Captive Breeding and Hand Rearing the Green-winged Macaw at Jurong Birdpark, Singapore

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The Green-winged Macaw *(Ara chloroptera)* is, next to the Hyacinth Macaw, the largest parrot. In comparison to the latter, it is about 10 cm (4 inches) smaller in body size, but its powerful build, massive head and large, powerful beak leave a lasting impression. Although the Green-winged Macaw should be the aristocrat of the macaws, it has never really succeeded. In contrast to the Scarlet, which is often confused with the Green-winged, the latter has a facial patch with rows of tiny red feathers. Its red feathers are also more crimson, and, of course, there is no yellow on the wings, simply blue and green. This magnificent bird unfortunately takes a back seat to the Scarlet and the Blue and Gold Macaws in its popularity as a pet.

Its habitat is in close proximity with the Scarlet, being a bird of virgin topped lowland forests and edges, mainly occupying bio-type up to an altitude of 450 meters.

In the wild, the breeding season is from November to December, in the south, and from February to March in the north. The general age of the breeding pairs is never less than six or seven years. There are even cases of birds breeding at 12 to 15 years of age. Hollow tree trunks and holes in damaged palms very high above the ground serve as nesting places. As many as three eggs are laid in each clutch, each egg measuring about 50 x 30 mm (2 inches x 1.25 inches) in size. Incubation by the female takes about 28 days. Rearing of the young takes some 90 to 100 days. After leaving the nest, the young chicks remain with the parents for a long time.

Breeding History and Conditions

The park has a wide collection of macaws, but of these only the Green-winged and the Scarlet have been bred with success. Before mid-1990, some of the macaws in the park were housed in a display aviary measuring 48 x 23 x 12 feet, with a glass panel for better viewing. Since then, the breeding pairs have been transferred to special breeding aviaries.

The display aviary was home to about 18 macaws. Some of the previous breeding and the one discussed took place in this aviary. Perches from a rambutan tree *(Nephelium)* were set up and, to satisfy the macaws's desire for gnawing, additional acacia branches were provided. Nest boxes of various sizes and shapes were also provided. These included tree trunks, vertical and horizontal boxes and even cylindrical concrete pipes. The nest material provided for the nest boxes was sawdust and for the pipes it was saw-dust with mud.

Jurong Birdpark's first ever breeding of the Green-wings was back in September 1985. This was about seven years after acquiring the birds. Exact dates were not recorded. As for the following years, there was no breeding.

In November 1987, 2 eggs were laid and hatched successfully. Unfortunately, in February 1988, the young were eaten by a snake which had entered the aviary through a damaged drainage pipe. The snake was caught and the pipe repaired. After this most unfortunate incident, the pair did not re-nest and stopped breeding for that year. However, in February 1989, the

pair nested again. Three eggs were laid but there was no record of the hatching. The eggs were infertile.

In April 1990, the only pair that had nested went into breeding again. As there was no direct visual observation on the actual egg laying, we had to estimate the date of laying from the date the chicks hatched. The pair had chosen the pipe to nest in and this was no surprise as they had always used the pipe whenever they nested. The pipe measured 40'' high and 15'' in diameter with an entrance hole of 6''. Incubation was solely by the female although the male was seen feeding the female during this period. The macaws were very aggressive and protective. The eggs hatched on the 18th, 19th and 20th of May.

The pair was allowed to raise the young for the first two weeks and when the youngest chick was 9 days of age, all three were pulled out to be hand-raised at the Park's Breeding and Research Centre's (BRC) nursery. The reasons for doing so were because we did not want to lose the nestlings, the aviary was to be renovated and suitable macaws of breeding age were to be housed in off-exhibit breeding aviaries for further breeding.

Adult Diet and Hand-rearing Diet

The adult Green-winged Macaws are fed in the morning on a diet of cut up fruits such as apple, banana, guava, papaya and vegetables such as lettuce, carrot and corn. In the afternoon, commercial parrot mixture plus Science Diet[1] Canine Maintenance dry pellets are given. Supplements such as Nekton[2] E to stimulate breeding; Nekton MSA, a calcium supplement and Nekton K for rearing of young are given as required.

The hand-rearing diet consisted of 3 parts Science Diet ground dog pellets and 1 part Cerelac[3] with water added to give the required consistency. The amount fed was 10% of the chick's body weight. A bent teaspoon was used for the feeding. After each feeding, the chick's beak and oral cavity were be cleaned with dampened cotton buds.

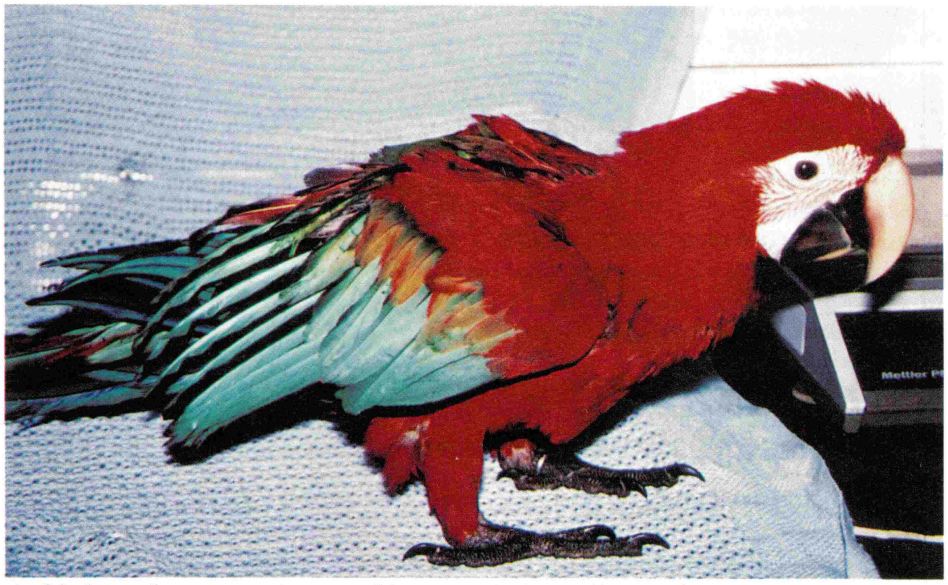
A four-hour feeding interval was established initially. On their 12th day at the nursery, the diet was changed to one of purely soaked ground dog food. The young birds consumed about 90 ml of food in two feedings each day.

When the youngest was about 60 days old, all three were transferred to

Green-winged Macaw (Ara chloroptera) hand-raised at the Singapore Jurong Birdpark, at 13 days old. This is one of a clutch of three that were naturally incubated and hatched in the nest.

Photos by Khaja Nazimuddeen

The Green-winged Macaw at two months, with younger siblings. They were then just transferred to a cage with a low perch during the day and offered soft fruits.



At 90 days, the macaw is now able to crack dog pellets and peanuts.

a metal cage. The birds were then offered the adult diet but twice a day hand-feeding continued.

At day 84, the diet was supplemented with Nekton B-complex to prevent nervous debility and to support metabolism in cases of vitamin B deficiency illnesses to which they are prone during weaning.

Hand-rearing Techniques

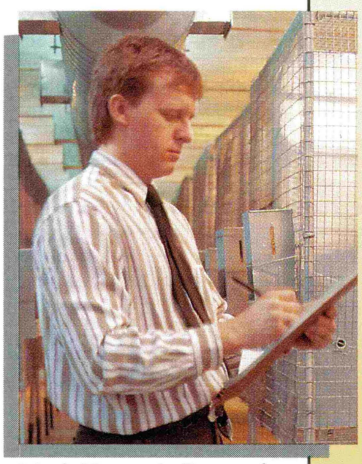
Our chicks were pulled out on May 28, 1990 at days 13, 11 and the youngest at day 9. They were placed in a plastic container lined with shredded newspaper. This was in turn placed in an Infant Isolette[4] Incubator maintained at a temperature of 28 degrees C. After being in the incubator for two weeks, the chicks were transferred to brooders. The two youngest were placed in a container measuring 25 sq. cm in size. As the oldest chick was very much larger, we had to place him in another container. In the brooder, temperature was maintained at 26 to 27 degrees C with the assistance of two 60-watt light bulbs and a thermostat. Temperature was read with a digital thermometer[5]. To regulate humidity, two bowls of water were placed beside the chicks' containers and a wet towel on top of the brooder. All chicks were ringed (banded) with closed leg-bands at day 13 to signify captive breeding.

Weight Fluctuation and Behavior Study

Hand-rearing young macaws has been a very educational experience. We believe that data collection such as daily weight records, photo takings and personal observations made possible by captive breeding and in particular hand-rearing, allow an aviculturist a unique chance to contribute scientific data which would otherwise be difficult to obtain.

As weight records provide invaluable information on the health and development of the young, we take the weight of our chicks daily, before their first feed.

In comparing the weight graph of each macaw young, we were able to make several interesting observations which show a close relationship between weight changes and bird behavior. The attached graph shows the weight growth of our three macaws, F001, F002 and F003, from their entry into the nursery up to the day they were weaned. F001, the oldest, and F002, the second macaw, had more or less similar weight gains but



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HARI

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their behavior was very different. Although F002 reached peak weight earlier at day 77 weighing 1140 g, it took a longer time to wean. The graph also shows that F002 lost more weight than F001 before weaning.

F001 was much more independent than the younger two. It was observed to be eating from the food provided at day 66. In contrast, F002 always wanted to be hand-fed. The graph also shows that when feeding was cut for F002 to once a day, it lost a substantial amount of weight. Hence, we had to resume feeding to twice a day.

Days 95 to 130 showed the most weight fluctuation. This was the time the chicks began preparing for their first flight and entering the weaning period. They all lost some weight before they could actually fly at about day 100 to 115.

The age difference between the three chicks was only two days each. Yet, when the two older chicks each weighed about 500 g at around day 30, F003 was 150 g less. This reinforces the point that chicks (such as the two older chicks) that have the advantage of being parent-raised for the first 10 days or more gain the extra weight that hand-rearing formula cannot match. No matter how close we come to formulating diets to substitute parent feed, we can never replace the beneficial enzymes that the chicks get through the parent, which serve as a nourishment during that critical stage of the chick's first few days.

All three chicks weaned after losing about 16 to 17% of their peak weight. We, at the BRC, allowed our birds to lose 10-15% of their peak weight during weaning. When any of them would lose more than 15%, we would increase the feeding amounts once again. Sometimes however, the larger parrots need to lose more than 15% of their peak weight before they are able to fly, so exceptions have to be made. Weight loss cannot always be taken as a sign of the bird being unwell, because we consider other factors like the age of the bird and its stage of growth (eg. first flight and weaning).

Medications

Throughout their stay in the nursery, all 3 chicks required very little medicaton. As macaws have very strong pumping actions during feeding, they sometimes have food entering the trachea. This is aspirated immediately, with Neosporin[6] administered to prevent infection. At day 36, F002 developed a white spot near its tongue and it was diagnosed as *Candida albicans.* Mycostatin[7] was applied for two weeks and the spot cleared completely.

Development of Green-Winged Macaw F001

Age (days)	Stages of Development
1	Parent-incubated egg hatches; chick is blind with very sparse white down.
2-8	Chick left with parents.
9-13	Chick pulled out; eyes half opened; pins emerging from wing sections; very restless; called out loudly during feeding; ringed at day 13 with closed leg band. No. JBPF001. (Plate 1: day 13).
17	Commissure of beak beginning to get dark; eyes fully opened; voice louder; feed 3 times a day.
19-20	Pin feathers erupting on body and wings; red pin feathers emerging from stubs on head.
21-24	Red pins on tail and lore appearing at day 24; feeding cut down to twice a day; second down of grey feathers more prominently visible.
27-31	Transferred to brooder from isolette incubator.
32-38	Red and green feathers starting to emerge from shaft on wings; red feathers out of shaft at cheek area below eyes; flaps both wings very vigorously during feeding.
39	Chick more aware of movements around it; calls out loudly upon sight of people entering the room.
40-55	Feather growth on all parts of the body developing quite continuously except area below crop, which was the last area to have stubs emerging from. (Plate: day 51).
60-64	Transferred to metal cage measuring 36 x 24 x 24 inches with low perch during the day; back into brooder at night; diced fruits introduced with ground Science Diet sprinkled over it; also hand-fed with mashed papaya and banana; at day 64, chick perching steadily. (Plate 3: 2 months).
65	F001 observed eating soaked dog pellets.
66	Chick seen eating fruits; on examining crop, some food found; weight 860 g.
67	Red feathers cover area below crop; chick almost fully feathered except for the legs which are still bare.
70-72	Chick very active, characteristics of which are climbing around cage using beak and massive legs; left overnight in the cage with a heat lamp on during the night.
75	Feather growth completed by the emergence of feathers on the legs; except for the tail which has yet to reach full length, it is complete in appearance.
79-80	Chick at peak weight of 1159 g at day 80; fed twice a day with 200 ml of the hand-rearing formula.
81 +	Weight fluctuating; weaning period; chick observed to be biting perch and preening itself; also made attempt to hold long beans with its toes and to consequently nibble on it.
90	Able to crack dog pellets and even peanuts. (Plate 4).
95	F001 makes first flight of 15 m across nursery room.
100	Syringe feeding introduced to prevent food from entering the trachea and also to speed up the feeding process; behavior of bird changes suddenly; becomes very violent; refuses to eat and has to be forced fed.
105-112	Amount of food fed in the morning reduced by half to induce the bird to eat.
115	Able to say "hello" and mimic other sounds.
120	Bird brought outdoors to be given its first bath; seemingly revelled in the sprays of water and eventually concluded the event by preening itself in the sun.
125	Feeding cut down to once a day; now able to crack and eat the sunflower seeds. From day 125 to weaning day, weight fluctuations limited to a maximum of 5 g.
126-144	From day 126 to 144, F001 fed very little and from day 144 to 148, no feeding done; the weight quite stable; weaned at day 144 at 974 g.

Acknowledgements

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Products Mentioned in the Text

1. Science Diet Canine Maintenance: Adult dog food, manufactured by Hill's Pet Products, Division Colgate-Palmolive Company.
2. Nekton products: manufactured by Nekton-Products, West Germany.
3. Cerelac Wheat: Milk Cerelac for infant and children, manufactured by Nestle, West Malaysia.
4. Isolette Incubator: Nacro Scientific Air Shields Division, Hatboro, Pennsylvania 19040 U.S.A.
5. Diehl Thermotron Plus: Digital thermometer, manufactured by Diehl Pte. Ltd., West Germany.
6. Neosporin: Eye drops, maufactured by the Wellcome Foundation of London, England.
7. Mycostatin oral suspension: Liquid Nystatin, manufactured by E.R. Squibb and Sons Ltd., Hounslow, Middlesex, England.

References

1. Handbook of Macaws: Dr. A.E. Decoteau, 1982, by T.F.H. Publications.
2. The World of Macaws: Dieter Hoppe, 1983, by T.F.H. Publications.
3. The Handbood on Aviculture: Frank Woolham, 1987, Blandford Press.
4. Parrots of the World: Joseph M. Forshaw, 1977, by T.F.H. Publications. ●