

PsittaScene



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Amazon country - Argentina's "Impenetrable" Forest

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We wake up as early as possible, around 5 or 6 am while it's still dark. One of us prepares breakfast (tea or coffee with cookies or crackers) while the others gather all the equipment needed for the day: ropes, harnesses, measuring equipment, and water, lots of water: at least 2 litres per person. You don't want to forget anything since the parrot nests we are studying are far away from the campsite. Yes! We all stay in tents throughout the breeding season (mid October to early March - spring and summer in Argentina).

Depending on their location, the nest-trees are linked with paths forming "circuits" or "tours". "Circuits" can be as far as 20 km (12.5 mi) from the campsite and once you leave the road behind, you may need to walk 1 or 2 km (0.6 - 1.2 mi) through the dense forest.

We work in pairs, each checking a dozen nests every morning. By the time we reach the first nest the sun and the temperature are usually up! The most exciting part of the day starts: nest checking in the Chaco forest. This will take many hours and we need to be efficient: data has to be collected quickly so that chicks aren't bothered and because we have to be back to the campsite by noon - it's impossible to perform any task during the hottest hours of the day. Temperatures may be as high as 49° C (120 ° F). Not even the lizards dare to muck around!

After lunch, it's time to process the data collected in the morning, prepare the activities for the afternoon and of course, take a rest in our hammocks!

From 4 to dark (around 8-9 pm) we go out again checking nests or doing observations on the vegetation - this will enable us to monitor changes in food availability throughout the season.

Blue-fronted Amazon Parrots (*Amazona aestiva*) are one of the most popular pet birds in the world. Their flamboyant, interactive personalities, talking ability, and striking colouration are some of the qualities that can make them wonderful companions. In the wild, they are found in Argentina, Brazil, Paraguay, and Bolivia, South America. We have been studying the reproductive ecology and population dynamics of this species in the Chaco region of Argentina since 2002. The aim of our study is to determine the main factors that affect the reproductive success of Blue-fronted Amazons in this region. This information is particularly relevant in estimating the impact that harvesting could have on wild parrot populations. The World Parrot Trust recently committed major funding for our 2006-2007 field season.

The demand for parrots as pets has resulted in an significant international trade. The sustainability and implications of this trade have been extensively analysed and discussed. Parrots face many pressures including habitat destruction and poaching for the pet trade. The effect of these factors is exacerbated by the low reproductive rate of most parrot species as a result of relatively late age of the first reproduction, small clutch size, low survival of chicks and fledglings, absence of second broods, reproduction that does not take place every year, and restrictive nesting requirements. Some people think that in a few cases sustainable harvesting programs might be feasible for some parrot species. The Blue-

fronted Amazon is viewed by some as one of those species.

In Argentina, most Blue-fronted Amazons breed in the dry forests in the Chaco region where our study takes place. This thick, thorny forest, locally known as "Impenetrable", is dominated by hardwood trees, which offer excellent nesting cavities. The Impenetrable is also home to a diverse fauna including jaguars, peccaries, anteaters, giant armadillos and over 300 species of birds.

Current management

The exportation of wild Blue-fronts has been banned in all countries except Argentina, where so many chicks and adults are being legally captured and exported every year that their populations are potentially being threatened. From 1983 to 1991 approximately half a million Blue-fronted Amazons were authorized by the Argentinean government to be collected for the pet trade. This so-called "off take" peaked when about 75,000 Blue-fronted Amazon permits were granted in 1985 alone.

After a four-year total ban (1992 through 1995), an experimental management plan was launched in 1996. From that, a long term management plan was created which is still being followed today. Currently this plan involves the capture of chicks and adults under specific rules (such as harvesting all-but-one chick from a nest) and authorizes the extraction of more than 5,000 parrots each year.



Photo: Angel Nuevo Gonzalez

However, this management plan lacks scientific support. No exhaustive research has been conducted about Blue-fronted Amazon biology and as a result very little is known. Thus, most of the rules and principles of the management plan are arbitrary. The current number of chicks and adults harvested each year could have an important impact on Argentina's Blue-fronted Amazon population.



Photo: Igor Berkunsky

The Argentinean government's management plan for Blue-fronted Amazons allows harvesting all-but-one-chick from a nest, a plan that can only be assessed with thorough study of the species' biology.



Chicks are weighed and measurements are taken of the tarsus, wing, and head regularly until fledging. Feather development is also carefully tracked. This data helps researchers understand how the wild chicks evolve and grow over time.

Amazon ecology

We collected data on different reproductive parameters of Blue-fronted Amazons during four consecutive breeding seasons and evaluated:

- 1 nest survival and main causes of nest failure, and
- 2 egg survival, hatchability and chick survival in successful nests.

We also studied the characteristics of nest cavities, including reoccupation during the following breeding season, and if nest predation and chick removal affected cavity reoccupation.

Blue-fronted Amazons are highly mobile. All but a few of those breeding in Chaco leave their breeding grounds in flocks after their chicks have fledged and the season of fruits and seeds ends (March-April). Where these Chaco Blue-fronts go is unknown, though it is likely that they move northwest, where ripe fruit is still available.

Arriving back at their Chaco breeding grounds in September, Blue-front pairs begin to scope out natural nesting cavities in "Quebrachos" (*Schinopsis* and *Aspidosperma* trees), often re-using their cavity from previous years. Eggs are laid between October and December, and the last chicks are fledged (though not weaned) by mid-February. A clutch consists of an average of 4 eggs though in general two chicks per nest survive to fledge.

In the "Impenetrable" forest, breeding pairs of Blue-front Amazons occur in large

numbers. We work with two groups of nests: "natural nests" located at the Provincial Park (nests without harvest of nestlings), and "harvested nests" in

neighbouring areas where the local people participate in the national Blue-fronted Amazon harvesting program.

Our team consists of a permanent core group of field technicians and volunteers (mainly biology students) from around the world. Each breeding season we search intensively for nests. We find nests mainly by observing the behaviour of breeding pairs and revisiting cavities used in previous years. Each nest tree is fully measured and described - 30 to 60 nests are studied every year. So far, we have followed 140 nesting attempts in 89 different cavities.

Nests are checked on average every three days until the chicks fledge or the nest fails. Data on the number of eggs laid, egg size, number of chicks hatched and fledged are recorded in order to determine breeding success. In addition, chick growth and development are monitored using regular weights, measurements and diet analysis. The chicks are banded and checked for ectoparasites. Blood samples are taken for DNA analysis and endoparasites. Adults are also banded and censused and blood samples are taken.

We also study the vegetation which allows us to better understand their environment: what kind of forest patches they prefer, how much available food there is, when each kind of fruit is available, how many available cavities there are, etc.

Photo: Igor Berkunsky



Plastic bags set in 3-litre water bottles serve as an inexpensive parasite removal and sampling system. While appearing disheartened, chicks are unharmed and parasites drop off into the bag for later processing in the laboratory.



When holes made to harvest parrots are not carefully repaired, precious nest cavities become useless for future breeding.

Significant Results

One of the most common methods for harvesting parrots is to collect some, but not all, of the chicks from the nest. The main argument that supports this approach is that these chicks would not survive or would have a very low probability of survival because in most nests natural brood reduction occurs. Therefore, theoretically, partial chick removal would not greatly affect the number of chicks fledged. However, in most cases this assumption is not based on good quality scientific data.

Our preliminary results show some interesting facts about the "brood reduction" theory on which Argentina's harvesting plan is based. Although, in theory, the removal of chicks does not affect the number of fledglings, we found evidence to the contrary. In practice, chicks are harvested when they are 40 to 50 days old and we now know that at that age, the probability of survival is actually really high. In fact, brood reduction as a result of starvation was relatively uncommon and it was restricted to the first week after hatching. Therefore chicks harvested based on brood reduction theory would most likely have survived to fledge.

Another important observation came from our work, this one about cavity reoccupation. Both legal and illegal harvesting involves making a hole in the tree at the base of the cavity. Those cavities that are not properly repaired (carefully covered with mud which fades away in a few months) are consequently not reoccupied the next breeding season. On the contrary, cavities

that are well covered have reoccupation rates similar to those observed for cavities without chick removal. This means there doesn't seem to be any direct effect of partial removal of chicks on cavity reoccupation. This observation led us to perform educational activities with parrot harvesters to avoid cavity destruction in the future.

Modelling harvest impacts

This is the first long term study of the reproductive ecology of Blue-fronted Amazons in the Chaco region. They are one of the preferred species for the parrot pet-trade and Argentina's local community based national harvest program allows exporting approximately 5,000 young parrots per year. Therefore, the data collected in this study are important to correctly model the impact that chick harvesting could have on parrot populations. Our results indicate that the harvest of chicks does not affect cavity reoccupation (provided that the hole is repaired appropriately). However, because chicks are harvested after natural brood reduction occurs, the harvesting of chicks results in a 50% reduction of fledglings produced per nest. Our results also provide good quality data on the reproductive ecology of some of the most important populations of this species. This allows comparisons with other studies conducted

on the same species elsewhere and in other species of the same genus.

Having completed four breeding season studies, we are beginning to fill in some of the knowledge gaps regarding Blue-fronted Amazon breeding ecology. We still have more seasons to go and many things to find out. Our hope is that with the information we will generate, a review will be made of the harvesting management plan in order to guarantee the long-term survival of our Blue-fronted Amazon population.

Our research is possible thanks to those who have believed in and supported it. We require climbing equipment (ropes, carabineers, ascenders, etc), measuring equipment (i.e.: scales), and many other items such as leg bands, digital cameras, GPSs, laptops, etc. We always need and welcome help and can be contacted at aaestiva2002@yahoo.com.ar.

Thanks to: Our core team - Román Ruggera, Joaquín Carrera, Chantal de la Fournière, Sarah Faegre and Angel Nuevo González, Scientific Argentinean institutions CIC and CONICET, University of La Plata, University of Buenos Aires, The World Parrot Trust, The Amazona Society, Parrot People Fundación and Parrots International, all of our volunteers and the local people (Park rangers and neighbours of the Reserve) that have been helping us during all these years.



Photo: Igor Berkunsky

Because the eggs are incubated immediately after laying, differences in size become apparent soon after hatching. Although clutches of up to 6 eggs have been recorded, a more typical brood contains 4 chicks with 2, on average, surviving to fledge.



A young Hyacinth must gain strength and skill to open tough palm nuts.

On top of the plateaus or mesas and throughout the wide valleys, three other species of palms hide their trunks underground to protect their hard-won biomass from the dry season fires that are typical of this dry forest. These palms present their leaves and nut bunches at ground level. The rock-hard, golf-ball-sized nuts are the favourite (and almost only) foods of the Hyacinth Macaw.

The Brazilian government created the world's largest protected area of dry tropical forest and named it Parnaíba Headwaters National Park (Parque Nacional das Nascentes do Rio Parnaíba) in this region in 2002. At 1.8 million acres (1/3 the size of New Jersey) this park protects more Hyacinth Macaws, Maned Wolves, and dry tropical forest than any other protected area in the world. To put this in context, the world's wet tropical forests have been 50% destroyed since 1930, while the world's dry tropical forests have been more than 90% cleared for crops and cattle grazing. Consequently this large park is of exceptional conservation importance. The dry tropical forests of central Brazil are by far the most biologically diverse in the world, and this new park is the finest example of this diversity.

Bordering the eastern edge of the park is a private property of 2,500 acres (four square miles) of dry forest and palm-lined streams belonging to 49-year-old Lourival Machado Lima. Since 1995, Mr. Lima has been the field director of a conservation project for Hyacinth Macaws, and currently he is hosting a research team that is conducting the world's first direct study of the reproductive rate of a protected population of Hyacinth Macaws.

Since 1996, Mr. Lima, with support from Charles Munn, the nonprofit Tropical Nature, Kaytee Avian Foundation, the Wildlife Conservation Society, the Brazilian nonprofit BioBrasil Foundation, and the Minnesota Zoo, have been actively

Turn the other cheek

Hyacinth photo ID's are revealing

By CHARLES MUNN PhD

North of the Brazilian capital of Brasília, at the junction of four states in NE Brazil - Piauí, Tocantins, Maranhão, and Bahia - lies a 50,000-square kilometre (Costa-Rica-sized) wilderness of 1,000-foot-high red-rock cliffs topped by brushy plateaus ranging from 50 acres to 100 square miles in size. Beneath the cliffs roll broad, open valleys covered with dry tropical forests; open woodlands, and golden grasslands dotted with 100-foot-tall *Mauritia* palms. Through the valleys run transparent streams bordered by thicker gallery forests dominated by these same majestic palms, which are favourite food and nest trees of Blue-and-Gold Macaws (*Ara ararauna*), and favourite roost and loafing trees of the world's largest and most spectacular parrots - Hyacinth Macaws (*Anodorhynchus hyacinthinus*).

protecting the macaws of his lands and of the surrounding 100,000 acres of wilderness, most of which is now inside the new park. As part of this protection, he and his team spend an enormous amount of time and effort combing distant valleys for palm nut bunches to put out at a feeding location on his land during the non-nesting season (February through August). Each year since 1996, the flocks have grown larger and larger as the protected location kept the birds from roaming close to towns and small roads where they can be shot (illegally) by subsistence and "sport" hunters. In 2005 and 2006, on some days, the count of macaws at the feeding location was in excess of 100 birds, once reaching 105 individuals, but more typical numbers of birds visiting during a morning or afternoon feeding session is 30-60 birds. Often there are 30-40 birds on the ground all at the same time, all in perfect golden light, all within 9-16 meters of the cameras of visiting photographers, film crews, and select ecotourists.

After years of watching the birds at the feeding spot, Mr. Lima and Mr. Lima's sister-in-law, Edilene Gonçalves Nobre, who is a third-year biology student at the Universidade Estadual do Piauí (UESPI), a local state university, decided to census the individual birds on Mr. Lima's land through digital photography. Accordingly, Ms. Gonçalves spent five months (Feb through April in 2005 and 2006) gathering data about this large population of Hyacinth Macaws. The beaks of Hyacinths (and other large macaws) make them individually identifiable. They display an enormous amount of information as they are full of lines, cracks, gouges, dots, chevron patterns, and innumerable other small irregularities that change very slowly over a number of months. Ms. Gonçalves found that working within the period of 2-3 months, these visible beak irregularities allow you to build up a unique, unambiguous, definitive photo dossier of each and every Hyacinth at the site.



Large flocks of Hyacinths gather at a palm nut buffet provided to give awestruck ecotourists an exceptional view. Close-up photographs taken from the blind allow researchers to identify individual birds within the flock.



Images of both sides of the beak of one individual Hyacinth show a variety of unique features. High quality close-up images of the skin around the eye may prove even more promising than beak images for individual identification. The tiny periorbital dots remain unchanged over time unlike the ever-changing beak.

During the 2005 census, Ms. Gonçalves received major photographic assistance and training in computer manipulation of the beak images from Paula Linsemeier and Brett Backhouse, two generous zoologists from the Adelaide Zoo in Australia. The photo census techniques involved using a 600 mm, f 4 Nikon lens (left over from WCS macaw photo census work in the late 80's in Manu, Peru) with a D70 Nikon camera body to photograph at very close range the beaks of at least 187 Hyacinth Macaws.

In 2005, Ms. Gonçalves was able to photograph both beak sides of a total of 93 birds, six of which turned out to be

recently-fledged birds from the 2004-2005 (September - January) nesting season.

In 2006, after improving her techniques, she photographed both beak sides of 121 different Hyacinth Macaws, seven of which were recently fledged birds from the 2005-2006 nesting season. The marks, lines, and other irregularities on the beaks were always easy to match when the photos were of sufficient quality.

In 2006, another 66 unique left beak sides and 46 right beak sides were not matched left with right. In general, the predominance of perching while showing the left side may reveal a preference related to the best escape routes to safe perches in trees, which were to the left of the birds. These leftover beak sides represent a minimum of 66 other unique birds, and possibly a few more (if some of the 46 leftover right beak sides represented individuals whose left sides were never photographed...). As it is likely that most or even all of the unmatched right sides go with the 66 unmatched left sides, we assume that the population of birds in the 2006 season was a minimum of 121+66, or 187. Now that Ms. Gonçalves has refined and improved her techniques further, it should be possible to match almost all beak sides to achieve an even more definitive count in the upcoming 2007 post-nesting season (Feb through July).

In both years, the new fledglings were easy to detect by their habit of fluffing their head feathers, flipping their wings (part of typical begging by fledglings), and by their relatively smooth beak sides when

compared with the adults. They also showed less angular, more rounded, slightly smaller head profiles as a result of their less muscled skulls. They will build up jaw muscles quickly over the first few weeks post fledging.

Mr. Lima's team of macaw guards (who protect not only his land, but also more than 100,000 acres of the most vulnerable, most wildlife-rich parts of the national park) know of approximately 12 nests of Hyacinth Macaws within a radius of 20 miles of Mr. Lima's property, but so far, there has been no regular photography of the birds at their nests to test whether the same birds nest every year in particular cliff cavities. In most cases, such photography would be difficult, as the distance from lens to nest cavity would be too great to permit good definition of the beak lines and cracks. In practice, Mr. Gonçalves discovered that reliable, usable results for the beak photos were obtained when the birds were in good light (not back-lit) and at a distance of 8-18 meters (25-60 feet) from the lens. Typically, most of the birds near the blind on Mr. Lima's land regularly were within this distance and could be photographed for the beak survey.

When Ms. Gonçalves compared the beaks of all the birds from the 2005 census to those of the 2006 census, she noticed that a number of them appeared quite similar but were not identical. In order to determine if similar looking beak sides were really the same bird whose beak had changed from one year to the next, an accessible subset



Charles Munn (left) and Lourival Lima have worked together for years to protect and study the Hyacinth Macaws on the Lima family's land.

of birds needs to be monitored year round. By taking new photos every 2-4 weeks the very gradual changes in the beak patterns could be monitored throughout the year. As we do not foresee being able to carry this out in 2007, we inquired about possible ways to use skin wrinkles around the base of the lower mandible or around the eye to match birds from year to year without having to follow the slow but steady changes in their beak cracks.

Mr. Carlos Yamashita, the outstanding Brazilian field biologist, suggested a novel approach based on the yellow skin characteristic of Hyacinths. He advised us to try to photograph from even closer range and to study the dots of raised skin around the eyes of the Hyacinths within two or three millimetres of the eye itself. Ms. Gonçalves starting testing this idea in 2006, and she believes that Mr. Yamashita may be correct, in that the dots around the eyes seem to be irregularly distributed around the clock face, as it were, and also showed certain unchanging angles. In 2007, we hope to use these dots to try to build up an "eye ring dot dossier" and match the eye ring dots to the beaks. Then in 2008 we will check to see if the dots allow us to test whether beaks that look quite similar from year to year are in fact the same birds. In practice, Ms. Gonçalves found that, if light conditions were good, she could photograph these small periorbital dots well with the 600 mm lens from distances up to 14 m (45 feet) though the closer the better.

All these techniques rely simply on good lenses and good photographic technique

combined with painstaking sorting and comparison of the images. Using these straightforward techniques systematically, we might soon be able to monitor a population of individually identifiable Hyacinths year round at these feeding spots, and maybe even some birds at selected, more accessible nests. Furthermore, in the high season for these feeding flocks (February through July), we might be able to detect rare cases of natural deaths by seeing a particular bird show up over and over again without its mate. When the mate does not appear again during the season, we would assume that it has died, for it seems unlikely that a bird, even if suddenly divorced, would stop coming to the feeding location.

Another particularly useful application of this beak photo technique would be to try to figure out if the same Hyacinths nest in the same low, eminently photographable, traditional tree cavities in the Brazilian Pantanal year after year, because, surprisingly, no reliable data exist to date to address even this most basic question.

Interesting, the 2006 figure of only seven fledglings out of a minimum of 187 is a very, very low recruitment rate. We don't believe we have missed other fledglings among the 187 birds in the 2006 season, but we would like to redouble our efforts in 2007 to make sure that there is no possibility of undercounting fledglings. Because the images were analysed a bit differently in 2005, we are not yet sure of the recruitment rate for that season or how it compares to 2006. Fortunately, in the



Photo: Lin Imanishi

Wild Hyacinths may take up to 6 minutes to open a single palm nut.

future, the photo analysis should be able to proceed with much greater efficiency now that these techniques have been further refined.

We believe that this direct count of fledglings in a large population of wild Hyacinths is a first and we hope to extend this work to allow us to understand population dynamics in this population and also among other individually recognizable macaws around the Americas.

Persons wishing to participate in the daily photo census of the Hyacinths on Mr. Lima's land should contact the World Parrot Trust or Ms. Gonçalves edilenegnobre@hotmail.com.

For those wishing just to photograph these amazing birds for fun please contact Tropical Nature Travel at liz@tropicalnaturetravel.com. The tours offered by Tropical Nature Travel to this dry forest region offer some of the best wildlife viewing and photography in Brazil.

Photo: Joana Eckles



A group of Hyacinths eating their favourite food, where the palms present their leaves and nut branches at ground level.