extensive data on reintroduced bears. Consequently GPS collars may be programmed to emit VHF signals between 9am and 3pm, and to take five GPS fixes during daylight hours in order to collect data to determine mortality and movement patterns. After the initial three month period, the frequency of data collection may be decreased to save energy. It is sufficient to program VHF emissions to be transmitted for just a few hours per day, four days a week, for one week each month, and reduce the GPS fixes to twice daily. This provides enough opportunity to keep track of the bear and sporadically download the collar data via UHF signals without draining the battery excessively. Collar reprogramming is done remotely via the wireless signal. Should data be collected from the air, the collar should be programmed to emit UHF signals during the hours of least turbulence to facilitate safe data collection.

**SATELLITE TELEMETRY MONITORING**

Should there be sufficient funds in the project budget, we strongly recommend the use of satellite collars that function using the Iridium satellite network. Iridium coverage is much better than other satellite network coverage, and data transmission is more reliable. Collar configuration can be altered directly through the collar prior to deployment and also whilst it is on the bear via satellite transmission. In the first three months post-release, it is important to closely monitor reintroduced bears, and thus the collar should be programmed to provide extensive data. We generally program collars to send VHF signals of activity and mortality between 8am and 4pm, take 5 GPS positions daily and connect with the satellite three times a day. After the first three months, it is advisable to reprogram the collar to take less data, saving energy and prolonging the collars life. We reprogram collars to take two GPS positions per day, connect with the Iridium satellite once per day and to send VHF signal between 9am and 3pm. Five months after release, the satellite connection can be further reduced to once or twice per week in order to prolong collar battery life to approximately three years.

**EVALUATING REINTRODUCTION SUCCESS**

It is important to determine a method of evaluating reintroduction success in order to adapt strategies or suspend future operations. Determining reintroduction success is a complex procedure due to the number of factors involved including survival, adaptation, integration into the local population, conflict avoidance and procreation. It would be impractical to expect to be able to exhaustively study such a complicated group of variables, so we generally evaluate success from our personal experiences with reintroduced bears.

We consider bears to be successfully reintroduced should they be surviving in the wild without creating conflict 12 months after the release date.
POST-RELEASE PROBLEM SOLVING

When releasing bears in the proximity of human presence, there is a high potential for them to return in search of available foodstuffs, and thus become ‘problem bears’ (Fig. 48). Previously we have managed situations involving post-release ‘problem bears’ by incorporating soft release protocols to gradually distance them from the area of potential conflict. This should only be done in remote areas where there is no significant population and with the consent of any inhabitants there may be. To follow is a step by step description of how we have managed to successfully distance bears that have caused problems post-release.

1) Construct a raised platform approximately 2m from the ground close to the rehabilitation enclosure, with a recipient securely attached at the top using galvanized wire or metal supports. This prevents the recipient from being destroyed or taken.

2) The recipient is half filled with ‘chapo’, which the bear was provided during rehabilitation on a daily basis (page 45. ‘Non-Natural Alimentation’) and is covered with a thick rubber lid to protect its contents from rainfall, sun, birds, insects and other wild animals that may be attracted.

3) After one month, the platform is relocated approximately 400m further away from the rehabilitation enclosure in the desired direction in which the bear is required to move. It is important to take measures to conceal the presence of the release team when moving the platform to weaken the link between humans and food. Non-natural food will continue to be provided once every two days, reducing the quantity and quality in order to force bears to search for natural food in the forest.

4) After a further month, if the bear continues to return to the feeding platform, it should be moved or reconstructed approximately 1km from the rehabilitation enclosure in the same direction. Non-natural food will be now provided every three days until eventually the bear no longer returns to feed.

If telemetry signals show that the bear remains close to the feeding platform or that it is closing in on populated areas, this demonstrates that the release isn’t functioning and an alternative plan of action must be devised. A potential alternative in such situations is the relocation of bears to zoos, sanctuaries or to natural areas where potential conflict with humans is not an issue.
RELOCATION

When releasing animals back into the wild, there is always a risk that some level of habituation has occurred during the rehabilitation process, exacerbating the potential for post-release conflict. For this reason, attempts are made to ensure that rehabilitated Andean bears are reintroduced far enough away from human settlements in order to minimize the risk of conflict. Despite taking all possible measures to avoid conflict, it is vitally important to have contingency plans in place prior to reintroduction in order to intervene in the event of bears being involved in nuisance situations, failing to adapt into their new environment or becoming injured or sick. It is important to account for such contingency plans in the planning phase of any reintroduction, and funds must be available to deal with any necessary relocation mission.

A decision needs to be made regarding the best possible strategy of dealing with problems arising with reintroduced bears. In extreme cases where there is perceived to be absolutely no other option, Andean bears must be captured and relocated. A reintroduced bear should be relocated if either...

a. Livestock depredation has been confirmed
b. There have been constant, insistent incursions into the human domain in search of food and/or garbage (Fig. 46).
c. The bear is severely injured, or if there have been dental fractures of the canine teeth.

Depending on the individual case at hand there are a range of different options for Andean bear relocation. They are:

1. **Natural Sanctuaries**

   Natural sanctuaries are permanent refuges with an intensive management plan to provide bears with environmental conditions that simulate their natural habitat. Natural sanctuaries should be located in protected areas within the natural distribution of the species. They can be designed within existing natural boundaries, for example on islands in the middle of lakes or...
streams that are sufficiently isolated from the shore embankments. This type of natural sanctuary was applied for a rehabilitating Andean bear on one of the Cuicocha Lake islets (Fig. 49) in the south-eastern limits of the Cotacachi-Cayapas ecological reserve in Ecuador. Due to the bear’s proficiency in water, there is a potential for them to escape. However, a good diet and the company of other bears can eliminate this possibility.

Natural sanctuaries can also be man-made, such as the ones at La Senda Verde in Bolivia, and the Chaparri Reserve in Perú (Fig. 50). The Chaparri Reserve has successfully housed, maintained and managed 15 bears over the past 12 years. It encompasses a total area of five hectares, and is divided into seven sub-sections of between 2,000 and 10,000m² each. This enclosure division permits specific isolation and management by sex, age, health status and in cases of maternity. The outer wall of the entire enclosure consists of a 0.5m tall fence consisting of 10cm x 10cm matrix electro-welded mesh, above which seven parallel circuits of electrified cables run. The electrified cables intermittently discharge 10,000 volts of low amperage to keep the bears from scaling the low mesh fence. As the electric cables may go unnoticed, the low mesh barrier acts as a reference obstacle to deter the bears from approaching.

The costs involved in maintaining and feeding bears in captivity are high and permanent, therefore a secure funding source must be found prior to any decision to move a bear to a natural or man-made sanctuary. Generally, costs are covered by either the administration of the resident protected reserve, private institutions or partnering NGO’s that have the resources, stability, capacity and continuity that is demanded in funding such long-term initiatives.

2. Protected Areas

In certain circumstances, the best solution for dealing with nuisance bears is to translocate them to a private or state protected area. The protected area must meet the following criteria/requisites:

- Similar ecosystem, climate and altitude to the initial release site.
- Presence of an unsaturated native Andean bear population.
• Absence of human intervention and assurances of future protection.
• Difficult or restricted access for the general public.

In such cases, the primary objective is to prevent the emergence of human-bear conflicts, therefore bears must be translocated sufficiently far away from human settlements to rule out any possibility of contact. In order to relocate them to such remote regions, they may be transported using a combination of trucks, helicopters, horses and/or hammocks (Fig. 51).

3. Zoos

If wild relocation is not an option, and there are no natural sanctuaries available, bears may be relocated to respectable zoos that follow ethical procedures, meet standard enclosure size requirements, provide first-rate veterinary care and prioritize environmental education.

Euthanasia

Should all alternative options of relocation or re-release become exhausted, euthanasia may be considered as a last resort. Euthanasia is a disputed and delicate issue, and if implemented, can often generate negative publicity. Though it is a method that have successfully gone to great lengths to avoid, euthanasia by definition is a ‘humane act’ and many rehabilitation programs worldwide are forced to consider euthanasia as an option. As such, it must also be considered an alternative approach in Andean bear reintroduction programs in South America when there are no other options available.

RECAPTURE

Reintroduced bears that require relocation or need medical attention must be recaptured. Capturing wild or reintroduced animals is a complicated process, and should only be carried out under the leadership of experts who have extensive experience of bear capture techniques. To follow are four distinct recapture methods that may be employed to perform a relocation or provide veterinary treatment.
IZNACHI TRAP

IZNACHI TRAP DESIGN

Basic Materials:
10m$^2$ of 1mm thick sheet metal
25mm$^2 \times 2$mm thick quadrangular steel tubes
42x 2 inch bolts
42x nuts
1x 3m x 0.5 cm diameter nylon cord
2x spring bolts
1x Forked prong

**Design Principles:**

The Iznachi trap consists of 10 disarmable metal panels that are assembled exteriorally using two inch bolts and nuts to form a 220cm long x 80cm wide x 90cm high container. It is important that the trap can be disassembled to facilitate transportation up steep slopes through dense forest into remote areas. The trap is designed so that its interior is completely smooth, with no orifices or cracks in which the bear could injure its claws or teeth. At the front of the trap, a sliding door is positioned that enables the trap mechanism to function (Fig. 53).

**Mechanical System:**

The mechanism that triggers the sliding door to seal the trap is situated on the outside of the trap (Fig. 54). It consists of a metal fork structure that runs along the top of the trap, the prongs of which are set into 0.5cm diameter orifices in the base of the raised door, keeping the trap door in an open position. The other extremity of the metal fork is attached to a length of nylon cord, which itself runs along the top of the trap to its posterior end, at which point it enters the trap over a pulley and through a 0.5cm diameter orifice (Fig. 54). On the interior of the trap, the bait (cow leg) is securely attached to the nylon cord to set up the mechanism. Nylon cord is used instead of metal cable to avoid the possibility of the animal injuring itself.
Windows and Openings:

Apart from the front entrance, the only other openings the trap possesses are two small observation windows and minute ventilation holes on the roof (Figure 54). One of the observation windows is situated on the posterior panel of the trap, and the other on the anterior lateral panel, each one being 20cm (vertically) by 5cm (horizontally) in dimension (Figure 55). The windows serve an essential purpose in estimating bear body mass for anesthesia and it is recommended that one window is vertically positioned to facilitate the darting process (Fig. 56). To reduce the captured animals stress, and prevent them from injuring themselves on the sharp window edges trying to escape, the amount of light entering the trap should be minimized by installing securely fitting metal shutters to leave the interior smooth and block out any light.

The six ventilation apertures enable slight air flow in and out of the trap without letting in considerable light. They are situated in the superior posterior panel, are 0.5cm in diameter and are positioned 16cm apart, 3cm from the both posterior edges of the panel (Fig. 54).

Trap bait and sensor

Once the bear pulls on the bait, this triggers the metal fork to release from the raised door, which slams shut and is fixed in place by two spring bolts that are situated lateral to the door on the exterior of the trap. The spring bolts secure the door once it has fallen so the bear cannot lift it up.
Decomposing cow legs are ideal bait for trapping bears as they are extremely pungent in order to attract the bear’s highly sensitive olfactory sense. Andean bears naturally eat carrion in the wild, and one or two cow legs securely attached to the nylon cord, provide an ideal grabbing structure to assist the trap mechanism. When the bear pulls on the cow leg, this triggers the trap door to close, which in turn activates the trap sensor.

A VHF radio collar is used as the trap sensor. The collar is attached to the trap door in its raised position. A magnet is tightly secured to the collar to impede signal emission, using a cord that is attached to a tall post situated alongside the trap. When the bait is pulled and the trap door closes, the collar falls with the door causing the magnet to separate with the collar head, and trigerring the trap signal to be activated. During the capture period, the trap should be monitored for activity every hour between 6am and 7pm.

**Trap maintenance**

To maintain the trap in good functioning order and prevent corrosion, it is important to lubricate various parts of the mechanism including the spring bolts, sliding door channels and the pulley wheel.

**SNARE TRAPS**

Snare traps are a good capture method that requires experience and an extensive knowledge of snare trap procedure and the inherent risks of badly set snare trap mechanisms. During snare traps activation, qualified veterinary personnel must be within 10 minutes of the capture site.

- The conflict site should first be investigated in order to identify the entry trails used by the nuisance bear to arrive there.
- Two or three snare traps should be placed in strategic capture points along these trails.
- Prior to trap activation the trail is baited using rotting meat or animal fat, and camera traps are positioned to determine the frequency of the bears' visits.
• Snare traps are set, baited and activated.
• If it is not possible to monitor the snares visually without disturbing the bears, a radio-collar must be used as a trap sensor, which will be checked every 20 minutes when the snares are activated. This is important in order to minimize the stress experienced by the bear from being in the trap.
• Once a bear enters a snare trap (Fig. 57), the team approach the capture site rapidly and the captured bear is immobilized and transported following the guidelines described previously (page 29).
• Again, if the capture site is far from the transport container, the bear will be transferred using a hammock (Fig. 51).

BAITED TREE

This bear capture technique is a complex and hazardous procedure that should only be performed by experienced professionals, and if all other techniques are not viable options.

• In the conflict area, a suitably statured tree is selected and baited on the lower branches with decomposing cow legs, honey, fruit, and dog food.
• A small camouflaged hideout is previously constructed approximately 200m away from the baited tree.
• A camera trap should be fitted facing the baited tree in order to identify the nuisance bear and confirm it is visiting the tree. It is important to ensure that the bear is frequently visiting the tree before proceeding with the recapture (Fig. 58).
• The team, composed of an experienced veterinarian, a biologist and an assistant keep watch from the hideout on a daily basis. Once the bear is in the treetop eating the bait, the veterinarian or experienced biologist cautiously approach the tree trying not to be sensed by the bear by coming from an upwind direction, and
discharge a tranquilizer dart at the bear. The rest of the support team maintain their position in the camouflaged hideout.

- The other two team members move to surround the tree on opposite sides at a distance of 20m, with the aim of confusing and distracting the bear, averting the bear from jumping from the tree.
- Should the tranquilized bear remain in the tree, a pulley system with a hammock is used to descend the bear to the ground
- As with the other methods, should the recapture site be far away from the transport container, a hammock should be used to mobilize the bear

**FEEDING PLATFORMS**

Another alternative recapture method is using feeding platforms of approximately 2m by 1.3m in size, and 1.5m in height from the ground. The feeding platform should be constructed using wooden logs and planks. The platform is then baited with decomposing cow legs, honey, fruit, dog food and/or freshwater fish intestines.

- A camouflaged lookout should be previously constructed 200m from the platform, and only be used once the recapture mission is in progress.
- A camera trap should be fitted facing the platform in order to identify the nuisance bear. It is important to ensure that the bear is frequently visiting the platform before proceeding with the recapture (Fig. 59). The camera trap should be checked each morning until it is confirmed that the bear is taking the bait.
- When the bear climbs the platform to take the bait, the veterinarian or qualified biologist approach the platform, and discharge a tranquilizer dart at the bear.
- Should the tranquilized bear stay on the platform, a hammock attached to a rope is used to descend the bear to the ground.
- If the bear flees from the platform, the direction of its movement is observed, and after waiting five minutes, the bear is tracked and located.
- Again, if the capture site is far from the transport container, the bear should be transferred using a hammock (Figure 51).
POST RELEASE OUTREACH AND EDUCATION

Should there be communities surrounding the bear release site, it is vital that they are informed on the projects activities and educated about the importance of nature conservation. Carefully considered mutually beneficial cooperation contracts should be signed by the reintroduction team members and the community to ensure all parties are in agreement with the bear release and to finalize details regarding potential conflict and its ramifications, damage compensation, and community involvement in reporting any sightings and evidence.

An essential element of every reintroduction program is an environmental awareness and education campaign, which should be executed both during and after bear reintroduction. Its success should be analysed and evaluated progressively to determine any tangible environmental improvements brought about by such programs (Fig. 60). Campaign effectiveness can be ascertained through ongoing bear populational studies and periodic local opinion polls.

Should funds be sufficient, locals can be employed as part-time park rangers during the first year after release, becoming integrated into the post-release tracking team to teach them the importance of nature conservation first hand whilst providing financial benefits in the communities.

CHAPTER VIII: CAPTIVE MANAGEMENT CONSIDERATIONS

CAPTIVE BREEDING PROGRAMS

Captive breeding programs are tangible methods of reinforcing the captive population of a species. Often, captive breeding programs can provide a means of bolstering wild populations of a species.
through the reintroduction of captive bred, rehabilited individuals. They should only be considered as viable options where a population is in critical danger of extinction and in cases where there is no potential of reinserting rescued individuals.

Since 1990, a total of eight Andean bear cubs have been born in captivity in Ecuador, of which seven have survived to adulthood (Fig. 61). These experiences indicate that captive breeding of Andean bears is achievable, though undoubtedly more investigative research on Andean bear reproductive behavior is required in order to improve captive breeding strategies.

In the cloud forest region of Intag in northwest Ecuador, cubs of approximately three to four months are frequently seen with their mother during the maize season (between March and July) on a level that seems more than purely coincidental. Contrastingly, in the paramo regions of Papallacta female bears have been observed with infants at two different times of year. In this region, it appears there are either two distinct estrus cycles or no defined periods of estrus at all. As a result, it can be concluded that regional differences in estrus cycles exist, hence reproduction programs must not expect defined breeding periods, and understand that estrus cycles may vary on an individual basis.

The decision of whether to introduce male and female bears for specific breeding purposes, or whether males and females can be housed together year-round, will need to be based on the temperaments of the bears, evidence of affiliative or aggressive interactions, and the facilities available at each institution. The design and size of habitat areas provided to Andean bears will depend upon whether or not they are to be separated during the reproductive process. The challenges that can arise during specific breeding interactions include males being overly aggressive, and females not being receptive to males. Inexperienced and young bears may require additional time together before successful copulation occurs.

Ex situ cubbing dens are normally smaller, confined spaces adjacent to larger holding areas in which the female can move around. The cubbing den should be in a quiet area away from the main enclosure. The female should be given access to it routinely prior to separation in order to develop familiarity with the area. Maternity dens for pregnant Andean bears can be constructed in the form of an igloo using concrete, and should measure approximately 2.5 m long x 2 m wide x 1.50 m high. The entrance should be approximately 0.50m wide x 0.50 m.

Remote monitoring of the cubbing den via video camera and microphone is strongly recommended, and can be accomplished by modifying the den to include a camera and low-level lighting prior to parturition. The use of video and audio equipment in the den has proven to be an excellent resource in the management of the cubs, and in sharing the
experience with the public in a controlled forum. It is vital that the parturition area is completely isolated from any background noise as not to disturb the nesting female and her cubs.

Expectant female bears become extremely intolerant to interactions with males, and avoid potential disturbances at all costs. Consequently, during captive breeding programs, it is important to relocate the female into a separate enclosure possessing a cubbing den.

Following separation, females will eventually settle down into the cubbing den. There are no specified methods of testing for Andean bear pregnancy, though physiological and behavioral traits that indicate pregnancy can be observed. Pregnant females tend to gain a lot of weight and their coats look sleeker. Their activity decreases significantly and their appetite simultaneously decreases.

It is possible that female Andean bears can become pseudo-pregnant, and as a result become isolated in the parturition enclosure unnecessarily. Non-pregnant females generally become restless when isolated, and tend to bang on enclosure fencing or give other indications that they want to have access to other areas of the habitat. Should this happen, they should be observed, and potentially tranquilized for veterinary examination to determine whether they are pregnant. If they show no signs of pregnancy, they are relocated back into the main enclosure.

In the weeks prior to parturition, female Andean bears begin to collect branches, grass and leaves with which to prepare their birthing nest. It is important to provide an abundant supply of dry materials in the parturition enclosure to facilitate natural nest building behavior.

Prior to birth, female Andean bears tend to leave the den for short periods during the day, yet after the birth she may stay in the cubbing den for up to 10 days before emerging to forage for food.

After giving birth, cubs may be heard vocalizing and the female is particularly prone to disturbance during the initial post-partum period. Efforts should be made to avoid unnecessary noise in the vicinity of the bear enclosure during this time.

The female generally brings her cubs out of the maternity den while she feeds at around six to eight weeks after birth. Although the cubs may be capable of independent locomotion at this time, they are extremely unsteady. They may be completely weaned at approximately 10 months old. Ideally, cubs should be separated from their mother at an age of between 12 and 18 months.
GERIATRIC ANDEAN BEAR CARE

Old aged Andean bears in captivity need special attention, constant care and a specialized diet to provide them with a high level of comfort during their twilight years. Above the age of 20 years, Andean bears begin to lose their fur and teeth (Fig. 62), become frail and weak, and often experience a loss in body weight. Once their physical state begins to deteriorate, it is good practice to remove them from exhibition and provide them with enclosures that are away from any kind of auditory or visual disturbance. Enclosures should be relatively small, and possess a thermoregulated heating system in colder climates. The floor should consist of comfortable substrates such as sand, and also covered with hay and dry vegetation that is replaced on a daily basis. Enclosures should be equipped with various enrichment tools that will improve bear well being without jeopardizing their health.

The diet of geriatric bears must be adapted to account for their loss of teeth and the metabolic shifts that accompany old age. It can be based on the ‘chapo’ recipe (page 45), and must not include any citric fruits. A water source must always be easily accessible, and where necessary should be manually provisioned. Monthly health checks must be performed by a qualified veterinarian, and any necessary treatment administered. If it appears that the bear is suffering unnecessarily, euthanasia must be considered as an ethical option.

NECROPSY

In the unfortunate event of a bear dying at any time during capture, rehabilitation, transport or release, it is vitally important to perform a necropsy examination, collecting samples of each bodily organ (Appendix V). If organ samples are taken in the field, they must be collected in sterile ziplock bags and conserved in alcohol.

For long term preservation, samples should be preserved in 10% formaldehyde solution. Sample containers should be labelled with detailed descriptions such as the animals name or identity code, sex, date of death and tissue type.
ACKNOWLEDGEMENTS

We would like to thank the following people and organisations for their invaluable assistance and support to our work. Without them, this guide would not have been possible to write and publish. A humble and sincere thank you to all:

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REFERENCES


Rodríguez, E.D. 1991. Evaluación y uso del hábitat natural del oso Andino Tremarctos ornatus (F. Cuvier, 1825) y un diagnóstico del estado actual de la subpoblación del Parque
Nacional Natural de las Orquídeas, Antioquia - Colombia. Trabajo de Grado, Depto. de Biología, Bogotá, Colombia.


APPENDICES:
APPENDIX I: HEMATOLOGICAL AND SERUM CHEMISTRY VALUES FOR ANDEAN BEARS IN ECUADOR

<table>
<thead>
<tr>
<th>Serum and blood parameters</th>
<th>N</th>
<th>Units</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholesterol</td>
<td>33</td>
<td>mMol/L</td>
<td>7,98</td>
<td>3,32</td>
<td>11,66</td>
<td>1,97</td>
<td>0,34</td>
</tr>
<tr>
<td>Total protein</td>
<td>27</td>
<td>g/L</td>
<td>77,30</td>
<td>60</td>
<td>114,0</td>
<td>15,30</td>
<td>2,95</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>34</td>
<td>mMol/L</td>
<td>7,33</td>
<td>4,88</td>
<td>10,88</td>
<td>1,64</td>
<td>0,28</td>
</tr>
<tr>
<td>Blood urea nitrogen</td>
<td>29</td>
<td>mMol/L</td>
<td>4,77</td>
<td>1,96</td>
<td>8,50</td>
<td>1,51</td>
<td>0,28</td>
</tr>
<tr>
<td>Glutamic oxalic transaminase</td>
<td>38</td>
<td>U/L</td>
<td>30,23</td>
<td>3</td>
<td>108</td>
<td>20,68</td>
<td>3,35</td>
</tr>
<tr>
<td>Glutamic pyruvic transaminase</td>
<td>39</td>
<td>U/L</td>
<td>21,43</td>
<td>3</td>
<td>79</td>
<td>19,41</td>
<td>3,10</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>31</td>
<td>U/L</td>
<td>97,57</td>
<td>16</td>
<td>239</td>
<td>58,21</td>
<td>10,45</td>
</tr>
<tr>
<td>Calcium</td>
<td>32</td>
<td>mMol/L</td>
<td>1,87</td>
<td>1,40</td>
<td>2,58</td>
<td>0,29</td>
<td>0,05</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>35</td>
<td>mMol/L</td>
<td>1,68</td>
<td>0,48</td>
<td>3,22</td>
<td>0,70</td>
<td>0,12</td>
</tr>
<tr>
<td>Glucose</td>
<td>18</td>
<td>mMol/L</td>
<td>3,56</td>
<td>1,11</td>
<td>7,66</td>
<td>1,46</td>
<td>0,34</td>
</tr>
<tr>
<td>Urea</td>
<td>38</td>
<td>mMol/L</td>
<td>9,85</td>
<td>2,75</td>
<td>20,35</td>
<td>4,48</td>
<td>0,73</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>45</td>
<td>L/L</td>
<td>0,43</td>
<td>0,33</td>
<td>0,55</td>
<td>0,05</td>
<td>0,007</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>46</td>
<td>g/L</td>
<td>144,45</td>
<td>102</td>
<td>194</td>
<td>20,89</td>
<td>3</td>
</tr>
<tr>
<td>Leukocytes</td>
<td>44</td>
<td>x10^9/L</td>
<td>9,11</td>
<td>3,20</td>
<td>16</td>
<td>2,98</td>
<td>0,45</td>
</tr>
<tr>
<td>Erythrocytes</td>
<td>37</td>
<td>x10^12/L</td>
<td>7,87</td>
<td>4,82</td>
<td>10,58</td>
<td>1,52</td>
<td>0,24</td>
</tr>
<tr>
<td>Segmented leukocytes</td>
<td>45</td>
<td>x10^9/L</td>
<td>6,47</td>
<td>4,28</td>
<td>8,11</td>
<td>0,94</td>
<td>0,139</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>44</td>
<td>x10^9/L</td>
<td>2,20</td>
<td>0,91</td>
<td>4,01</td>
<td>0,77</td>
<td>0,116</td>
</tr>
<tr>
<td>Monocytes</td>
<td>46</td>
<td>x10^9/L</td>
<td>0,13</td>
<td>0</td>
<td>0,55</td>
<td>0,13</td>
<td>0,0189</td>
</tr>
<tr>
<td>Eosinophiles</td>
<td>43</td>
<td>x10^9/L</td>
<td>0,16</td>
<td>0</td>
<td>0,82</td>
<td>0,22</td>
<td>0,033</td>
</tr>
<tr>
<td>Basophiles</td>
<td>43</td>
<td>x10^9/L</td>
<td>0,01</td>
<td>0</td>
<td>0,27</td>
<td>0,05</td>
<td>0,007</td>
</tr>
<tr>
<td>Band cells</td>
<td>40</td>
<td>x10^9/L</td>
<td>0,027</td>
<td>0</td>
<td>0,64</td>
<td>0,11</td>
<td>0,017</td>
</tr>
<tr>
<td>Mean cellular hemoglobin concentration</td>
<td>36</td>
<td>g/L</td>
<td>334,17</td>
<td>243</td>
<td>530</td>
<td>43,10</td>
<td>7,19</td>
</tr>
<tr>
<td>Mean cellular volume</td>
<td>38</td>
<td>fl</td>
<td>53,21</td>
<td>32</td>
<td>86</td>
<td>13,15</td>
<td>2,13</td>
</tr>
<tr>
<td>Mean cellular hemoglobin</td>
<td>38</td>
<td>pg</td>
<td>18,33</td>
<td>12,70</td>
<td>26,30</td>
<td>3,03</td>
<td>0,48</td>
</tr>
</tbody>
</table>
## APPENDIX II: INDEX OF ILLNESSES AND DISEASES COMMONLY EXPERIENCED IN ANDEAN BEAR REHABILITATION PROGRAMS

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>MEDICATION (Generic)</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bear cub diahorrea</td>
<td>Soy milk and Camomile</td>
<td>Mix 1 part soy milk to 1 part camomile infusion</td>
</tr>
<tr>
<td>Parasitosis</td>
<td>Albendazole</td>
<td>25 mg/Kg body weight. Three doses every five days</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Cefalosporina</td>
<td>50mg/Kg body weight every day for three weeks</td>
</tr>
<tr>
<td>Tick Infestation</td>
<td>Ivermectine (1%)</td>
<td>1ml/50Kg One subcutaneous treatment</td>
</tr>
<tr>
<td>Miasis</td>
<td>Lepezef (Aerosol)</td>
<td>Apply every 10 days</td>
</tr>
<tr>
<td>Alopecia</td>
<td>Mirrapel</td>
<td>Supplement diet with minerals. Environmental enrichment</td>
</tr>
<tr>
<td>Exoparasites</td>
<td>Ivermectine (1%)</td>
<td>1ml/50Kg One subcutaneous treatment</td>
</tr>
</tbody>
</table>
APPENDIX III: IZNACHI RESCUE CENTER ANIMAL RECEPTION FORM

Andean Bear (*Tremarctos ornatus*) Reception Form: Iznachi Rescue Center

<table>
<thead>
<tr>
<th>BEAR ID</th>
<th>SEX</th>
<th>DATE OF ENTRY</th>
<th>APPROXIMATE AGE ON ARRIVAL</th>
<th>PHYSICAL CONDITION ON ARRIVAL</th>
<th>ORIGIN</th>
<th>BODY WEIGHT ON ARRIVAL (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BODY LENGTH (cm)</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>FACIAL MARKINGS</td>
<td></td>
</tr>
<tr>
<td>FRONT PAW (cm)</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACK PAW (cm)</td>
<td>D</td>
<td>F</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Osos Andinos en CROI

<table>
<thead>
<tr>
<th>ID Zoo</th>
<th>Identificación</th>
<th>Nombre de Pila</th>
<th>Sexo</th>
<th>Macho</th>
<th>Hembra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fecha</th>
<th>Peso (Aprox.)</th>
<th>Largo Total (cm)</th>
<th>Cuello (cm)</th>
<th>L Mano (cm)</th>
<th>L Pata (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Diagnóstico**

**Tratamiento**

**Medicamento/Dosis**

**Exámenes solicitados**

---

**Registro Interno**

Firma Médico Veterinario
APPENDIX V: NECROPSY REPORT FOR ANDEAN BEARS

Nombre Doméstico:  
Encontrado por:  
Fecha:  

# ISIS Otros ID:  
Edad:  
Feso:  

Localización:  
Fecha de Muerte:  
Fecha de Necropsia:  

Circunstancias de la muerte (encontrado muerto, trauma por compañero de exhibición, enfermedad, eutanasia, accidental, etc.)


Hallazgos Macoscópicos.

Improntas (Citologías):

Tejidos Enviados:

<table>
<thead>
<tr>
<th>Corazón</th>
<th>Pulmones</th>
<th>Timo</th>
<th>Esófago</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiroides</td>
<td>Paratiroides</td>
<td>Diáfragma</td>
<td>Hígado</td>
</tr>
<tr>
<td>Rínón</td>
<td>Bazo</td>
<td>Pancreas</td>
<td>Adrenales</td>
</tr>
<tr>
<td>Intestino Delgado</td>
<td>Intestino Grueso</td>
<td>Ciego</td>
<td>Estómago</td>
</tr>
<tr>
<td>Mesentero</td>
<td>Gónadas</td>
<td>Útero</td>
<td>Vejiga Urmaria</td>
</tr>
<tr>
<td>Glándula Mamaria</td>
<td>Ganglios Linfáticos</td>
<td>Médula Osea</td>
<td>Tuétano de Huesos</td>
</tr>
<tr>
<td>Piel</td>
<td>Hipófisis</td>
<td>Cerebro</td>
<td>Otros</td>
</tr>
</tbody>
</table>

Muestras enviadas a.

Muestras almacenadas:  
[] formalina  [] Refrigeradas  [] Otro  

Disposición de la Carcasa:

Comentarios:

Solicitudes Especiales:

Código de Mortalidad de ISIS:

Diagnóstico Final (Causa de Muerte):

Prosector:

Taken from the Guide for Andean Bear Care in Captivity; ‘Guía para el Mantenimiento del Oso Andino (Tremarctos ornatus) en Cautiverio’ (2002).
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>LOCAL NAME</th>
<th>ENGLISH NAME</th>
<th>FAMILY</th>
<th>FOOD SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Agave americana</em></td>
<td>Maguey (P)</td>
<td>American aloe</td>
<td>AGAVACEAE</td>
<td>Soft center of leaf fronds</td>
</tr>
<tr>
<td><em>Furcraea andina</em></td>
<td>Cabuya (P)</td>
<td>Fique</td>
<td>AGAVACEAE</td>
<td>Soft center of leaf fronds</td>
</tr>
<tr>
<td><em>Bomarea sp.</em></td>
<td></td>
<td></td>
<td>ALSTROMELIAE</td>
<td>Tubers</td>
</tr>
<tr>
<td><em>Annona cherimola</em></td>
<td>Chirimoya (P)</td>
<td>Chirimoya</td>
<td>ANNONACEAE</td>
<td>Fruits</td>
</tr>
<tr>
<td><em>Anthurium sp.</em></td>
<td>Anturio (C), (P)</td>
<td>Tailflower</td>
<td>ARACEAE</td>
<td>Spadix, rhizome, stem, infructescence</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Family</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>--------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td><em>Oreopanax spp.</em></td>
<td>Pumamaqui (E)</td>
<td>ARECACEAE</td>
<td>Leaf buds and young leaves</td>
<td></td>
</tr>
<tr>
<td><em>Aiphanes erinaceae</em></td>
<td>Palma espinosa (E)</td>
<td>Spiny palm</td>
<td>ARECACEAE</td>
<td></td>
</tr>
<tr>
<td><em>Bactris setulosa</em></td>
<td>Macanilla, Albarico (V)</td>
<td>Spiny palm</td>
<td>ARECACEAE</td>
<td>Stem heart (Medulla)</td>
</tr>
<tr>
<td><em>Catoblastus kalbreyerii</em></td>
<td>Chonta o macana (C)</td>
<td>ARECACEAE</td>
<td>Fruits and medulla</td>
<td></td>
</tr>
<tr>
<td><em>Ceroxylon echinulatum</em></td>
<td>Palma de ramos (E)</td>
<td>ARECACEAE</td>
<td>Leaf buds and young leaves</td>
<td></td>
</tr>
<tr>
<td><em>Ceroxylon vogelianua</em></td>
<td>Palma real (C)</td>
<td>ARECACEAE</td>
<td>Fruits and medulla</td>
<td></td>
</tr>
<tr>
<td><em>Ceroxylon sp.</em></td>
<td>Palma de ramos (B), (E); Ramos (B); Palma (P); Palma de cera (C), (V)</td>
<td>ARECACEAE</td>
<td>Leaf buds and young leaves</td>
<td></td>
</tr>
<tr>
<td><strong>Chamaedorea pinnatifrons</strong></td>
<td><strong>Palma agria (E)</strong></td>
<td><strong>ARECACEAE</strong></td>
<td><strong>Leaf buds</strong></td>
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<td><strong>Euterpe precatoria</strong></td>
<td><strong>Palmiche, Palmito (V)</strong></td>
<td><strong>ARECACEAE</strong></td>
<td><strong>Leaf buds, fruits and medulla</strong></td>
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<tr>
<td><strong>Euterpe sp.</strong></td>
<td><strong>Palmito (B); Chuni palmito (B)</strong></td>
<td><strong>ARECACEAE</strong></td>
<td><strong>Leaf buds, fruits and medulla</strong></td>
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<td><strong>Geonoma sp.</strong></td>
<td><strong>Palmiche, Palmera (C) (P)</strong></td>
<td><strong>ARECACEAE</strong></td>
<td><strong>Medulla</strong></td>
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<tr>
<td><strong>Oenocarpus sp.</strong></td>
<td><strong>Mapora (V)</strong></td>
<td><strong>ARECACEAE</strong></td>
<td><strong>Medulla</strong></td>
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<tr>
<td><strong>Prestoea acuminata</strong></td>
<td><strong>Palma ramos silla, suripalma (B); Palmiche (C)</strong></td>
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<td><strong>Leaf buds, fruits, Inflorescencia. Medulla.</strong></td>
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<td><strong>Palmito (E)</strong></td>
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<td><strong>Prestoea montana</strong></td>
<td><strong>Palmito (E)</strong></td>
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<td><strong>Espeletia pycnophylla ssp.</strong></td>
<td><strong>Frailejón (E)</strong></td>
<td><strong>ASTERACEAE</strong></td>
<td><strong>Leaf medulla</strong></td>
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<td>Blechnum sp.</td>
<td>Helecho (P)</td>
<td>Fern</td>
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<td>Cordia lutea</td>
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<td>Cordia rotundifolia</td>
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<td>Aechmea sp.</td>
<td>Chimincho (P)</td>
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<td>Ananas comosus</td>
<td>Piña (E), (P)</td>
<td>Pineapple</td>
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<td>Espinillo (B)</td>
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<td>Bromelia spp.</td>
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<td>Lengua de suegra (E)</td>
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<td>Puya aristiguietae</td>
<td>Piñuelo (V)</td>
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<td>Achupaya (P)</td>
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<td>Puya spp</td>
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<td>Aguarongo (E), Achupaya(E), (P)</td>
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<td><strong>Tillandsia complanata</strong></td>
<td>Huicundo, Achupaya (P)</td>
<td><em>Tillandsia complanata</em></td>
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<td><strong>Tillandsia denudata</strong></td>
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<td>Salvajina (P)</td>
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<td><strong>Tillandsia spp.</strong></td>
<td>Clavel del aire (A)</td>
<td><em>Tillandsia spp.</em></td>
<td>BROMELIACEAE</td>
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<tr>
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<td>Huicundo (E)</td>
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<tr>
<td><strong>Vriesea tucumanensis</strong></td>
<td>Chacra de mono (A)</td>
<td><em>Vriesea tucumanensis</em></td>
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<td><strong>Vriesea sp.</strong></td>
<td>Huicundo (P)</td>
<td><em>Vriesea sp.</em></td>
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<td><strong>Echinopsis pachanoi</strong></td>
<td>San Pedro (P)</td>
<td>San Pedro cactus</td>
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<td>Succulent stem and fruits</td>
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<td><strong>Carica pentagona</strong></td>
<td>Babaco (E)</td>
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<tr>
<td><strong>Hedyosmum racemosum</strong></td>
<td>Chilca castil (B)</td>
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<td>Zapallo (P)</td>
<td>CUCURBITACEAE</td>
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<td><em>Weinmannia sp</em></td>
<td>Encenillo</td>
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<td>Bark</td>
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<tr>
<td><em>Cyathea sp.</em></td>
<td>Zarro (C);</td>
<td>CYATHEACEAE</td>
<td>Cataphyll, Leaf sap, base of rachis</td>
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<td>Helecho arborescente (E),(P)</td>
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<td><em>Nephelea incana</em></td>
<td>Helecho árbol(A)</td>
<td>CYATHEACEAE</td>
<td>Base of rachis</td>
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<tr>
<td><em>Nephelea sp</em></td>
<td>Helecho árbol(A)</td>
<td>CYATHEACEAE</td>
<td>Base of rachis</td>
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<tr>
<td><em>Asplundia sp.</em></td>
<td>Llama chaqui (B)</td>
<td>CYCLANTHACEAE</td>
<td>Leaf buds</td>
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<td><em>Carludovica palmate</em></td>
<td>Paja toquilla (E)</td>
<td>CYCLANTHACEAE</td>
<td>Leaf buds</td>
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<tr>
<td><em>Cyclanthus bipartitus</em></td>
<td>Rabihorcado (C)</td>
<td>CYCLANTHACEAE</td>
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<td><em>Rhynchospora sp.</em></td>
<td>Malojillo (V)</td>
<td>CYPERACEAE</td>
<td>Soft center of leaf fronds</td>
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<td><em>Gaultheria glomerata</em></td>
<td>Uvilla (P)</td>
<td>ERICACEAE</td>
<td>Fruits</td>
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<td><em>Gaultheria vaccinioides</em></td>
<td>Tumana (P)</td>
<td>ERICACEAE</td>
<td>Fruits</td>
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<td><em>Vaccinium floribundum</em></td>
<td>Uvilla (P)</td>
<td>ERICACEAE</td>
<td>Fruits</td>
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<td><em>Vaccinium spp.</em></td>
<td>Macha macha, Tisisa (B); Mortiño (E)</td>
<td>ERICACEAE</td>
<td>Fruits</td>
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<td><em>Pernettya prostrata</em></td>
<td>Macha-macha (P)</td>
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<td><em>Psammisia spp.</em></td>
<td>Frutilla (B)</td>
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<tr>
<td><em>Hyeronima dukei</em></td>
<td>Motilón (E)</td>
<td>EUPHORBIACEAE</td>
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<td><em>Hyeronima macrocarpa</em></td>
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<td>EUPHORBIACEAE</td>
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<td><em>Amburana cearensis</em></td>
<td>Ischpingo (P)</td>
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<td><em>Inga feuillei</em></td>
<td>Guaba, pacae (P)</td>
<td>FABACEAE</td>
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<td><em>Inga sp.</em></td>
<td>Guaba, pacae (P)</td>
<td>FABACEAE</td>
<td>Ice-cream-bean</td>
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<td><em>Quercus humboldtii</em></td>
<td>Roble (C)</td>
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<td>Pitumba (B); Guayabillo (E)</td>
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<tr>
<td><em>Cassearia cf. pitumba</em></td>
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<tr>
<td><em>Gunnera acuminata</em></td>
<td>Querusilla (A)</td>
<td>GUNNERACEAE</td>
<td>Fruits, rhizomes and base of petiole</td>
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<tr>
<td><em>Gunnera spp.</em></td>
<td>Querusilla (A), (B)</td>
<td>GUNNERACEAE</td>
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<td><em>Clusia sp</em></td>
<td>Castañeto (C)</td>
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<td>Platanillo (B), (E)</td>
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<td>Heliconia spp</td>
<td>Platanillo (B), (E)</td>
<td>False bird-of-paradise HELICONIACEAE</td>
<td>Leaf buds</td>
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<td>Calatola venezuelana</td>
<td>Fruto del Salvaje (V)</td>
<td>ICACINACEAE</td>
<td>Fruits</td>
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<td>Durazno de monte (E)</td>
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<td>Beilschmiedia sp.</td>
<td>Curo, Amarillo (V)</td>
<td>LAURACEAE</td>
<td>Fruits</td>
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<td>Nectandra acutifolia</td>
<td>Laurel (B)</td>
<td>LAURACEAE</td>
<td>Fruits</td>
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<tr>
<td>Nectandra membranacea</td>
<td>Laurel amarillo (B); Chicinco (E)</td>
<td>LAURACEAE</td>
<td>Fruits</td>
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<tr>
<td><strong>Nectandra sp.</strong></td>
<td>Laurel (P); Curo (V)</td>
<td>Small wild avocado</td>
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<td>Fruits</td>
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<tr>
<td><strong>Ocotea aff. rugosa</strong></td>
<td>Pinchimuyo (E)</td>
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<td>Fruits</td>
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<td><strong>Ocotea cf. macropoda</strong></td>
<td>Urcuviquean (E)</td>
<td>Wild avocado</td>
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<td>Fruits</td>
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<tr>
<td><strong>Ocotea spp</strong></td>
<td>Laurel (B), Laurel amarillo (C); Aguacatillo (E); Curo (V)</td>
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<td>Fruits</td>
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<td><strong>Persea americana</strong></td>
<td>Aguacate (E), Palta (P)</td>
<td>Avocado</td>
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<td>Fruits</td>
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<td><strong>Bunchosia sp.</strong></td>
<td>Ciruelo fraile (P)</td>
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<td><strong>Bombax discolor</strong></td>
<td>Pasallo (P)</td>
<td>Silk cotton tree</td>
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<td><em>Amaranthus sp.</em></td>
<td>Achera (E)</td>
<td><em>Amaranthus</em></td>
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<td>Leaf buds</td>
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<td><em>Calathea lutea</em></td>
<td>Bijao (E)</td>
<td><em>Calathea</em></td>
<td>MARANTACEAE</td>
<td>Leaf buds and rhizomes</td>
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<td><em>Stromanthe stromanthoides</em></td>
<td>Achera pequeña (E)</td>
<td><em>Stromanthe</em></td>
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<td>Leaf buds</td>
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<tr>
<td><em>Miconia spp.</em></td>
<td>Bizcochero (A)</td>
<td><em>Miconia</em></td>
<td>MELASTOMATAECE</td>
<td>Fruits</td>
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<td></td>
<td>Calvario (B)</td>
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<td><em>Ficus cuatrecasana</em></td>
<td>Bibosi, matapalo (B)</td>
<td><em>Ficus</em></td>
<td>MORACEAE</td>
<td>Fruits</td>
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<td>Higuerón (E)</td>
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<td><em>Ficus máxima</em></td>
<td>Bibosi, matapalo (B)</td>
<td><em>Ficus</em></td>
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<td>Higos (E)</td>
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<td><em>Ficus sp</em></td>
<td>Bibosi, matapalo (B), (E),(P); Higuerón (C); Higos (E); Higuera (P); Higuerón blanco, Mora (V)</td>
<td>MORACEAE</td>
<td>Fruits</td>
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<td><em>Cecropia sp</em></td>
<td>Guarumo</td>
<td>MORACEAE</td>
<td>Inflorescence</td>
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<td><em>Musa paradisiaca</em></td>
<td>Platanos,bananos (B), (E) Banana</td>
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<td>Fruits and leaf buds</td>
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<tr>
<td><em>Musa sapientum</em></td>
<td>Banana (A); Cambur (V)</td>
<td>MUSACEAE</td>
<td>Fruits and leaf buds</td>
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<td><em>Ardisia sp.</em></td>
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<tr>
<td><em>Eugenia uniflora</em></td>
<td>Arrayán(A), (B); Pichana (B)</td>
<td>MYRTACEAE</td>
<td>Fruits</td>
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<td>Eugenia sp.</td>
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<td>Myrcia sp.</td>
<td>Pichana (B)</td>
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<tr>
<td>Myrcianthes spp.</td>
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<td>Psidium guajava</td>
<td>Guayaba (B), (E)</td>
<td>Apple guava</td>
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<td>Epidendrum sp.</td>
<td>Orquídea (P)</td>
<td>Orchid</td>
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<td>Pseudobulb</td>
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<td>Oncidium macranthum</td>
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<td>Pseudobulb</td>
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<tr>
<td>Oncidium sp.</td>
<td>Orquídea (P)</td>
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<td>Pseudobulb</td>
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<td>Otoglossum sp.</td>
<td>Orquídea (P)</td>
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<td>ORCHIDEACEAE</td>
<td>Pseudobulb and flower</td>
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<td>Orquídea (C)</td>
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<td><em>Passiflora ligularis</em></td>
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<td>Sweet granadilla</td>
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<td><em>Passiflora mollissima</em></td>
<td>Tumbo (P)</td>
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<td><em>Chusquea lehmannii</em></td>
<td>Suro (E)</td>
<td></td>
<td>POACEAE</td>
<td>Stem center</td>
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<tr>
<td><em>Chusquea lorentziana</em></td>
<td>Caña (A), (B)</td>
<td></td>
<td>POACEAE</td>
<td>Stem center</td>
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<tr>
<td><em>Chusquea polyclados</em></td>
<td>Suro (P)</td>
<td></td>
<td>POACEAE</td>
<td>Shoots</td>
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<td><em>Chusquea scandens</em></td>
<td>Suro (E), (P)</td>
<td></td>
<td>POACEAE</td>
<td>Cane, Shoots</td>
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<td><em>Chusquea spp.</em></td>
<td>Caña (A), (B), (P); Taja, bombilla (B); Chusco (C)</td>
<td>Bamboo</td>
<td>POACEAE</td>
<td>Cane (E), fresh shoots (C) (P)</td>
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<td></td>
<td>Suro (E); Bambú, kurkur(P)</td>
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<td><em>Cortaderia sp.</em></td>
<td>Cortadera (B), Sigse (E)</td>
<td>POACEAE</td>
<td>Soft center of leaf fronds</td>
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<tr>
<td><em>Guadua sp</em></td>
<td>Caña guadua (E)</td>
<td>POACEAE</td>
<td>Fresh shoots</td>
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<tr>
<td><em>Neurolepis sp.</em></td>
<td>Agroman (E)</td>
<td>POACEAE</td>
<td>Soft center of leaf fronds</td>
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<tr>
<td><em>Sacharum officinarum</em></td>
<td>Caña de azúcar (A), (B), (E), (P); Sugarcane caña dulce (P)</td>
<td>POACEAE</td>
<td>Stem center</td>
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<tr>
<td><em>Zea mays</em></td>
<td>Maiz, Choclo (A), (B), (E), (P); Maize</td>
<td>POACEAE</td>
<td>Fruits</td>
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<td><em>Podocarpus oleifolia</em></td>
<td>Chaquiro (C)</td>
<td>PODOCARPACEAE</td>
<td>Bark</td>
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<td><em>Panopsis yolombo</em></td>
<td>Yolombo (C)</td>
<td>PROTEACEAE</td>
<td>Fruits</td>
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<tr>
<td><em>Hesperomeles sp</em></td>
<td>Manzanito (B), (E),</td>
<td>ROSACEAE</td>
<td>Fruits</td>
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<tr>
<td><em>Prunus sp.</em></td>
<td>Capulí (E), Muji (V)</td>
<td>ROSACEAE</td>
<td>Fruits</td>
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<tr>
<td><em>Rubus robustus</em></td>
<td>Mora (E)</td>
<td><em>Rubus robustus</em></td>
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<tr>
<td><em>Rubus urticifolius</em></td>
<td>Mora (E)</td>
<td><em>Rubus urticifolius</em></td>
<td>ROSACEAE</td>
<td>Fruits</td>
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<td><em>Rubus spp.</em></td>
<td>Kari kari (B); Mora (B), (E)</td>
<td>Blackberry</td>
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<td>Fruits</td>
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<tr>
<td><em>Gonzalagunia sp.</em></td>
<td>Cafetillo (E)</td>
<td><em>Gonzalagunia sp.</em></td>
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<tr>
<td><em>Palicourea perquadrangularis</em></td>
<td>Café de monte (E)</td>
<td><em>Palicourea perquadrangularis</em></td>
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<td><em>Sabicea villosa</em></td>
<td>Bejuquillo (E)</td>
<td><em>Sabicea villosa</em></td>
<td>RUBIACEAE</td>
<td>Fruits</td>
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<tr>
<td><em>Micropholis crotonoides</em></td>
<td>Capurillo, Caimito</td>
<td><em>Micropholis crotonoides</em></td>
<td>SAPOTACEAE</td>
<td>Fruits</td>
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(V)
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<td>Lucuma ovobatta</td>
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<td><em>Lucuma ovobatta</em></td>
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<tr>
<td><em>Pouteria lúcuma</em></td>
<td>Lúcuma (B) ; Leuma (E)</td>
<td><em>Pouteria lúcuma</em></td>
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<td><em>Pouteria sp.</em></td>
<td>Caimito</td>
<td><em>Pouteria sp.</em></td>
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<tr>
<td>Physalis peruviana</td>
<td>Aguaymanto (P)</td>
<td><em>Physalis peruviana</em></td>
<td>SOLANACEAE</td>
<td>Berry</td>
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<tr>
<td>Solanum betaceum</td>
<td>Tomate de árbol (E)</td>
<td><em>Solanum betaceum</em></td>
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<tr>
<td>Solanum quitoense</td>
<td>Naranjilla (E)</td>
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<td>Cecropia sp.</td>
<td>Guarumbo (E) ; Cetico, toro blanco (P)</td>
<td><em>Cecropia sp.</em></td>
<td>URTICACEAE</td>
<td>Fruits, flower buds</td>
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<td>Citharexylum montanum</td>
<td>Espinillo (B)</td>
<td><em>Citharexylum montanum</em></td>
<td>VERBENACEA</td>
<td>Fruits</td>
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### REINO FUNGI

| Callambas, hongos (E) | Mushrooms | Specimen |

### ANIMALES

| Chulupi (B) | BLATOIDAE | Specimen |
| Cucarachas (E) | Cockroaches |

### Clase Gasterópoda

| Churo (E) | Snail | Specimen |

### Orden Himenoptera

| Hormiga (B), (P) | Ant | Specimen |

### Bos taurus

<p>| Vacas, ganado (B), (C), (E) | BOVIDAE | Specimen |
| Cow | | |</p>
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<tr>
<td><em>Ovis sp</em></td>
<td>Oveja (E), (V)</td>
<td>Sheep</td>
<td>BOVIDAE</td>
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<td><em>Bufo paracnemis</em></td>
<td>Rococo (A), (B)</td>
<td>Rococo Toad</td>
<td>BUFONIDAE</td>
<td>Abdomen only</td>
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<td><em>Lama glama</em></td>
<td>Llama (B), (P)</td>
<td>Lama</td>
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<td><em>Cavia aperea</em></td>
<td>Cuy (E)</td>
<td>Wild guinea pig</td>
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<td><em>Odocoileus peruvianus</em></td>
<td>Venado (E)</td>
<td>White tailed deer</td>
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<td><em>Mazama sp</em></td>
<td>Soche</td>
<td>Brocket deer</td>
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<td><em>Oreochromis sp</em></td>
<td>Tilapia (E)</td>
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<td>CICHLIDAE</td>
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<td><em>Liophis spp</em></td>
<td>Culebra boba (E)</td>
<td>Water snake</td>
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<td><em>Penelope montagni</em></td>
<td>Pava de Monte (B),(E)</td>
<td>Andean Guan</td>
<td>CRACIDAE</td>
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<td>Morfo (E)</td>
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<td>CASTNIIDAE</td>
<td>Larvae</td>
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<td><em>Cuniculus taczanowskii</em></td>
<td>Guanta de altura</td>
<td>Andean paca</td>
<td>CUNICULIDAE</td>
<td>Specimen</td>
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<td><strong>DASYPODIDAE</strong></td>
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<td><em>Equus caballus</em></td>
<td>Caballo (B), (E)</td>
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<td>Escarabajo (P)</td>
<td>Beetle</td>
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<td>Grillos (B), (E)</td>
<td><strong>Crickets</strong></td>
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<td><em>Martiodrilus spp.</em></td>
<td>Gusano (B); Cuicas, lombrices (E)</td>
<td>Worms</td>
<td><strong>GLOSSOSCOLECIDAE</strong></td>
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<tr>
<td><em>Pontoscolex corethurus</em></td>
<td>Gusano (B); Cuicas, lombrices (E)</td>
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<td><strong>GLOSSOSCOLECIDAE</strong></td>
<td>Specimen</td>
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<tr>
<td><em>Thamnodrilus baloghi</em></td>
<td>Cuicas, lombrices (E)</td>
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<td><strong>GLOSSOSCOLECIDAE</strong></td>
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<tr>
<td><em>Hypostomus cordobae</em></td>
<td>Vieja de agua (A)</td>
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<td><strong>LORICARIIDAE</strong></td>
<td>Specimen</td>
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</table>
Hypostomus sp  
Vieja de agua (A)  
LORICARIIDA  
Specimen

Loricaria spp.  
Vieja de agua (A)  
Suckermouth catfish  
LORICARIIDA  
Specimen

Choloepus spp.  
Perezoso (C)  
Sloth  
MEGALONYCHIDAE  
Specimen

Abejas negras (E)  
Black honey bee  
MELIPONIDAE  
Specimen

Nyctidromus albicollis  
Garza (B)  
NYCTIBIDAE  
Eggs

Actinote  
Mariposas  
Butterflies  
NYMPHALIDAE  
Specimen

Myioborus miniatus  
Slate-throated Whitestart  
PARULIDAE  
Specimen

Prochilodus platensis  
Sábalo (A), (B)  
PROCHILODONTIDAE  
Specimen

Nasuella olivacea  
Coati andino (C)  
Mountain Coati  
PROCYONIDAE  
Specimen

Cuchucho andino (E)
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<td><em>Laterallus albigularis</em></td>
<td>White-throated Crake</td>
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<td><em>Heterocomphus spp.</em></td>
<td>Escarabajos (E)</td>
<td>SCARABAEIDAE</td>
<td>Specimen and larvae</td>
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<td><em>Sus domesticus</em></td>
<td>Domestic pig (P)</td>
<td>SUIDAE</td>
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<td><em>Nothoprocta spp.</em></td>
<td>Perdiz (B), (E)</td>
<td>TINAMIDAE</td>
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<td><em>Tapirus pinchaque</em></td>
<td>Danta, tapir (E)</td>
<td>TAPIRIDAE</td>
<td>Specimen</td>
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<tr>
<td><em>Tapirus terrestris</em></td>
<td>Anta (B)</td>
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<td><em>Ramphocelus icteronotus</em></td>
<td>Flame-rumped Tanager</td>
<td>TRAUPIDAE</td>
<td>Eggs</td>
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<td><em>Trichomycterus alterus</em></td>
<td>Yusca (A)</td>
<td>TRICHOMYCTERIDAE</td>
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<td><em>Bothrops sp.</em></td>
<td>Equis (E)</td>
<td>VIPERIDAE</td>
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