

# SAVING THE BLUE-THROATED MACAW *ARA GLAUCOGULARIS*: - A SPECIES RECOVERY PLAN -



## Credits

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Blue-throated Macaw *Ara glaucogularis* – Loro Parque Fundación  
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**Approval by the Ministry for Sustainable Development**

**Ministerio de Desarrollo Sostenible**

La Paz 11 de Mayo de 2004  
**DGB-CITES No. 479/04**

Señor:  
**Bennett Hennessey**  
**PRESIDENTE ASOCIACIÓN ARMONIA**  
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Santa Cruz.-

**Ref.: Aprobación Plan "Salvando la Paraba Barba Azul *Ara glaucogularis* un Plan de Recuperación para la Especie".**

Señor Hennessey:

Comunico a usted que una vez evaluado el plan titulado "*Salvando la Paraba Barba Azul Ara glaucogularis un Plan de Recuperación para la Especie*" presentado por la Fundación Loroparque y la Asociación Armonía, de acuerdo a informe técnico y recomendación para su aprobación por el Consejo Consultivo de Vida Silvestre en la cuarta reunión que se llevó a cabo el 13 noviembre del 2003, el VRNMA a través de la Dirección General de Biodiversidad resuelve aprobar el presente plan, en los siguientes términos:

1. Todos los Recursos Naturales son Patrimonio del Estado, y es su deber preservar la biodiversidad y la integridad del patrimonio genético de la flora y fauna ... (Art. 55 de la Ley N° 1333). Por lo tanto, sea la Dirección General de Biodiversidad a través de la Prefectura del Departamento de Beni la instancia que asume la responsabilidad de organizar, fortalecer y coordinar un mecanismo multisectorial para la aplicación y monitoreo a todas las actividades relacionadas con la recuperación de la Paraba Barba Azul (*Ara glaucogularis*), incluyendo las del presente plan.
2. La Prefectura del Beni organizará un taller regional y otras consultas a expertos nacionales e internacionales para complementar el plan y elaborar una agenda de trabajo con todas las instancias involucradas y definir el rol de cada una de ellas en el proceso.
3. Promover, alentar, apoyar e involucrar a las universidades en planes de investigación sobre la ecología de la especie.

## Ministerio de Desarrollo Sostenible

4. La aprobación del Plan "Salvando la Paraba Barba Azul *Ara glaucogularis* un Plan de Recuperación para la Especie", involucra asumir todas las observaciones hechas por el Consejo Consultivo de Vida Silvestre, de los técnicos de la DGB y otras que surgieran durante y del proceso de implementación del plan. Se adjuntan copias del informe técnico y del Acta de la reunión del CCVS respectivamente.

Sin otro particular, saludo a usted con las consideraciones distinguidas.



Ing. Jorge Mariaca Peltés  
DIREC. GENERAL DE BIODIVERSIDAD  
Viceministerio de Recursos Naturales  
y Medio Ambiente  
Min. Desarrollo Sostenible

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C.c. Prefectura Beni.  
Arch. DGB-CITES

## Executive Summary

### Current Status

The Blue-throated Macaw (*Ara glaucogularis*), a restricted range species endemic to Bolivia (Stattersfield *et al.* 1998), is considered as one of the most threatened bird species of the world (BirdLife International 2000) and is placed in the category **Critically Endangered** under the criteria C2a of the IUCN Red List (BirdLife International 2000, Hilton-Taylor 2000). Although the species has been protected since 1986 by the national legislation of Bolivia, as well as by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to which Bolivia has been a signatory party since 1979, its population has further declined since its rediscovery in the Beni savannas in 1992.

The latest extrapolated population estimate, based on the actual count of 36 distinct individuals, give a maximum number of free-ranging Blue-throated Macaws as low as 120, scattered over 8 different areas and separated into two disconnected sub-populations to the north and the south of Trinidad, the Capital of the Beni Department. In contrast, the captive population of Blue-throated Macaws in breeding facilities in Europe and the United States, which accounts for more than 1000 individuals of all internationally registered birds, is increasing due to the establishment of successful breeding programmes.

### Habitat requirements and environmental needs of the Blue-throated Macaw

Several key factors have been identified so far by field researchers, which are linked to the occurrence of the species. Within its currently known distribution range, the Blue-throated Macaw seems to be confined to those forest islands and riparian forests of the Beni savannas, also called the Llanos de Moxos, where the Motacú Palm (*Attalea phalerata*) makes up more than 60 percent of the total vegetation cover. This palm species apparently provides adequate nesting possibilities once it has died off and at the same time offers the most stable food supply throughout the year. It is speculated however that other, less common plant species, which are also consumed by this macaw species in lesser quantities, might play a significant role in providing vital components for the well-being of the species.

### Causes for the decline of the wild population

The major reason for the decline of the Blue-throated Macaw in the wild is assumed to be related to the past and present trafficking of live specimens for the national and international pet market. However, other causes, such as the continuing alteration of key habitats of the Blue-throated Macaw as a consequence of an expanding cattle farming business and its related activities, are likely to impact negatively on the life-cycle of this species. Furthermore, a number of other, still insufficiently understood biological and environmental factors, such as the influence of inter-specific competition with other parrots species, a reduced fertility rate among breeding pairs resulting from continued in-breeding within the very small and fragmented sub-populations, as well as other human disturbance factors related to unsustainable tourism practices and misconceived protection measures, might pose a serious threat to the survival of the species and thus will have to be remedied with adequate methods where necessary.

## Recovery Goal

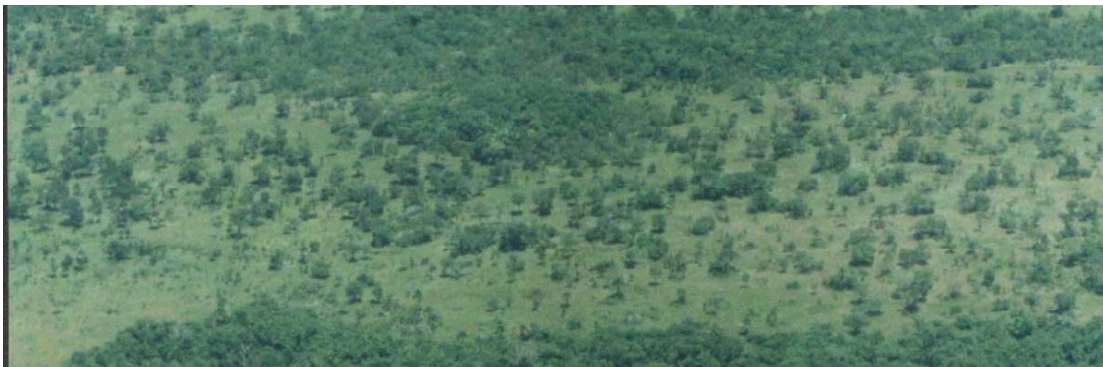
- **To halt and reverse the decline in the status and distribution of the Blue-throated Macaw and restore its wild population to a non-threatened status, as measured against all criteria of the IUCN Red List (Collar et al., 1992, BirdLife International 2000, Hilton-Taylor 2000).**

Further to the above goal, the implementation of recovery measures for the species is simultaneously expected to be beneficial for biodiversity conservation, and to contribute to a more sustainable use and development of Bolivia's natural resources.

## Recovery Criteria

The recovery goal will be considered as accomplished under the following conditions:

- **The wild population has attained a non-threatened status, defined as having established a population number and trend, and geographical distribution that are better than the threshold values for inclusion in the IUCN Red List Vulnerable status.**
- **Sufficient sub-populations have been identified, within the geographical distribution of the species, between which a sufficiently high exchange of individuals and therefore of genetic variability is guaranteed, and the danger of a long-term genetic erosion within the species is reduced to a non-threatening level.**
- **Currently existing factors imposing serious threats to reproductive success, survival of individual birds and gene flow within the species have been eliminated or are sufficiently controlled.**



## 1. Introduction

Until the latest revision in 1981 by Ingels (Ingels *et al.* 1981) on the species status of *A. glaucogularis*, commonly now called the Blue-throated Macaw, neither its exact geographic range nor its true status as an independent species were known. In earlier reports of naturalists and researchers from the 19<sup>th</sup> and 20<sup>th</sup> centuries (e.g. Azara 1805, in Ingels *et al.* 1981, Dabbene 1920, Olrog 1959, Forshaw 1973), *A. glaucogularis* was still considered as either the juvenile form of *Ara ararauna*, the common Blue and Yellow Macaw, or was simply regarded as a sub-species of it. Paraguay as well as Northern Argentina and Southern Bolivia were outlined as the present and the historic range of the species.



Although by the end of the 1970s and beginning of the 80s, individuals of the Blue-throated Macaw were exported from Bolivia to the United States and Europe (Lanning 1982), published information on the estimated range and population status in the wild were only based at the time on reports from professional bird trappers and exporters (Lanning 1982). Ten years later, the presence of this species was finally verified by a

team of researchers in an area north of Trinidad, the capital of the Beni Department (Jordan and Munn 1993).

Shortly after, the Bolivian NGO Asociación Armonía, with strong financial backing from the Tenerife-based NGO Loro Parque Fundación, took the lead in the struggle to preserve this species. As a result of the following field surveys it became clear that, although only recently “rediscovered”, the species was already on the verge of disappearing from the wild. Through cooperation agreements with the Federation of cattle farmers of the Beni (FEGABENI) and the local authorities in Trinidad, as well as by means of educational programmes carried out in different areas within the known distribution of the species, it was hoped to reduce the still ongoing small-scale trafficking of Blue-throated Macaws, and achieve a better protection of the remaining small populations still surviving on privately owned cattle farms. The latest systematic counts carried out in 2002 indicated, however, that the population has further declined and that immediate and effective conservation measures have to be taken now to prevent the final extinction of the species in the wild (Armonía 2002). To prevent extinction in the wild of the Blue-throated Macaw, and to bring about the conservation of this species, its habitat and related biodiversity, the necessary measures must be clearly defined and prioritized. This is a key purpose of this Recovery Plan for the Blue-throated Macaw. The formulation of this plan has made extensive reference to the BirdLife International Yellow-crested Cockatoo Recovery Plan (PHPA/LIPI/BirdLife International-IP 1998).



## **2. Legislation relevant to the trade, use and protection of the Blue-throated Macaw**

### **2.1. International legislation**

At an international level and within the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) the Blue-throated Macaw is placed under Appendix I. Furthermore, within the legal framework established by the European Union to regulate the trade in endangered species within the member countries, it is listed under Annex A, which includes the most threatened species. Species listed under both conventions can only and exclusively be traded under clearly defined and exceptional circumstances (see also [www.cites.org](http://www.cites.org), [www.redlist.org](http://www.redlist.org)).

### **2.2. Legal status in Bolivia**

In 1975 Bolivia accepted the conditions of CITES and ratified it in 1979, thereby becoming a full signatory member of CITES.

Already before, in 1973, the Supreme Decree (D.S.) 11251 was enacted, which prohibited the capture and the hunting of several Amazonian bird species and outlined time periods where no hunting was permitted. Following a ministerial resolution issued in 1985, a general hunting ban was declared for one year.

On the 8<sup>th</sup> of November 1990, the Supreme Decree 22641 was passed, under which a general hunting prohibition for an indefinite period of time was established (and which is still valid today) although already since June 1986 a general hunting ban for all wildlife had been announced.

Within the Supreme Decree 25458 of July 21, 1999, the general hunting prohibition established in the afore-mentioned Decree 22641 was finally ratified, but this allows the sustainable use of some wildlife species as long as impact studies, inventories and coordinated plans for their sustainable use have been established.

Furthermore, since 1992 the Bolivian Government has prohibited and takes sanctions against the possession and the traffic of any wildlife species within its national territory under the environmental legislation and its article 111°, which states: Whoever is, without explicit authorization, commercializing hunting products, who is stimulating and promoting the possession, the transport, and the acquisition of wild species of fauna and flora or their derivatives, or those which are not exempt from the general hunting ban, and thereby puts those species at risk of extinction, will be punished with imprisonment up to two years, will forfeit the products and/or the species which will be wherever possible returned to their natural habitat where advisable, and will furthermore have to pay a penalty equivalent to the full value of those species.

In the Supreme Decree 25458 of July 1999 it was also announced that all natural resources are part of the national patrimony, and that a large variety of species exist in Bolivia which are threatened or which are in danger of extinction and which are therefore protected.

### 3. Description and Taxonomy

Class: Aves  
Order: Psittaciformes  
Family: Psittacidae  
Genus: Ara  
Species: glaucogularis  
Sub-species: none described

The macaw species currently known as *Ara glaucogularis* was described formally by Wagler (1832 in Ingels et.al. 1981) under the name of *Sittace caninde*. Until very recently this macaw remained a kind of mystery. Apart from known differences between this species and *Ara ararauna*, historically speaking a lot of confusion existed with regard to the taxonomic status of *Ara glaucogularis*. In the first edition of Forshaw's book on the parrot species of the world (1973), he considered *A. glaucogularis* as a juvenile colour morph of *A. ararauna*, a juvenile form of a subspecies of *A. ararauna* or a true distinct species. These assumptions and the confusion about the true status of the species were also a result of the fact that only five specimens from scientific museums all around the world were known at that time and that, until the nineteen seventies when the first individuals of this species appeared on the market, it was not known to aviculturists (Low 1980 in Ingels et.al. 1981).

Just until very recently the species was known under the scientific name of *A. caninde*, but as Ingels et.al.(1981) point out, Dabbene (1920) already had demonstrated many years before that the Blue and Yellow Macaws known from Paraguay by Azara (1805 in Ingels et.al.1981) as *A. caninde*, undoubtedly were *A. ararauna* and that therefore *A. caninde* was a synonym for *A. ararauna*. As Dabbene suggested the name *A. glaucogularis*, this name remained as the valid scientific species name. Ingels et.al. (1981) suggested the English name Blue-throated Macaw under which this species is known now among ornithologists as well as among parrot breeders. Furthermore, the type locality was incorrectly designated as Santa Cruz de la Sierra, based on Dabbene's examination of one museum specimen from the Argentina Natural History Museum, which supposedly was collected from Santa Cruz de la Sierra in Bolivia. Although the Blue-throated Macaw and the Blue and Yellow Macaw are without any doubt recognized now as different species, morphologically speaking they are very similar. The following descriptions of the two species are not complete but nevertheless give an overview of the morphological characteristics which allows their identification in the field:



In the Blue-throated Macaw both the forehead and the crown are blue. The naked facial area with white skin is reduced. It has approximately seven facial streaks above the eye and seven streaks below. The bluish-coloured streaks are wider and cover a good part of the naked skin area. Up to five facial streaks connect to the entirely blue-coloured throat. The beak is lead-coloured. The Blue and Yellow Macaw has dark blue primaries and secondaries contrasting with pale blue coverts, whereas the Blue-throated Macaw has all-dark blue wings. The yellow colour of the breast tends towards orange compared the bright yellow in Blue and Yellow Macaw . The Blue-throated Macaw is smaller than the Blue and Yellow Macaw , has a smaller and more rounded head. Its beak is daintier and the call is higher pitched than in the Blue and Yellow Macaw .

The forehead and the front part of the crown in the Blue and Yellow Macaw are green. The naked part of the face is much wider than in the Blue-throated Macaw which is still more emphasized by the fact that it has only 5 facial streaks above the eye and four streaks below it which leaves the cheek area without feathers. The facial streaks are black. The lower facial streak, which is the widest one, connects to the black-coloured chin and throat, which end in a small bluish edge on the lower part. The upper surface of the rectrices and the remiges is of a more intensive and darker blue colour than the rest of the other blue-coloured plumage.

#### **4. Discovery and historical range**

Apart from the confusion over the taxonomic status of the Blue-throated Macaw, strong controversy also existed until very recently about the geographic distribution of the species. Historically, it was assumed that the Blue-throated Macaw occurred in the south of Bolivia, as well as in northern Argentina and Paraguay and that the species is typically related to the Chaco bio-geographic region (e.g. Olrog 1959, Ridgely 1981). Most of this confusion about its exact geographic distribution however may have been the direct result of the unclear taxonomic status and the wrong identification of the Blue-throated Macaw for its sister species, the Blue and Yellow Macaw. Ingels et.al. (1981) clearly showed later on that there is no reliable proof of its existence outside of Bolivia or in the Chaco region and that the Blue-throated Macaw is a species endemic to Bolivia.

The currently known geographic distribution in the Llanos de Moxos located in the Beni Department was for the first time established by Lanning (1982). Although he was unable to visit the Beni and without having observed the species in the wild, he managed to talk to professional trappers and animal traders in Santa Cruz who indicated to him that this species is trapped along the upper Mamoré Rive and south of the city of Trinidad, and has been exported mainly to zoos in Europe. According to their information, the species could frequently be found in this area but that its numbers were always much lower than in the Blue and Yellow Macaw, with which it sometimes associated (Ridgely 1981).

In 1982, traders reported that they had found the species in the western and central part of the Beni between Santa Rosa, 227m NN, 14°10' S, 66°53' (Paynter and Traylor 1975), Santa Ana, 220 m 13°45' S, 65°35' W (Paynter and Traylor 1975) and San Miguel. 13°55' S, 65°23' W, as well as in the south-east area of the Beni, namely in Monteverde, about 55 km north-east of Trinidad (see map in Lanning 1982) and close to San Nicolas 14°16' S 64°25' W. Furthermore they claimed having found the species in Canaima, approximately 110 km southeast of Trinidad (see map in Lanning 1982). Another location indicated by them was the extreme northeastern region of the Santa Cruz Department. (Lanning 1982). Chicks of this species

were extracted from nests close to Monteverde and San Miguel (Lanning 1982). According to an other Bolivian resident, familiar with the capture and the export of macaws, the distribution of this species covers the area between the towns of Reyes, 232m 14°19'S 67°23'W and San Nicolás, 14°16'S 64°26'W (USBGN 1955) and that the highest concentrations of these birds are found in the zone of San Nicolas and Santa Rosa (Riviere et al. 1986).

Although from 1981 on it became obvious that the real distribution of the Blue-throated Macaw were the Llanos de Moxos, it took almost one decade more until they were actually located and observed by scientists in their natural environment. In 1992, Charles Munn, led by an ex-macaw trapper, managed to find and document this species for the first time in its habitat (Jordan and Munn 1993).

## 5. Current geographical distribution

Current geographical distribution includes records from 1993 to 2002.

### 5.1. Confirmed geographical distribution

The confirmed present geographical distribution is determined from confirmed sites of occurrence. A conservative definition is used, being the direct observation of free-living birds at the sites made by personnel of the Armonía / LPF Blue-throated Macaw project, and other acknowledged field scientists. However, most of these direct observations are confirming sightings made by lay people in the Beni.

In the ten year period, 80 sites were periodically to frequently visited across five provinces in the Beni, and there were 11 sites with Blue-throated Macaws present:

**Table 1. Searches for the Blue-throated Macaws(1993-2002).**

PROVINCE	NO. SITES VISITED	NO. SITES WITH BTMs <sup>1</sup>
Cercado	4	2
Mamoré	30	4
Itenez	13	0
Marbán	32	5 <sup>2</sup>
Yacuma	1	0
TOTAL	80	11

1 = Number of sites where the Blue-throated Macaw (BTM) has been seen

2 = 1 site corresponds to a sighting of Blue-throated Macaws in flight, in 1993 only.

(Source: technical reports of the Armonía and Armonía/LPF Blue-throated Macaw conservation project).

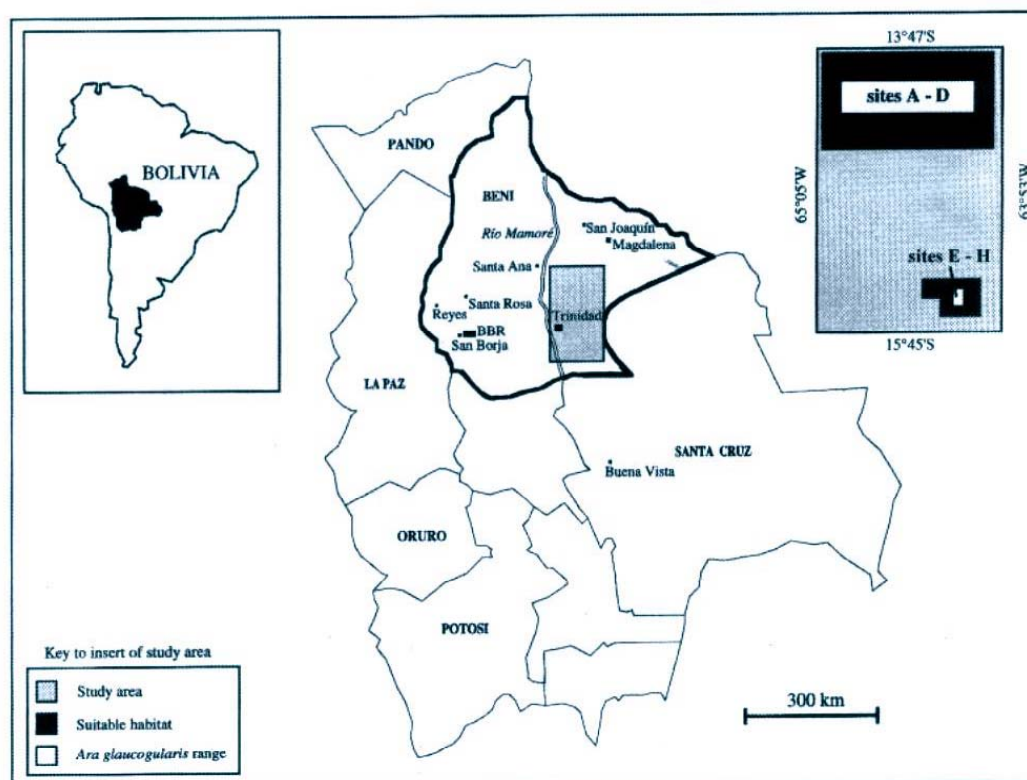
The area of the confirmed distribution, is delimited by the following coordinates: 13°50'S, 15°23'S; 64°24'W, 64°59'W.

Hesse and Duffield (2000) give a geographical range of 2,508 km<sup>2</sup>.

**Table 2. Confirmed distributional limits of the Blue-throated Macaw(1993-2002).**

ZONE <sup>1</sup>	LIMITS	COORDINATES
NORTH	North	13°50' S 64°59' W
	South	14°02' S 64°50' W
	East	13°49'45" S 64°18'46" W
	West	13°47' S 65°01' W
SOUTH	North	15°12' S 64°46' W
	South	15°23' S 64°36' W
	East	15°23' S 64°36' W
	West	15°15'30" S 64°46'20" W

<sup>1</sup> In relation to Trinidad, capital of the Department of Beni

**Figure 1.** Geographical distribution given by Hesse and Duffield (2000)

## 5.2. Possible geographical distribution

The possible current geographical distribution is also restricted to Bolivia: there are no recent reliable reports from other countries. This distribution in Bolivia includes all confirmed sites, plus reported occurrence at other sites principally based on information from residents of the Beni and Santa Cruz Departments. All documented reports from persons other than personnel of the Armonía / LPF Blue-throated Macaw project, and other acknowledged field scientists have been screened by the former, who evaluated the form, content and credibility of the information.

Thus the possible present distribution is bounded by the following most distant sites according to the above reports.

Reyes	- 14°19'S 67°23'W
San Joaquin	- 13°06'S 64°40'W
Bella Vista	- 13°16'S 63°42'W
Ascención de Guarayos	- 15°42'S 63°06'W
Buena Vista	- 17°28'S 63°37'W

However, it is important to note that the sites Ascención de Guarayos and Buena Vista are outside of the bio-geographical region characterized by the otherwise seasonally inundated lowland savanna habitat within which all other confirmed and unconfirmed sites are recorded. Ascención de Guarayos and Buena Vista are located in the bio-geographical region characterized by semi-deciduous sub-humid Chiquitano forest.

## 6. Biogeography of the Beni savannas or Llanos de Moxos

The biogeography of the Beni savannas is highly complex. Although Langstroth (1999) and Beck (1984) classify the phyto-geographical influences somewhat differently, they do agree on the following main classification of its biogeography:

### 6.1. Species with a wide distribution in neotropical areas

Within this class, Langstroth identifies plant species with a very broad distribution in humid neotropical forests like *Ceiba pentandra*, *Hura crepitans*, *Spondias mombin*, *Guazuma ulmifolia*, *Genipa Americana*, *Maclura tinctoria* and *Sterculia apetala* as well as species with a wide distribution in dry tropical forests as *Astronium fraxinifolium*, *Cordia alliodora*, *Hymenea courbaril*, *Tabebuia ochracea*, *Randia armata* y *Samanea tubulosa/saman*. Beck (1984) mentions various aquatic species with a wide neotropical distribution like *Pistia striatiotes*, *Nymphoides indica* and *Thalia geniculata*. Furthermore, the majority of the avifauna of this region includes species which are widely distributed all over the Neotropics, namely the aquatic species *Casmerodius albus*, *Egreta thula*, *Ardea cocoi*, *Platalea ajaja*, *Ciconia maguari*, *Mycteria americana*, *Jabiru mycteria* and *Dendrocygna autumnalis*, the neotropical forest species *Crypturellus undulatus*, *Galbula ruficauda*, *Psarocolius decumanus*, as well as species of more open areas like *Machetornis rixosus*, *Tyrannus melancholicus*, *Emberizoides herbicola*, *Molothrus bonariensis* and *Scaphidura oryzivora*.

### 6.2. Species of the Cerrado

Typical plant species of the Cerrado, which are found in the Llanos de Moxos, include *Curatella americana*, *Tabebuia aurea*, *Pseudobombax longiflorum*. Typical bird species, which inhabit some parts of the Cerrado, are *Cypsnagra hirundinacea* and *Suiriri islerorum*.



### 6.3. Species of the Amazonian Varzea

Langstroth (1999) lists the following plant species as indicators for the Amazonian influence in the region: *Vitex cymosa*, *Calycophyllum spruceanum*, *Hura crepitans*, *Cordia tetrandra*, *Albizia niopoioides*, *Cecropia* spp., *Ceiba pentandra*, *Guazuma ulmifolia*, *Triplaris americana*, *Casearia aculeata*, *Cordia nodosa*, *Maclura tinctoria*, *Rheedia brasiliensis*. Among the bird species found in the Llanos de Moxos which are also typical for Amazonian riparian forests he names *Lamprosar tanagrinus*, *Thripophaga fusciceps*, *Cacicus cela*, and *Gymnoderus foetidus*.

### 6.4. Species of the humid Chaco

Principally these are species which are well adapted to environments where extreme hydrological changes in the course of the year pertain, as can be found for example in the Pantanal region. Woody plant species typical for those areas are: *Aspidosperma*,

*Celtis spinosa*, *Coccoloba cujabensis*, *Bactris glaucescens*, *Copernicia alba*, *Dichapetalum beckii*. Among the bird species, which demonstrate the humid Chaco influence in the Llanos de Moxos region are *Embernagra platensis*, *Molothrus badius*, *Dendrocolaptes major*, *Theristicus caerulescens* and *Amblyramphus holosericeus*.

## 7. Characteristics of the environment of the Blue-throated Macaw

### 7.1. Vegetation

It must be mentioned that, within the few existing studies on the vegetation formations of the Llanos de Moxos, these formations are classified differently. The following chapters contain therefore a synthesis of investigations carried out in different areas by Langstroth (1999), Yamashita y Machado de Barros (1997), Gutiérrez (1997) and Hanagarth & Sarmiento (1990). According to those researchers, the landscape of the Llanos de Moxos area can be divided into the following principal zones.

#### 7.1.1. Elevated areas (“Alturas”)

According to Hanagarth, these are elevated landscapes, which never flood, or only in exceptional years with an extreme precipitation. Langstroth (1999), Hanagarth and Sarmiento (1990) and other authors suggest that these naturally elevated areas are eroded remnants of river banks which were created by formerly existing rivers, and streams which in the course of time disappeared (paleo river beds). However, as Gutiérrez (1997) and Hanagarth (1993) point out, the vegetation of those currently existing forest islands demonstrate nevertheless a strong difference in their vegetation structures compared to those which currently exist along

rivers and smaller streams of the area (see also below). Elevated areas are quite rare in the entire Llanos de Moxos. In the Espiritu farm, where Hanagarth (1993) carried out his investigations, they cover less than 2 % of the total farm area. Exactly those areas however, are considered as the prime habitat of the Blue-throated Macaw.



Depending on the edaphic conditions and the vegetation in the surroundings, those areas are dominated by various types of evergreen forest. In the El Cielo Farm, Gutiérrez (1997) found that the majority of the islands visited by the Blue-throated Macaws were surrounded by a pasture typical of the semi-elevated areas, and by a vegetation characteristic of the frequently inundated “Bajios” and “Yomomos” (see below 7.1.3. and 7.1.4.)

In general, the islands frequented by the Blue-throated Macaw in the El Cielo farm (Gutiérrez 1997) are dominated by motacú *Attalea phalerata* and guayabochi *Calycophyllum spruceanum*. Both plant species on the other hand are associated with *Lonchocarpus guillemianus*, *Astronium fraxinifolium*, *Cordia glabrata*, *Piptadenia robusta* and *Albizia polyantha*. In some areas, the highest forest canopy is build up by *Ficus trigona*, an emerging tree species with an ample canopy. Many tree species on the elevated areas offer fruits highly appreciated by most mammals and birds. According to their dominance these are: *Attalea phalerata*, *Inga boliviensis*, *Genipa americana*, *Vitex cymosa*, *Swartzia*, *Guazuma ulmifolia*, *Coccoloba cujabensis*, *Sterculia striata*, *Guarea guidonia* and *Talisia cerasina*.

A large part of the forest islands, which were analyzed in El Cielo have vegetation in the lower stratum, which is dominated by lianas (vines). Characteristic vine species of the lower vegetation layer are *Cissus hassleriana* and *Desmoncus polyacanthos*.

Also mentioned by several authors as an outstanding characteristic of some of those forest islands, is the complete lack of any ground vegetation and a zero regeneration among the



different plant species shaping the forest islands. Yamashita and Machado de Barros (1997) note that the emerging trees exceeding 30 metres of height, which could provide adequate nesting places for large psittacines like most species within the genus *Ara*, are generally to be found only in the centre of those forest islands.

Langstroth, who carried out his study in a zone close to the southern distribution boundary of the Blue-throated Macaw distribution, found many of the tree species known from the investigations in the northern area, but also lists the species *Rheedia achachairu*, *Salacia elliptica*, *Ceiba sp.*, and *Guarea sp.* A comprehensive analysis of the different island types can be found in Langstroth (1999).

### 7.1.2. Semi-elevated areas (“Semialturas”)

According to Hanagarth (1993) the semi-elevated areas are characterized by a high concentration of sodium in the soil and minor inundations of short period. Their vegetation structures are mixed, with dispersed trees and understorey vegetation formed by different grasses and herbs (see also Langstroth 1999) while at the same time several principal vegetation associations can be distinguished.

The most open vegetation formation is characterized by a sedge locally called “Toruna”. It is found on compact clay-containing soils where the topography is clearly elevated over the surrounding areas (“bajios”). Nevertheless it occasionally suffers seasonal inundations of short duration. Generally it contains very few woody plants with the exception of some spiny species having the ability to resist long dry periods. It is one of the most frequent plant formations



within the geographic range of the Blue-throated Macaw. Identified plant species within this specific environment are the sedge species *Paspalum virgatum*, *Setaria gracilis*, *Paspalum plicatulum*, *Cynodon dactylon*, *Sporobolus aff. indicus* and the small shrub *Mimosa pallida*.

In another plant association found on these semi-elevated areas, locally called “tusecal”, typical species of the Chaco region generally found further to the south appear. This

association is dominated by *Machaerium hirtum* and the other understory species *Bromelia serra*, and *Portulaca cryptopetala*.

Other open savanna woodlands, called “arboledas” in the Beni region, can be found on those semi-elevated areas and are frequently associated with termite savannas. One of those plant formations frequently containing termite mounds and locally called “tajibal” is dominated by the Tajibo tree *Tabebuia heptaphylla* and the Cuta tree *Astronium fraxinifolium* (Langstroth 1999) while a very similar formation called “Alcornocal” is dominated by *Tabebuia aurea*.

In fairly even areas with large and extensive termite mounds, several plant species form little islands on top of those mounds while the area between those islands are mainly filled with different grasses and herbs. Common tree species in those islands are *Tabebuia heptaphylla*, *Tabebuia aurea*, *Genipa Americana*, *Vitex cymosa*, *Machaerium* cf. *hirtum*, and *Pithecellobium scalare*. Frequently occurring bushes are *Celtis*, *Cupania*, *Casearia*, *Randia* y *Xylosma* (Langstroth 1999). A lot of those tree and shrub species also occur in more or less dense forests in the lower lying areas (see below). In contrast to the motacú islands on higher grounds, this forest is made up of deciduous species. As strongly associated with the forests of the semi-elevated areas, Gutiérrez (1997) describes a specific type of forest found on the forest edge of the semi-elevated areas, which suffers more occasional inundations. The typical trees of this forest edge community are *Swartzia jorori*, *Astronium fraxinifolium*, *Spondias bombim*, *Lonchocarpus guillemineanu*, *Attalea phalerata*, *Piptadenia robusta* and *Cecropia* aff. *membranacea*. The mid-level strata consist of small trees and shrubs, among others, *Combretum* sp., *Coccoloba mollis*, *Neea ovalifolia* and *Triplaris americana*. The herbaceous level comprises species like *Heliconia rostrata* as well as several other species of the Legume family. Gutiérrez (1997) considers this type of forest found in the semi-elevated areas to constitute an important habitat for a large variety of animal species, notably for many psittacines, among others the Blue-throated Macaw, which on certain occasions was observed feeding on plants of this forest type.

Finally, one of the most obvious plant formations of the Llanos de Moxos needs to be mentioned: The stands of the white palms *Copernicia alba*. Those palm forests are found at an intermediate topographic level between the semi-elevated areas and the lower lying areas locally called “Bajios” (Gutiérrez 1997). In some areas, those palm stands make up the entire woody plant stratum, which is connecting to adjacent forest edges, and have a very dense appearance with an extensive ground cover. These palm forests suffer inundations of several months in a year. The ground cover within those palm stands is dominated by the sedge species *Psalpum virgatum* and *Sporobolus* sp.

### **7.1.3. Low-lying areas locally called “Bajios”**

Bajios cover the major part of the Lanos de Moxos and therefore form the prevailing vegetation and landscape structure within the known range of the Blue-throated Macaw. In those areas, the vegetation has to cope with flooding between four and nine months of the year as well as with dry periods, lasting from four to eight month (Hanagarth 1993).

Grasses, herbs and water plants are the dominant vegetation forms, while woody species are very scarce. In those low-lying areas the yearly inundation is mainly caused by the overflow of the Mamoré river and only to a smaller degree by local rains. One of the dominant vegetation formations in the Bajios is the grassland, made up of *Luziola peruviana* and *Leersia hexandra*. The soil in this area is highly compacted and of clay origin. Only very few shrub species like *Thevetia amazonica* and *Ipomoea fistulosa* can be found here. Each year

during the rainy season the vegetation cover is restored almost entirely with annual plant species.

Within the Bajío plant association, Gutiérrez (1997) includes the “cosoriò” forest, which forms another important habitat utilized by the Blue-throated Macaws such as in El Cielo farm mentioned before. There, this vegetation type occupies the borders of the El Cielo and the Pernambuco lagoons. Its vegetation structure is similar to the one found along the borders of rivers of this area. The “cosoriò” forest is characterized by a variety of climber species frequently appearing at early succession stages as well as by some small trees not exceeding 8 metres of height, both forming an almost impenetrable plant cover. The canopy level is built up among others by *Erythrina fusca*, *Piptadenia robusta*, *Inga boliviensis*, and the palm *Astrocaryum* sp. The herbaceous layer consists of several lianas within the family Bignoniaceae, as well as the species *Cissus hassleriana* and *Cissus sycioides*. Especially the flowers of the species within the genus *Erythrina* spp are a highly favoured food source of many psittacines. During the dry season when most of the trees of this plant association are in flower, they possibly play an important role in the nutrition of *Ara glaucogularis*.



#### 7.1.4. Pantanos, Curiches and Yomomos

These plant formations are found in geological depressions, which are flooded during the whole year while their edges stay inundated during ten to eleven months. On the “Espíritu” farm, which was closely investigated by Hanagarth (1993), those plant formations cover approximately 10 % of the total farm area. From an ecological point of view they form a highly important component of the landscape for their capacity to maintain a year round available water supply for the wildlife of the area.

Another typical plant association found within the entire range of the Blue-throated Macaw is named after a sedge species locally called “janguillo”. These “janguillares” or permanent

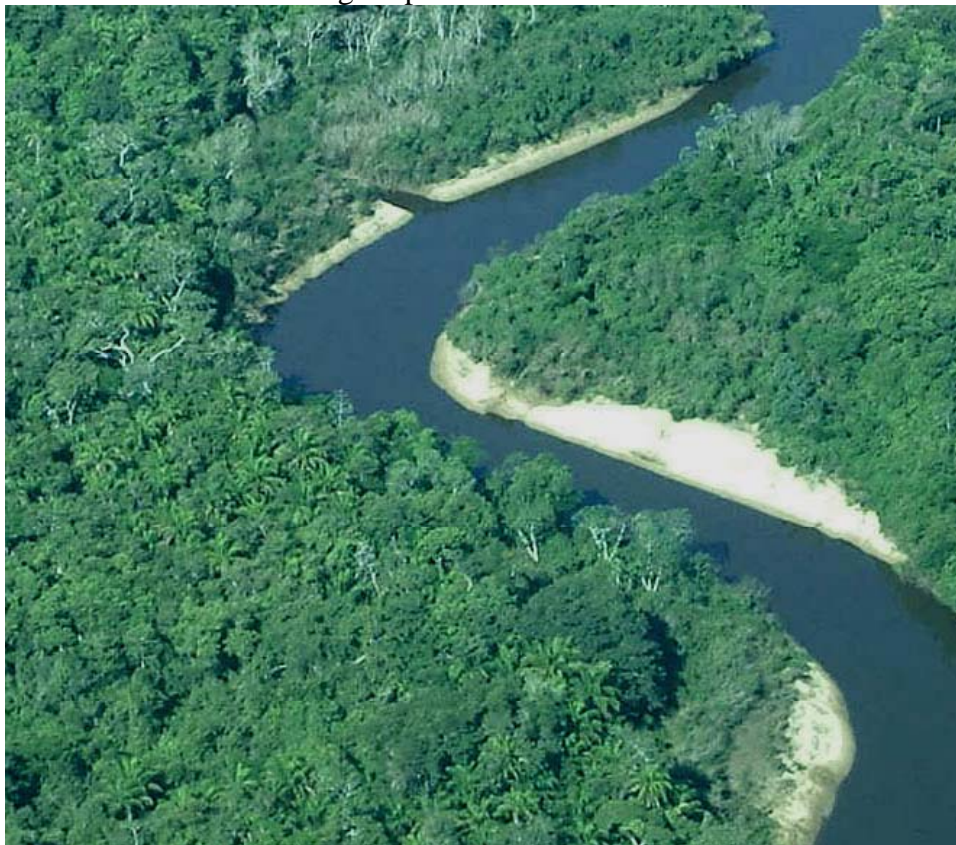
wetlands are made up almost entirely of the sedge *Cyperus giganteus*, which grows up to two meters. In general, those areas are impenetrable due to the dense stands of this sedge. This sedge species is found in geological depressions where no water flow and no water exchange with the surrounding atmosphere is possible due to the mass of accumulated dead leaves. Within those wetlands, small forest islands made up of *Tabebuia insignis*, *Hyptis atrorubens*, and *Hibiscus furcellatus* are encountered. Tajibo stands found within those wet areas are of high importance as potential nesting sites for several species of herons and are locally called “garceros” (Hanagarth 1993).

Along the borders of the lagoons of those areas, like at the “El Cielo”, “Pernambuco” and “Santa Rosa” lagoons, plant formations locally called “Taropales” and “Patujusales” are encountered which are also characteristic vegetation types of anthropogenically created ground depressions. A lot of the species of those plant communities form floating carpets during the flooding period, but become part of the substrate after the water has receded. As members of this plant community on the El Cielo farm, Gutierrez (1997) mentions *Eichhornia azúrea* and *Pontederia rotundifolia*, as well as *Thalia geniculata* and *Paspalum repens*.

#### **7.1.5. Vegetation along rivers and small streams**

The last geo-ecologically distinct component of the Llanos de Moxos with its characteristic vegetation structure is found along the rivers and small streams of the area. The gallery forests along the rivers are made up of a series of distinct vegetation types, largely depending on the characteristics of the riverbed and the soil. On sandy beaches small woodlands prevail made up of *Salix humboldtiana* and *Tessaria integrifolia* while towards their outside edges the shrub *Gynerium sagittatum* and forests of *Cecropia* sp. and *Ochroma* sp dominate. These riparian forests can reach up to several hundreds of meters of width, but in some river meanders might be replaced by forest-free areas. Depending on the soil characteristics, this riparian forest can reach heights of up to 20 meters and more.

In the forested areas along river courses found in his study site, Langstroth (1999) documented forests of outstanding importance for the local wildlife. As common plant



species he mentions *Attalea phalerata*, *Acacia polyphylla*, *Ampelocera ruizii*, *Inga* spp., *Spondias mombin*, *Triplaris americana*, *Cordia nodosa*, *Cordia alliodora*, *Maclura tinctoria*, *Sapium glandulosum*, *Ficus* spp., *Albizia niopoides*, *Hura crepitans* and *Calycophyllum spruceanum*.

According to Yamashita and Machado de Barros (1997) the density of palm species like *Attalea phalerata*, *Syagrus sancona*, and *Astrocaryum* sp. varies significantly between different riparian forests. As those palms are serving as prime food supply for many psittacines, their distribution and their density strongly influences the presence and movement patterns of parrots (see also 7.4.). In riverbeds and meanders of former rivers, meadows of floating grasses of *Paspalum repens* and *Polygonum hispidum* (Hanagarth 1993) are encountered.

## 7.2. Geology and Geomorphology

The Llanos de Moxos consist of a very flat low-lying area with a width of 200 to 400 km, showing a slight northward inclination towards the Beni–Mamore Rivers, which are finally draining into the Rio Madeira (Beck 1984). They are part of what is generally called the High Amazon Basin or more specifically the southwest Amazon drainage. The average altitude above sea level is between 150 – 160 meters with the lowest elevation of 135 meters in the north and 210 meters around the Chapare region in the southeast (Langstroth 1999). Geomorphologically, they are stretched out between the Precambrian Escarpment to the east and the Andes to the west.

Langstroth (1999) summarizes the soils found in the Moxos region as follows: In contrast to the Venezuelan and Colombian Llanos, the Llanos de Moxos generally are not dominated by the otherwise characteristic oxisoles of many tropical regions. However in their northern region are large patches of lateritic consistency, which carry plant formations largely distinct from the alluvial pampas region which prevail in the southern and central part of these Moxos plains – the principal distributional range of the Blue-throated Macaw. The topsoils of the inter-fluvial plains around the centre and the south of the region are shallow with a very poor drainage due to an underlying layer of clay. The soils of the floodplains along active rivers are generally made up of Entisoles and Inceptisols. Langstroth (1999) states that the vegetation cover as well as the existing soil types of the Llanos de Moxos, are a result of interacting abiotic, biotic and anthropogenic factors. Hanagarth (1993) presents a comprehensive analysis on the geology and the tectonic history, as well as on the flood system of the Beni savannas.

## 7.3. The Climate in the Llanos de Moxos

The climate in the Llanos de Moxos is characterized by marked seasonal extremes of rainfall and, as a result, the availability of water. According to Beck (1984), for approximately seven months of the year more than 100 millimetres of rain falls, while two months are completely dry and the other three months are transitional. The average yearly precipitation in Trinidad is about 1,800 mm (Langstroth) with extremes between 1,322 mm (1974) and 2,454 mm (1981) measured in the Espiritu farm, which is located next to the Yacuma river. On certain occasions the precipitation can exceed 200 mm within a few hours (Beck 1984).

Between the years 1946 and 1960, 82% of the average yearly amount of rain was falling between October and April with an average of 125 mm per month (Langstroth). The yearly flooding of the area generally starts in December and lasts until May. In the years from 1946 to 1960, the average monthly precipitation between May and September was as low as 95 mm making up around 18% of the average annual rainfall.

The average temperature in Trinidad is 27° C (Langstroth 1999). In the Bolivian wintertime between June and October, the minimum temperature generally does not fall below 15° C, however it can drop down to 6° C when cold Antarctic fronts, locally called “Surazos”, occasionally reach the Llanos de Moxos (Beck 1984, Langstroth 1999).

Apart from sharply dropping temperatures during these exceptional climatic conditions, even during the winter time the temperature may go up to 35° C or more (Langstroth 1999). During the rainy season, temperatures are moderate as a result of the cloud cover and rarely surpass 40° C. Although the relative humidity during that time generally is high, the evaporation is sufficient to permit the drying up of the ground wherever it is exposed to the sun (Langstroth 1999).

#### **7.4. The habitat of the Blue-throated Macaw**

Since its rediscovery in 1992, the Blue-throated Macaw has been observed in a variety of different habitats previously mentioned. Dependent on seasonal changes, most of the different forest types found within the geographic range of this species provide certain food items.

Yamashita and Machado de Barros (1997) for instance observed the Blue-throated Macaws in gallery forests along streams and rivers; Gutiérrez (1997) reported having seen them in small forest islands of the semi-elevated areas and in the inundated forests surrounding the Pernambuco lagoon. However, until now the only habitat, which was constantly associated with Blue-throated Macaws in all of the available reports are those forest islands dominated by the motacú palm *Attalea phalerata*. Motacú dominated forest islands occur both on naturally and artificially elevated areas (see below). According to 18 vegetation transect counts carried out by Yamashita and Machado de Barros (1997) in forest islands of the Llanos de Moxos 69% of all registered trees were motacú palms (N = 171) and 5% were made up of other palm species. The density of motacú palms was given as 1.72 individuals per 100 sqm. Some of the motacú palms encountered during this census reached a height of 11 metres and a trunk diameter at breast height (DBH) of 65 cm. Their classification of the motacú palms they measured into different age groups is shown in table 3.



**Table 3. Definition of the development classes of the motacú palm *Attalea phalerata*.**

Age classes	Number of individuals	Percentage
Class 1. immature without trunk	17	9.9%
Class 2. in good condition but without exposed trunk	29	17.0%
Class 3. in good condition with exposed trunk	33	19.0%
Class 4. senescent	88	51.4%
Class 5. dead	4	2.3%

It is evident from these data that the old and senescent palms in number exceed the new ones significantly. Thus, they conclude that the islands of motacú are not regenerating sufficiently. They suggest that the lack of regeneration is due to over-grazing and excessive use of fire over centuries. However, they affirm that 80-90% of motacú palms produce fruits all year-round and are capable of having up to five clusters of fruits of different stages of maturity at the same time. Therefore they believe that at least for a few more decades there will be no lack of motacú fruits in the region.

## 8. Human land use practices in the Llanos de Moxos

According to Beck (1984), cultivated lands in the Beni Department currently cover less than 1% of the total surface. The majority of it is located on higher ground which never floods and where the former forest cover was eliminated through deforestation and fire.

Generally, shifting agriculture is practiced in these areas and the principal products cultivated are corn, rice, yucca and plantain, products that serve as the staple food resource of the people. Secondary products are sugar cane, citric fruits (especially grapefruits), mangos, avocados, coffee, tobacco and also coca.

In the alluvial forests of the area, small isolated agricultural fields can be found which belong to indigenous people and colonizers. These groups preferably cultivate their crops in those places, as the soft wood growing on those sites allows easy removal and guarantees a fast growth of their crops due to the accumulation of rich soils during the flooding periods. If the yearly inundations do not last too long no major disadvantages arise from the cultivation of these seasonally flooded areas.

Before the introduction of cattle into the Beni savannas some 300 hundred years ago, (Langstroth 1999) and until the start of commercializing meat on a grand scale, the land use was limited to agriculture and small-scale exploitation of forest products. Meanwhile, livestock-raising has become the dominant way of land use in the Beni. In 1999 three million plus head of cattle were grazing the native forage species, this number having increased from 2.5 million in 1990. The number of cattle in 1999 in the Beni represented 46% of all cattle in Bolivia ([www.infoagro.gov.bo](http://www.infoagro.gov.bo)). The surface area of the Beni is 213,654 km<sup>2</sup>, and thus the estimated minimum cattle density is 0.14 per hectare, and the carrying capacity for cattle has been reported as between 3 and 8 hectares per head (Vera 2001). However, the impact of this activity on the natural vegetation has not been systematically evaluated to date (see section 9.2. for more information).



## 9. Status of the Blue-throated Macaw

The Blue-throated Macaw is placed in the category Critically Endangered, under the criteria C2a, in the IUCN Red List (BirdLife International 2000, Hilton-Taylor 2000). Thus, this species qualifies as Critical because its population is extremely small and each isolated subpopulation is probably tiny and declining as a result of continued illegal trade, and other pressures.

### 9.1. Status of the wild population

Before 1982 there appear to be no estimates of the wild population size. Lanning (1982) reported a population size between 500 and 1000 individuals based on two separate guesses by two local bird exporters. Yamashita and Machado de Barros (1997) conducted surveys in 1993 and 1994 and, based on a minimum number of 54 individuals detected within an area of 2000 km<sup>2</sup>, extrapolated to a total population estimate of 200 birds in an area of 8000 km<sup>2</sup>. Within these 8000 km<sup>2</sup> the same type of vegetation is found, the key element according to Yamashita and Machado de Barros being the “palm islands” (see below), although gallery woodland is also mentioned as a habitat of occurrence. Using the same extrapolation method as Yamashita and Machado de Barros (1997), Hesse and Duffield (2000) estimated the total population, based on counts made in 1997-98, to be 120 birds within an estimated area of suitable habitat of 8,657 km<sup>2</sup>. In this study, suitable habitat was defined as only “palm islands” within the seasonally inundated lowland savanna-forest. The most recent field survey conducted in 2002, covering the same area of previously confirmed occurrence, revealed a still lower number of individuals counted (range 23 to 30 individuals). The sequential population estimates should also be considered in the context of reports of the numbers of Blue-throated Macaws being trafficked in Bolivia and also exported from the country.

### 9.2. Status of the captive population

The most recent International Studbook – ISB (Bueno, 2000) provides a figure of 277 individuals that were registered as being in captivity between the years 1975 and 1999. Not



all of these 277 birds are still living. The total number of birds registered in the European Studbook – ESB during the same time period was 195 of which 173 were still living at the end of 1999 (Bueno, 2000). Contained within this living total of 173 there were 58 individuals incorporated into the Endangered Species Breeding Programme in Europe – EEP and, as a result of reproduction within the captive breeding programme, it increased by 56.8% from 1995 to 1999, and a further 26.6% to 79 birds at the end of 2002 (Reinschmidt 2003). The sex ratio (males/females) in the EEP population has varied as follows: 1999 - 0.89:1, 2000 – 0.76:1, 2001 – 0.86:1, 2002 – 1:0.83. The ESB population increased by 163.5% over the period 1995 to 1999, but the increase was mainly due to more institutions registering their captive birds for the first time. In 2003, 929 Blue-throated Macaws have been registered in the North American regional studbook (Harpe, *in litt*, 2003), most of these birds being in private ownership. A single institution in that region hatched out approximately 770 chicks from 1988 to December of 2002. These records will be integrated into the ISB. In the North American region the estimate of unregistered birds brings the total estimated population in that region to between 1000 and 1100 (Harpe, *in litt*, 2003).

In a separate captive animal registry, the International Species Information System – ISIS, there were 78 individual Blue-throated Macaws held by 20 institutions in May 2003. There is some overlap between the ISIS registry and the ISB. To date, in no recognized registry are registered any government / non-governmental institutions or private holders of captive Blue-throated Macaws in Bolivia.

The EEP population is demographically well balanced, with only 7% of the population over 15 years of age, and more than 80% younger than 10 years. Mortality appears to be low, with most occurring in the first five years of life, and then only re-occurring from the age of fifteen years. More data are required to analyze mortality statistically. The EEP population has genetic representation from eight founders, of which one is dead. There are a further three founders which have not yet bred to make a genetic contribution to the population. Founder representation is uneven, with two individuals having a combined contribution of about 76% of that total founder representation in the population (Bueno 2000).

The Loro Parque Fundación coordinates the EEP and ESB, and is the holder of the ISB jointly with Asociación Armonía.

## **10. Ecology of the Blue-throated Macaw**

As a result of the recent rediscovery of the species, and its documented scarcity in the wild, relatively little information exists so far on the ecology and behaviour of this macaw in its natural habitat.

### **10.1. Diet and feeding in the wild**

Very few direct observations have been made on the natural food items of the Blue-throated Macaw. Jordan and Munn (1993) observed, how Blue-throated Macaws were cracking unripe palm nuts of *Attalea phalerata* and were drinking the juice from them. Yamashita and Machado de Barros (1997) reported a total of eight different plant species used for food, of which four belong to the family Palmae (*Attalea phalerata*, *Acrocomia aculeata*, *Syagrus botryophora*, *Astrocaryum vulgare*), one to the Euphorbiaceae (*Hura crepitans*), one to Cholospermaceae (*Cholospermum hibiscoides*), one to Sapindaceae (*Sapindus saponaria*) and one to the Rubiaceae family (*Genipa americana*). The plant parts consumed were the mesocarp, flower petals, and the leaf stems as well as the inflorescence. In September 2002

members of the Armonía/LPF team observed four individual Blue-throated Macaws eating the dry flowers of the tree *Eugenia sp.* In the same year, two workers of different farms where Blue-throated Macaws were documented informed project members that they observed this species eating the flowers of the guayabochi (*Calycophyllum spruceanum*) and the fruits of the cuta tree (*Astronium fraxinifolium*).



Furthermore, two independent observations made by a farm worker and a member of the Armonía/LPF team, of Blue-throated Macaws walking around in a mud-filled riverbed and on the bottom of a forest island, suggest that this species might also consume earth as a source of minerals, or to help remove natural toxins from food (Emmons and Stark 1979, Gilardi et al. 1999). Mineral in-take at clay licks (“salitrales”), which are absent in the Beni savannas, is well documented for several smaller Psittacine species (*Amazona spp.*, *Pionus spp.*) and for other members in the genus *Ara* (*A. chloroptera*, *A. ararauna*, *A. macao*) (Munn 1994).

From the data collected to date on the feeding habits of the Blue-throated Macaw it is evident that, although Blue-throated Macaws do consume a variety of different plant species and plant parts, their staple food supply is formed by the seeds of the Motacú palm (*Attalea phalerata*), one of the most common palm species within the forest islands in the Beni savannas, as well as in the riparian forests along lagoons and rivers of the area.

## 10.2. Reproductive Biology

### 10.2.1. Breeding activity in the wild

According to information collected by Boussekey *et al.* (1997), the breeding season of Blue-throated Macaws in the wild starts in the dry season lasting from August until November. The same period is reported by Brightsmith (1999). By contrast, Lanning (1982), Hesse (1996) and Duffield and Hesse (1997) state that the breeding season for the Blue-throated Macaw in the Beni commences with the onset of the rainy season between October and November and lasts for about 3 months. As the latter authors outline, the timing of the breeding coincides with the fruiting season of many tree species and thus guarantees optimal feeding conditions

for successfully raising the chicks, which hatch after an incubation period of 25 to 26 days, and fledge after about 90 days from hatching.

### 10.2.2. Reproductive potential

According to information from bird traders and bird hunters given to Lanning (1982), Blue-throated Macaw clutch size varies between 1 and 2 eggs and is thereby lower than the reported clutch sizes from captive breeding pairs (see 10.3.). No information is available to date concerning the average breeding success in the wild, the survival rate of young and their recruitment into the reproducing population.

### 10.2.3. Nest site selection

Field observations made by Armonía/LPF team members on nests and nest site selection indicate that Blue-throated Macaws have a strong tendency towards selecting dead Motacú palm trees as preferred nest sites. These findings are also in agreement with findings from Jordán and Munn (1993) and Boussekey *et al.* (1997). Yamashita and Machado de Barros (1997) confirm that Blue-throated Macaw also uses other tree species to establish their nests. However, only trees where a nest cavity of at least 30cm in diameter can be established will serve as potential nest sites. Table 4 presents an overview of the characteristics of nest sites confirmed by the above-mentioned authors and reported by farm workers in the different farms with Blue-throated Macaw presence.

**Table 4. Observations on nest cavity selection by the Blue-throated Macaw between 1993 and 2002 (Armonía/LPF field team data).**

Tree species	Nº of incidences	Nº dead trees	Elevation (m) above ground
Motacú <i>Attalea phalerata</i> – Palmae	12	9	13, 15
Totaí <i>Acrocomia aculeata</i> – Palmae	10		5, 6, 6-7
Sujo <i>Sterculia striata</i> – Sterculiaceae	4		
Tarumá <i>Vitex cymosa</i> – Verbenaceae	3		10
Palma blanca <i>Copernicia alba</i> – Palmae	3	1	
Guayabochi <i>Calycophyllum spruceanum</i> -Rubiaceae	1		20
Ajo <i>Gallesia integrifolia</i> – Phytolaccaceae	1		
Paquíó <i>Hymenaea courbaril</i> – Ceasalpinioidae	1		
Tajibo <i>Tabebuia sp.</i> – Bignonaceae	1		
Toborochi <i>Chorisia sp.</i> – Bombacaceae	1		



Of the ten species of trees reported as nesting sites for the Blue-throated Macaw, only the Motacú, Totaí vivo and Guayabochi were reported by the Armonía/LPF field team. Cavities have been reported as natural crevices and as active excavations by the Blue-throated Macaws. Orientation of the nest-hole has been reported as west, east and north-east, and height above ground ranges from 5 to 20m. Evidently palms, and especially dead Motacú palms, are favoured.

### **10.3. Maintenance and breeding in captivity**

The Blue-throated is relatively uncomplicated to maintain in captivity, and does not appear to require any noticeably different treatment from the other large *Ara* species. A fundamental requirement is that good conditions are consistently provided and applied to all aspects of its management in captivity. Details on captive maintenance and breeding can be found in Low 1994 and Abramson *et al.* 1995, and specifically to the management of the species at the Loro Parque Fundación Breeding Centre (in prep).

Age of first reproduction is recorded as five years in females and six in males. Successful breeders are so far recorded up to the age of 23 years, but the ages of maximum fecundity in both sexes are nine and ten years (Bueno 2000). The gender of this species is determined either by endoscopy or by DNA analysis. In particular, the latter technique could be applied to Blue-throated Macaws in the wild. In general, the behaviour of the Blue-throated Macaw is very similar to other large *Ara* species, but the courtship behaviour is unique (Abramson *et al.* 1995).

The clutch size in captivity can vary from 2 to 4 eggs, with 2 and 3 most frequent. They are laid at 2 to 3 day intervals, and the incubation period is 25-26 days. The average egg weight at laying is 29.5g, with average chick weight at hatching being 21.3g, although 18g is also recorded. Captive conditions to encourage parent rearing of young are preferred, but artificial incubation and hand-rearing can be achieved with very few losses. Parent-reared young are weaned by day 110-120 after hatching, and hand-reared young by day 75-100 (Schubot *et al.* 1992, Abramson *et al.* 1995).

The primary value of being able to successfully maintain and breed this species in captivity is to establish and manage a long-term viable captive population as a safety measure and as an additional conservation tool to assist its recovery in the wild state. To this end, it is important that as many captive birds as possible, especially wild caught founders, become accessible for inclusion in the studbooks (ISB, EEP and North American Studbook in preparation) and to coordinated management under the cooperative breeding programmes (EEP). Fundamental to such management is that each bird must be individually identifiable (leg-band, microchip). The trend is for an increasing number of Blue-throated Macaws in captivity to be incorporated into the managed programmes. An additional value of successful captive breeding is to reduce or eliminate the pressure for future illegal trafficking of Blue-throated Macaws internationally, as well as in Bolivia.

There are no reports of captive Blue-throated Macaws having been released to the wild, within the confirmed geographical distribution, or anywhere outside of it. Reintroduction of captive birds to the wild might prove to be part of a viable conservation strategy for this species, but such action will need to adhere to strict guidelines (IUCN/SSC/RSG 1995) and include a rigid release protocol and follow-ups of released birds. Other species of macaws and parrots have been reintroduced from captivity to the wild, partly with success. (Wilson *et al.* 1994, Nycander *et al.* 1995, Meyers *et al.* 1996, Sanz and Grajal 1998, Boyd *et al.* 2001, Hilburn *et al.* 2001).

## 11. Behaviour of the Blue-throated Macaw

From the limited observations, which have been made of Blue-throated Macaws in the field, it seems that this species differs in some aspects of its behaviour from other large macaw species. In contrast to *A. ararauna*, *A. severa* or *A. macaw*, the Blue-throated Macaw does not demonstrate a gregarious behaviour, i.e. to forage or to roost in large groups. Most of the time when this species has been observed in the field, it has been seen in pairs or in groups of three. However, it is important to recognize the possibility that this could be an artifact of very low population density.

Other behavioural differences of the Blue-throated Macaw concern foraging and roosting habits. Blue-throated Macaws do not seem to follow set routes on a daily basis to reach preferred foraging sites, as known for other *Ara* species, but rather they forage in an opportunistic and casual way (Armonía report). Neither has it been observed that individuals regularly return to established roosting sites just before nightfall. Based on this rather unpredictable behaviour, and the problems encountered while trying to monitor their movements in the Beni savanna habitat without the help of modern surveillance techniques (radio telemetry), the home range and dispersal patterns of adult and fledged birds still remains unknown.



Observations made by the field team in the confirmed sites to the north of Trinidad (see Fig. 1) indicate that individuals used adjacent forest islands approximately two km apart, although local farm workers have stated that they do make more extensive journeys, roaming between islands up to 6km apart.

According to the information gathered from ex-trappers of macaws and farm hands, there even seems to exist the possibility of long-range movements in Blue-throated Macaws, which appear in higher (relatively) numbers at preferred nesting areas during the onset of the breeding season and then disappear from those areas for a couple of weeks.

## **12. Threats to wild populations of the Blue-throated Macaw**

### **12.1. Animal trafficking**

Trafficking has been and still is considered a serious threat to many parrot species, which are particularly vulnerable to over-exploitation (Collar and Juniper 1992, BirdLife International 2000). From the information provided by persons who have studied Blue-throated Macaws in their habitat, and collected on-site information, a consistently low number of individuals of Blue-throated Macaws, and a low recruitment rate have been reported (Bucher 1992, Munn 1992 in Hesse and Duffield 2000). As such, this species is especially prone to suffer from any kind of exploitation, and has a high extinction risk.

#### **12.1.1. Historic overview of commerce in the Blue-throated Macaw**

Exact figures of how many animals have been legally (until 1984) and illegally (after 1984) extracted from the wild and either exported from the country or kept as pets within Bolivia, are not available.

During the decades of the 70<sup>s</sup> and 80<sup>s</sup> and before the establishment of the legal framework prohibiting the capture of Blue-throated Macaws and other wildlife species, the harvest of several macaw species (*Ara spp.*) was widely practiced. The principal importing country was the United States of America. For this business, exporting companies were established in Bolivia and bought the macaws from so-called “paraberos” or macaw trappers who used to capture the birds using specialized techniques whereby macaws were attracted to trees prepared with traps and slings and a decoy, another macaw with cut wings, tied up to the tree (Escalante, pers. comm. 2001; former technician of animal export companies). As the companies were predominantly interested in acquiring juvenile and adult birds, the collection of chicks straight from the nest cavities was only opportunistically practiced (Aramayo, pers.comm. 2001; ex-trapper).

Yamashita and Machado de Barros (1997) mention the limited availability of the Blue-throated Macaw on the international market before 1980. Lanning (1982) reported 90 individuals estimated by two Bolivian bird exporters to have been exported in 1981, and the highest estimate of export between 1981 and 1992 is 390 birds (Hesse and Duffield 2000). Nilsson (1981 and 1989 in Yamashita and Machado de Barros, 1997) reported records of 38 and 112 Blue-throated Macaws imported to the US in the years 1980 and 1980-85 respectively. Using this as a basis, Yamashita and Machado de Barros (1997) estimated the number of Blue-throated Macaws entering commercial trade in the 1980s worldwide to be 1200. Despite the fact that the Blue-throated Macaw was excluded from the international trade in 1983 (WTMU 1988), and the exportation of live animals from Bolivia was banned in 1986 by means of a Supreme Degree of the Bolivian Ministry, small-scale trafficking of many psittacine species still continues to date (Hesse and Duffield 2000, Weisel 2003).

### **12.1.2. Current trend in the Blue-throated Macaw traffic**

At present, the use of wild-captured birds in Bolivia is basically limited to the following areas:

#### **a. Pet birds in local households**

Farm workers of private farms collect chicks from nests in a more or less opportunistic way, as a result of their own initiative to acquire a pet bird for their family or by following the orders of the landowner to get them animals for their family. (S. Angulo, pers. obs. 2001). In general, there is no registry and no information available on the number of animals thereby extracted each year from their natural environment, neither does there exist any private or official data base on the total number of wild animals kept in private households in Bolivia (Martínez, 1999).

#### **b. Use of feathers for folkloric dances in festivals**

In the whole Beni Dept. a widespread and typical dance called “la danza de los matcheteros” exists, during which men and women of the different dance groups wear headdresses or “tocados” made out of the feathers of different parrot species, but mainly from large macaws. In order to acquire the necessary feathers, all parrots encountered around community areas are hunted with firearms and without discriminating between the different species (S. Angulo, pers. obs. 2001). Two reports exist of individual Blue-throated Macaws hunted to use their meat as fish bait, in both cases the hunters having no idea that they hunted an endemic species in danger of extinction (Armonía 1993-2002). According to recent information (June 2003) from one of the San Ignacio de Moxos dance group, the people which make the head dresses frequently buy the feathers from indigenous people who hunt the birds predominantly as food item (Weisel pers. obs. 2003).



### **c. For sale on the internal and external market**

Although in the specific case of the Blue-throated Macaw, there is no recent evidence of large-scale trafficking with this species, it has been sufficiently documented in the past few years by Armonía/LPF field workers that animals are still trafficked on a small scale. Due to the very low numbers of this species even this small-scale trade with Blue-throated Macaw individuals might be serious enough to cause the final extinction of this species in the wild within a couple of more years.

From data collected by A. Hesse between 1993 and 2002 during personal interviews with farm workers of cattle farms and members of communities living within the currently known range of the species, it has become evident that the illegal trafficking of Blue-throated Macaw individuals has been maintained and still continues, despite the general hunting prohibition of all wildlife and the legal protection of this species. Although these data on the still on-going trafficking activities are for obvious reasons not included in this Species Recovery Plan, they might form an important tool for future coordinated action campaigns to counteract this species-threatening activity. Workers on the farms are generally familiar with most of the macaw nests on the land where they work, even if the areas are huge, indicating both vulnerability of the macaw and interest by the workers.

### **12.2. Habitat alterations**

Several authors (e.g. Beck 1984, Erickson 1995) give evidence that the Llanos de Moxos have been populated a long time before the introduction of cattle some 300 years ago. Very little is known however about the impact of those former cultures on the landscape and its vegetation cover, but chronicles from the early 17<sup>th</sup> century tell about the use of fires to create new areas for cultivation and to hunt wildlife by setting up fire-lines. With the onset of the cattle farming in the Llanos de Moxos, the yearly and systematic burning of the savannas (“chaqueo”) in order to improve the grazing conditions for cattle, control the vectors of diseases (ticks, flies) and to enlarge the grazing area for cattle has become a wide-spread practice.



Savanna habitat, as well as the forest islands and riparian forests along rivers and lagoons, serving as important retreat and resting areas for cattle during the flooding period from December to May, are affected in different ways by cattle. Hanagarth (1993) outlines five principle factors contributing to the alterations of the vegetation of the savanna and the forest islands. These are:

- Soil compaction along the main travel routes of cattle
- Change of the soil chemistry through high concentrations of ammonia and other organic components from the urine and faeces of cattle
- Soil erosion
- Selective foraging and the related reduction of plant regeneration
- Yearly burning and the replacement of species with more fire resistant plant species.



In a study on the microhabitat characteristics of Blue-throated Macaw habitat, carried out in 1993/1994, Yamashita and Machado de Barros (1997) evaluated the age structure and tree species along line transects in areas where Blue-throated Macaws and their nests were observed. One result of their study on the age structure of Motacu palms was that only about 20% of the palms analyzed (N = 171) were healthy, full-grown plants, and only around 10% were young, trunkless palms. The rest were old and senile palms or snags (just the trunk without the palm leaves left) and juvenile palms without fruits. A population structure of young immature palms out-numbered by old palm individuals indicates a long-term palm-grove decline. This result confirms an ongoing influence of cattle farming on palm regeneration, especially of Motacú palms, although its negative effect on the long-term survival of Blue-throated Macaw remains unproven to date.

Another factor which is closely related to the establishment of large scale cattle farming in the Beni, and which is likely to affect the long-term availability of adequate habitat, nest sites and thereby the abundance and distribution of the Blue-throated Macaw in the future, concerns the widespread use of natural resources on cattle farms.

In order to satisfy the daily needs of farm personal and to build-up and maintain the farm infrastructure (Langstroth 1999), natural resources frequently exploited are:

- Different tree species to obtain fire wood for cooking (*Chorisia sp.*, *Calycophyllum spruceanum*),
- Palm leaves (preferably from *Attalea phalerata*) for roof construction

- Large hardwood trees for house construction, fence posts, corrals, etc. (*Tabebuja sp.*, *Sponia mompin*, )

Although the motacu palm appears to provide the most stable food supply and nesting possibilities for Blue-throated Macaws, it is not known yet to which degree this species needs to complement its diet with other plant species in order to stay healthy and reproductive. The motacú palm islands are raised lands where the cattle take refuge during the flooding season. Although they are already subject to disturbance and degradation, it is important to consider their vulnerability to more extensive deforestation in the future should the land use pattern change, in particular the flood season refuge for cattle.

### **12.3. Other Human disturbance factors**

Apart from the documented, small-scale trafficking of Blue-throated Macaws, there appear to exist some other human related disturbance factors, which, if not considered and regulated, might negatively impact the recovery of the species in the future.

#### **12.3.1. Uncontrolled and unsupervised Blue-throated Macaw tourism**

Blue-throated Macaw tourism so far only exists on a small scale and has been restricted to three areas to the north of Trinidad with confirmed Blue-throated Macaw occurrence. Although sustainable and well-planned nature tourism will probably be one of the most promising conservation tools to motivate farm owners in the future to actively participate in the conservation of this species, strict guidelines have to be developed and rigorously applied in order to avoid any negative impact on the few remaining populations. Reported negative impacts to date include the abandonment of nest-sites by Blue-throated Macaws due to excessive disturbance in attempting to prepare close viewing/ photography access, the acquisition of these nest-sites by the Blue-and yellow Macaw from the same cause, and damage to Motacu palms in attempts to increase nest-sites at convenient tourist access points (Armonía 1993-2002). It will be crucial to monitor the expectations of the landowner community with regard to ecotourism based on the Blue-throated Macaw, as well as regularly evaluate the actual and potential economic benefits in the area of occurrence of the species.

#### **12.3.2. Misconceived local “protection measures”**

Some of the farm owners on which farms Blue-throated Macaws live, not only understand that the presence of Blue-throated Macaws might open-up the opportunity to receive additional incentives from tourism, but they have also developed a strong pride in having this rare species on their farms. However, due to misinterpretation of information about the endangered status of the species, some of them have tried to remedy the situation with well-intentioned, but inappropriate measures of removing eggs or chicks from nests in attempts to boost reproduction and increase protection.

## **12.4. Natural enemies**

### **12.4.1. Predators**

No documented cases of nest predation or predation of sub-adults or adults of Blue-throated Macaws exist and this still needs further investigation. However in some of the confirmed Blue-throated Macaw sites, numerous possible predators occur in forest islands and riverine forests. Among others the Armonía/LPF field team documented the presence of *Ramphastos toco*, *Cebus apella*, *Saimiri sciurus*, *Callicebus moloch*, *Nasua nasua* and *Eira barbara*.

#### **12.4.2. Parasites and diseases**

No information exists on the types of diseases and parasites, which affect the Blue-throated Macaw in the wild, their frequency of occurrence and their impact. However, a range of diseases and parasites, originating from wild birds, has been identified in captive parrots, with a high probability that the Blue-throated Macaw is susceptible to them. The diseases include circovirus infections (pathogen of the Psittacine Beak and Feather Disease), polyomavirus infections, herpesvirus infections (especially Pacheco's and Pacheco's-like disease), Proventricular Dilatation Disease infections (PDD), other virus infections (adenovirus, reovirus, influenza virus etc.), and infections with pathogenic bacteria, fungi (especially *Aspergillus* and yeasts) and protozoans such as flagellates (Abramson *et al.* 1995). Furthermore, the widespread occurrence of parasites, predominantly ecto-parasites, in wild bird populations, and in particular on young birds in the nest, is well known.

Many of the diseases, and to lesser extent parasites, are prevalent in captive birds and can pose a distinct danger to wild birds in small, vulnerable populations if the diseases are transmitted through the accidental or deliberate release of captive birds into the wild.

#### **12.4.3. Nest-site competitors**

In the Beni there are a variety of species, which could act as competitors to the Blue-throated Macaw. These could be mammals using cavities as sleeping sites, but which could also have a predator role, such as the Common opossum *Didelphis marsupialis*. Naturalised bees *Apis mellifera* can also colonize cavities and effectively exclude the macaws. Avian competitors may extend to toucans, woodpeckers and woodcreepers (*Xiphocolaptes major*) and other macaws such as *Ara chloroptera* and *Ara severa* but are most likely to be *A. ararauna*, this species having been well documented as conflicting directly with the Blue-throated Macaw at actual and potential nest-sites (Brace *et al.* 1995, Boussekey *et al.* 1997, BirdLife International 2000, Hesse and Duffield 2000, Armonía 1993-2002).

The characteristics of a nest-cavity, which render it suitable for occupancy by the Blue-throated Macaw are still lacking in detail, as is the essential information about the frequency of occurrence of these and other cavities within suitable habitat. Thus, the effect of competition from other species, and the possible requirement and methods to manage a reduction in competition clearly relates to the acquisition of knowledge about whether or not there is a lack of nest sites.

#### **12.5. Reduced gene pool**

It is possible that natural recovery of the Blue-throated Macaw is limited by the very small, fragmented population, with greatly reduced gene flow and a decreased fertility rate as a consequence. Furthermore, this species may show low genetic variability (from possible historical population constriction related to previous climatic and habitat conditions), again with the potential to hinder natural recovery.

#### **12.6. Increased access throughout the Beni region**

In general terms, experience from other places around the world tells us that the habitats and species suffer negative impacts when previously inaccessible areas become accessible. The common pattern is for roads, pipelines, etc which are constructed into and through natural areas to act as conduits for people to enter, convert land and exploit natural resources (Noss

1987). There is the potential for this to happen in the Beni, with possible negative impact on the Blue-throated Macaw (Reid 1999).



### **13. Conservation efforts to date**

#### **13.1. Legal protection and enforcement.**

The legal protection of the Blue-throated Macaw is established within the Supreme decrees 22641 and 25458, which constitute and regulate the sustainable use of all wildlife in Bolivia (see also 2.2.). As no appropriate studies or management plans for the population of the Blue-throated Macaw exist to date which could form the legal basis for any sustainable use of the species, the Blue-throated Macaw is automatically excluded from and legally protected against any kind of commercial exploitation, capture or intentional destruction. Therefore, all future actions of anti-trafficking units, police or customs officers to fight the trafficking of this species are legally covered and permit them to enforce the supreme decrees by means of soliciting penalties. The establishment of a specially trained and equipped official wildlife and police unit, which can exclusively dedicate its operations to the task of fighting the trafficking of wildlife in Bolivia, would be highly desirable for the near future. The enforcement of wildlife laws to date is still weak, as can be judged from the documented and widespread small-scale trafficking of wildlife and the unauthorized keeping of wild animals as pets in many Bolivian private homes (Martinez 1999, Hesse and Duffield 2000, Weisel 2003).

Furthermore, there is no protected area in Bolivia in which the Blue-throated Macaw is known to occur (Wege and Long 1995).

#### **13.2. Establishment of inter-institutional cooperation**

From 1993 until 2002, several official agreements between Armonía and other relevant official parties in Bolivia involved in the conservation of the Blue-throated Macaw were

signed, and are aiming at the development of a joint strategy and mutual support to halt the decline of the species and to preserve it as an important ecological, economical, aesthetical and cultural component of the Llanos de Moxos area and of Bolivia. The parties involved have included the Federación de Ganaderos del Beni y Pando (FEGABENI), the Regional Government Authority in Trinidad (Prefectura y Comandancia General del Beni / Administración Departamental), the Ministerial branch of the Bolivian Ministry for Sustainable Development (Dirección General de Biodiversidad, DGB) and the Technical University of the Beni (Universidad Técnica del Beni, UTB).

### **13.3. Efforts to determine the distribution of the Blue-throated Macaw**

During the past ten years, field surveys to determine the distribution of the species were only carried out by the Armonía/LPF field team, although behavioural and ecological data were also collected by other scientists (Jordan and Munn 1993, Yamashita and Machados de Barro 1997, Boussekey *et al.* 1997) within the confirmed distribution of the Blue-throated Macaw

Due to inherent logistical difficulties in the Beni (no road access to most farms for almost seven months of the year) and the high costs of air travel, explorations concentrated mainly on an area of approximately 8,600 km<sup>2</sup> east to the Río Mamoré (for coordinates and area see Tab.2 and Fig.1). Some field surveys however were conducted in more remote locations with suspected Blue-throated Macaw occurrence, but yielded no positive results so far (Itenez Reserve, upper Río San Martín, cattle farms along the upper Río Yacuma and near San Ramón).

Additionally, in the past years, the Blue-throated Macaw conservation team collected valuable information from ex-parrot trappers, park guards, farm workers and ranchers about the potential occurrence of Blue-throated Macaws in locations not yet surveyed by the field team (see possible geographical distribution, section 5.2.). This information, which for conservation reasons is not published here, form an important basis for future explorations and might assist in the detection of still unknown populations of the species in the remoter, less accessible areas.

### **13.4. Environmental education and information**

Over the last ten years, environmental education programmes, and the dissemination of relevant information related to the conservation of the Blue-throated Macaw in the Beni, were carried out by the Armonía/LPF field team. In 43 different locations within the surveyed area, children, farm workers, teachers and local authorities were informed about the ongoing conservation project and its objectives. Basic classroom materials, ecological encyclopedias and informative material related to general environmental education of the public and the protection of the Blue-throated Macaw were donated to schools and families working on cattle farms in the area. Additionally, a 15-minute video was produced showing various aspects of the biology, the habitat and the current threats to the Blue-throated Macaw survival. Copies of the videos were distributed among local and national authorities, Fegabeni and the Trinidad-based Technical University of the Beni to promote joint efforts to save the species from extinction and to spread the information through broadcasting on national and local TV channels.

From June 3<sup>rd</sup> to July 2<sup>nd</sup> 2000, a diagnostic field-study was carried out for the Blue-throated Macaw conservation project by members of the Noel Kempff Natural History Museum, with the goal to evaluate the current socio-environmental and educational situation in schools within the northern and southern confirmed range of the species (Herrera de Pinto, Cabrera

Zárate, 2000). In the course of the study, about a 100 members of local communities and governmental institutions received non-formal training for possibilities to actively participate in the conservation of the environment and the Blue-throated Macaw. On several other occasions, the project has been promoted throughout the Beni Department via the FEGABENI-operated radio station “El Ganadero”, in the capital of the Beni Dept. “El Ganadero” is a widely heard and well-appreciated programme which is transmitted several times a week and reaches almost every cattle ranch in the Beni.



### 13.5 Research

Field research in recent years has concentrated predominantly on the collection of data on the geographical distribution of the Blue-throated Macaw and the determination of basic environmental parameters related to the presence and the nest-site preferences of the species (bio-geographical characteristics of its habitat, vegetation structure, preferred nesting trees, food choice and food availability). Information gathered to date on its breeding biology, natural threats from predation and inter-specific competition, home-range size, dispersal patterns and its population structure and dynamics is based on sporadic, short-term observations, largely obtained during the shorter period of the dry season, and still is considered rather incomplete.

Available research data from the captive stock include information on hatching success, age/disease-related mortality rates, diseases affecting Blue-throated Macaws, clutch size and bloodline documentation on the offspring. To determine the extent of potential threat for the long-term survival of the captive stock, as well as for the free-ranging population, stemming from the very limited number of individuals reproducing in captivity and in the wild, a genetic screening (via DNA analysis) is urgently required.

### 13.6. Establishment and management of the captive stock

As outlined in sections 9.2 and 10.3, captive stocks have become firmly established, with low mortality and successful breeding. The effective management of the captive populations is steadily improving.

## 14. Recovery Strategy

### 14.1. Goal

To halt and reverse the decline in the status and distribution of the Blue-throated Macaw and, in the long-term, restore its wild population to a non-threatened status, as measured against all criteria of the IUCN Red List (Collar et al.1992, BirdLife International 2000, Hilton-Taylor 2000).

Further to the above goal, the implementation of recovery measures for the target species is simultaneously expected to be beneficial for biodiversity conservation, and to contribute to the sustainable use and development of Bolivia's natural resources.

### 14.2. Recovery Criteria

The recovery goal will be considered as accomplished under the following conditions:

- The wild population has attained a non-threatened status, defined as having established a population number and trend, and geographical distribution that are better than the threshold values for inclusion in the IUCN Red List Vulnerable status.
- Enough sub-populations have been identified within the geographic distribution range of the species between which a sufficiently high exchange of individuals and therefore of genetic variability is guaranteed and the danger of a long-term genetic erosion within the species is minimized to a non-threatening level.
- Currently existing factors, imposing serious threats to the reproductive success, the survival of individual birds and the gene flow within the species have been eliminated or are sufficiently controlled.



### 14.3. Recovery Plan Review Process

This Recovery Plan is a tool to coordinate the work and clarify the roles of different interested parties in the complex matter of conserving the Blue-throated Macaw, its habitat and its biological requirements. To ensure optimal observance and impact of this plan, it is envisaged to assemble an International Advisory Committee. The advisory committee members will regularly review the Species Recovery Plan's remit and progress, and will discuss and resolve problems as they arise. In addition, informal meetings of key individuals from national and

local government authorities, the local university, Fegabeni and the implementing scientists and NGO's will take place to help coordinate and prepare logistic, legislative and conservation related measures necessary for the proper implementation of the plan.

An anticipated important element of onward review and adjustment of the strategy will be the development of a PHVA (Population and Habitat Viability Analysis) based on data from field and captivity.

#### **14.4. Action Programme**

The Recovery Plan matrix (page 43) summarizes the key activities for implementing a successful and long-term conservation programme with the aim to restore a viable population of the Blue-throated Macaw in its natural habitat.

The left column of the matrix outlines the currently identified and suspected limiting factors and threats responsible for inhibiting the recovery of the populations in the wild, the following column defines the corresponding objectives within the Recovery Plan while the next four columns denominate the proposed activities to counteract the identified limiting factors and threats, the relative importance of the suggested activities, the institutions or agencies recommended to take action and responsibility for implementing them, the time frame within which the activities should be started or implemented, and finally the indicator(s) against which the progress and the success of the actions will be measured.

According to the considered urgency of the actions and their expected short-, medium- and long-term effects on and benefits for the survival of the species, they are classified into three different priority categories. These are:

##### **Essential activities (\*\*\*):**

- (i) Those that are expected to have the strongest short-term impact on the most immediate threat(s) presently challenging the survival of the wild population;
- (ii) Those that are considered to generate the most urgently needed scientific information for possible necessary adjustments of proposed recovery actions during the accompanying review process;
- (iii) Those that have a high chance for short-term implementation.

##### **Important activities (\*\*):**

- (i) Those that will improve the medium and long-term protection of the species and its breeding success;
- (ii) Those that will help to better protect and restore the preferred environment and the living conditions of the species;
- (iii) Those that will positively influence the genetic diversity within the wild and the captive populations;
- (iv) Those that will help to raise awareness in the population about the threatened status of the Blue-throated Macaw and stimulate their participation in future conservation activities.

##### **Desirable activities (\*):**

- (i) Those that will support the effectiveness of the above-mentioned activities or will expand the basic knowledge in order to facilitate improved management decisions in the future.



Identified threats and limiting factors which might put at stake the survival of the Blue-throated Macaw in the wild, are classified within five different categories:

- ❑ **Trafficking of individuals for the pet-trade and the lack of adequate law enforcement.**
- ❑ **Past and present habitat alterations possibly leading to the deterioration of necessary habitat requirements of the species.**
- ❑ **Lack of sufficient scientific data to allow for the identification of the principal causes underlying the past and present population decline.**
- ❑ **Human disturbance factors apart from the regular cattle breeding business and its related activities.**
- ❑ **Insufficient support and cooperation from the public in past conservation measures, based largely on the lack of adequate knowledge and understanding of the critical situation of the Blue-throated Macaw and of how to assist.**

The proposed activities to counteract these limiting factors and threats are summarized below according to the priorities they have been assigned and in relation to the different fields where action is necessary:

### **Essential activities (\*\*\*)**

#### **14.4.1. Trafficking and law enforcement**

- Stricter implementation of controls on access to private lands, especially by establishing an identity system for visitors.
- Nest-site guarding.

#### **14.4.2. Habitat protection and management**

- Improved control of annual burning of cattle grazing land: use of fire-breaks to prevent



the destruction of Blue-throated Macaw nesting and feeding habitat.

- Reduction of forest understorey damage: exclusion of cattle by fencing-off areas within palm islands plus sapling protection.

#### **14.4.3. Human disturbance: reduction of damaging – promotion of sustainable**

- Develop guidelines for sustainable and responsible tourism.
- Inform landowners and key workers not to remove Blue-throated Macaw young (or any other birds) from nests as a “protection” measure.

#### **14.4.4. Research and conservation management**

- Conduct extensive field surveys in suitable habitat within the possible present geographical distribution (see definition above).
- Establish field stations and programme of ecological research to incorporate: breeding performance and principal causes of losses, growth and development reference values, food preferences and feeding ecology in breeding and non-breeding seasons, home-range and dispersal.

#### **14.4.5. Awareness, education and capacity building**

- Establish and operate educational programmes based at the Trinidad centre for captive Blue-throated Macaws, using birds unsuitable for release.
- Expand existing outreach education programme to communities within the Beni Dept.

### **Important activities (\*\*)**

#### **14.5.1. Trafficking and law enforcement**

- Stricter surveillance and control at key sites of transportation through official wildlife and police officers (road, air, waterways), especially in the Beni and Santa Cruz Departments.

#### **14.5.2. Habitat protection and management**

- Improvement of damaged forest understorey through habitat restoration.

#### **14.5.3. Human disturbance: reduction of damaging – promotion of sustainable**

- Encourage the landowners who permit hunting and sport fishing to direct these away from sensitive areas of the Blue-throated Macaw. Promote reduction of subsistence hunting.

#### **14.5.4. Research and conservation management**

- Health status: field research to identify principal parasites, diseases and predators and evaluate their impact on the Blue-throated Macaw population at all stages of its life history. This will include assessment of disease risks from liberated pet parrots.
- Develop and implement suitable measures to control these agents where necessary.
- Define suitable nest cavities from known Blue-throated Macaw sites. Survey breeding habitat to quantify incidence of suitable sites, nest occupation by Blue-throated Macaws related to their number present in the surveyed area and the overall number of available nest sites.
- Quantify usage of suitable and other nest cavities by other species, and document competition with Blue-throated Macaws.
- Conduct DNA analysis of wild and captive Blue-throated Macaws to determine the extent of genetic variability of the species (using feathers and/or feces from inside or underneath nest cavities).

- Carry out an extensive population-monitoring programme in already known sub-populations and within pre-defined time schedules.

### **Desirable activities (\*)**

#### **14.6.1. Trafficking and law enforcement**

- Information-gathering at local, regional and national levels in Bolivia about the illegal trafficking of the species.

#### **14.6.2. Habitat protection and management**

- Reduction of deforestation: establish plantations of palms and appropriate tree species to supply construction, fuel and fencing materials.
- Creation of one or more private protected areas for the Blue-throated Macaw .
- Monitor landowner and worker attitudes with regard to future land uses to anticipate and counteract additional threats.



- Install artificial nest-boxes in experimental locations and document occupancy by Blue-throated Macaws and other species
- Continue and improve management of the captive population within official cooperative programmes internationally (International studbook, European and North American regional species survival plans).
- Effective management of captive Blue-throated Macaws in Bolivia:
  - 1) registration of certified holders and managed breeding exchange,
  - 2) establishment of a centre near to Trinidad for captive Blue-throated Macaws for:
    - a) birds unsuitable for release to the wild to be used for education,
    - b) birds suitable for release to the wild if all required conditions met.

- Experimental reintroduction of captive birds to carefully selected sites strictly following the IUCN guidelines for the reintroduction of wild species and with the explicit authorization of the relevant Bolivian Government authority..
- Sustained reintroduction of captive birds, and translocation between sites, strictly following the above mentioned guidelines and legal prerequisites for this action.

#### 14.6.4 Awareness, education and capacity building

- Conduct activities to increase public awareness at national and international level.
- Promote the production of high-quality broadcasting material to demonstrate the uniqueness of the Blue-throated Macaw and its habitat in the Beni Department, and support the development of a quality nature tourism beneficial for the long-term conservation of the species.



## 15. BLUE-THROATED MACAW RECOVERY PLAN: ACTIVITY SCHEDULE

A.g. = *Ara glaucogularis*

THREATS AND LIMITING FACTORS	OBJECTIVES	ACTIVITY	PRIORITY	AGENCY	FREQUENCY, TIMING	INDICATOR, MEANS OF VERIFICATION
Illegal trafficking of Blue-throated macaws.	Control of illegal capture and trade.	Stricter implementation of controls on access to private lands. Establishment of an identity system for visitors.	***	FEGABENI, landowners, LPF/Armonía.	Continuous.	Positive feedback from private landowners. More fledged young with parent birds post-breeding season.
		Stricter surveillance and control at key sites of transportation (road, air, waterways), especially in the Beni and Santa Cruz Departments.	**	Regional Gov: Police Dept, Natural Resource Management Dept.	Continuous.	Official statistics of law enforcement controls and their frequency in Bolivia. Statistics of third country customs authorities on the detection of illegally traded specimens.
		Information-gathering at local, regional and national levels in Bolivia.	*	LPF/Armonía and NGO network.	Continuous.	Internal reports on leads and follow-ups.
		Nest-site monitoring/guarding.	***	LPF/Armonía.	Beginning of A.g. breeding season 2003	Increase of fledging success and size of population.
Habitat deterioration and loss through ecologically unsustainable land management practices.	To conserve habitat and key features of habitat for the species throughout its range.	Improved control of annual burning of cattle grazing land: use of fire-breaks to prevent the destruction of A.g. nesting and feeding habitat. Initial experimental phase.	***	FEGABENI, landowners, LPF/Armonía.	Yearly in advance of the annual burning.	Area of habitat not burnt.

		Reduction of deforestation: establish plantations of palms and appropriate tree species to supply construction, fuel and fencing materials.	*	FEGABENI, landowners, LPF/Armonía, Forestry Dir Gen.	Beginning Nov/Dec 2003.	Area of plantations established. Rate of decline of deforestation and forest deterioration.
		Reduction of forest understorey damage: exclusion of cattle from critical areas within palm islands plus sapling protection	***	FEGABENI, landowners, LPF/Armonía, UTB, other research entities.	Beginning Nov/Dec 2003.	Rate of recovery of forest understorey in targeted areas.
		Improvement of damaged forest understorey through habitat restoration measures.	**	FEGABENI, landowners, LPF/Armonía, UTB, other research entities.	Beginning Nov/Dec 2003.	Rate of recovery of forest understorey in targeted areas.
		Creation of one or more private protected areas for A.g. and Beni biodiversity.	*	NGOs, other potential private owners, relevant governmental authority where indicated.	Beginning January 2005	Legal acquisition of adequate land area, protection system installed, recuperation of habitat and biodiversity increase, continued presence and successful breeding of A.g.
Human disturbance (see text for definition).	Eliminate human activities which impact negatively on A.g. and its habitat.	Develop guidelines for sustainable and responsible tourism	***	Landowners, LPF/Armonía, Beni Dept. of Tourism, tour operators.	Beginning May 2004.	Increased site fidelity and breeding success by A.g. Increased landowner willingness to participate in A.g. conservation. Increased awareness and understanding by tour operators of sustainable tourism benefits.

		Encourage the landowners who permit hunting and sport-fishing to direct these activities away from sensitive areas for A.g. Promote reduction of subsistence hunting.	**	FEGABENI, landowners, LPF/Armonía.	Continuous.	Increased site fidelity and breeding success by A.g. Evidence of recuperation of populations of game species.
		Inform landowners and key workers not to remove A.g. young from nests as a “protection” measure.	***	FEGABENI, landowners, LPF/Armonía.	As required.	Increased site fidelity and breeding success by A.g.
Extinction risk due to the potential vulnerability of the small, fragmented A.g. population from parasites, diseases and predators.	Minimize the extinction risk posed by parasites, diseases and predators.	Field research to identify principal parasites, diseases and predators and evaluate their impact on the A.g. population at all stages of its life-history	**	LPF/Armonía, UTB, other research entities.	Beginning Nov/Dec 2003.	Profile of parasitism, disease and predation established.
		Develop and implement suitable measures to control these agents where necessary.	**	LPF/Armonía, UTB, other research entities.	Beginning Nov/Dec 2004.	Increase of fledging success and size of population.
Breeding possibly limited by lack of suitable nest cavities and competition for these with other species.	Establish extent of limitations and reduce their effects to increase breeding success.	Define suitable nest cavities from known A.g. sites. Survey breeding habitat to quantify incidence of suitable sites	**	LPF/Armonía, UTB, other research entities.	Beginning July 2003.	Profile of suitable nest cavities and frequency of occurrence in breeding habitat.
		Quantify usage of suitable and other nest cavities by other species, and document competition with A.g.	**	LPF/Armonía, UTB, other research entities.	Beginning July 2003.	Nest cavity usage and competitive interactions with A.g. described and quantified.

		Install artificial nest-boxes in experimental locations and document occupancy by A.g. and other species.	*	LPF/Armonía, UTB, other research entities.	Beginning July 2004.	Nest-box usage and competitive interactions between A.g. and other species described and quantified.
Lack of essential information on the distribution, population dynamic, population size and ecology of A.g.	Acquire sufficient information on the distribution, population size and ecology of A.g. to effect necessary conservation measures.	Conduct extensive field surveys in suitable habitat within the possible present geographical distribution (see definition in text). Establish field stations and programme of ecological research.	***	LPF/Armonía, landowners, UTB, other research entities.	Beginning July 2003.	Information available on essential biological parameters for effective conservation measures.
		Conduct regular monitoring of known populations	**	LPF/Armonía UTB, other research entities	From November 2003	Information on the population dynamics of A.g., better control of the efficiency of applied recovery strategies
Natural recovery possibly limited by the very small, fragmented population, and possible low genetic variability, i.e. below minimum viable population size,.	Consolidate a viable population through meta-population management and possible reintroduction.	Conduct DNA analysis of wild and captive A.g. to determine extent of genetic variability of the species.	**	LPF/Armonía, UTB, other research entities.	From December 2003	Genetic profile of species, and comparison of existing variability in the wild and captive populations.
		Continue and improve management of the captive population within official cooperative programmes internationally.	*	LPF/Armonía, Regional zoological associations (threatened species programmes)	Continuous	Regular reports of the ISB, and the EEP and SSP threatened species programmes, with data on all relevant life-history parameters.



		Effective management of captive A.g. in Bolivia: 1) register of certified holders and managed breeding exchange, 2) establishment of a centre near to Trinidad for captive A.g. for: a) birds unsuitable for release to the wild to be used for education, b) birds suitable for release to the wild if all required conditions met.	*	LPF/Armonía, Regional zoo associations (threatened species programmes), National and Regional Gov: Natural Resource Management Dept. UTB	1) March 2004. 2) June 2005	1) Registration and monitoring of holders in Bolivia certified to breed A.g.  2) Functioning centre dedicated solely to captive A.g., with effective management for: a) educational presentation, b) potential release to the wild.
		Experimental reintroduction of captive birds to carefully selected sites.	*	LPF/Armonía, landowners, Regional zoo associations, National and Regional Gov: Natural Resource Management Dept. UTB, other research entities.	January 2005.	Survival rate of released birds.
		Sustained reintroduction of captive birds, and translocation between sites, if indicated.	*	LPF/Armonía, landowners, Regional zoo associations, National and Regional Gov: Natural Resource Management Dept. UTB, other research entities.	From January 2006, as indicated.	Survival rate of released birds; absolute increase in wild population size and distribution; reduction of fragmentation of wild population.
Insufficient knowledge of A.g. and understanding of its	Establish widespread recognition of the species, and attitudes	Establish and operate educational programmes based at the Trinidad		LPF/Armonía, Regional Gov: Vice-Ministry of	June 2005	Extent of use of the education centre and programmes, and of integration into local school's curriculum.

importance and it's threatened status in Bolivia.and internationally	supportive of measures to conserve it, the habitat and biodiversity in the Beni.	centre for captive A.g., using birds unsuitable for release.	***	Education, Natural Resource Management Dept. UTB, other NGOs		Measures of improved recognition and support to conserve A.g..
		Expand existing outreach education programme to communities within the Beni Dept.	***	LPF/Armonía, other NGOs, UTB, landowners, Regional Gov.	Continuous.	Measures of improved recognition and support to conserve the A.g.
		Conduct activities to increase public awareness at national level.	*	LPF/Armonía, other NGOs.	Continuous.	Measures of improved recognition and support to conserve A.g.
		Promote and support the production of high-quality broadcasting material for national and international dissemination	*	LPF/Armonía, regional government, renowned film production companies	Beginning January2004	Improved public support for A.g. conservation measures. Rising interest of landowners for support and active participation in the conservation of A.g. and its habitat.

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## Photographs

Loro Parque Fundación: front cover, pages 6, 8

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