

ANNEX 4

FAUNA RESCUE AND REDISTRIBUTION PLAN

1 INTRODUCTION

This document provides answer to what has been established in article 99 of DS 95/2001 Regulation of the Environmental Assessment System, referred to the permit for hunting or trapping animals of the protected species referred in Article 9 of the Act N°4.601, about Hunting, and thus reply the enquiries raised by the authority in relation to this subject. With regards this, the requirements for its granting and the technical and formal contents needed to allow its compliance, will be those pointed out in the Article 99 of DS 95/2001. Namely, the quoted Article states: **In the Environmental Impact Study or Declaration, as the case may be, the measures and/or suitable conditions for sustainable use of the protected species must be pointed out.**

It is understood that the applicability of this Environmental Permit per Sector, in the framework of the assessment of SEIA, it is done considering the characteristics of the assessed project and the background presented in the Base Line.

In terms of the features of the project, and its relation with this permit, surfaces will be affected and there will be land movement of machineries during the construction stage that will make the specimens of the identified local fauna to get away or get closer.

While with the Base Line background, and especially with the bibliography review, a group of individuals potentially present in the area of influence of the project has been determined. The land research confirmed and specified such background regarding spatial distribution, fauna diversity, richness and abundance of some of the species in the area of study ¹.

According to the above, this environmental permit is requested for all the registered individuals in the Base Line and is potentially identifiable in the area of direct influence of the project. The requirements for its granting, will precisely correspond to the guarantee of the sustainable use of such species, through its protection which in the particular case of this project will be carried out as per the environmental measures pointed out in Chapter 6 of EIA, and among those, rescue and redistribution of species is included. Exactly for this rescue, the Owner will request the corresponding authorization to the Livestock and Agriculture Service, allowing complying with what is pointed out in Article 9 of the Act N° 4.601² and gives rise to PAS 99.

¹ The campaigns considered autumn season (15 and 16 April 2005), summer (18 March 2008) and spring (between 8 and 10 December 2006). For further details of these campaigns and the bibliographic background, please refer to Chapter 5 of EIA.

² Art 9° of the Act N° 4601.- Hunting or trapping of animals of the protected species, in the wild, will be only possible in determined sectors or areas, and previous to the Livestock and Agriculture Service authorization.

For further accuracy with regards the requirements of granting of such authorization, it is necessary to analyze what has been stated in Article 16 of D.S N° 5 Regulation on the Law of Hunting, which establishes that the authorization to trap must be requested by people or institutions that require to trap, with at least 30 working days in advance, before the trapping has been done³. With regards this, the Owner will fully comply with the stated in the Article, in every case that requires the trapping of such species, before the anticipated inspection to the work sites.

Without prejudice of the above, by request of the authorities (in the processing of EIA PHAM framework) some details about the capture of those species identified on-site in the areas of direct influence of the works are presented in this report and which abundance of information in this stage of the project can be done. Nevertheless, once the project is environmentally approved and previous to the beginning of the works, the Owner will formalize the request of authorization for trapping of the species according to what has been stated in Article 9 of the Act N°4.601 and its regulation (before SAG). In such opportunity, the background refereed to the specialization of professionals in charge of the rescue, and the rest of the details required per sector will be presented.

Considering the features of the project and the results of the Base Line Study, the target of the Plan is to rescue those specimens from the conservation interest species which have low movement, and/or reduced populations, endemism and are in the area of direct influence of the project.

³ ARTICLE 16.- People or institutions that require to trap or hunt animals of the protected species, for research or scientific exhibition purposes must obtain a permit which could be granted by the Service, previous to a request by the interested party with at least 30 working days in advanced. Such request must include the following information:

- a) Name, identification number, address, telephone number, zip box and fax of the petitioner
- b) Curricular summary of the participant researchers
- c) Scientific research project to be carried out:
 - c.1) Description of the project (goals, facilities, etc.),
 - c.2) Species, sex and amount of specimens to be trapped or hunted,
 - c.3) Hunting, trapping and managing method,
 - c.4) Trapping location and destination of the animals,
 - c.5) Timetable of the activities and period of time the permit is requested for,
 - c.6) Transport conditions and captivity facilities and
 - c.7) State of the populations to be intervened.

2 BACKGROUND OF THE PROJECT

The goal of the Project is the generation of electric energy through the construction and operation of two run-of-river power plants in hydraulic series, Alfalfal II Power Plant and Las Lajas, which together will generate a maximum power of 530 MW, to supply it to the Central Interconnected System (SIC) through a transmission system connected to a substation. The transmission system is not part of this EIA.

2.1 GENERAL DESCRIPTION

The Alto Maipo Hydroelectric Project comprises two run-of-river power plants arranged in hydraulic series in the upper part of the Maipo River: Alfalfal II and Las Lajas.

Alfalfal II Power Station: Designed for a flow of 27 m³/s, will receive waters collected from the streams located in the upper part of Volcán River and Yeso River. In the upper part of the Volcán River, a maximum of 12,8 m³/s will be collected through 4 intakes that will intercept La Engorda, Colina, Las Placas and El Morado streams. The collected flow will be directed up to the El Volcán tunnel through an underground pipe. Through this tunnel the collected waters will be directed to the Yeso river valley, where the contribution of such river will be taken through an intake located 700 m downstream the reservoir and will be directed through an underground pipe and an intake well.

From the intake well, the flow will be conducted through a pressure pipe up to the adduction tunnel of Alfalfal II Power Plant. At a near distance from the beginning of the headrace shaft, the surge shaft and the forebay of this power plant will be located. The gross head is estimated in 1.146 m.

The powerhouse will be installed in a cavern excavated in the rocky massif. The generation equipment counts with two Pelton turbines of 136 MW of nominal power each one of them.

The discharge tunnel of Alfalfal II Power Plant will supply its flow to an adduction tunnel of Las Lajas Power Plant. The generated flow from Alfalfal II Power Plant can be directed towards the powerhouse of Las Lajas Power Plant, or to the forebay of this last one, in both cases through the before mentioned tunnel.

Las Lajas Power Plant: Designed for a flow of 65 m³/s, will receive the waters generated in Alfalfal and Alfalfal II Power Plants, besides the contributions of the intermediate watershed of the Colorado River located between the intakes of Alfalfal Power Plant (Colorado and Olivares) and the current intake of Maitenes Power Plant. The contribution of Aucayes ravine will be added to this.

Las Lajas Power Plant considers a forebay, located in the right bank of the Colorado River.

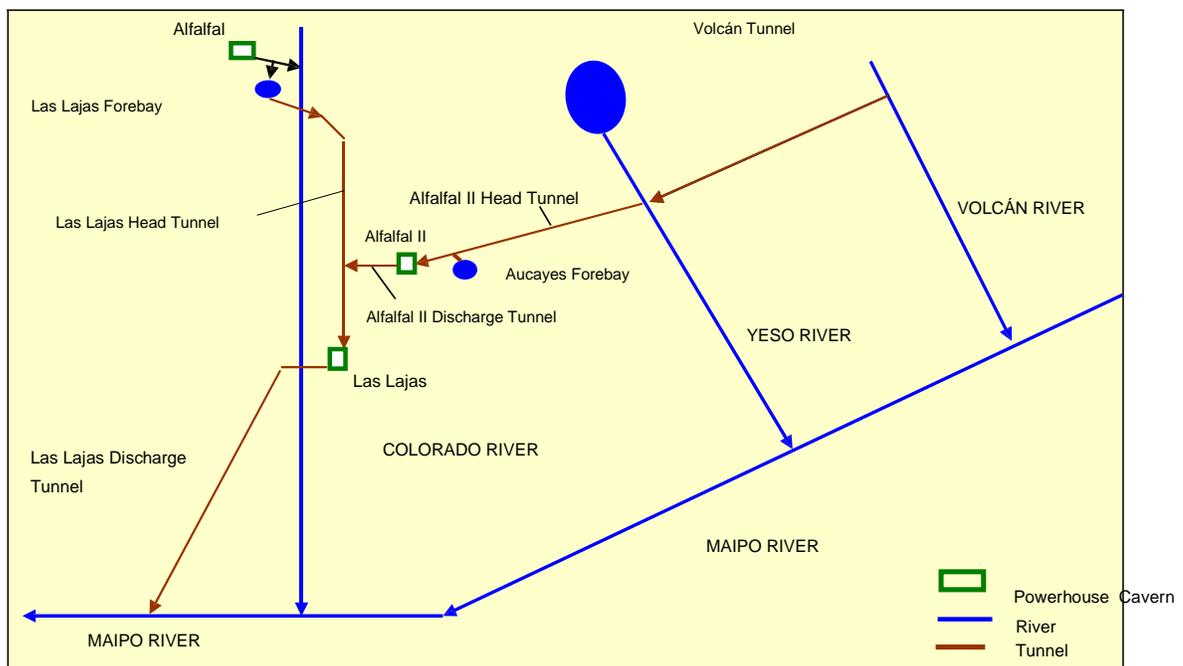
The collected waters in Maitenes intake will be conducted through a canal located in the left bank of Colorado River, both existing. The crossing towards the forebay of Las Lajas is done through a siphon under the river.

The adduction of Las Lajas Power Plant contemplates a pipe crossing the Colorado River, through a siphon and connects with Las Lajas tunnel. Las Lajas tunnel will receive the contribution from the discharge tunnel from Alfalfal II Power Plant; besides, this tunnel which will receive in its route the contribution of Aucayes stream, contemplates a surge shaft and will end in a pressure shaft which will feed the turbines. The gross head is estimated in 485 m.

The powerhouse will be located in the left bank of the Colorado River in a cavern excavated in the rocky massif. The generation equipment will count with two Pelton turbines of 135 MW of nominal power each one of them.

The discharge tunnel of Las Lajas Power Plant will discharge its waters directly to the Maipo River, in Las Lajas area.

Figure 1
Alfalfal II - Las Lajas Simplified Scheme



2.2 DESCRIPTION OF THE WORKS AND ITS RELATION WITH PAS 99

The rescue of individuals will be done previous to the surface occupation by the PHAM works. Redistribution of reptiles and micro mammals will be done from the surfaces used by the camp sites, muck disposal sites and installations of works. While for the amphibian, the rescue will be done in the areas where bridges and intakes will be located.

It is worth to remember that the zones used for camp sites, installation of works and muck disposal areas, will be re-vegetated at the end of the construction stage.

Clarification that the Rescue Plan will not be performed in all the sectors of the works, given that there are areas presenting a low abundance of vertebrates and, either for a high degree of natural intervention or natural conditions, which will be confirmed by the new land campaigns⁴.

Finally, it is important to remember that the project has defined a set of environmental management measures, aiming to mitigate and compensate the effects over fauna, such as minimization of the intervention area, optimization of the internal environmental management of the contractors and its workers, and restoration of the intervened areas (see Chapter 6 of EIA).

3 DETAILS OF THE RESCUE AND REDISTRIBUTION PLAN

3.1 SPECIMENS SPECIES TO BE RESCUE

The redistribution of the affected individuals by the execution of the project will be concentrated in native species with conservation problems, especially those with low movement. The species identified in the Base Line (in the specified areas) and which are assumed to redistribution, correspond to those identified in the following table:

Table 1
Fauna Rescue Plan Affected Species

Scientific Name	Common Name	Area	Type of
Amphibian Class			
<i>LEPTODACTYLIDAE</i> Family			
<i>Alsodes nodosus</i>	Toad	EA	Aucayes Bridge
<i>Pleurodema thaul</i>	Four eyes small toad	EN-MO	Intake
BUFONIDAE Family			
<i>Bufo spinulosus</i>	Thorny toad	EA	Aucayes Bridge
REPTILES CLASS			
TROPITURIDAE Family			
<i>Liolaemus valdesianus</i>	Lo Valdés small lizard	EN-MO	Service road, muck disposal, camp site and works Installations, substation
<i>Liolaemus moradoensis</i>	El Morado small lizard	EN-MO	Service road, muck disposal, camp site and works Installations, substation
<i>Liolaemus nigroviridis</i>	Black-greenish small lizard	EN-MO	Service road, muck disposal Camp site and works installation, substation

⁴ It is worth to remember that the environmental criteria of location of the works (camp sites, muck disposal and works installations), considered the minimization of surfaces with vegetation presence.

Scientific Name	Common Name	Area	Type of
Amphibian Class			
TEIIDAE Family			
<i>Callopistes palluma</i>	Iguana	RC	Service road, muck disposal, camp site and works Installations, substation
MAMMALS CLASS			
SPALOCOPOCIDAE Family			
<i>Spalacopus cyanus</i>	Cururo	RY	

Notes:

Location/sector
 RC: Colorado River
 EN-MO: La Engorda - El Morado Stream
 EM: El Manzanito Stream
 RY: El Yeso River
 EA: Aucayes Stream

4 CAPTURE AND MANAGEMENT METHODOLOGY

The group methodology of species to be rescue will correspond to the following:

A. Amphibian

- **Captures**

For capture of amphibians, searches in the environments that presented suitable conditions of micro-habitats for anuran, that is to say, areas with presence of wet prairie, streams, rivers and the kind will be performed. The trapping techniques consider collections by hand and through the use of seine net. Stones will be lifted in areas where there is the possibility on finding amphibians, such as the edges of sectors with presence of superficial water.

- **Transfer**

The specimens will be located in plastic waterproof-tight containers, where an adequate wet environment will be set for its maintenance and transfer. The transfer of the specimens will be done in the lowest amount of time possible, no more than 24 hours of being trapped.

B. Reptiles

- **Captures**

For the reptile capture, searches in all the surface affected by the superficial works of the project will be done, with special emphasis in the environments frequented by the reptiles (e.g. rocky areas, shrub zones, ecotones). The trapping technique considers collections by hand (when possible) and through the use of canes with a knot with a noose. The rescue area will be covered through scanning the whole surface. During the journey, individuals of all the observed species will be collected.

- **Transfer**

The specimens will be located in a fabric bag or plastic containers. The use of bags and containers will ease the capture and transfer, and its permeability will let airflow.

C Micro-mammals

- **Redistribution**

Rescue of mammals will not be done, but conditions to favor the spontaneous migration of the individuals that may exist in the zones to be intervened, through the personal supervision of specialist personnel in land previous to the start of the works will be carried out.

Particularly the case of the Cururo⁵ (*Spalacopus cyanus*), the method of controlled disturbance will be done, whose monitoring on the colonies of the area of direct influence, will be carried out through the follow up of the movement of the colonies over time (Valverde et al. 1991)⁶. For this, the advance edges of this station colonies will be geo-referenced, together with a characterization of the location habitat of these colonies. This methodology has been previously used presenting a high degree of natural redistribution by the individuals on habitat alteration events (non-published data Escobar & Lobos)⁷. This monitoring will be done in the Yeso river works area, area where this species has been registered. The study will be done previous to the works, and it will complement the base line generated by EIA (section 6.4.1.6 of EIA).

5 CAPTURE LOCATIONS AND DESTINATION OF THE ANIMALS

According to the in-field observations, the areas planned for the capture for the rescue of individual area presented in Figure 2. These are part of sectors within the area of direct influence of the superficial works of the project (muck disposal areas, work installations, camp sites), with presence of the species mentioned in table 1. Preliminarily, the species to be capture per sector are pointed out in table 2.

In order to decrease the probability of resettlement of the areas of influence of the project, during the search of specimens, the area will be disturbed in order to eliminate some natural refugees.

⁵ Species of endemic fossorial rodent from Chile, which prefer well drained open habitats, of soft soil ad great vegetable cover (>60%) (Valverde 1990). It also occupies boggy zones and hard soil slopes (Muñoz-Pedrerros & Yáñez 2000). It is a colony species which establishes family groups of variable sizes, being a feature of the species, the movement of these colonies while searching for food.

⁶ Valverde, V. M., J. Gutiérrez, L. C. Contreras & O. Contreras. 1991. Spatial and temporary disturbance of the soil by the underground rodent *Spalacopus cyanus*. *Biology and Experimental Medicine Files* 24(2): R-201. Valverde, V. M. 1990. Activity rhythms of the underground rodent *Spalacopus cyanus* and its effect on the herbaceous vegetation. *Biology Files and Experimental Medicine* 23(3): R-263.

⁷ Muñoz-Pedrerros, A. & J. Yáñez. 2000. *Mammals of Chile*. Ediciones CEA, Valdivia, Chile.

With regards the destination of the animals, in the same figure 2, the redistribution areas of the species to be rescue area shown. It has been determined per priority that these areas will be as close as possible to the capture sites, although out of the area of direct influence of the project. Given that such areas have in general the same vegetable formations and similar geomorphologic conditions, guaranteeing in this form suitable resources for feeding, reproduction and refugee of the species. For the special case of reptiles, it has been also considered that the redistribution areas have the same exposure to solar radiation.

This proposal of redistribution sites of species will be validated per sector by SAG once the presentation of capture authorization is formalized. In the case SAG determines it so, a new prospecting of availability of habitat for the redistribution of terrestrial vertebrates will be done, leaving an open opportunity to define new areas of redistribution.

Table 2
Distribution of Species to be Rescue

Classification		Zone where the rescue will be done				
Species		River Colorado	La Engorda - El Morado	Stream Manzanito (in bridge zone)	El Yeso	Stream Aucayes
Scientific Name	Common Name					
Amphibian Class						
<i>LEPTODACTYLIDAE</i> Family						
<i>Alsodes nodosus</i>	Toad	x		X		x
<i>Pleurodema thaul</i>	Four eyes small toad	x		X		x
BUFONIDAE Family						
<i>Bufo spinolosus</i>	Thorny toad			X		x
REPTILES CLASS						
TROPITURIDAE Family						
<i>Liolaemus</i>	Lo Valdés small lizard		x			
<i>Liolaemus</i>	El Morado small lizard		x			
<i>Liolaemus nigroviridis</i>	Black-greenish small lizard		x	X	x	x
TEIIDAE Family						
<i>Callopistes palluma</i>	Iguana	x				
MAMMALS CLASS						
SPALOCOPOCIDAE Family						
<i>Spalacopus cyanus</i>	Cururo			X		

Source: Table 5.4.2.6 of EIA

Further background about this matter could only be presented during the Permit process per sector.

6 ACTIVITIES SCHEDULE

Table 3 includes the rescue methods and the opportunity (date/time) to carry it out. It will be only possible to count with greater accuracy about dates of the activities once the construction programs of the Contractor are available.

Table 3
Rescue of the Specimens of Conservation Interest Program and other Measures

Species	Criterion which justifies the Measure							Place where the Measure will be				Type of Measure	Opportunity	
	C.C.			D.R.	P.R.	EN.	P.F.	B.M.	RC	EN-MO	RY			EA
	P	V	R											
<i>Alsodes nodosus</i> Toad	x					x		x				x	Transfer in conservation buckets	Between end of Spring and beginning of Summer; 2 or 3 campaigns.
Four eyes small toad - <i>Pleurodema thaul</i>		x						x		x			Transfer in conservation buckets	Between end of Spring and beginning of Summer; 2 or 3 campaigns.
Thorny Toad - <i>Bufo spinulosus</i>		x						x				x	Rescue in conservation buckets for its transfer	Between end of Spring and beginning of Summer;
Lo Valdés small lizard - <i>Liolaemus valdesianus</i>			x	x	x	x				x			Rescue with knot and by hand	Spring and Summer;
El Morado small lizard - <i>Liolaemus moradoensis</i>			x	x	x	x				x			Rescue with knot and by hand	Spring and Summer;
Black-greenish small lizard - <i>Liolaemus nigroviridis</i>		x				x				x	x		Rescue with knot and by hand	Construction Stage
Iguana - <i>Callopistes palluma</i>		x			x	x	x		x				Rescue with knot and by hand	Spring and Summer;
Cururo - <i>Spalacopus cyanus</i>	x					x					x		Supervision during the works	Construction Stage

Notes:

Criteria justifying the measure

CC: Conservation Category (P= Endangered; V=Vulnerable; R=Rare)

DR: Restricted Distribution

PR: Reduced Population

EN: Endemic

PF: Rarely Frequent

BM: Low Movement

Location/sector

RC: Colorado River

EN-MO: La Engorda - El Morado Stream

EM: El Manzanito Stream

RY: El Yeso River

EA: Aucayes Stream

Rescue of the fauna works through capture will be assessed previous to the use of explosives, penetration footprint execution, permanent modification of flows for the groups of amphibian and reptiles. To the black-greenish small lizard (*Lilolaemus nigroviridis*) and Cururo (*Spalacopus cyanus*) species, conditions to favor the spontaneous migration of the individuals (previous to the start of the works) that might exist in the zones to be intervened will be generated through the supervision of specialist personnel in the field. For the case of the *Spalacopus cyanus* (Cururo), the control disturbance method will be used which has resulted the most effective for such species.

7 CONDITIONS OF TRANSPORT AND CAPTIVITY FACILITIES

A. Amphibians

All the captured individuals will be kept in duly ventilated plastic containers, with a small amount of water and substratum (moss or another vegetable material) to keep humidity. Depending on the size of the individuals, it will not exceed 5 to 10 individuals per container. The trapped individuals will not stay in the bags for more than 24 hours.

Before its release in the final redistribution site, the captured individuals will be identified and classified according to age group. In the case of the trapped of tadpoles, these will be kept in containers of greater size with enough water to avoid desiccation, not exceeding 24 hours.

B. Reptiles

All the trapped individuals will be temporary located , for less than 24 hours, in fabric bags or plastic containers with a maximum of 4 individuals of the same species per bag. These bags and containers will be located during the day in areas with partial shade, until their redistribution.

C. Micro-mammals

The controlled disturbance methodology does not contemplate the capture of individuals of the *Spalacopus cyanus* species.

8 STATES OF THE POPULATIONS TO BE INTERVENED

According to Table 8.1 and section 5.4.2.4 of EIA, two species are in the endangered category, one is *Alsodes nodosus*; this toad was registered in Aucayes Stream and El Toyo, the latter is part of the area of direct influence of the Project. Adult individuals were seen with reduced tail. The other one is cururo, *Spalacopus cyanus*, fossorial rodent which counted with many active burrows in the Lo Encañado small lake zone during both prospecting; it is a species of gregarious habits and complex sociability.

Four species have a vulnerable category:

- . The thorny toad (*Bufo spinulosus*) registered in the La Engorda ravine, in larval state and in the Lo Encañado small lake area, both larval and adults state.
- . The four eyes small toad (*Pleurodema thaul*) registered in the area near the Alfalafal Power Plant, Quempo stream and Lo Encañado small lake.
- . The black-greenish small lizard (*Liolaemus nigroviridis*), registered in the canyon of La Engorda ravine, and adjoining areas of the El Yeso reservoir.
- . The iguana (*Callopistes palluma*) observed in the Las Lajas tunnel area.

Whereas two species of **Rare** conservation category were detected: Lo Valdés Lizard (*Liolaemus valdesianus*) and El Morado small lizard (*Liolaemus moradoensis*), both located in the wet prairie areas of La Engorda and El Morado.

Out of the species to be rescue by PHAM, 5 are considered simultaneously as beneficial for the balance maintenance of the natural ecosystems and with reduced population densities as per the Hunting Book of SAG (1998), 1 as beneficial for the forestry, farming and livestock and 1 beneficial for the balance maintenance of the natural ecosystems (see Table 4).

Table 4
Conservation State of the Species to be Rescue

Classification		Protection		Origin (3)
Species		Criterion of Protection (1)	State of Conservation (2)	
Scientific Name	Common Name			
Amphibian Class				
<i>LEPTODACTYLIDAE</i> Family				
<i>Alsodes nodosus</i>	Toad	S-E	P	E
<i>Pleurodema thaul</i>	Four eyes small toad	E	V	
<i>BUFONIDAE</i> Family				
<i>Bufo spinulosus</i>	Thorny toad	B	V	-
REPTILES CLASS				
<i>TROPITURIDAE</i> Family				
<i>Liolaemus valdesianus</i>	Lo Valdés small lizard	S-E	R	E
<i>Liolaemus moradoensis</i>	El Morado small lizard	S-E	R	E
<i>Liolaemus nigroviridis</i>	Black-greenish small	S-E	V	E
<i>TEIIDAE</i> Family				
<i>Callopistes palluma</i>	Iguana	S-E	V	E
MAMMALS CLASS				
<i>SPALOCOPOCIDAE</i> Family				
<i>Spalacopus cyanus</i>	Cururo	-	P	E

Source: Table 5.4.2.9 of EIA

Notes: (1) Criterion of protection (CP)

E = species classified as beneficial for maintenance of the natural ecosystem balance

B = Species classified as beneficial for forestry, farming and livestock activities

S = Species classified with reduced populations density

(2) Conservation State (EC) for the Central Zone – Chile.

P = Species classified as in Danger of Extinction

V = Species classified as Vulnerable conservation state

R = Species classified as Rare

I = Species classified as rarely or insufficiently Known

(3) Origin

N = Native

E = Endemic

I = Introduced

9 DETERMINATION OF THE RESCUE EFFICIENCY AND EXPECTED RESULTS

A specific follow up will be established to assess effectiveness of the rescue and redistribution program, in order to assess the presence of the released species in the redistribution areas over time. Given that reptiles change their skin along the whole year, and the rubbing of their scales with the substratum, rocks and branches early erases any paint that might be placed, it has been considered to do a follow up in the case that captured specimens are marked with acrylic paint, 15 days after the rescue and redistribution was done. In the case that specimens were not marked with acrylic paint, it has been considered to make a follow up looking for registration of the redistributed specimens in the redistribution site with a dateline of 6 to 12 months once the works had started.

For determination of efficiency of the rescue, data of the capture and mortality of the individuals between the transfer and during the redistribution of live individuals will be taken.

In the case of controlled disturbance of the *Spalacopus cyanus* species, experiences previous to the follow up of the colonies of this species have shown a high degree of movement of the colonies and natural redistribution before intervention events of the habitat. So it is expected that the colonies near the disturbance areas will naturally move away before the start of the interventions. If no observation of this pattern is seen, interventions towards supporting this movement will proceed.

10 CURRICULAR PROFILE OF THE RESEARCHES

Identification of the specialist team accountable for the Fauna Environmental Management Plan, their experience and functions will be included in the process per sector of the capture of animals which will be presented to the Authority for its approval at least 30 working days before the start of the construction works.

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