Captive Husbandry Management of the Lear's Macaw (Anodorhynchus leari) at Al Wabra Wildlife Preservation

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Abstract

The Lear's Macaw is a critically endangered species which suffered greatly at the hands of wildlife traffickers, angry farmers and altered habitat. Their wild population was thought at one point to number less than 200 individuals (Gilardi, 2001), but the discovery of a second previously unknown population and tighter protection in the field has led to a substantial increase and today there is estimated to be 600 plus wild birds (CEMAVE, 2006). Although the species is much more secure today then they were ten years ago, they are still highly conservation dependant and a lot of work is still required to ensure their long-term survival. Part of the conservation action for the species is to establish a healthy and genetically viable captive population from birds which have been seized from traffickers and birds which have been rescued after being shot and injured by angry farmers trying to protect their corn plantations from raiding Lear's Macaws. Al Wabra Wildlife Preservation is home to four pairs of wild caught Lear's Macaws that were seized at an airport in the United Arab Emirates and subsequently sent to Qatar for care and housing. The ownership of these birds was returned to the Brazilian Government and they along with AWWP were to be included in the INSTITUTO BRASILEIRO DO MEIO AMBIENTE E DOS RECURSOS NATURAIS RENOVÁVEIS (IBAMA) studbook managed captive breeding program. After eight years, AWWP finally achieved breeding success in mid 2006, with the successful hatching of a female off-spring; the first chick bred in the entire IBAMA managed program and the first official captive breeding of a Lear's Macaw in 22 years.

Introduction

The Lear's Macaw *(Anodorhynchus leari)* is the closest living relative of the Hyacinth Macaw *(Anodorhynchus hyacinthinus)* and bears a close physical resemblance. The two species do however have major ecological differences. The Lear's Macaw occurs in a relative dry environment in the North-eastern Brazilian State of Bahia. Their preferred habitat type consists of mostly low scrub of, in particular, spiny and hostile looking plants. Preliminary field research indicates that they have developed a close affinity to a specific plant, the Licuri palm *(Syagrus coronata)* (Brandt & Machado, 1990). Narrow diet specialization is rare in parrots and obviously causes the birds to be more vulnerable because of their dependence on the availability of their food source. Additionally, Lear's Macaws strongly favor semi-communal roosting and nesting in cavities in sandstone cliffs, which is also unusual among parrots.

Today the known roosting and breeding sites are limited to just two; Serra Branca and Toca Velha. Tthe species is listed as critically endangered on the IUCN Red List (IUCN, 2004) but is most likely to be listed to endangered status as a result of the substantial recent increase in population size (De Soye, *pers com*). A census conducted in 2001 placed the estimated wild population at only 246 birds (Nascimento *et el,* 2001) but the population has now increased to more then 600 individuals (CEMAVE, 2006).

The primary food source, the Licuri nut, is highly nutritious but also extremely hard to open; however, Lear's Macaws have adapted well to

their Licuri rich environment and handle the hard nut with relative ease and efficiency. The birds perform daily migrations between feeding grounds and their roosting and nesting sites, traveling considerable distances and most frequently arriving back from feeding in almost complete darkness (Brandt & Machado, 1990). It would appear that they have developed unusually good night vision for a primarily diurnal species.

In the Aviary

Lear's Macaws are exceptionally rare in captivity, causing them to be a popular target for poachers who trap birds for the illegal aviary market. Confiscated and re-possessed birds form a significant proportion of the known captive population, exceptions being two birds bred at Busch Gardens in Florida, USA and an undisclosed number of birds kept in private collections in Switzerland. All other birds in captivity are property of the Brazilian government and managed through their official environment agency IBAMA. Any other captive Lear's Macaws are essentially illegal and a product of the poaching industry that is currently one of the biggest known threats to the wild Lear's Macaws.

Eight Lear's Macaws were seized at Sharjah airport and placed in the care of Al Wabra Wildlife Preservation (AWWP), in 1998. Acknowledging that poaching of live birds for private parrot collectors remains a major threat for the species (IUCN, 2004) the AWWP agreed on request from IBAMA, to return the ownership of the birds to the Brazilian Government in 2003. Hereby the birds held at AWWP became an integrated part of the breeding effort of the Brazilian Government and effectively unavailable for the illegal trade that threatens the species.

Additional member institutions participating in the recovery effort are the zoos of Rio de Janeiro and Sao Paulo, and more recently also the Crax and Lymington Foundation in Brazil. Four Lear's Macaws arrived at the Loro Parque Foundation in the Canary Islands early in November 2006, becoming the first Lear's Macaws to be officially exported out of Brazil. It is possible that four Lear's Macaws will leave Brazil, this time destined for the breeding facilities of the Association for the Conservation of Threatened Parrots (ACTP) located in Schoneiche, Germany. Furthermore, three birds confiscated in the United Kingdom in 1998 are currently held at Harewood Bird-gardens. In 2006 the first international studbook was created for the species and the Blue Macaw Coordinator for Al Wabra Wildlife Preservation was appointed co-studbook keeper.

General Introduction to the Lear's Macaw at Al Wabra

The birds kept at AWWP had been wild-caught as adults; this became obvious as veterinary staff at AWWP found a slug from a shotgun in one of the birds, which was subsequently surgically removed. The birds have remained nervous since their arrival to Qatar and have adapted poorly to captive conditions. A number of health problems including poor kidneys also suggested that the birds might have been treated poorly after capture and during transport.

Although generally nervous, the birds develop trust in their keeper and are very much capable of recognizing individual persons from quite a distance and respond very differently depending on their experiences with a particular person. Research into physiology, nutrition, behavior and particularly health of the birds has been ongoing at AWWP since 2003. Different housing arrangements have

been used to increase the birds' well being and optimize conditions for successful reproduction. Attempts to keep the birds in very social flocking conditions did not appear to stimulate breeding behavior. In one case, a single sex bonding formed between two males that could only be broken after they were forcefully re-paired with females and kept separate; one of these pairings eventually produced an offspring. The pair of Lear's Macaws that produced the offspring bred in 2006 was also observed to calm down considerably towards their keeper after a tame pair of Hyacinth Macaws *(Anodorhynchus hyacinthinus)* was introduced to an enclosure alongside theirs. Generally large aviaries with a good view to the surrounding landscape have been preferred but we are also experimenting with a smaller setup where a pair stays completely secluded with no visual access to any other birds. All aviaries have access to climate-controlled shelters and most outside areas are planted, and provided with artificial rain. Aside from being hotter in summer, the climate in Qatar is not unlike the climate of the Brazilian Caatinga. The Lear's Macaws at AWWP have proven to be extraordinarily heat tolerant and often discard the option to use the air-conditioned shelters, even during the warmest months of the year. However, being able to control the temperature of nesting sites and feeding stations is important as they breed in summer and food spoils very quickly in these extreme conditions.

Nesting

Relating to the Lear's Macaws preference for cavities in cliffs in the wild, artificial substitutes have been provided to the birds at AWWP as well as the more traditional wooden nest boxes. Often the Lear's Macaws seem to prefer to roost inside a sheltered area either in the inside aviary or its passageway or even a half-open wooden nest box. Artificial nesting cavities have been made of concrete, including very large structures that simulate the size and structures that we know from wild nests and, in one enclosure, two deep tunnels that become cooler the deeper the birds enter. It was in such a nest that the first breeding success with Lear's Macaws at AWWP was achieved.

Housing

The aviary used for the successful pair of Lear's Macaws is a structure of steel, aluminum, galvanized mesh and concrete. The size of the aviary is 5 meters wide, 16 meters long and 8 meters high, with the sheltered section being split into two levels. The ground is natural soil and a few small eucalyptus trees as well as grasses grow largely undisturbed by the birds. At the back end there is an artificial but natural looking sandstone cliff wall made out of concrete with earthy color tones. Built into the second level of this wall are the entrances to two nesting cavities. The nesting cavities are accessed by staff from inside the second level through a rear door, allowing nest inspections without the birds knowing. The nest tunnels are made of concrete and are approximately 49 cm in diameter and extend in zigzag bends between two and four meters into the room, the cavity entrance is around 24 cm in diameter. An air-conditioning unit directed at the back end ensures that the deeper the nest goes the cooler it gets, e.g. with 40 centigrade at the nest entrance the bottom of the nesting cavity is around 30 centigrade. In the bottom of the nesting chamber is a 5 cm deep layer of fine sand and wood shavings.

The inside aviaries for the birds are on the ground floor of the same building and are connected to the outside aviary through a flight hole. The size of the room is 15 m^2 and is where the birds are fed. Additional nesting opportunities are also provided here.

The interior is designed with perches evenly spread out providing plenty of flight space as well as concrete ledges that are often used. Lear's macaws are excellent fliers that utilize the entire flight space and they are also routinely spend time on the ground. The facility has an artificial rain system that the birds only occasionally use.

Diet

The Lear's Macaws at AWWP are fed a diverse diet twice a day that includes a morning feed of fruit salad and what we at Al Wabra call "parrot soft-food mix", which consists primarily of frozen vegetables, boiled beans and pulses and some sprouted seeds. In the afternoon the birds are offered a dry food mixture that includes seeds, pellets and nuts.

The morning food is fed early in the morning at around 6AM and then removed again before

Table 1.1: Lear's Macaw Diet

Food Items	Lear's Macaw Maintenance Diet		Lear's Macaw Breeding Diet	
	Morning: per pair	Afternoon: per pair	Morning: per pair	Afternoon: per pair
Parrot soft food mix:	2 table spoon (30g).	-	2 table spoon (45g).	-
Fruit salad:	2 table spoon (30g).	-	2 table spoon (30g).	-
Zeigler pellets maintenance ®:	4 pieces (5g).	8 pieces (10g)	-	-
Zeigler pellets breeder ®:	-	-	4 pieces (5g).	8 pieces (10g).
Milk thistle seed:	-	8 seeds (1g).	8 seeds (1g).	8 seeds (1g).
Lear's Macaw dry food mix:	-	1 table spoon (15g).	-	1 table spoon (15g).
Brazil Nuts:	4 pieces	4-pieces.	4-pieces.	4 pieces.
Walnuts:	-	4-halves.	2-pieces	4 halves.
Hard boiled egg:	-	-	1 table spoon (10g).	-
Crushed mineral block:	-	(1g).	-	(1g).

Table 1.2: Descriptions of food mixtures

Parrot soft food mix	
• Mixed frozen veg:	5 parts.
• Boiled beans and pulses:	3 parts.
• Sprouted seed:	2 parts.
• 100% cranberry concentrate:	2ml/per cup.
Lear's macaw dry food mix	
• NutriBird - P15 pellets: 50:50 original/tropical®:	1 part.
• Prestige Parrot premium mix®:	1 part.
Fruit Salad	
• Apple	• Mango
• Banana	• Paw Paw
• Broccoli	• Pear
• Carrot	• Orange
• Celery heads	• Red Bell-peppers
• Endives	• Red Chili

lunch at around 10AM. In the afternoon at around 2-3PM the dry food is offered and kept with the birds until next morning. The birds are fed restricted amounts, preventing obesity and, more importantly, ensuring that the birds eat a wide selection of the foods that are offered. Birds with too much food in their food-bowl will usually eat only their favorite items leaving their diet one-sided. The daily period between 10AM and 2PM where no regular food is available for the birds is often spent resting or using enrichment such as fresh branches of eucalyptus or canár trees or half ripe barley, corn or millets. Removing the food and any leftovers that may have fallen down prevents the fresh foods from spoiling in the warm climate, which is in particular important with the sprouted seeds.

For food and water, stainless steel dishes are used and great care is taken concerning the hygiene of dishes and feeding areas. Leftover perishable food is always removed from the aviary before it has a chance to sour. The drinking water that is used is thoroughly filtered in a triple action filter that includes a 5 micron particle filter followed by a 1 micron activated carbon filter and finally a UV sterilization filter.

The afternoon feeding includes dry seeds, pellets and nuts that can be kept in the aviary until the next morning with little concern about the food spoiling. By far, the most popular food items are nuts and both walnuts and Brazil nuts are relished by the birds. Walnuts are always opened for a quality check before feeding and Brazil nuts are purchased unshelled.

Regular review of the bacteriological pressure of food and water is performed by our in-house Laboratory Department who also performs regular faecal investigations on all the Lear's Macaws including parasite, fungal and bacteriology as well as investigating the gut-flora balance. If a flora imbalance or high levels of budding yeast is detected, the birds are mostly treated initially with lactobacillus on the food using PT-12® from Re-Scha Company.

Reproduction

In 2006 AWWP experienced its first breeding

success with the species, producing one offspring, the first to be bred in the IBAMA managed breeding program and openly the first breeding success of the species in 22 years. The following information is derived from AWWP's successful breeding pair.

Breeding behavior such as mating and courtship-feeding has only been observed for a short period before the birds' first breeding attempt. Unlike most captive macaws, this pair did not become aggressive towards their keeper; this is likely related to the fact that the birds were and are naturally timid.

Three eggs were laid at approximately 72-hour intervals. The first egg was laid on June 17th 2006 and initially the parents seemed to be doing a good job of incubating the eggs although regular nest inspections revealed that they did move the eggs around quite a lot inside the nesting chamber. When checked, the eggs were always warm and development was confirmed in the first egg after five days of incubation. On day 9, the eggs were unexpectedly found in different positions with two grouped together and the other some distance away. Two of the eggs were cold to the touch so it was decided to remove the clutch for artificial incubation. The three eggs were exchanged with two dummy eggs made of hard plastic that the parents accepted and continued to incubate. Examinations by candling of the three eggs quickly revealed that in one egg, the only one that was warm, an embryo was developing normally but that in the other eggs there was no development visible at all. As the two eggs were subsequently opened and examined, it was revealed that one had not been fertilized and that the other had started development but had died very early.

The artificial incubation temperature for the remaining egg was 37.3ºC centigrade and the relative humidity maintained between 35 and 40%. Although a low humidity was maintained, the egg showed inadequate weight loss and only a projected 9% loss would be achieved. Incubator humidity was further decreased to around 20% and on day 20 a pinhole was made in the shell above the air-cell to facilitate faster weight-loss. At the time of hatching an estimated weight-loss of 12% was achieved. Although the parents ending up incubating the dummy eggs exemplarily, they destroyed the dummies and removed them from the nest just after the scheduled hatch date.

The Lear's Macaw eggs were white and oval shaped and had some calcification granules on the surface. They measure approximately 45mmx35mm and weigh approximately 30g when fresh.

Hatching

As anticipated and due to the inadequate egg weight loss, the chick hatched with difficulties and underwent assisted hatching. Likely due to the poor weight loss, the chick was too large to rotate for hatching inside the egg and was malpositioned. After the egg showed no significant progress in the later stages of the hatching phase it was opened at the large end where it was determined that the chick was alive but had its head lodged in the small end and that blood-vessel retraction had not yet began. Over the course of 24 hours an artificial air pocket was made in the small end by carefully pushing the blood vessels with a cotton-tip to stimulate their retraction and creating space around the bill of the chick. After the chick had achieved its first breath of air, it commenced to external pip and with only a little further assistance managed to hatch on its own thereafter but at the small end of the egg 24 hours later. The incubation

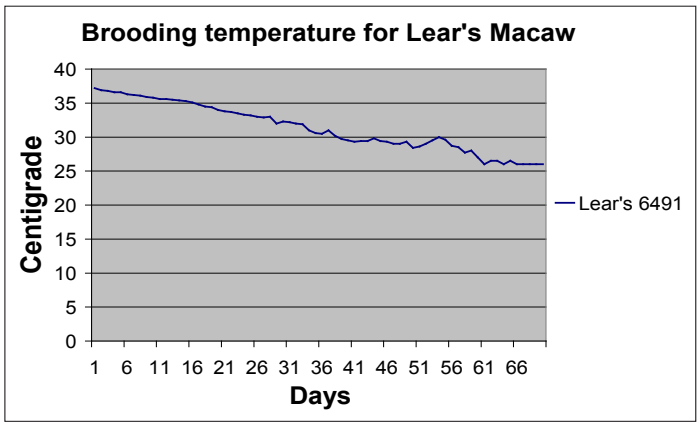
time is difficult to determine precisely as the hatch was assisted but it is within 26 - 28 days.

Hand-rearing

The newly hatched chick weighed 19.26g and immediately elicited a good feeding response. The yolk was almost fully absorbed and faecal had been passed in the shell. The chick had already been given fluids in the shell and, after hatching, initially given fluids in the form of Lactated Ringer's Solution, 5% Glucose and water mixed in equal parts fed via a 1ml syringe for the first 9 hours. A dose of a lactobacillus especially developed for parrots by the Ludwig-Maximilians-University of Munich (Klinik für Vögel, Lactobazillen Ch Nr.01/04) was administered on the first day with water. For the first regular feedings a 10% solids to 90% (by weight) liquid solution of Kaytee Macaw Exact® hand-rearing food with no additional supplements were fed 10 times a day and then gradually reduced to less feedings with 5 feedings on day 5, 4 feedings on day 7, 3 feedings on day 17, 2 feedings from day 47 and finally 1 feeding a day from day 102. The feeds were always evenly distributed over an 18-hour day (05.00-23.00) with initial feeds in the night for the first few days. After 10 days a soft silicon tube was used for tubing the food directly to the crop.

After hatching in a Grumbach® incubator, the chick was initially kept in a Brinsea® still air Hatch-maker brooding at 37.2 centigrade. It was moved to a moving air Proffi® brooder at day 3 and maintained at a temperature around 36.8 °C. By day 38 the chick was moved to a larger still air brooder with 30.2°C and finally at day 60 it was kept at room temperature of approximately 26°C, when it was moved to a fledgling cage but still kept in a plastic tub. The temperature setting was determined based on the chick's behavior and it generally preferred significantly higher temperatures than most parrots and often when the temperature was routinely lowered it had to be raised again. After day 68, lights were kept on during the day in the nursery and the chick started slowly to explore its surroundings and leave the tub.

Table 2.: Temperature setting during brooding



Interest in actual food items came early and a food dish was offered from day 70. Food items were offered by hand and accepted readily; later the chick started eating a little food independently and was observed taking food regularly from day 99. The main choice of weaning food was initially the Zeigler® parrot pellets. But shortly after, a wide range of food items including fruits and vegetables were taken. Preferred however, were still the Zeigler® pellets and Brazil nuts. The chick was finally weaned from hand-rearing formula by day 120. The bedding used in the brooding tubs throughout, except during first few days, was a commercial cat-litter Max's Catlitter® (COPRICE, Australia) made from rice by-products that are digestible and almost, but unfortunately not entirely, dust free. The relative humidity maintained in the brooders and the nursery rooms was between 45% and 60%. Every week until weaning swab samples were

taken from the cloacae and the buccal area, and sent, together with a fresh faecal sample, for bacteriological and mycological examinations.

The chick was banded with a 16mm. closed stainless steel leg-band on day 18.
Throughout the hand-rearing process a degree of restricted human contact with the chick was used and this was enforced to an increasing degree as the chick became older. After fledging it was quickly exposed to visual contact with a group of other young parrots, in this case 5 young Spix's Macaws *(Cyanopsitta spixii)* that were kept in an adjacent cage. The Lear's Macaw chick was also later kept together with this group of Spix's Macaws in the absence of other young Lear's Macaws with which it could socialize. It was calm and "friendly" with the other young and smaller parrots, as has been observed before with young Hyacinth Macaws kept together with Blue-headed Macaws *(Propyrrhura couloni)* here at AWWP. Meticulous record keeping was done throughout the hand-rearing period with the following data collected at every feeding session (Table 3.):

The Lear's Macaw chick developed like a young Hyacinth Macaw. However, it did mature significantly faster in almost all aspects of physical development. Freshly hatched, the chick was pale pink, covered in pale blonde down feathers on the head, neck, back and flanks. The eyes were closed and did not start opening until day 17 and were not kept open all the time until day 21. The first feather growth to penetrate the skin was recorded on the back at day 14. The wing, tail and breast feathers first started to break out of their sheaths on day 23. The naked skin around the eyes and beak was initially white and first developed a yellow coloration at 50 days. Vigorous wing flapping was practiced regularly from day 46, but the first short flight was not until the chick was 85 days old. During the rearing period, the chick was observe eating its own faeces on several occasions. Although cleaning was done coinciding with every feeding session, this behavior was regularly observed between days 28 to 70. Similar behaviour was also observed in young Hyacinth Macaws hand-reared at AWWP.

Table 3.: Hand-rearing data collection at each feeding session.

Date	Time	Feed No.	Temp Degrees Celsius	Relative Hum %	Weight Before Feeding	Weight After Feeding	Total Volume Fed	%Solids / Liquids	Food Type	Comments

The chick behaved not unlike other macaw chicks with a strong head-bobbing feeding response and reacted to intimidating situations by turning onto its back, although in this individual this was observed to a lesser degree than is typical in some other species such as Hyacinth macaws. DNA sexing revealed the chick's sex to be female.

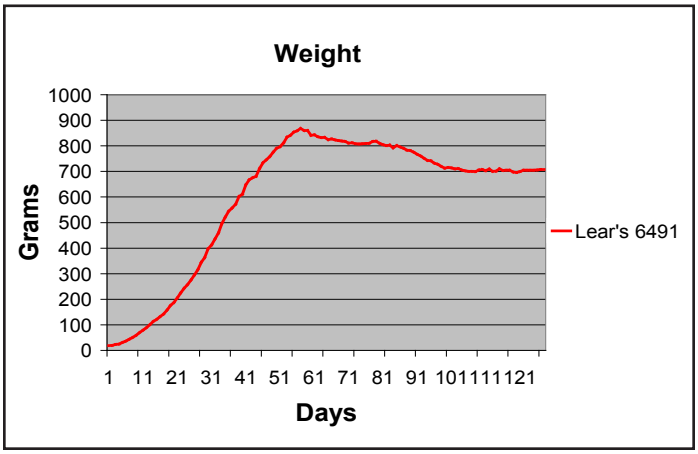
The weight gain was initially relatively fast with an average daily weight gain of 14.6g until it peak in weight at 868g, an average weight gain of 7.2% of the previous day's weight for the period. The highest weight gain was 21.4% of previous day's weight on day 4. Peak bodyweight was achieved at day 58 and the post peak weight low leveled

Table 4.: Physical development

Development	Age (day)
Feather-tracts visible under skin on back, flank and thighs	6/8
Bill color turning darker	7
Feather-tracts visible under skin on breast	9
Feather-tracts visible under skin on wings	10
Feather-tracts visible under skin on crown	13
Pin-feathers breaks skin on back	14
Pin-feathers breaks skin on flank, breast and thighs	15/16
Pin-feathers breaks skin on wings, skin darker around nostrils + forehead	18
Pin-feathers breaks skin on crown and feathers break tip of pins on tail, wings and back	23
Feathers breaking pin's throughout body	30
Head and shoulders fully covered with pins, active wing flapping	45/46
Naked skin around eyes and bill become yellowish	50
Massive feather development on wings	55
Climbing and attempting to perch	62
Climbing out of container, samples food items and tail longer than 20cm	72
Hard food items felt in crop	83
First flight in excess of 1 meter	85
Tail longer than 30 cm.	95
Observed to take food regularly	99
Completely weaned from hand-rearing	120
Post fledging moult	150

out at just above 700g at around day 105 and has slowly increased since to 750g at day 150.

Table 5.: Growth curve



Conclusion

Breeding the Lear's Macaw at the Al Wabra Wildlife Preservation was not only a unique and rewarding experience for us but hopefully also will provide a range of information that will benefit the entire breeding program of IBAMA, leading to more successful captive breeding in the near future, thereby creating a safe sustainable population in captivity. We also hope that the parents will develop their experience and hopefully one day we will announce their successful parent-rearing of young Lear's Macaws.

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Recommended reading:

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Website: www.alwabra.com/awwp

Explanation of proprietary nutritional products mentioned in text:

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