

EAZA Best Practice Guidelines

Ecuadorian Amazon Parrot, *Amazona lilacina*



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Preamble

Right from the very beginning it has been the concern of EAZA and the EEPs to encourage and promote the highest possible standards for husbandry of zoo and aquarium animals. For this reason, quite early on, EAZA developed the “Minimum Standards for the Accommodation and Care of Animals in Zoos and Aquaria”. These standards lay down general principles of animal keeping, to which the members of EAZA feel themselves committed. Above and beyond this, some countries have defined regulatory minimum standards for the keeping of individual species regarding the size and furnishings of enclosures etc., which, according to the opinion of authors, should definitely be fulfilled before allowing such animals to be kept within the area of the jurisdiction of those countries. These minimum standards are intended to determine the borderline of acceptable animal welfare. It is not permitted to fall short of these standards. How difficult it is to determine the standards, however, can be seen in the fact that minimum standards vary from country to country.

Above and beyond this, specialists of the EEPs and TAGs have undertaken the considerable task of laying down guidelines for keeping individual animal species. Whilst some aspects of husbandry reported in the guidelines will define minimum standards, in general, these guidelines are not to be understood as minimum requirements; they represent best practice. As such the EAZA Best Practice Guidelines for keeping animals intend rather to describe the desirable design of enclosures and prerequisites for animal keeping that are, according to the present state of knowledge, considered as being optimal for each species. They intend above all to indicate how enclosures should be designed and what conditions should be fulfilled for the optimal care of individual species.

Summary

The Ecuadorian Amazon parrot is listed as Endangered on the IUCN Red List. It is found only on the central and south west coast of Ecuador. In captivity the species is managed as a European Endangered Species Breeding Programme (EEP) which acts as an insurance for the wild population.

Collections participating in this EEP can either hold breeding pairs (in which case they must be housed alone with access to a nest box), nonbreeding groups (which can either be a same sex group or a flock in a mixed aviary), or both. Either option is equally important to the EEP.

Ecuadorian Amazon parrots have been kept and bred well in captivity for the last thirty years. These Best Practice Guidelines document methods for the successful husbandry of this species. Recommendation boxes highlight the important key points of each section, which readers should pay particular attention to.

Acknowledgments

A great deal of the text for these Best Practice Guidelines is based on the general 'Amazon Parrot Husbandry Guidelines', produced by Berna Perry and Mark Pilgrim in 1995. We are very grateful for Berna's considerable contribution and wealth of experience. Other parts of the guidelines were written following a husbandry survey of zoo collections holding Ecuadorian Amazon parrots.

We are also very grateful to Andrew Owen and Andrew Woolham for their review of the captive management sections and the Parrot TAG Chair Simon Bruslund and members of the Ecuadorian Amazon parrot EEP for their review and input. For the feeding section we must thank Dr. Andrea Fidgett and for the Veterinary section we must thank Stephanie Sanderson and Prof. Dr. Michael Lierz for his review.

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Section 1: Biology and Field Data

Biology

1.1 Taxonomy

| | |
|------------|-------------------------|
| Order: | <i>Psittaciformes</i> |
| Family: | <i>psittacidae</i> |
| Subfamily: | <i>psittacinae</i> |
| Tribe: | <i>arini</i> |
| Genus: | <i>Amazona</i> |
| Species: | <i>Amazona lilacina</i> |

Common name(s): Ecuadorian Amazon, Lilacine Amazon, Red-lored Amazon

Prior to being classified as a full species in 2014, the Ecuadorian Amazon parrot (*A. lilacina*) was classified within the *Autumnalis* group, which consisted of *A. autumnalis autumnalis*, *A. a. slavini*, and *A. diadema*. Research undertaken by Dr Mark Pilgrim showed it to be significantly different in both morphology and genetics to warrant re-classification. Photographs and details of all four are given below.

1.2 Morphology

1.2.1 Weight

As the species is not sexually dimorphic we expect no difference in weight between males and females. From two captive specimens held at Chester Zoo of good bodily condition the male weighed 380g, the female 365g. From information on ZIMS from 354 weight records from 61 individuals, we expect males and females between the ages of 2 and 15 years old, to weigh between 280g and 380g.

1.2.2 Colouration

The plumage is mainly green, with red on the forehead and lores extending high onto the crown and behind the eye, forming a line where it meets the green ear coverts. The cheeks are bright lime green. The feathers of the crown are lilac tipped with red. The carpal edge is pale green and the primaries are green becoming deep blue towards the tips, as are the secondaries. The speculum is bright red.



Amazona lilacina

The tail is green with deep blue on the outer webs; the lateral feathers are edged with pale green. The bill is dark grey to black with a faint dark horn coloured area on the culmen below the nostrils as in this photograph. This is not as obviously distinct as in the races of the closely related *A. autumnalis*.



Amazona lilacina at Chester Zoo

The periophthalmic ring is almost white and the iris is orange. The legs are grey. Immature birds are similar with less red of less intensity of colour on the forehead and lores. The green on the cheeks is also less intense than in the adults. The iris of immature birds is dark brown. There are no clear visual differences between the sexes.

Prior to being classified as a full species in 2014, the Ecuadorian Amazon parrot (*A. lilacina*) was classified within the *Autumnalis* group, which consisted of *A. autumnalis autumnalis*, *A. a. slavini*, and *A. diadema*.

To avoid confusion, descriptions and photographs of these similar looking species are shown below. If you are in any doubt that your birds are Ecuadorian Amazons, please send a photograph to the species coordinator.

A. a. autumnalis: the plumage is mainly green, with red on the forehead and lores. The cheeks and ear coverts are yellow, the extent of this is highly variable - from almost nothing to the whole cheek. The feathers of the crown and occiput are pale lilac-blue tipped with black; these gradually fade into the green nape. The carpal edge is pale green and the primaries are green becoming deep blue towards the tips, as are the secondaries. The speculum is bright red. The tail is basically green with deep blue on the outer webs; the lateral feathers are edged with pale green. The bill is grey with a large horn coloured patch on the upper and lower mandibles. The periophthalmic ring is almost white and the iris is orange. The legs are grey. Immature birds are similar with less red of less intensity of colour on the forehead and lores. The yellow on the cheeks is also less intense than in the adults. The iris of immature birds is dark brown.



Amazona autumnalis autumnalis



Amazona autumnalis salvini

A.a.salvini is as *A.a.autumnalis* without the yellow on the cheeks, these being of emerald green. The red is confined to the lores and the crown. The occiput, nape and upper area of the hind neck are blue. The inner webs of the lateral tail feathers are red at their base. Immature birds are similar with less red of less intensity of colour on the forehead and lores. The iris of immature birds is dark brown. There are no clear visual differences between the sexes.

A distinctive feature of *A.diadema* is that the red feathers of lores are of deep crimson and extend onto the feathered cere. The cheeks are grass green and the throat has a vinaceous-red patch in the middle just under the lower mandible. The crown is lilac shading to blue. The feathers of the occiput and nape are green, with paler edges; those of the nape are green edged with lilac. There are no clear visual differences between the sexes.



Amazona diadema

1.3 Physiology

A healthy Amazon parrot should have a body temperature of 41°C. The heart rate varies from 120 to 200 beats per minute depending on state of activity.

1.4 Longevity

Although there is no data for this in wild living specimens, it is estimated that Ecuadorian Amazon parrots live approximately 20 to 30 years in the wild. The oldest wild-caught male and female lived in captivity for 35 years, unknown age at capture.

The oldest male captive bred individual is still alive at 28 years old, as is the oldest captive bred female at 22 years old. We expect these captive bred individuals to live as long, if not longer, than 35 years; however they have not yet been in captivity for long enough, with the first wild imports arriving in just 1982.

Field Data

There is very little information known about this species in the wild. The Field Data section contains information from both personal observations from field visits [Pilgrim and Biddle 2012 – 2016] and limited published material.

1.5 Conservation Status/Zoogeography/Ecology

1.5.1 Distribution

Ecuadorian Amazon parrots are endemic to the coastal forests of central and south Ecuador.

Locations occupied by the species have a presence of both mangrove and dry tropical forest; close enough together for the birds to fly daily between the two habitats.

The species appears to exist just in two small isolated sub-populations within the remaining range [Pilgrim and Biddle *in litt.* 2016].



Remaining populations within this approximate area.

1.5.2 Habitat

Ecuadorian Amazon parrots roost communally in mangrove forests, flying at dawn to dry forest feeding grounds where they remain throughout the day, foraging in small groups. At dusk, they re-group in the edges of the dry forest, flying back to communal roosts in the mangroves as the sun goes down. Brief descriptions of the habitat types are given below. For Ecuador as a whole, two seasons are recognised; the dry summer season from July to December and the wet winter season.

Mangroves are halophyte forests distributed along the coast, located at the mouths of river systems. The soil is characterised by an unstable swampy structure and the trees have a high tolerance to salinity. The mangroves of Ecuador shelter a large number of species, such as: 42 species of birds, (Ortiz 1990); mammals such as the Crab-eating raccoon (*Procyon cancrivorus*), Mantled howler monkey (*Alouatta palliata*), White-faced capuchin (*Cebus capucinus*), Jaguar (*Panthera onca*); and reptiles such as Green iguanas (*Iguana iguana*).

One subpopulation of Ecuadorian Amazon parrots roosts on the mangrove island of Isla Corazon, close to the fishing town of Manta in the Manabí Province of Ecuador. Here the mangroves consist of four tree species; Red mangrove (*Rhizophora mangle*), Black mangrove (*Avicennia germinans*), White mangrove (*Laguncularia racemosa*) and Jeli Mangrove (*Cornacarpus erectus*). Isla Corazon is also home to a large number of bird species and provide nesting sites for one of the largest Magnificent frigatebird (*Fregata magnificens*) colonies in the Pacific.



Mangrove of Isla Corazon, Manabí Province, Ecuador (November 2012)

Tropical dry forests of Ecuador are found only on the south west coast, extending from central Manabí Province, through Guayas and into northern El Oro. They occur in lowlands with elevations of less than 300m. Average rainfall ranges from 30 to 150 cm per year, but this is highly seasonal and 90% of this rainfall occurs between December and May, with most falling in March. During the dry season temperature increases, making it a harsh environment for survival; plant growth and productivity is heavily dependent heavily on the rainy season. The annual mean temperature is between 24 and 26°C. The soil is mostly sandy or clayey.

Although compared to the wet forest, the level of biodiversity is low; dry forests show a very high level of endemism and species richness. For example in the Cerro Blanco Forest, where the second subpopulation of Ecuadorian Amazon parrots occur, more than 700 vascular plants have been recorded, 20% of which are endemic to south west Ecuador. Despite human pressure and its close proximity to Ecuador’s most populated city Guayaquil, the Cerro Blanco dry forest is abundant in biodiversity, with 54 species of mammals including monkeys (*Alouatta palliate*, *Cebus albifrons*) peccaries (*Pecari tajacu*), agouti (*Agouti paca*), 6 species of wild cat including the Jaguar (*Panthera onca*), 34 species of bat, plus 8 species of amphibians and 12 species of reptiles. There are also 221 species of birds recorded for the area, including the Great green macaw (*Ara ambiguous*) and the Grey-cheeked Parrotlet (*Brotogeris pyrrhoptera*) which is endemic to the region and currently being promoted by the Parrot TAG as a species to take on from private aviculture. The Cerro Blanco Forest is likely to be the only remaining protected dry forest within the remaining range of the Ecuadorian Amazon parrot.



Dry forest feeding grounds surrounding Isla Corazon, Manabí Province (November 2012)

1.5.3 Population

In 1996 the global population of Ecuadorian Amazon parrots was estimated at 400-600 individuals [Juniper and Parr 1998]. On-going habitat loss and trapping pressure imply that the population is in decline and population estimates from flock counts in the Cerro Blanco Forest have decreased from a minimum of 214 in 2006 [Berg and Angel 2006] to a minimum 140 in 2014 [Pilgrim and Biddle *in litt.* 2016].

The two remaining confirmed subpopulations are geographically isolated by a lack of continuous habitat and have a total minimum estimate of 240 individuals [Pilgrim and Biddle *in litt.* 2016].

There are likely to be a few more birds scattered within the El Oro province, but no such large mangrove roosting site (as Isla Corazon or the associated roosting site for the Cerro Blanco sub-population) has been identified, bringing the total population estimate to approximately 300 individual in 2014.

1.5.4 Conservation Status

This newly described species is listed as Endangered as it is estimated to have a very small and fragmented population. It is thought to be in on-going decline owing to continued habitat loss and trapping pressure [IUCN Red List 2014]. The pre-split species is listed under CITES Appendix II.

Conservation efforts are currently focused on the Cerro Blanco forest, the feeding grounds of the largest remaining population. A research and monitoring programme is run in collaboration between Chester Zoo and an Ecuadorian NGO Fundación Pro-Bosque. Chester Zoo also supports the work of Fundación Pro-Bosque to protect and restore this threatened forest.

In the past trapping pressure for the international pet trade was rife. A confiscation of approximately 150 birds entered Europe in the 1980's; a number of these birds founded the EEP. Today the scale of capture for the pet trade is much lower. Surveys from November 2012 suggest that the local pet trade is occurring on a small scale; for example, within one village close to an occupied site there were at least 4 individuals being kept as pets and a further 10 in a neighbouring village.

Today, habitat loss and degradation driven by agricultural expansion, timber and fuel wood harvesting and development are regarded as the largest threats to the Ecuadorian Amazon parrot. Already, it is expected that the dry forest has been reduced to 1% of its original coverage [The Encyclopaedia of Earth] and that at least 70% of Ecuador's coastal mangrove has been destroyed for the development of the shrimp farming industry [National Coordinator Corporation for Mangrove C-CONDEM]. Mangrove destruction mainly took place between 1970 and the mid 1980's, in 1987 the government implemented a prohibition on building shrimp farms in or near coastal mangrove forests [Clirsen 1991].

Mangrove forests are still protected today, however there is not such protection for the tropical dry forest that this species so heavily relies on. Participants of this EEP are strongly encouraged to help support field conservation efforts in any way they can.

1.6 Diet and Feeding Behaviour

Very little is known about the behaviour of this species in the wild. As part of the research and monitoring project in the Cerro Blanco, Fundación Pro-Bosque Park Rangers have observed Ecuadorian Amazons feeding on fruits of the following tree species in the Cerro Blanco Forest: *Cochlospermum vitifolium*; *Ceiba trichistandra*, *Ochroma pyramidale*, *Bombacopsis trinitensis*, *Vitex gigantea* among others.

Kunz [1995] observed them feeding in the morning or late afternoon, most frequently feeding on buds or stamens and pollen of the open flowers of Kapok (*Ceiba trichistandra*, *Bombaceae*). They were also seen in a fig tree (*Ficus sp.*, *Moraceae*) during several successive days. On these occasions Kunz notes the lavish use of fruits, they were dropped after a few bites. Kunz also observed Ecuadorian Amazons feeding on the fruits of *Caesalpinia pai-pai* (*Caesalpinaceae*). Rather than attempting to copy wild-diet ingredients, zoo diets [Section 2.2] must re-create nutrient composition and as evidenced by the limited information presented above, suitable data for wild-diet ingredients is lacking.

1.7 Reproduction

Very little is known about the reproduction of this species in the wild. In general they spend most of their time high in the forest canopy, they have cryptic green plumage and are well hidden in the foliage, they have a nervous disposition and fly off quickly when approached [Forshaw 1989 and pers. Obs]. They become extremely cautious around nest sites, moving slowly and quietly to avoid the attention of predators. For this reason very little has been published on the behaviour of these parrots in the wild and there are just three cases of wild nests being observed [Kunz 1995, Berg and Angel 2006].

1.7.1 Age of Sexual Maturity

There is no information on age of sexual maturity in wild birds but in captivity the majority of birds are sexually mature by 3 years, with breeding generally starting between 3 - 6 years on average. From studbook data recorded on 46 captive dams and 46 captive sires, the youngest to reproduce were a pair at Zoo de Lyon who were both 2 years 10 months old when their chicks hatched.

The oldest dam at first reproduction was at least 18 years old; the oldest sire at first reproduction was at least 20 years old. Both were wild caught individuals so their exact hatch dates are unknown.

1.7.2 Incubation Period

There is no information on this for wild birds. In captivity normal incubation period is from 26 to 28 days. Records from captive birds confirm that incubation is performed by the female alone.

1.7.3 Eggs and Clutch Size



Blown Ecuadorian Amazon parrot egg

There is no information on this for wild birds. In captivity clutch size can range from 1 to 5 white eggs, laid on alternate or every third day.

The mean clutch size in captivity is 1.8 (97% have between 1 and 3 eggs). Below are measurements from a number of eggs from a number of different breeding pairs housed at Chester Zoo:

| | Length (mm) | Breadth (mm) | Fate (DEI – Died Early Incubation) |
|-----------------|-------------|--------------|---------------------------------------|
| Pair 1 clutch 1 | 40.7 | 27.8 | DEI – came in fertile |
| | 38.0 | 28.5 | Infertile |
| | 36.4 | 28.8 | Infertile |
| Pair 1 clutch 2 | 39.1 | 28.8 | Infertile |
| | 39.3 | 29.2 | Hatched came in fertile |
| Pair 2 clutch 1 | 44.0 | 27.4 | Hatched came in fertile |
| | 42.8 | 28.8 | Infertile |
| Pair 3 clutch 1 | 40.5 | 30.3 | DEI – came in fertile |
| Pair 3 clutch 2 | 39.5 | 30.8 | Infertile |
| | 40.9 | 30.1 | Hatched came in fertile |
| | 41.5 | 29.2 | Hatched came in fertile |

1.7.4 Hatching Details and Seasons

In Ecuador, the breeding season is believed to be from late December to early April [Kunz 1995, Juniper and Parr 1998, Berg and Angel 2006]. Two nests were observed by Kunz in 1994 in the Cerro Blanco Forest; the first from 11th January – 26th April, the second from 19th February – 22nd May. Both nests were in Ceiba tree sp (*Bombacaceae*). A further nest was observed in 1999 by Berg and Angel, again in the Cerro Blanco Forest; a pair was first seen occupying the cavity on the 9th December, believed to have begun incubation, on the 7th February 2000 a chick was first seen at the entrance and both parents were seen regurgitating food to the young on 12th February. Chicks were observed begging at the entrance of the cavity on the 10th March and were likely to have fledged by the 25th March. There have been no more reports of wild nests.

1.8 Behaviour

Again, there is very little information from this species in the wild, the below information comes from a very limited number of publications.

1.8.1 Activity

Apart from when nesting, Ecuadorian Amazon parrots spend their nights in communal roosts in large flocks and their days in much smaller groups dispersed through the dry forest. They become active at first light and travel from their roosting site to feed, flying in loose association with individual pairs discernible within the flock by their close proximity. They spend the warmest parts of the day at rest in the canopy and feeding, becoming active again in the evenings before returning to the roost communally for the night.

The distance between the dry forest and mangrove appears to be approximately 5 – 15 km, a continuous distance that wild Ecuadorian Amazon parrots would fly twice per day.

1.8.2 Predation

The primary purpose of communal roosting appears to be to reduce predation. It is reported that mangrove trees offer greater protection from predators such as the Grey-backed hawk (*Leucopternis occidentalis*) and may provide safety from land predators. Mangroves are disproportionately frequently used as roost sites by many birds and bat species but the importance of this is poorly researched. Interestingly the mangrove habitat does not appear to provide any food or offer any suitable nesting opportunities.

1.8.3 Social Behaviour

The social make-up of a flock in the wild can be observed when the whole flock flies from the mangrove to the dry forest or vice versa. The flock will be made up of tightly knit pairs and triplets, and occasionally single birds. During this flight birds call very loudly to one another. This vocalisation continues until the flock lands at the roost site for the night.

During the breeding season pairs separate from the flocks and remain closely bonded, the majority of males are very belligerent and protective of their females.

During the day when in smaller groups, Ecuadorian Amazon parrots are very quiet and inconspicuous in the forest, until late afternoon when they begin to re-group on the edges of the forest, calling loudly to each other just before their flight back to the communal roosts.

1.8.4 Sexual Behaviour

Again, there is very little data from wild populations of Ecuadorian Amazon parrots, but in general Amazon parrots are long lived and monogamous with the pair bond maintained year-round and this last for many years and multiple mating attempts [Forshaw 1989]. Field studies on the Puerto Rican parrot (*Amazona vittata*) have shown that re-pairing happens rapidly if one of the pair is lost [Snyder *et al* 1987].

Courtship behaviour appears to maintain and reinforce this pair bond prior to reproduction [Juniper and Parr 1998]. During the breeding season Ecuadorian Amazon parrots separate from their flocks to find suitable cavities in the trunks of large tree in which to nest. They will generally use hollow trees or palms, often modifying disused woodpecker nests. Nesting

occurs in the dry forest as cavities need a minimum diameter of 15 cm [Snyder *et al* 1987], it is believed that no mangrove tree species have large enough trunks to sustain this cavity size.

They become territorial and extremely cautious around the nest site, moving slowly and quietly when entering or leaving the nest cavity to avoid the attention of predators. Observations have shown that during the nesting period the male continues to join the flock and fly back to the communal roosts in the mangroves [Kunz 1995, Berg and Angel 2006]. When returning to the nest in the morning, the male will either fly as an individual or as part of a small group. If in a group, flying past the nesting tree, landing high in the canopy, before making a silent approach cautiously to the nest cavity. They are always quiet when at the nest, approaching or leaving it [Kunz 1995].

Section 2: Management in Zoos and Aquariums

2.1 Enclosure

Section 2.1 provides a general guide as to what has been used and found to be appropriate without suggesting these are the only suitable options.

Within the captive breeding programme (EEP) there are two types of participation; breeding collections and those collections keeping the species for display only. Participants with breeding pairs are expected to have a second aviary available for the species in which to keep offspring (in some occasions when offspring are kept together with their parents for successive breeding seasons the pair will stop breeding). Participants who offer to assist the EEP by holding genetically overrepresented or surplus animal for display may hold a single sex flock or keep the species in a mixed aviary.

2.1.1 Boundary

The mesh of each aviary should be no more than 1.5 cm square or 1.5 cm by 2.5 cm of 16 gauge non galvanised wire. If non galvanized mesh cannot be sourced, galvanized mesh that is thoroughly pressure cleaned and then washed down with vinegar seems to be safe. This size will prevent most birds and rodents including mice, young rats and weasels from entering and spreading diseases or eating the parrots' food (making assessments of how much food has been eaten impossible).

A stand-off barrier may be necessary in public situations to prevent people from coming into contact with the birds.

A predator anti-dig barrier should also be placed underground around the perimeter of the aviary. This can either be mesh or concrete to a minimum of 60 cm.



Mesh no more than 1.5 cm x 2.5 cm of 16 gauge

Partitions between aviaries can either be solid or of opaque sheeting, however parrots are highly sociable intelligent species, so do prefer double mesh. If mesh is used it should be doubled with a 5 cm space so that parrots in adjacent aviaries cannot bite each other's feet. Some birds in adjacent aviaries with mesh partitions will spend long periods aggressively interacting with their neighbours; this should be avoided as it may distract them from breeding.

Alternatively a having a planted space between aviaries, planted with bamboo or similar, can be used to create a semi-visual barrier, allowing adjacent pairs to interact with each other

without causing undue stress. This has been used with great success at Loro Parque and was used at Durrell for many years with the St. Lucia Amazons (*Amazona versicolor*). Also this can make aviaries more aesthetically pleasing.



Wood lined with sheet metal / wire mesh

Parrots have powerful bills and can be very destructive. This should be taken into account when considering structures in the enclosure. Any exposed timber-framed aviaries will quickly be destroyed. It is important to be careful as to what any wood is treated with, as some wood preservatives may be toxic.

Ideally the aviary frame should be made of stainless steel, non-galvanised metal or aluminium. Lead and zinc-free paint should be used when painting any metal mesh or parts of the aviary accessible to the birds. While this species is not as destructive as some other parrots such as large macaws, all wood should ideally be lined with either non galvanised sheet metal or wire mesh that prevents them getting to the wood.

2.1.2 Substrate



Indoor areas with concrete floor

Indoor areas should have concrete floors with good drainage to allow them to be periodically hosed down. This will also help ease the daily removal of any uneaten/spilled food. However if the room is to remain dry, fresh wood shavings or a thin layer of sand make a suitable covering.

The easiest substrate to use for the outdoor part of the flight is probably washed or sharp sand, to a depth of at least 10 cm. This can be easily raked to remove any dropped food and faeces. Soil is not recommended as this may host parasites. Gravel, bark chippings or grass covered floors may also be used in well ventilated areas, but these are not as easy to maintain or keep clean and there may be a higher risk of aspergillus if bark is used.



Outdoor area with washed sand

Some institutions prefer bare concrete floors in the flights. This is only hygienically beneficial if the drainage is very good and faeces can be regularly washed away with a pressure hose. Any dropped food needs to be picked up.

Some collections use suspended cages in which the floor is wire mesh and suspended off the ground. The advantage of suspended cages is that they are easy to keep clean, the faeces and dropped food can be easily cleaned - any spilt food must be collected and removed. They also help to

prevent birds from infecting and re-infecting themselves with the eggs of roundworms (capillaria and ascarids).

2.1.3 Furnishings and Maintenance

Perches should be of wood, preferably from fresh natural branches that have been washed to remove any droppings from wild birds. They should be of various thicknesses so that the birds can choose the most comfortable to roost on. As they are often interestingly shaped they can be aesthetically pleasing in an on-show aviary. Oak, sycamore, hawthorn and beech branches are a good choice for perching as they are hard and last well.

Perches need to be placed at the ends of an aviary to allow for maximum exercise/flight opportunities. If there are too many perches throughout the aviary birds may become lazy and use these to climb around, rather than fly around the aviary.

Perches should be placed under shelter in some areas so that the birds have the opportunity to shelter from the rain. Equally it is important to have one perch open to the elements, as this species greatly enjoys rain-bathing. A shady, sheltered area within the enclosure is important not only for the birds themselves to escape the sun and rain but also for the nest-box that should be in a protected area of the flight.

It is important that perches are positioned so they don't allow birds to defecate in their food or water.

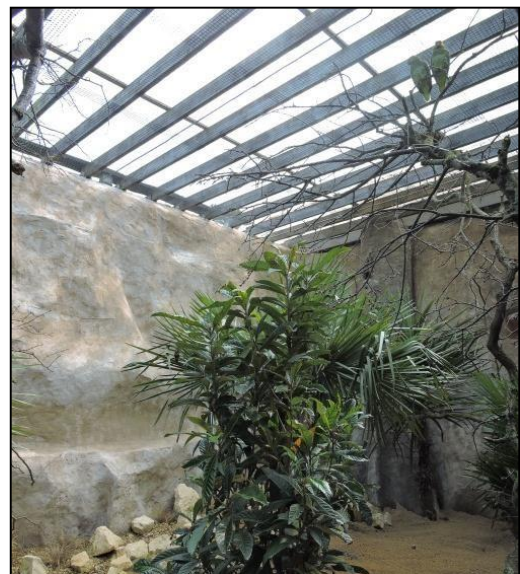
Firmly fixed perches should be provided as unstable perches may lead to unsuccessful mating. However, it is also recommended to provide moving branches and swings as parrots have been seen to use these frequently and even set them in motion on purpose.

Hemp rope is now widely used in parrot enclosures. It is another good and cheap means of environmental enrichment. Once the birds get used to it, they will use it to climb and swing on, and spend a great deal of time teasing it apart. When the fibres are separated the rope should be replaced to avoid the birds getting tangled in it.

They will often choose to utilise a flat surface to stand and mate on if available, like the top of nest box. In general perches need to be changed at least once a year, more frequently if chewed.



Some perches firmly fixed to allow mating



Softwood perches should also be available

In addition, softwood perches such as willow, elder and fruit trees are also important enrichment. Parrots will spend a great deal of time destroying them, which helps to maintain the condition of their beak. These softwood branches will need to be replaced much more regularly, but the benefits to the birds make this very worthwhile.

Standard wall mounted flag pole holders (in various shapes and sizes) are great for holding and easily exchange of browse for parrots.



Wall mounted flag pole holder



Live plants can be used in large aviaries

In large aviaries live plants can be used and will greatly enhance the look of the aviary. Living plants are not essential in off-show aviaries as long as frequent supplies of fresh leafy branches are provided for enrichment, however on-show aviaries that are planted with trees and shrubs are far more aesthetically pleasing than those that are not. Large well-established trees and shrubs have a better chance of surviving the attention of the birds in large aviaries than small plants introduced into small aviaries. Great care must be taken to ensure that no parts of the plants used are toxic, see below for a list of plants best avoided. Rocks and artificial cliff faces may be used and can give a more 'natural' look to a parrot enclosure. The following plant species have worked well in parrot aviaries: Bamboo, Trachycarpus palm, Carex Grasses.

In the outdoor aviary in Barcelona Zoo several plants have been used: *Ficus benjamina*, *Ficus carica*, *Grevillea*, *Viburnum* and *Ligustrum*. Most of the plants were destroyed but they now make good perches.

The following plants are known to be poisonous to mammals, they may or may not be poisonous to birds but are probably best avoided ('Garden Review' 1994. Bakker. Spalding. Lincolnshire):

| Plant Type | Degree of toxicity | Poisonous part of plant | Be especially cautious of |
|-------------------------|--------------------|-------------------------|---------------------------|
| Woody plants | | | |
| Daphne | *** | Whole plant | Fruits |
| Euonymous, Spindle tree | ** | Whole plant | Fruits/seeds |
| Hedera, Ivy | ** | Leaves/berries | Fruits |
| Ilex, Holly | ** | Berries | Fruits |
| Laburnum, Golden chain | *** | Whole plant | Pods/seeds |

| | | | |
|---|-----|--------------|---------|
| Ligustrum, Privet | *** | Whole plant | Fruits |
| Lonicera, Honeysuckle (<i>L.pileata</i> , <i>L.nitida</i> no danger). | *** | Berries | Fruits |
| Rhamnus, Buckthorn | ** | Berries/bark | Fruits |
| Robinia, False acacia | ** | Whole plant | Bark |
| Sambucus racemosa Elder | ** | Berries | Berries |
| Viburnum, (eg. Guelder Rose) | ** | Fruits | Fruits |

Conifers

| | | | |
|---|-----|-------------|--------|
| Juniperus sabina, Savin | ** | Whole plant | Fruits |
| Juniperus ccmunis, Common juniper | ** | Berries | Fruits |
| Taxus, Yew | ** | Whole plant | Seeds |
| Thuja, Arbor-vitae | ** | Whole plant | |
| Herbaceous plants | | Whole plant | Fruits |
| Aconitum, Aconite | ** | | |
| Arum | ** | Whole plant | Fruits |
| Colchicum | ** | Whole plant | Fruits |
| Convallaria, Lily of the valley | ** | Whole plant | Fruits |
| <i>Datura suaveolens</i> , Trumpet flower | *** | Whole plant | Fruits |
| Helleborus, Christmas rose | ** | Whole plant | Seeds |
| Heracleum mantegazzianum Giant Hogweed | ** | Hairy stems | Juice |
| Solanum, Nightshade | ** | Whole plant | Fruits |

NB the sap of cherry branches is potentially toxic also.

Dropped food and faeces should be picked up daily. General good hygiene within enclosures is the best way of preventing disease.



It should be possible to enter each aviary individually without having to pass through the neighbouring one causing unnecessary disturbance.

A system where feeding can be done without entering an aviary at all, through a hatch is ideal and will save time as well as avoiding disturbing the birds while they are breeding. This can also be an important tool to prevent conflict with aggressive individuals.

A safety porch, or double doors, is essential on any aviary to prevent escape.

Safety porch essential to prevent escape

2.1.4 Nest Boxes

Ecuadorian Amazon parrots are cavity nesters in the wild, usually taking over a woodpecker nest and enlarging it. In captivity they will use a nest box. This should be constructed of plywood that has been treated with a non-toxic wood preserver, large wood plates and hollowed out logs have also been used.

Some collections have shown that having a variety of nest boxes available, offering the parrots a choice, is beneficial. However others believe providing too many options will prevent the birds from focusing on a particular nest. If experience has shown that birds like a particular nest location (and ideally inspection should be accessed from outside the aviary) then one nest box should be sufficient.

The nest box should be hung in a shady area in the outside part of the enclosure. There are many different shapes and sizes of nest box which are successful, there are though a few factors which most of the successful ones have in common; amazon parrots seem to prefer boxes which have a dark interior, this can be achieved by having a long deep box or by having a tunnel leading into the nest chamber.

A small entrance hole is also preferable with a diameter of 10 cm, positioned so that direct sunlight doesn't enter the nest.

Positioning of the nest box in the safety porch or corridor at the rear of the aviary (if it is on-show) is preferable to having the nest inside the aviary, as this reduces the need to enter the aviary, often with a ladder which causes considerable stress and disturbance to the breeding birds.

There should be a secure perch firmly fixed 8 cm below the entrance hole where the birds can alight before entering the nest and where the male can sit while the female is in the nest. There should be a gap of 45 cm above the nest box to allow the male to sit.

A 10 cm deep layer of pine wood shavings (not saw dust, which is too dusty) makes an ideal substrate in the nest box and these will be thrown out or shifted around by the birds, until they are to their liking.



Long deep outdoor nest box with small north facing entrance hole



Indoor nest box with tunnel leading to nest chamber

Strips of softwood placed in the nest-box and to partially obstruct the entrance, the birds mimicking the natural behaviour of enlarging a woodpecker hole will shred these. It has been reported that this stimulates breeding behaviour. Non-galvanised wire mesh attached to the insides of the nest box is recommended to allow easier access.



Wire mesh attached to inside of nest box to allow easier access at Lyon Zoo

Non-treated softwood blocks should be securely fixed inside the nest cavity. These may be chewed by the female during brooding, which helps to keep the nest substrate clean and discourages her from chewing the walls of the nest box and in some instances from feather plucking the nestlings.

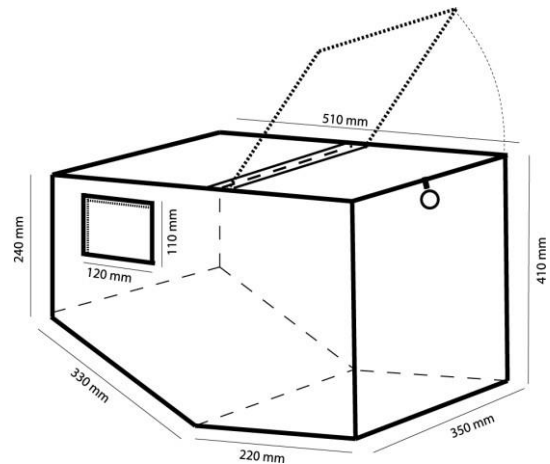
The following nest box sizes have been used successfully:

- length 60 cm X width 30 cm X height 45 cm
- length 72 cm X width 34 cm X height by 34 cm
- length 54 cm X width 34 cm X height 38 cm

The youngest pair to breed in captivity were at Lyon Zoo. The new unproven pair were introduced on 16th March 2015 and their chicks hatched 18th June 2015. The following nest box used successfully in this case:



This box is made of 30 mm thick wood, with all angles protected by angle iron. A wire mesh (10 x 25 mm) covers all inside panels. The nest box is placed in the security lock between the keepers corridor and the outside, on the door of the inside pen. A hole in the concrete wall provides the birds with access to the nest box. This allows keepers the opportunity to look inside the nest box (when the female is not in the nest) without disturbing birds. The nest box is removable.



Birds should be disturbed as little as possible during breeding however it can be beneficial to habituate the birds to nest inspections. Easy access to the nest box via a 13 cm square inspection hatch positioned towards the base of the nest allows regular quiet and calm nest inspections by the keeper.

Allowing the nesting birds to become accustomed to this will produce calmer nesting birds that will better tolerate egg and chick manipulations, such as weighing, closed-ringing etc. than birds that experience little or no nest checking. These birds are far more likely to break eggs or injure nestlings than those conditioned to a level of measured and calm “interference”.

Experience and a level of caution is always required whenever any nest inspection takes place and this can be achieved by regularity – checking nests at the same time of day, talking quietly as the nest is approached, so that the sitting bird is aware of the keepers presence, gently tap on the side of the box before partially opening the inspection door and continuing to talk to the bird as the nest is inspected.

If birds are left alone during breeding it is essential to have a nest box camera installed to enable regular monitoring of nesting birds.

If females become very aggressive when on the nest, and chicks have to be handled, a good option would be to have the ability to remotely close the entrance of the nest for inspections or to use a board to push aside the female to access the chicks.

In summary, furnishing an aviary is a balance between providing a complex and stimulating environment for the birds and an enclosure, which is practical to clean and service for the keeper.

2.1.5 Environment

Ensure there are no sharp objects e.g. protruding nails in the aviary, as these may lead to unnecessary injuries - there is a potential risk of Amazons getting their leg band caught on thin sticks, nails, screws or wire pointing upwards and the damage can be horrible. Ideally aviaries should be south or south-west facing to allow plenty of sun, especially in winter.

Inside aviary: The inside area of the aviary should be well lit, preferably with natural light. Inside shelters should be fitted with lights that have a dimmer system, allowing day length to be extended to 13 hours during the shortened winter months, replicating the photo-period available to the birds in the tropics. All surfaces should be non-porous and easily cleaned. A good example of this is “White walling,” a 3 mm plastic sheeting, glued as a laminate on top of existing timber walls, the seams are covered with plastic edging strips using a silicone bead to secure in place.

Tubular heaters or similar, protected by a mesh cage (to prevent chewing) and a solid sloping metal top to prevent birds defecating on or sitting on the heater should be installed to keep the temperature above 0°C. Inside shelters should be heated to a minimum winter temperature of 15°C. Shelters should be dry and draught-proof.

Outside aviary: As amazons will generally not use a pool or bowl to bathe in, a water sprinkler system creating a fine rain over part of the outside aviary is hugely beneficial, particularly during hot or dry weather. They will greatly enjoy hanging from the roof of the aviary, calling loudly and thoroughly soaking themselves. This is hugely beneficial to their plumage and to their general well-being. Another benefit of these mist sprays is that in very hot weather they lower the aviary temperature, this is especially important when chicks are in the nest-box.

2.1.6 Dimensions

If birds are bred in relatively small aviaries, one should consider moving birds to larger flocking aviaries, if available outside the breeding season, which will allow them greater room to exercise, interact with other parrots (not necessarily of the same species) and actually more closely resembles the behaviour of the parrots in the wild. This technique is used by some zoos, e.g. Paradise Park, Loro Parque.

Enclosures must be large enough to allow birds’ sufficient exercise. A minimum height of 3 m should be used as nervous birds will have more confidence if they are able to perch above head height. The minimum width should be 2 m; a length of 6 m is considered adequate where visitors can view from one end only. Where visitors can walk along the length of an aviary however, greater width is required. If visitors are viewing the enclosure through glass windows, it is recommended that a darkened area is installed on the outside to prevent birds from flying into the glass. In new introductions to glass barriers the glass should be marked with dirt (some use peat-moss with water, clay or chalk water) which is then gradually removed. Permanent markings with labels or UV reflecting markings in the direction facing the birds is an advantage.

Birds can be bred in either on-show or off-show aviaries. The photographs below are on- show breeding aviaries at Barcelona Zoo. The birds have access outside and inside all year round and the dimensions are:

- inside: 5.20 m² floor area and 3 m height
- outside: 14.4 m² floor area and 6 m height



Below is the on show breeding aviary at Lyon Zoo:



Landau zoo has also been successful at breeding the species in their aviaries, photographs are shown below and the dimensions are as follows:

- inside: 210 cm x 470 cm x 230 cm height (sloping roof)
- outside: 400 cm x 400 cm x 200 cm height



Indoor aviary at Landau Zoo



Outdoor aviary at Landau Zoo

ENCLOSURE RECOMMENDATIONS:

- Aviary mesh should be a no more than 1.5 cm² or 1.5 cm by 2.5 cm of 16 gauge non galvanised wire.
- Wood should be protected from chewing, or not used at all.
- Indoor areas should have concrete floors with good drainage, covered with wood shavings, or sand.
- Outside areas may be of sand, bark chippings or grass.
- Enclosures must ensure that predators such as mustelids and rats cannot dig their way in and strict vermin control measures are required.
- Perches should wood of various thickness or hemp rope and should not be positioned over food or water containers. At least one perch should be firmly fixed so as not to swing.
- A shady, sheltered area within the enclosure is important.
- Food dishes should be constructed of non-porous ceramic or stainless steel.
- Fresh water should always be available.
- Dropped food and faeces should be picked up daily.
- It should be possible to enter each aviary individually without having to pass through the neighbouring one.
- A safety porch is essential.
- The inside area should be well lit and with the ability to be heated if necessary.
- A nest box containing a layer of wood shavings should be provided.
- The minimum size of the aviary should be; height 3 m, width 2 m and length 6 m.

2.2 Feeding

Wherever possible, zoo personnel must make dietary decisions on the basis of data and evidence, rather than opinion and anecdote [Fidgett and Gardner, 2014]. Zoos can seldom mimic birds' natural diets and rather than attempting to copy wild-diet ingredients, zoo diets must re-create nutrient composition. Due to the challenges of measuring what is actually being eaten in wild situations, relatively few dietary items have been defined chemically [Valdes, 2014; Section 1.6 this manual]. Produce (fruit and vegetables) are a regular component of diets fed to animals in zoos because they are readily available, highly palatable, and offer variety of colour, taste and texture. However, most of what is available has been cultivated for human consumption and such produce is nutritionally inferior to superficially similar ingredients consumed by animals in the wild. For example, domestic fruits tend to contain higher levels of simple carbohydrates (sugars), lower concentrations of complex carbohydrates (e.g. dietary fibre) and are typically lower in protein than plant parts consumed in the wild [Allen, & Oftedal, 1996].

Diets for Amazon parrot species vary depending on factors such as distribution in the wild, seasonal availability of feed items and body size. Parrots in general, and Amazons in particular, are highly intelligent animals that require a great deal of stimulation in captivity. For this reason, diets tend to be very diverse, offering a variety of colours, shapes and textures as one mechanism for providing environmental enrichment. Captive Amazons are also prone to becoming overweight. When food is available in excess, as is often the case when such a diverse range is offered, birds are able to self-select preferred items (mainly fruit, oily seeds and nuts) which easily satisfy energy requirements, but otherwise provide poor nutrition: low quality protein, high levels of fat; poor mineral content and, of concern for laying females, an imbalanced Calcium: Phosphorus (Ca:P) ratio.

Birds usually eat a quantity of food to satisfy their energy needs and of course wild, free-flying parrots will expend more energy than their captive counterparts. However the daily needs for amino acids, minerals and vitamins remain fairly constant regardless of energy expenditure. Therefore, birds in captivity must acquire the same daily quantity of nutrients as free-living birds, but with much less food consumed.

For a better understanding of how this could happen, it is necessary to first calculate the energy required to maintain the basal metabolic rate (BMR), i.e. the metabolic rate when it is sitting at rest and not active. The formula is as follows:

$$\text{Energy (kJ)} = [73.5 \times \text{Mass (kg)}^{0.73}] \times 4.184 \text{ (Robbins, 1993)}$$

Thus, substituting the heaviest weight recorded for Ecuadorian Amazon parrots at Chester Zoo (380g), the equation becomes:

$$[73.5 \times 0.38^{0.73}] \times 4.184 = \sim 150 \text{ kJ}$$

As a general rule, daily energy requirements for captive animals are calculated as $2 \times \text{BMR}$ (assuming moderate activity).

For Ecuadorian Amazon parrots $2 \times \text{BMR} = \mathbf{300 \text{ kJ}}$

From food tables [McCance & Widdowson 1991], 300 kJ of energy could be supplied just consuming **one** of the food items in the quantity described below:

| Food Item | Quantity |
|-----------------------------------|---------------|
| Banana (medium sized, flesh only) | 70 g |
| Brazil nuts (2 whole) | 30g |
| Sunflower seeds (small handful) | <u>12.5 g</u> |

Thus a small handful of sunflower seeds (~12.5g) would satisfy the **entire** daily energy requirements of a 380g Amazon parrot.

With this in mind the quantity of oily seeds (e.g. sunflower, hemp) and nuts should be strictly limited. Smaller seeds such as plain canary, millets and safflower are less oily but still have mineral imbalance, however because they take much longer to eat they are better options for enrichment purposes.

Fruit is often a large component of amazon diets since it is highly palatable, offering a variety of colour, taste and texture, and is readily available in zoos. Yet it is important to remember that most of what is available has been cultivated for human consumption and thus nutritionally, domestic fruits generally offer little more than sugar and water as compared with fruits consumed by birds in the wild. Vegetables are also readily available and can supply similar enriching attributes of colour and texture whilst also being a source of important nutrients. In particular, dark green leafy vegetables (but not lettuce) are an excellent source of calcium and phosphorus in a favourable ratio for skeletal development and egg production.

Beans and pulses are another good food group for parrot diets since they contribute high quality protein, low fat and less sugary carbohydrates for energy. Many are highly palatable e.g. mung and soya beans, and chick peas, however red kidney beans should not be used since they contain a component believed to impede the uptake of calcium. Care is required in the preparation and presentation of pulses since all beans should be soaked for 24 hours before use, changing the water often during that time to prevent microbial/fungal growth and contamination, particularly if stored in warm, humid conditions while soaking and/or sprouting. It is vitally important that the beans are thoroughly rinsed before being fed out to birds. Boiling of pulses is not recommended as it diminishes both the quantity and the quality of the proteins and leaches out minerals to the boiling water.

While manufactured or pelleted diets may not appear stimulating to parrots (or keepers), most good quality, established, proprietary brands contain a balance of nutrients otherwise difficult to guarantee in other food items; minerals, fat-soluble vitamins, and specific amino acids such as lysine and methionine known to be limiting in avian nutrition. Furthermore, the consumption of pellets is easier to monitor than the use of conventional broad spectrum

'supplements' that often come in a powder form, generally sprinkled over the diet once it has been prepared.

Returning to the difficulty of providing variety without quantity, it is far better to vary individual items between, rather than within a feed. To achieve this it is recommended to feed twice a day. The first feed should comprise 'nutritious' items (pellets, pulses, dark green leafy vegetables) and be available all day. A second feed of 'treat' items can be offered later using limited amount of fruit, seeds and nuts (no more than 3 of each types daily). Using these desired items in enrichment devices generally limits their consumption but provides the motivation to work for 'treats'. Furthermore providing different items on different days reinforces the novelty and variety of each item.

Reducing the quantities of fruit and seeds will help with pest control and reduce wastage and/or spoilage issues. A diet based on pellets, pulses and vegetable is less likely to foster these problems and ensures the birds always have access to food.

2.2.1 Basic Diet

In addition to the energy requirements described above, ideally the diet must satisfy the following nutrient requirements. These are provided as a guide only and are ranges for Psittacines, based on National Research Council requirements for domestic fowl and diet nutrient amounts that have been successfully used in zoos.

| Protein | Fat | % | | IU/kg | | |
|---------|-----|------------|-----------|-------------|-----------|---------|
| | | Ca | P | Vit A | Vit D | Vit E |
| 12 - 22 | 1 | 0.6 - 2.75 | 0.4 - 0.6 | 1500 - 4000 | 200 - 500 | 10 - 25 |

The higher protein value would be a requirement for females laying eggs or rearing chicks. Using the mineral quantities described, the Ca: P ratio should be at least 1:1, but 2:1 is preferred, particularly for egg production.

To achieve this, ideally the diet should comprise:

| 1 st (main) feed | % | 2 nd (enrichment) feed | % |
|-----------------------------|----|-----------------------------------|----|
| Pellets | 25 | Fruit* | 20 |
| Pulses* | 30 | Seeds* | 5 |
| Vegetables* | 20 | | |

For items marked with * the choice for inclusion is fairly extensive, however it is recommended that no more than 2-3 different examples of each be presented at any one meal. A different selection should be offered on consecutive days to provide variety. Thus perhaps instead of feeding a pulse mix comprising six ingredients, a couple of pulses could be fed in rotation over 3-4 days. A similar rotation could be used for fruit, seeds and vegetables.

Fruit and vegetables should be fresh and as much variety as possible should be given. Uncontaminated seedling grasses are enjoyed, as are the branches of non-toxic trees, including the leaves, buds, blossoms and fruit. It is a good idea to vary the diet slightly, each day, to make life a bit less predictable for the birds.

2.2.2 Special Dietary Requirements

Enhancing the nutritional plane of the diet before the start of the breeding season (late February to early March) and thereafter during the rearing period, is likely to be beneficial, providing the female with extra nutrients for both egg and chick production. Using sprouted instead of dry seed is one way to achieve this. A conditioning diet, often egg-based, will provide a broader spectrum of nutrients (protein, vitamins and minerals) for this purpose. Alternatively parrot 'breeder' pellets provide similar nutritional benefits.

See Appendix 1 for an example diet sheet for description of dietary changes made at Chester Zoo during the breeding season. Ensure cuttlefish is always available *ad libitum*. It may be ignored for many months, but when a female is producing eggs it will likely then be consumed in large quantities.

2.2.3 Method of Feeding

Ecuadorian Amazon parrots should be fed twice a day in washed, ceramic or stainless steel dishes that are placed on rodent-proof feeding trays. The food should be offered inside the shelter. If food is placed outside it will require some form of cover to prevent it getting waterlogged or sun bleached. The first feed should comprise pellets, pulses and vegetable and be available all day. All fruit and vegetables should be thoroughly washed before use. Treat items, (fruit, seeds and nuts) are fed later in the day in strictly restricted quantities, perhaps as part of an enrichment programme.



Feeding dishes should be stainless steel or ceramic



Food should be offered inside the shelter

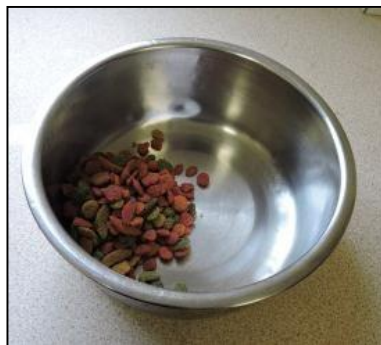
Food dishes should ideally be constructed of non-porous ceramic or stainless.

It is very important to ensure that mice cannot get to the food as they are carriers of diseases which can kill parrots, *Salmonella typhimurium* and *Yersinia pseudotuberculosis* are two of the most serious. Almost all keepers of seed eating birds are troubled by mice at some time, while it is essential to control these unwelcome intruders, great care must be taken that birds have no access to the poisons or traps which are used to control them.

Two meals should be fed as a way to transition from no-pellet diets to those with pellets. Once pellets are readily accepted, everything can go into one dish, and an example of a food bowl presentation can be seen below:



Step 1



Step 2



Step 3



Step 4



Step 5



Extra nutrients added during breeding season

2.2.4 Water

Fresh water should always be available, off the ground though as parrots generally don't like to come to the floor to drink. Ideally it should be small enough to be thoroughly cleaned and refilled daily. Amazons tend not to bathe in pools of bowls, preferring to rain bathe, so running or moving water may stimulate more usage.

FEEDING RECOMMENDATIONS:

- Ideally the diet should comprise two feeds per day, the first and main feed comprising 25% pellets, 30% pulses and 20% vegetables. The second (enrichment) feed should comprise 20% fruit and 5% seeds. If pellets are readily accepted, everything can go into one dish.
- Enhancing the nutritional plane of the diet before the start of the breeding season and during the rearing period, is likely to be beneficial.
- Ensure cuttlefish or suitable alternative in the form of a mineral block is available ad libitum, but be aware that some cuttlefish can contain high levels of heavy metals depending on origin.
- Ceramic or stainless steel dishes should be used to present food.
- Fresh water must always be available.

2.3 Social Structure

Ecuadorian Amazon parrots are best kept in individual pairs, that is one male to one female.

2.3.1 Changing Group Structure

When introducing a pair together for the first time it is wise to house them initially in adjacent cages/enclosures for a few days so that their reactions can be monitored. If this is not an option a “howdy cage” can be used, placing the previous enclosure owner in the “howdy cage” allowing the new arrival access to the permanent flight first. It is usually obvious fairly quickly whether they are going to be compatible. The 'love at first sight' reaction is common especially with birds that have been alone for a while and were once part of a compatible pair.

A pair that is not initially compatible will ignore each other, sit at opposite ends of the enclosure and will not preen each other (allo-preen). It may take some time for some birds to pair up and so long as serious aggression does not occur they should be given a couple of years before being split up and re-paired.

Young birds are generally more likely to be more compatible with each other than are old birds. Ex-pet birds that have only been used to human company may prove more difficult to pair-up, but there are many instances where long-term ex-pets have become good breeding birds so it is worth being patient.

Introducing birds into a neutral aviary at the same time which neither bird has previously occupied can often work better than introducing a new bird into an aviary where its potential new mate is already established. If serious aggression results when birds are introduced it is unlikely that the pair will ever be compatible.

Mild aggression, for example when a bird lunges at another with its beak open, is a common reaction to being introduced to another, this should not cause too much concern if no actual

contact is being made. Newly introduced birds should be carefully monitored for a few days before being trusted together.

Before being brought into an established collection, the Ecuadorian amazon parrot should be isolated from the established birds and screened for a number of diseases (see section 2.7 Veterinary Considerations for Health and Welfare).

2.3.2 Sharing Enclosure with Other Species

Mixed species aviaries are possible with Ecuadorian Amazon parrots but need very careful monitoring to ensure that all of the occupants are doing well. It is also important to note that breeding is less likely to occur in mixed species aviaries so breeding pairs should not be kept in mixed species aviaries.

The success of mixing can depend on the species and indeed on the aviary - size and planting, number of feeding and roosting/perching sites. Ground dwelling birds, such as pheasants or partridges may work well with Amazons, as may small to medium sized passerines. Psittacines tend not to mix well with other parrots if breeding is intended. In Barcelona the Ecuadorian Amazons are kept (when not breeding) with White-naped pheasant pigeons (*Otidiphaps aruensis*), no aggression has ever been seen and the White-naped have even bred.

SOCIAL STRUCTURE RECOMMENDATIONS:

- Amazon parrots are best kept in individual pairs.
- When introducing a pair together for the first time it is wise to initially house them in adjacent cages/enclosures for a few days so that their initial reactions can be monitored.
- Before an individual is brought into an established collection, it should be isolated from the established birds and screened for disease.
- During the breeding season, it is unwise to bring new individuals into an established collection.
- In a non-breeding situation, mixed species aviaries are possible but need very careful monitoring to ensure that all of the occupants are doing well, and multiple feeding and roosting opportunities should be available.

2.4 Breeding

In captivity 91% of eggs hatch between April and June, with 45% of those in June.

2.4.1 Mating

Courtship and mating usually occurs during the months of April, May, June, and July and consists of tail flaring and eye blazing / eye pinning with general excitement and extra activity.

Mating may not be observed, occurring at dawn or dusk or possibly in the nest-box. Some pairs mate at the same time each day, others get extremely aggressive towards their keepers at this time and will also show great interest in the nest box.

A swelling of the vent area of the female may be noticed and she will be less agile than usual just prior to egg laying.

2.4.2 Egg Laying and Incubation

Ecuadorian Amazon parrots do not build a nest as such, but birds may arrange substrate in the nest box, to form a depression or scrape. Once the female begins to spend long periods of time in the nest box, egg laying is imminent. Unlike many parrots that are constantly in and out of the nest box regardless of breeding, Ecuadorian Amazons usually only show interest in the nest when they are ready to breed. Three eggs laid on alternate days is usual, but a gap of three to four days between eggs is not uncommon. 97% of captive Ecuadorian Amazons lay between one and three eggs. A longer gap between laying of up to ten days occurs occasionally but cannot be considered normal. The incubation period is 26 to 28 days.

2.4.3 Development and Care of Young

It is strongly recommended that Ecuadorian Amazon parrots are allowed to rear their own chicks. They will usually make excellent parents once given what they require; a good balanced diet, a suitable nest-box and a feeling of security.

In general, Ecuadorian Amazon parrots are very adaptable and soon get used to what is going on around them. Problems occur when something out of the ordinary occurs, letting strangers near aviaries where birds are used to seeing only a one or two people, for example, is far more likely to cause problems. This can happen with off-show birds which can be extremely nervous.

The chicks are altricial, meaning they are relatively helpless when hatched and require parental care in the form of feeding and protection. They are brooded very tightly by the female for the first couple of weeks after hatching. Their eyes begin to open at about 10 days. The first sign of feather growth on the wings occurs at about 16 days, followed closely by the ears opening. The rest of the feathers begin to emerge by day 25, the tail feathers being the last to come through. On hatching the chicks have a very sparse covering of whitish down. The chicks fledge at 9 to 12 weeks but are not independent for another 2 to 3 weeks. See Appendix 2 for more chick development photographs.



Chicks 5 – 10 days at Lyon Zoo



Chicks 15 - 20 days at Lyon Zoo

2.4.4 Artificial Incubation

Although natural incubation and parent rearing of the chicks is preferable there may be times when artificial incubation is required, for example if the pair have a record of being poor parents, or the eggs are abandoned. It should not be assumed that cold eggs are dead. They may still be viable if gently brought back to incubation temperature.

Eggs need to be incubated at 37.5°C with an initial relative humidity (RH) of 40%. They also require turning (most incubators have automatic turners). If eggs are turned by hand it is advisable to turn them an odd number of times each day so that they are a different way up during each night. The eggs should be weighed accurately so that during the incubation period the RH can be adjusted to achieve a weight loss of 16% by the time the embryo internally pips (that is the time when it breaks through the membrane and enters the airspace). This can be seen quite easily by holding a cool light (LED torches with around 600-900 lumen are particularly suitable) against the egg in a darkened room, this is commonly known as 'candling'. Getting the egg to lose exactly 16% of its fresh weight is probably best achieved by having two incubators set up, one running 'humid' the other running 'dry' the weight loss from the egg is measured every other day and plotted on a graph. The weight loss of the egg can then be manipulated by moving the eggs between incubators.

Once the chick has internally pipped the humidity should be increased from 40% - 60% to prevent drying of the egg membranes which can stick to the chick preventing its hatching. On hatching incubator temperature should be reduced by 1°C.

For incubation record keeping, including notes for ZIMS entries, the following terms should be used:

- ND = No development detected
- PD = Positive development detected
- EED = Early embryonic death
- MED = Mid-term embryonic death
- LED = Late embryonic death
- DIS = Dead in shell at hatching

2.4.5 Hand-Rearing

Hand-rearing should only be carried out in exceptional circumstances, a last resort for chicks that would otherwise die.

Ecuadorian Amazons take between 24 and 60 hours from internal pip to hatching. With artificially incubated eggs, if the chick has failed to get out of the egg 48 hours or so after externally pipping, that is, when the first chip is seen in the egg shell and it is obvious that there is no progress being made, a small hole can be made in the air-space end (the broader end) of the egg. A small drop of water on the membranes will soften them and this may be all that is required for normal hatching. Do not rush in and open an egg unless you are absolutely sure the chick is still not making progress. If you are sure that the chick is having problems, carefully remove the shell from the airspace end where it is not in contact with the chick. It is

usually possible to carefully free the chicks' head in this way. Once the head is free a small drop of glucose water may be given to weak chicks. In most cases the chick will push itself out of the remaining shell within a couple of hours. If bleeding occurs at any time during this procedure, stop immediately. If the chick is ready to hatch the yolk sac will not be visible. If the yolk sac appears to be external then the chick is not ready to hatch and if removed from the egg will almost certainly die.

There are many commercially produced hand-rearing diets for parrots. These are likely to be more successful in the long term than 'home made' diets but it is essential to follow the manufactures recommendations carefully. A full account, including weights, of hand-rearing one individual at Chester Zoo is provided as Appendix 3.

BREEDING RECOMMENDATIONS:

- Careful observation should be made of a pair in breeding condition.
- Once the female begins spending long periods of time in the nest box, egg laying is imminent.
- It is strongly recommended that Ecuadorian Amazon parrots are allowed to rear their own chicks.

2.4.6 Population Management

The aim of the Ecuadorian Amazon parrot EEP is to maintain a physically and genetically healthy population of Ecuadorian Amazon parrots in captivity to act as an insurance population for their wild counterparts. Although to date no reintroductions have taken place, this may in the future be a vital tool for the survival of this species. The captive population also provides opportunities for research, an invaluable resource for such a little studied species. Research on the captive population [Pilgrim, 2010] into its taxonomic status provided vital evidence that the Ecuadorian Amazon parrot is a full species rather than a subspecies of the *autumnalis* group it was previously grouped with. This had important conservation implications, allowing the species to be allocated a conservation status within the IUCN Red List [2014]. The presence of the Ecuadorian Amazon parrot in zoos also allows the interesting story of these birds to be told and their conservation need to be highlighted.

The genetic goal of the EEP is to maintain 90% of the genetic diversity of the founders over 100 years and the population is on track to reach this goal. However there are only a small number of Ecuadorian Amazon parrots in the EEP and in order to reach this goal we must continue to breed and increase the population. Pairs must be selected due to their mean kinship and inbreeding coefficient. It is necessary to actively encourage new holders to join this EEP, both to provide more space for breeding but also to hold groups of related or overrepresented individuals. If, in rare cases, approval is gained for overrepresented birds to leave the EEP, they must be fitted with a transponder micro-chip prior to leaving and all details must be provided to the species coordinator.

2.5 Behavioural Enrichment

It is important to ensure the birds are always kept in environments which are not only naturalistic, but also enriching to them.

Careful planting, can not only provide environmental stimulation for the birds, but also achieves a level of aesthetic for keepers and visitors, but also for the birds themselves, providing areas to hide, roosting sites, variety of perching, and also some level of browse provision. It is an important consideration though, that when positioning the perching, it is never placed too close to or above plants, as birds will use the security of a perch to strip plants of their leaves, and also prevents the birds from defecating on them.

Further browse, such as willow in leaf, and fruit tree branches, are always enjoyed, birds spend long periods of time stripping leaves, and peeling bark from boughs, these can be suspended by hooking them onto the enclosure boundary mesh walls, providing them with easy access.

Fruit kebabs can be a good way of presenting this element of their daily diet, and are always consumed but care should be taken on positioning, and chewed debris from the fruit will need removing afterwards.

As previously mentioned, Ecuadorian Amazon parrots, are best kept in single pairs when in a breeding situation, however, young can be flocked together for a couple of years, pre-sexual maturity, and the company of several others of this species is certainly stimulating, it also importantly allows juveniles the opportunity of learning key communication behaviours, which will be beneficial when paired up for breeding. It can also assist in establishing bonded pairings, so clear visual identification of individuals within the group is important.

2.6 Handling

2.6.1 Individual Identification and Sexing

Ecuadorian Amazon parrots are monomorphic. Birds should be DNA sexed, a feather sample can be used to do this. Surgical sexing is not recommended. It is extremely important to have birds sexed. Homosexual pairs will often act like a heterosexual pair.

Individual identification is also important; this is usually achieved by ringing. For individual identification steel closed rings are preferable, but these need to be put on when the chicks are small, around twelve days old. Aluminium rings are not suitable for large parrots as they may be able to crush them and thus constrict the leg.

Micro-chipping is recommended as a permanent marker which is also needed for CITES requirements when exporting birds.

2.6.2 General Handling

Birds in general are stressed by catching and handling and should only be done when absolutely necessary. Handling is less stressful if everything is ready in advance and the handler is well organised, relaxed and confident.

Pairs in breeding condition should not be handled. While integrating hand-reared birds into a group or introducing them to a prospective partner, human contact should be avoided as far as possible. Once a strong bond has been formed between the pair, this may be relaxed.

2.6.3 Catching/Restraining

Ecuadorian Amazon parrots should be netted in a dark cloth bag net in which they cannot get tangled. Gloves should not be worn as these increase the likelihood of the bird being injured. As shown in the photographs below, the bird can be restrained by holding the closed wings, back and feet with one hand, with the other around the back of the head holding the jaws. They can inflict a nasty bite, and can have an extremely strong grip, but with a little experience this can be avoided.



How to safely hold a parrot

Catching should be done with two or three people in the aviary. Once everyone is ready and in the aviary catching can start. One person drives the birds towards the catcher, who should have a clear space free from perches in which the bird should be encouraged to fly. All aviaries should have one corner free of perches and an open space. Avoid catching birds against the wire mesh if possible as this may increase the risk of injury. If catching a pair, it's always better

to bag up the first caught bird securely before trying to catch the second bird. Bagged birds can be hung from a convenient perch or ideally on a nail in the safety corridor.

When in the hand, it is always recommended to:

- Weigh the bird (by using pesola spring balance and placing the bird in a large securely closed bird bag or pillow case OR by placing in a padded wooden box on a set of digital scales, weighing them in a box on a scale with a separate display will allow 1g divisions so more accurate)
- Check and photograph the pectoral muscles and subcutaneous fat and give score (see Appendix 6 for Body Condition Score Template).
- Check and photograph plumage condition, is the bird in moult or feather-plucked?
- Check the eyes are bright.
- Check legs and feet.
- Record any overgrown or missing toe nails. Take biometric measurements if it is a planned move and you have time.
- Check and record rings - if too tight or damaged, remove and replace (ring if they don't have them).
- Check micro-chip number and record.

2.6.4 Transportation

Moving a bird short distances within the zoo is best done with the bird placed individually in securely fastened bird weighing bags or pillow cases. Alternatively a small wooden box may be suitable.

Ecuadorian Amazon parrots should not be crated with another individual, at times of stress even the most compatible of individuals can behave aggressively towards each other if confined together. Guidelines for the design of transport boxes for air travel are provided by the International Air Transport Association (IATA) and these can be found on the IATA website. These must be followed. Always ensure that the crate is sufficient for the animals' requirements.

Crates suitable for an Ecuadorian Amazon parrot should be a minimum of: length 40 cm x height 30 cm x width 30 cm. The construction must be robust enough to prevent the animal from escaping, constructed with 2 cm plywood with a meshed panel at the front. It is recommended that a piece of hessian sacking is placed over the panel, to keep the bird dark and quiet, but this can be removed to allow light to enter the crate for feeding. Access doors should be secured using screws to prevent accidental escape.

It is recommended that 2.5 cm diameter air holes are placed along the sides of the crate to allow ventilation, and a perch should be provided also. 5 cm dowel can be used secured at the correct height using screws at either end.

Food should always be included in the box; an additional bowl for water provision should also be incorporated, with easy access to provide fluids during transport. To include water straight away would mean that most of the water would be spilled before the bird actually needs it.

If transporting “in house”, or via an established animal transport haulier, medium sized Pet Carriers, with a suitable perch and bowls for food and water make excellent transport crates, however these may not be secure enough to send birds by air and it is recommended a purpose built plywood box is always used in these circumstances. A shallow covering of pine wood shavings will suffice as substrate. If possible, birds can be locked into an area where additional lighting can be left on overnight prior to transport; this means the birds have access to food and water up to the point of crating.

2.6.5 Safety

Aggression toward the keeper is generally not a problem for the Ecuadorian Amazon parrot.

2.6.6 Security

Unfortunately, security against theft is now an extremely important part of aviary design and management. Anti-theft devices, such as alarms, cameras and dogs should be used where appropriate.

2.6.7 Record Keeping

Record keeping is an extremely important part of Ecuadorian Amazon parrot husbandry. Records should be kept on all aspects of the birds including the origin and identification of the birds (usually ring numbers), the veterinary history for each bird and reproductive observations, such as dates and times that mating occurred, use of the nest-box, egg-laying, hatching and rearing.

If eggs are artificially hatched and reared, a detailed record of the procedures used is crucial. The weights and development of the chicks will be of great benefit in the future, when you may wish to repeat the exercise. Any records sent should be sent to the species coordinator as these records will also be very useful to other collections to compare with their own results.

IDENTIFICATION, HANDLING AND RECORD KEEPING RECOMMENDATIONS:

- All birds should be sexed and permanently marked with a ring and a microchip.
- Birds should only be handled when absolutely necessary.
- Pairs in breeding condition should not be handled.
- If needed, they should be netted in a dark cloth bag net in which they cannot get tangled.
- Security is an extremely important part of aviary design and management.
- Records should be kept on all aspects of the birds including the origin and identification of the birds, the veterinary history for each bird and reproductive observations.

2.7 Veterinary: Considerations for Health and Welfare

2.7.1 A Preventative Medicine Plan

Good health goes hand in hand with good husbandry and many of the components of a preventative health care plan are already taken care of in other parts of these Best Practice Guidelines. A summary of various components is given here.

Goals:

- Prevent disease entering animal collection.
- Maintain health of collection, including reproductive health.
- Prevent dissemination of disease to other institutions / release programmes.

Importance:

- Difficulty of diagnosis and treatment of overt disease.
- Often too late once show signs of overt disease.
- Difficulty in eliminating many organisms once established in the collection.
- General improvement of condition / performance of stock.
- Stock selection: Need for pre import husbandry, reproductive and medical history for individual and its group of origin.
- Quarantine: Imports + isolation of resident sick animals (facilities, carers, duration).

2.7.2 Quarantine

In terms of disease transmission birds are at most risk from conspecifics. It goes without saying that the best way to prevent the spread of infectious disease from one animal to an animal is to isolate the affected animals. However the risks posed by apparently healthy birds are often neglected. Many diseases can remain dormant for long periods only coming to the fore at times of stress (which includes reproduction seasons, hormonal changes etc.) In other diseases carrier birds clinically healthy does regularly shed pathogens without events of stress. Hence collections must quarantine all new stock entering the collection even if it appears healthy and there has been no history of infectious disease at the collection of origin. A suggested protocol is given below:

Facilities: Quarantine areas should be well separated from the main collection. They must be able to provide a physical environment suitable for the holding of these birds (see Section 2 Management in Captivity) and be secure from pest species (rodents, wild birds). They must be easily disinfected between the departure and arrival of new animals. Depending on origin of the bird, there may be certain legal requirements detailing the nature of the facilities required, for example DEFRA requires that all birds imported into the UK from non EU (and in future all non-BALAI approved collections) must be quarantined in a DEFRA approved facility. They give detailed specifications as to the structure and running of these. Quarantine facilities should always have an entering room where keeper's clothes are changed or protective clothes are put on. This divides a facility into a black and a white area. Quarantine facilities for unwell birds should be separated from quarantine facilities for new arriving birds.

Staffing: Birds in quarantine and unwell birds that are part of the collection but in isolation should be cared for by different staff to those looking after the healthy stock. Only dedicated protective clothing and footwear should be worn.

Duration: The government of the importing country may stipulate the time that birds have to be in quarantine, but a minimum quarantine period of 30 days is recommended irrespective of the source of the bird. If first examination results suggest a potential risk towards some diseases - quarantine time should be extended to 90 days. All birds should be de-wormed and subsequently test negative for parasites before release from quarantine.

2.7.3 Biosecurity

Keepers should be aware that disease agents could also be transferred to the birds with which they work on their hands, clothing, foot ware and any equipment they bring into the birds' enclosures. Where feasible it is recommended that anyone entering an animal's enclosure or handling the birds in anyway should wear clothing and use equipment that has not come in contact with any other birds.

Zoonoses are diseases transmissible to humans from other species. Diseases that can potentially cross between amazon parrots and humans include chlamydiosis (more commonly known as Psittacosis), Salmonellosis, and, in immunosuppressed individuals, Avian Tuberculosis. Protection against exposure should take a two-pronged approach. Birds are most likely to shed potentially zoonotic organisms when they are stressed hence it is good practice to routinely screen all new birds during quarantine and any bird that is unwell (see preventative medicine section for more details).

Hygiene is the mainstay for prevention of disease transmission. All animal food bowls and cleaning equipment should be kept strictly separate from those used by humans (preferably have a separate kitchen for and dedicated equipment). Keepers should wash their hands thoroughly with soap and water after cleaning out or handling the animals and should not eat, drink or smoke in animal areas. If a bird is suffering or suspected to be suffering from Chlamydiosis special precautions should be taken.

2.7.4 Disease Screening and Prophylaxis

This protocol applies to animals moving from other known collections within the EU. Additional testing may be required for animals from non EU or unknown sources. Before acquisition every effort should be made to get a full clinical history including diet sheet, de-worming regime, temperament/behaviour of the animal and relevant diseases of note diagnosed in the sending collection in the last five years. This should be made available to the curators and consulting vet for comment. This history will help determine the quarantine protocols required to protect both the receiving collection and the incoming animal.

EAZA and the Federation of Zoos require a certain amount of pre-export testing. Though this is mandatory it is rarely observed. If the pre-export testing is complete then quarantine requirements may be reduced from those set out below.

Pre-export screening:

- no cases of avian influenza within previous 30 days;
- zoos must not be subject to (or in an area that is subject to) restrictions applied to combat Newcastle disease;
- Psittacine birds must not come from a zoo at which psittacosis has been diagnosed, unless the interval between the last recorded case and the period of treatment under veterinary supervision is more than two months;
- where requested, tests for Salmonellosis and endoparasites should be carried out on a regular basis and within 30 days prior to transportation;
- the receiving zoo must be notified when yersiniosis has affected a zoo within two months before transport;
- in penguin collections there should be no clinical signs or evidence of aspergillosis or plasmodium infection within the previous two months;
- the receiving zoo should be notified if there is any clinical or pathological evidence within the last year of any of the following diseases: Pacheco's disease, PBF, Proventricular dilatation syndrome, TB, avian pox, avian diphtheria.

Pre-export birds must be tested for:

- chlamydia by choanal, conjunctival and cloacal swab (one swab), by PCR to detect shedders, and ideally also by serum for antibodies (receiving flocks should also be tested);
- circovirus and polyomavirus through blood feather tests and PCR;
- bornavirus through crop and cloacal swab, PCR and serum for Bornavirus antibodies;
- Herpesvirus (if the original flock contains different psittacine species from various continents) through a cloacal swab PCR and serum for herpesvirus antibodies;
- parasites and salmonella through faecal samples;
- screen faeces with staining for acid-fast rods.

Post-export screening:

Most zoos ensure the above tests are carried out by the sending institution prior to the importation of a new bird, however post export screening can also be carried out using the above tests and samples. The main diseases of concern are PBF, Polyoma, Proventricular Dilatation Syndrome, Chlamydia, Salmonella, *Camphilobacter*, Enteric parasites (additional disease screening may be indicated depending on the disease history at the animal's previous home). A physical examination and blood zinc and lead levels should also be taken, and samples should be stored for future reference.

2.7.5 Routine Treatments:

Routine health monitoring should include:

- regular health screening – using above outlined testing - all flocks should be free from polyomavirus, circovirus, bornavirus, chlamydia and kept as such. Chlamydia can enter through other birds, so regular check-ups and treatment if necessary is essential, particularly in outside aviaries;
- full post-mortem examinations on all dead birds and dead but fertile eggs, further diagnostic tests performed if there is any suspicion of infectious disease;
- parasite control - birds should be de-wormed before arrival, the frequency and type of parasite control required will depend on the individual collection however as a minimum, faecal egg counts should be performed for each pair of birds at least on a quarterly basis. If parasites are present a de-worming program can be initiated in consultation with the veterinarian. Faecal samples twice yearly are sufficient if there is no history of parasites. Control of intermediate hosts should be taken where appropriate. If birds are checked regularly there is no need to 'worm' as a precaution against roundworm infections. There are a number of products that may be used; it is recommended to consult a vet for advice on which one to use. The best time to de-worm is late winter or early spring, before the breeding season starts. If adult birds are infected with roundworms during the breeding season, they may pass them on to their chicks while feeding them;
- beak and claw problems – investigate and reduce predisposing factors;
- dietary records / evaluation;
- dehydration - it is important when birds are unwell and being kept at high temperatures that water is always available, as dehydration will quickly occur;
- egg bound females, that is, unable to pass an egg, will look very unwell quickly, generally sitting hunched on two feet (a healthy Amazon parrot usually sleeps with only one foot on the perch). Her feathers will be 'fluffed out' and her eyes will be slowly opened and closed. Such a bird needs veterinary attention immediately. A calcium/vitamin injection may help to prevent reoccurrence on passing the next egg. A healthy diet with plenty of vitamins and minerals, especially calcium and phosphorus is the best way to prevent egg-binding occurring.

Section 3: References

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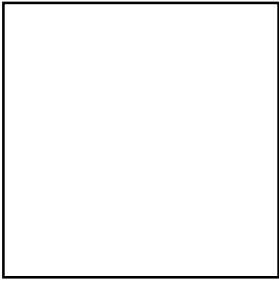
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Section 4: Appendices

Appendix 1: Example Diet Sheet (© Chester Zoo)

| Species Information | |
|--|--|
| <p>Ecuadorian Amazon Parrot <i>Amazona lilacina</i></p> <p>Feeding strategy: The Ecuadorian Amazon parrot is herbivorous. They feed on fruits of palms, <i>Cordia letea</i>, <i>Spondiax pourpurea</i>, <i>Minuartia arillate</i>, seeds of <i>Stenmadenia donnell-smithii</i>, <i>Virola</i>, <i>Casearia</i> and <i>Protium</i>, figs, legume seeds, leaf buds and some cultivated fruit including mangoes, citrus and even coffee beans (del Hoyo et al., 1997; Juniper and Parr, 1998).</p> <p>Est. weight: 0.3 – 0.5 kg Est. energy: 191 – 277 kJ</p> |  |
| DIET DESCRIPTION (per animal) | |
| Feed ingredient | Qty (g) |
| Prestige Amazona seed mix | 6g |
| J&J Mixed pulses (soaked) | 42g |
| Nutribird P15 pellet – Versele Laga | 30g |
| Parrot fruit mix | 25g |
| Parrot vegetable mix | 25g |
| Changes/Additions for breeding season | |
| Nutribird P19 pellet replaces P15 pellet | 30g |
| Haith's Rearing and conditioning food | 10g |
| Prestige Parrot sprouting seed mix | 20g |
| FOOD PREPARATIONS | Quantity as fed to one Ecuadorian Amazon |
| <ul style="list-style-type: none"> ▪ Parrot fruit mix includes apple, pear, papaya, grape, orange and banana diced to ¼ inch cubes. ▪ Parrot vegetable mix includes spring greens, broccoli, celery and rocket leaf diced and shredded. ▪ In both instances, fruit and vegetable composition will vary slightly on a seasonal basis. ▪ J&J mixed pulses are soaked for 24 hours, rinsed, refrigerated for a 24 hours, rinsed, then stored in the refrigerator for 24 hours. |  |

| | |
|---|--|
| <ul style="list-style-type: none"> ▪ Prestige parrot sprouting seed mix is prepared according to suppliers instructions. | |
| <p>FOOD PRESENTATION & COMMENTS</p> | <p>ENRICHMENT FEEDING</p> |
| <ul style="list-style-type: none"> ▪ Fresh water and dried cuttlefish should always be present in an enclosure. ▪ Food is presented once in the morning in a metal dish on a holder situated off the enclosure floor (to prevent consumption and contamination from pests). ▪ Nutribird pellets are fed according to breeding status. P15 is used during the non-breeding months (Oct-Jan) & P19 during the breeding months (Feb-Sep). ▪ When rearing young a 2nd feed is offered around late afternoon. | <ul style="list-style-type: none"> ▪ Please refer to Parrots and Penguins Team Enrichment sheet |
| <p>DIET COMPOSITION</p> | <p>EVALUATION</p> |
| <ul style="list-style-type: none"> ▪ Total as fed = 128g (54% DM) ▪ Key nutrient concentrations in non-breeding diet (as %DM): | <p>No nutritional guidelines available for the species</p> <p>No diet-related health problems diet at Chester Zoo</p> <p>No diet-related reproductive problems at Chester Zoo</p> <p>Diet approved & cleared for distribution</p> |
| <p>REFERENCES & CREDITS</p> | <p>PRODUCT INFORMATION</p> |
| <ul style="list-style-type: none"> ▪ del Hoyo, J., Elliot, A., Sargatal, J. (eds). 1997 Edition. Handbook of the birds of the World, Vol. 4. Barcelona: Lynx Edicions ▪ Juniper, T., M. Parr, (1998): Parrots: A Guide to Parrots of the World. New Haven and London: Yale University Press. ▪ Species photo: http://members.lycos.nl/vogelnest/hpbimg/6.jpg ▪ Diet photo: ©Chester Zoo ▪ Copyright (2011) for Species Diet Sheet by Chester Zoo, UK. All rights reserved. No part of this publication may be reproduced in hard copy, machine-readable or other forms without advance written permission from the Chester Zoo. | <ul style="list-style-type: none"> ▪ www.johnstonandjeff.co.uk ▪ www.versele-laga.com ▪ www.haiths.com |

Appendix 2: Chick Development Photographs (© Lyon Zoo)



2015.06.19: 2 eggs hatched



2015.07.01: 11 days for the oldest



2015.07.08: 18 days for the oldest



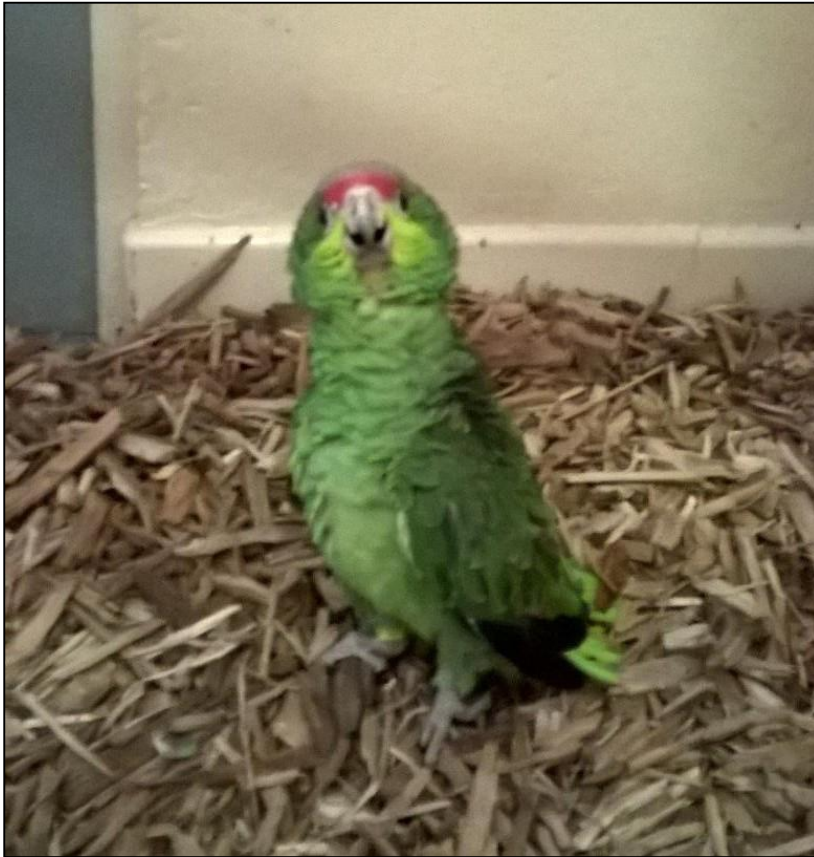
2015.07.14: 24 days for the oldest



2015.07.21: 31 days for the oldest



2015.08.12: 54 days for the oldest (moved in a box for the cleaning of the nest)



2015.08.15: First one out of the nest, 58 days.

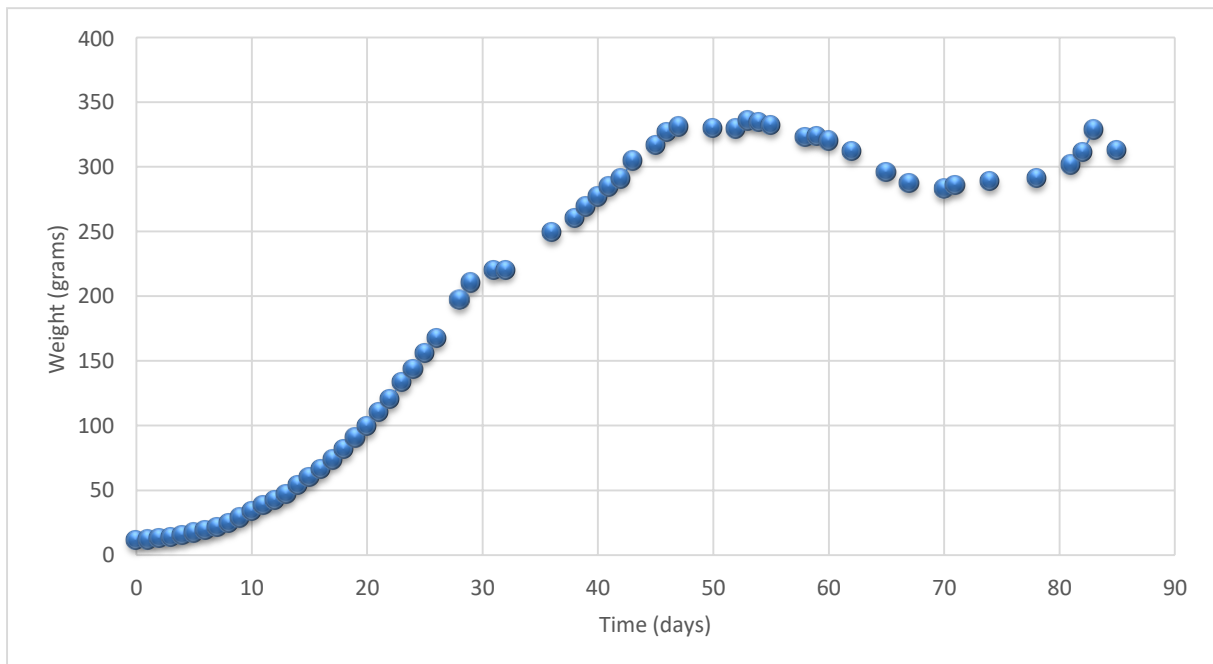
Appendix 3: Hand Rearing Weights (Chester Zoo)

| <i>Days old</i> | <i>Weight (grams)</i> | <i>Weight gain (grams)</i> | <i>Comments</i> |
|-----------------|-----------------------|----------------------------|----------------------------------|
| 0 | 11.9 | | Temp - 36°C. 2 hour feeds |
| 1 | 12.1 | 0.2 | |
| 2 | 13 | 0.9 | |
| 3 | 14.1 | 1.1 | |
| 4 | 15.4 | 1.3 | Temp - 34°C |
| 5 | 17.6 | 2.2 | |
| 6 | 19.5 | 1.9 | |
| 7 | 22 | 2.5 | |
| 8 | 24.6 | 2.6 | |
| 9 | 29.2 | 4.6 | Eyes starting to open |
| 10 | 34.1 | 4.9 | |
| 11 | 39 | 4.9 | |
| 12 | 42.6 | 3.6 | Put onto 3 hour feeds |
| 13 | 47.2 | 4.6 | |
| 14 | 54.1 | 6.9 | |
| 15 | 60.3 | 6.2 | |
| 16 | 66.8 | 6.5 | Temp - 28°C |
| 17 | 73.8 | 7 | Eyes about half open |

| | | | |
|-----------|--------|------------|--|
| 18 | 81.9 | 8.1 | |
| 19 | 91 | 9.1 | Temp - 26°C |
| 20 | 99.7 | 8.6 | Feathers on wings starting to come through skin |
| 21 | 110.5 | 10.8 | Temp - 24°C. All feathers coming through |
| 22 | 121 | 10.5 | |
| 23 | 133.5 | 12.5 | Eyes fully open |
| 24 | 143.6 | 10.1 | Temp - 22°C. Put onto 3.5 hour feeds |
| 25 | 156.6 | 13 | |
| 26 | 168 | 11.4 | |
| 27 | | | Temp - 20°C |
| 28 | 197.3 | 29.3 | Green feather tips coming through |
| 29 | 210.7 | 13.4 | |
| 30 | | | |
| 31 | 220.4 | 9.7 | Lots of feathers pushing through |
| 32 | 220.6 | 0.2 | Put onto 4 hour feeds |
| 33 | | | |
| 34 | | | |
| 35 | | | |
| 36 | 249.4 | 28.8 | |
| 37 | | | |
| 38 | 260.6 | 11.2 | |
| 39 | 269.2 | 9.4 | |
| 40 | 277.2 | 8 | |
| 41 | 284.9 | 7.7 | |
| 42 | 291 | 6.1 | |
| 43 | 305 | 14 | |
| 44 | | | |
| 45 | 316.9 | 11.9 | Last feed now at 9pm |
| 46 | 327.2 | 10.3 | |
| 47 | 331.1 | 3.9 | Starting to pick at paper towel. Given dish of chopped fruit/soaked millet. Feeds reduced to 4.5 hours |
| 48 | | | |
| 49 | | | Perch given at floor level |
| 50 | 330 | 1.1g loss | Monitor weight and return to 4 hour feeds if needed. |
| 51 | | | |
| 52 | 329.7g | 0.3 loss | Starting to play with fruit and millet quite a lot. Leave feeds as they are for now. Last feed now 8pm |
| 53 | 335.9g | 6.2g | Starting to turn away from hand rearing food before crop is full. |
| 54 | 334.9 | 1g loss | Moved into large cardboard box with perch slightly off ground. |
| 55 | 332.7 | 2.2g loss | Last feed now at 7.30pm |
| 56 | | | |
| 57 | | | |
| 58 | 322.9g | 9.8g loss | Eating fruit and millet really well but only picking at pellets. Very little interest in rearing food now. |
| 59 | 323.7g | 0.8g | Last feed now 5pm |
| 60 | 320.5g | 3.2g loss | |
| 61 | | | |
| 62 | 312.2g | 8.3g loss | Midday feed to be cut out, now only receiving 8am and 5pm feeds. |
| 63 | | | |
| 64 | | | |
| 65 | 296.1g | 16.1g loss | |
| 66 | | | |
| 67 | 287.6g | 8.5g loss | |
| 68 | | | Moved into enclosure during the day, returned to cage at night. |
| 69 | | | Still receiving 8am and 5pm feed. Has learnt to fly. |

| | | | |
|-----------|--------|----------|--|
| 70 | 282.6g | 5g loss | |
| 71 | 285.8g | 3.2g | |
| 72 | | | |
| 73 | | | |
| 74 | 289.2g | 6.6g | |
| 75 | | | |
| 76 | | | |
| 77 | | | |
| 78 | 291.2g | 2g | Now being left in enclosure overnight as happily eating all food in dish. Still on 8am and 5pm feeds. |
| 79 | | | |
| 80 | | | |
| 81 | 302g | 8.8g | |
| 82 | 311.3g | 9.3g | Now only on 5pm feed. Not given any hand rearing food today due to weight increase. Check weight tomorrow. |
| 83 | 329g | 17.7g | |
| 84 | | | |
| 85 | 313g | 16g loss | Continue to monitor weight - if drops much more will restart hand rearing food. Given access to outside flight. |

Appendix 4: Chick Growth Graph (Chester Zoo)



Appendix 5: Hand Rearing Weights (Loro Parque Zoo)

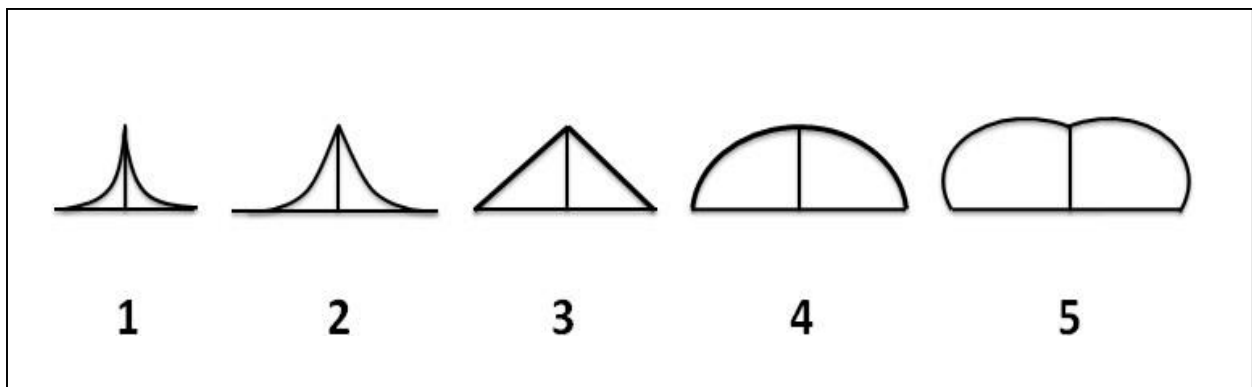
| day | #146 (g) | #147 (g) | #150 (g) |
|-----|----------|----------|----------|
| 1 | 13 | 13,8 | 10,8 |
| 2 | 15,2 | 16,7 | 12,6 |
| 3 | 18,7 | 19,8 | 14,1 |
| 4 | 23,2 | 25,4 | 17,9 |
| 5 | 28,3 | 33,1 | 21,6 |
| 6 | 34,4 | 39,9 | 23,8 |
| 7 | 41,3 | 48,8 | 28,5 |
| 8 | 52,8 | 54,6 | 35,9 |
| 9 | 58,1 | 61 | 43,2 |
| 10 | 67 | 69 | 51 |
| 11 | 76 | 80 | 52 |
| 12 | 86 | 86 | 74 |
| 13 | 93 | 103 | 86 |
| 14 | 107 | 111 | 101 |
| 15 | 115 | 117 | 115 |
| 16 | 128 | 133 | 133 |
| 17 | 146 | 146 | 146 |
| 18 | 164 | 162 | 171 |
| 19 | 179 | 178 | 180 |
| 20 | 199 | 190 | 193 |
| 21 | 216 | 209 | 212 |
| 22 | 229 | 223 | 231 |
| 23 | 254 | 252 | 251 |
| 24 | 264 | 259 | 277 |
| 25 | 282 | 273 | 292 |
| 26 | 287 | 288 | 303 |
| 27 | 302 | 296 | 319 |
| 28 | 313 | 306 | 331 |
| 29 | 318 | 308 | 338 |
| 30 | 333 | 319 | 362 |
| 31 | 342 | 330 | 369 |
| 32 | 351 | 344 | 385 |
| 33 | 370 | 359 | 375 |
| 34 | 380 | 347 | 381 |
| 35 | 386 | 353 | 394 |
| 36 | 387 | 370 | 393 |
| 37 | 395 | 358 | 379 |
| 38 | 400 | 358 | 377 |
| 39 | 408 | 356 | 370 |

| | | | |
|----|-----|-----|-----|
| 40 | 380 | 352 | 366 |
| 41 | 376 | 349 | 360 |
| 42 | 365 | 346 | 365 |
| 43 | 368 | 343 | 358 |
| 44 | 363 | 337 | 353 |
| 45 | 359 | 332 | 357 |
| 46 | 363 | 330 | 351 |
| 47 | 358 | 330 | 344 |
| 48 | 363 | 328 | |
| 49 | 360 | | 334 |
| 50 | 358 | 318 | 334 |
| 51 | | 310 | 330 |
| 52 | 344 | 310 | 350 |
| 53 | 342 | 315 | 347 |
| 54 | 342 | 306 | 333 |
| 55 | 347 | 302 | 347 |
| 56 | 341 | 308 | 338 |
| 57 | 341 | 296 | 333 |
| 58 | 346 | 305 | 325 |
| 59 | 336 | 299 | 319 |
| 60 | 327 | 285 | 313 |
| 61 | 321 | 285 | 306 |
| 62 | 314 | 275 | 304 |
| 63 | 309 | 273 | 304 |
| 64 | 309 | 271 | 297 |
| 65 | 314 | 266 | 297 |
| 66 | 311 | 262 | 296 |
| 67 | 306 | 262 | 300 |
| 68 | 309 | 263 | |
| 69 | 303 | | 301 |
| 70 | 306 | 259 | 302 |
| 71 | | 258 | |
| 72 | 300 | | 292 |
| 73 | 310 | 250 | 295 |
| 74 | | 247 | 295 |
| 75 | 307 | 244 | 299 |
| 76 | 316 | 241 | 299 |
| 77 | 319 | 250 | 303 |
| 78 | 316 | 255 | |
| 79 | 312 | | |
| 80 | 321 | | |

Appendix 6: Body Condition Score Guidelines

Regular and documented body condition scoring allows us to pick up on any changes or patterns. Body condition will change throughout the breeding season, but generally a score of 4 on the pectoral muscle and a 0 or 1 fat score is seen as healthy.

Pectoral muscle score



| Score Class | Prominence of sternum | Pectoral muscle shape |
|-------------|------------------------------------|---|
| 1 | Sternum sharp | Very thin. Very little muscle. Indicative of a sick bird |
| 2 | Sternum sharp. Easy to distinguish | Muscle depressed, concave in shape |
| 3 | Sternum easy to distinguish | Triangular in shape. Muscle neither depressed nor rounded |
| 4 | Sternum difficult to distinguish | Muscle slightly rounded, level where it joins sternum |
| 5 | Sternum difficult to distinguish | Muscle well rounded and raised higher |

Subcutaneous fat score

Small amounts of subcutaneous fat visible under the skin may be considered normal in most species.

Larger amounts of subcutaneous fat may be seen in the V shaped cavity (inter-clavicular) between the clavical (wishbone) and may also be seen in the ventral cavity directly below the sternum.

The amount of subcutaneous body fat should be recorded when birds are handled and recorded.

Bird ringers and ornithologists use the amount of fat present in the inter-clavicular area to gauge the condition of a bird and use the following five-step 0-4 scale.

The score of 4 – Obese is unlikely to be seen in a wild bird and would normally be associated with captive individuals.

| Score Class | |
|--------------------|---|
| 0 | No fat visible |
| 1 | Some fat visible in inter-clavicular area |
| 2 | Inter-clavicular area nearly filled with fat |
| 3 | Inter-clavicular area completely filled with a bulging pad of fat and fat deposits visible elsewhere. |
| 4 | Obese |