

Hand-rearing abandoned Greater Flamingoes *Phoenicopterus ruber* L. in Etosha National Park, South West Africa.

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ABSTRACT

Five out of seven *P. ruber* were handed-reared to the flying stage on artificial diet. Mortality was due to secondary pulmonary infection, probably arising from food particles accidentally entering the respiratory tract. Two of the survivors were hatched in captivity, the remainder being up to four days old when captured. The difference in growth between chicks reared only on artificial diet and those which initially received food from the parents was the most noticeable aspect of the experiment. Both species of African flamingo have now been successfully hand-reared in the Etosha National Park.

1 INTRODUCTION

Bock and Haas (1974) claim the first known completely successful hand-rearing of a flamingo during 1972 in the Wuppertal Zoo, although Lesser Flamingo *Phoeniconaias minor* were successfully hand-reared to the flying stage in Etosha National Park during 1971 (Berry 1974). During July 1974 the opportunity arose to repeat the experiment on Greater Flamingo *Phoenicopterus ruber* chicks. Late flamingo hatchlings are usually abandoned by the parents and we accordingly removed five recently hatched (immobile) *P. ruber* from a typically drying and deserted nesting site on the Etosha Pan. From experience gained during the hand-rearing of *P. minor* it was decided not to attempt to rear more than this number under intensive care.

Age of chicks

Two chicks were newly-hatched (day-old), one was estimated to be two days old and two were estimated to be four days old. At least three of the chicks had therefore been fed by their parents, a fact supported by their significantly greater body mass. In addition, two pipped eggs were also taken to time the duration of hatching. As both these chicks unexpectedly survived, they were added to the group of five. Their age was therefore precisely known.

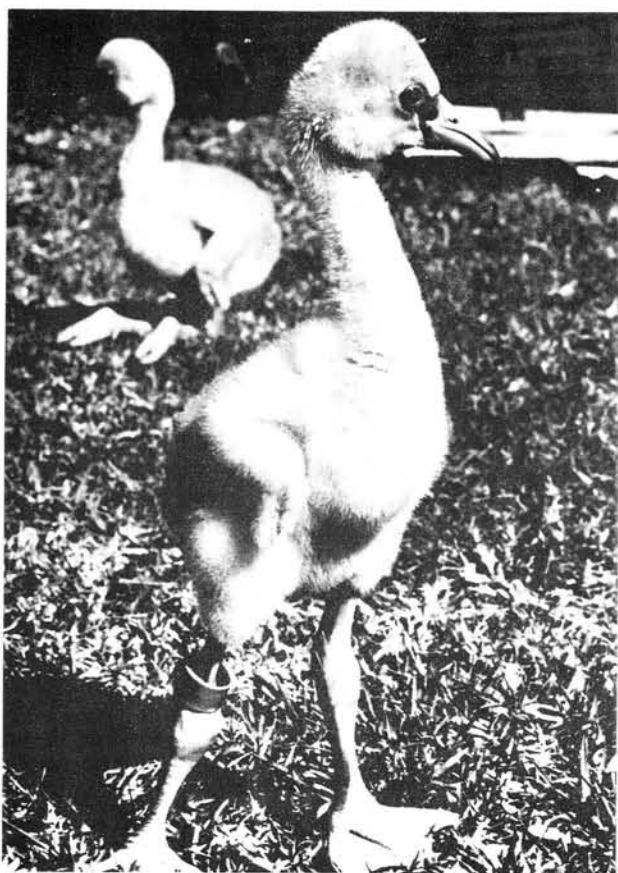
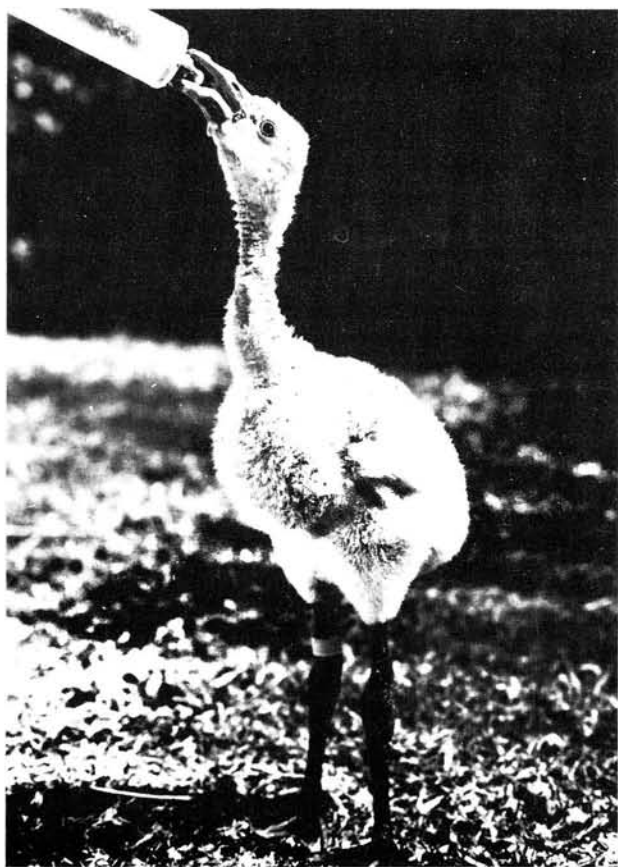
2 METHOD

Food: Due to field conditions the chicks were not fed for the first 24 hours of captivity, although water was administered to them sparingly through an eye dropper. "Pro Nutro"* (analysis given in Table 1) was mixed with water at body temperature to a consistency of thin porridge. Two egg yolks of domestic fowl were beaten in and given through a hand syringe (Plate 2) as described by Berry (1974) five times daily at three-hourly intervals. Egg albumen was included in the food after eight days.

* manufactured by Hind. Bros. and Co. Ltd., Republic of South Africa.

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Plate 1: Captive *P. ruber* at one week of age.Plate 2: Four-week old *P. ruber* being fed through a syringe.Table 1. Approximate analysis of "Pro Nutro" (per 100 g) which was used in diluted form for feeding *P. ruber* chicks.

Protein	22	g
Fat	11,5	g
Carbohydrate	56,2	g
Fibre	1,4	g
Minerals	4,5	g
Calcium	0,46	g
Phosphorus	0,48	g
Iron	5,5	mg
Iodine	45	mcg
Copper	2,5	mg
Zinc	4	mg
Vitamin A	3500	i.u.
Vitamin E	5	i.u.
Thiamine (Vitamin B ₁)	1,0	mg
Riboflavin (Vitamin B ₂)	1,5	mg
Pyridoxine (Vitamin B ₆)	1,0	mg
Pantothenic Acid	1,5	mg
Niacin	14,0	mg
Vitamin B ₁₂	0,5	mcg
Vitamin C	53,0	mg
Calories	413	Kcal

Feeding took place between 06h00 and 22h00, leaving a period of eight hours at night during which the chicks were not fed. After 12 days the feeding frequency was reduced to four times daily and the egg was omitted after 21 days. At 27 days three feeds a day were given. This was maintained until they could feed independently. Food and water mixture was then made available every morning and evening in a shallow dish measuring 0,35 m² and 5 cm deep. Fermentation of the mixture was avoided by flushing all residues in the dish away, outside the cage, before each feed. Fowl egg shells and clay from the Etosha Pan were made available throughout the captive period and were readily eaten in the initial stages.

Shelter: All seven chicks were taken to Okaukuejo, the main rest camp, one day after removal from the Pan. There they were maintained together indoors in a cardboard container which was warmed during the winter nights over a thermostatically controlled water bath set to give a temperature of 35°C inside the box. The container was lined with newspaper, changed daily.

During the warmer part of the day (10h00–17h00) they were allowed to exercise in a holding pen on the lawn and shallow dishes were put out for bathing. Initially they were bathed daily in warm water to remove food and excreta which soiled their down. When they began bathing themselves at three weeks of age, the supplementary warming at night was dispensed with. At this age they were given free outdoor range daily for increased exercise, although constant supervision was provided.

When the chicks were eight weeks old and feathering, they were kept outdoors until their release. Two enclosures were provided: one of 20 m² with a shallow pond of 2,5 m² for day use (Plate 3) and one of 10 m² for overnighting. Both were totally enclosed with chicken wire mesh and fish net. The cage used at night was imbedded in the ground with bricks and a 1-metre wide strip of double hessian was fastened around the sides to screen off predators.



Plate 3: *P. ruber* in an outdoor enclosure at age five months.

3 DISCUSSION AND CONCLUSIONS

Mortality: Two chicks, both of which were a day old when taken from the nest, died in captivity after seven and nine weeks respectively. Although always reluctant to feed, their gain in body mass was proportionate to the others until a week before death. One of them was killed in a weakened state by a slender mongoose, *Herpestes sanguineus*. Post mortems indicated that their weakened condition was due to secondary pulmonary infection (Ebedes pers. comm.), probably resulting from involuntary inhalation of food particles while being force-fed.

Amount of food eaten: The captive chick's initial intake was 10–35 ml of the food-water mixture per day. This increased gradually to 400–600 ml daily, after which they were able to feed independently. During the first seven weeks when food was given exclusively by syringe, a total of 14 kg was eaten. From seven to 27 weeks of age 180 kg of food was provided. When all five remaining chicks were independent feeders they ate on average a total of 1 250 g dry mass of food each day. Prior to release their combined body mass was 13 080 g, indicating a daily food intake of 9.6% of their body mass. This can be considered a minimum requirement as they expended energy only for maintenance under captive conditions. Barreda

(1959) gives a minimum daily food intake of 10% of body mass required by the piscivorous Guanay *Phalacrocorax bougainvillei* for sustenance in captivity.

Gain in body mass: (Figure 1) The body mass of the chicks was always measured before feeding while they were dependant on a syringe. Predictably their body mass fluctuated during the latter period of captivity as they were then feeding independently. The day preceding their release, at an age of 6½ months, their body mass was (g) 2 040, 2 200, 2 400, 3 200 and 3 240, a range which indicates sexual differences. This is, however, misleading and another factor, which relates to the age at which they were fed an artificial diet, may have been involved. The two heaviest birds were also the oldest when captured (four days) and had already benefitted from natural food. The chick whose body mass was 2 400 g had less parental feeding (two days), while the two chicks with the lowest body mass were hatched in captivity. They therefore never received natural food. The difference of 37% in body mass between the largest and smallest chick cannot therefore be explained on the grounds of possible sexual difference alone and was probably strongly influenced by the presence and absence of parental feeding respectively. Plate 4 shows the difference in size between the largest and two smallest chicks a day before their release (age 28 weeks).

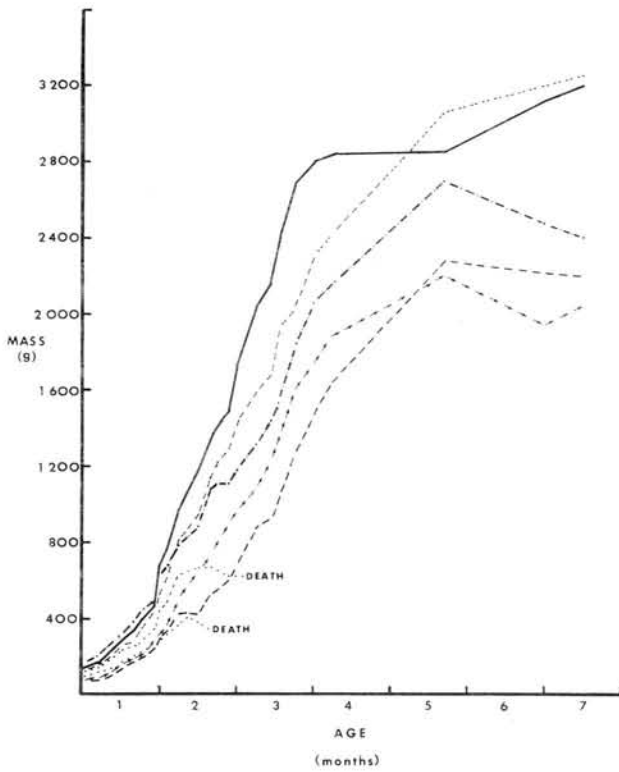


Figure 1. Body mass of 7 captive *P. ruber*.



Plate 4. Size difference between the largest and smallest hand-reared *P. ruber* at 28 weeks of age.

Development: Growth rates of wing, tarsus and culmen were measured according to standard procedures and are given in Figures 2, 3 and 4. A comparison of these vital external measurements of the full grown captives and wild *P. ruber* is given in Table 2. Wing and culmen measurements are comparable, but remarkable differences occur in the tarsal length. One captive flamingo had a tarsal length of 330 mm which is 20–27% greater than the range of 240–265 mm given for 12 wild *P. ruber* by McLachlan and Liversidge (1970). Tar-

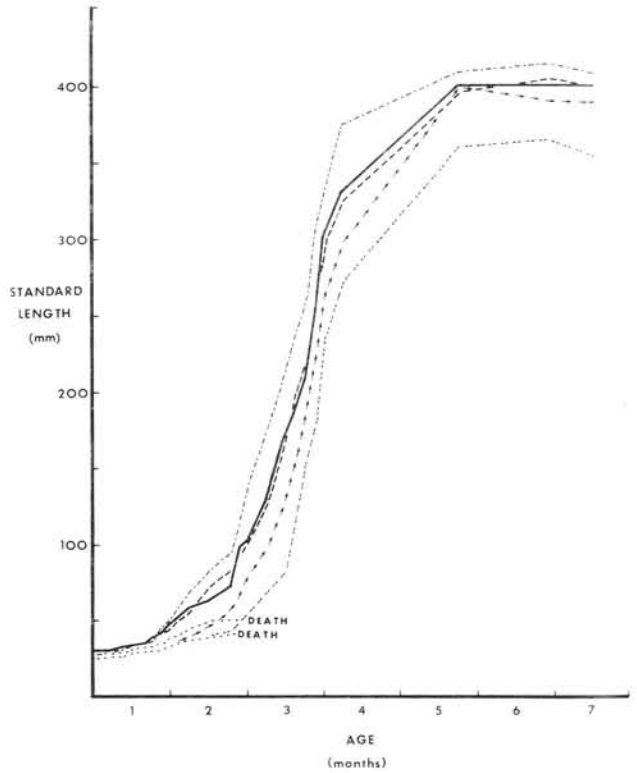


Figure 2: Wing growth of 7 captive *P. ruber*.

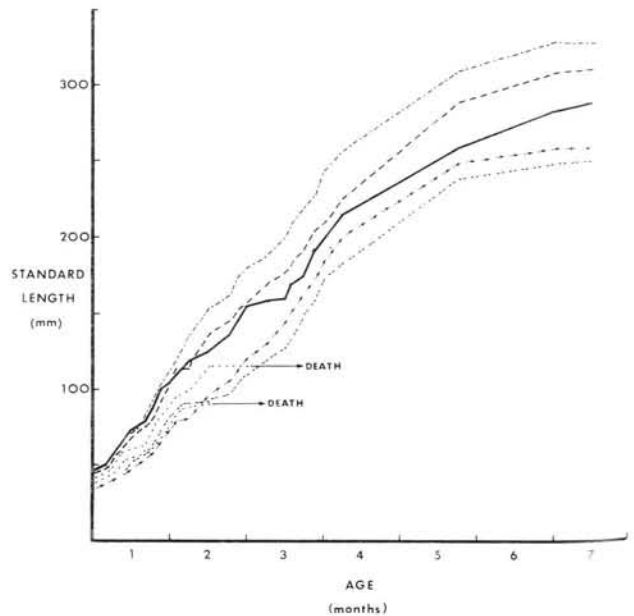


Figure 3. Tarsal growth of 7 captive *P. ruber*.

sal length of 11 wild *P. ruber* we have measured in South West Africa ranged from 260–350 mm and so McLachlan and Liversidge's data probably requires revision.

The tarsi hardened and darkened at one week of age, becoming black after a further week. At this age the largest chick began the characteristic trampling with its feet to stir up food in the water, although it was unable to feed effectively.

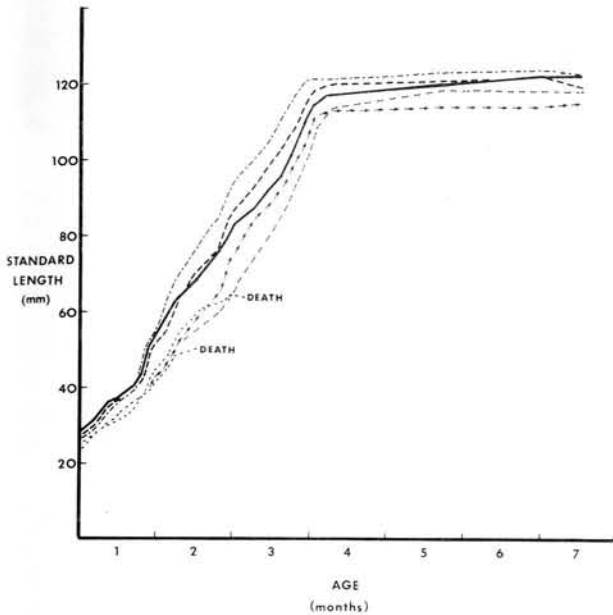


Figure 4: Culmen growth of 7 captive *P. ruber*.

Table 2. Measurements of 5 full-grown, captive *P. ruber* compared to wild *P. ruber*.

State	Wing (mm)	Tarsus (mm)	Culmen (mm)	
			straight	curved
Captive (present study)	355	255	119	142
	390	260	115	135
	400	290	122	143
	400	315	120	144
	410	350	123	148
Wild*	—	260	—	—
	—	260	—	—
	—	260	—	—
	—	265	—	—
	—	265	—	—
	—	275	—	—
	—	275	—	—
	—	295	—	—
	—	340	—	—
	—	350	—	—
Wild**	360-445(♂)	—	—	—
	355-425(♀)	—	—	—
Wild***	355-470	240-265	120-135	—

* measurements we made on flamingoes in South West Africa

** according to Kear (1969) p. 141

*** according to McLachlan and Liversidge (1970) p. 54.

The egg-tooth disappeared at 20 days of age from the chick which was most developed when captured, but remained visible up to 40 days of age on the two chicks hatched in captivity. Similarly, secondary down began replacing the natal down between three and five weeks of age, the change being complete at seven weeks. At this stage feathers were first noticeable on the scapulars, while primary and secondary flight feathers erupted on the wings at eight to nine weeks. White, sub-adult plumage began slowly replacing the grey, juvenal plumage at 10 weeks. It predominated only after age 20 weeks.

Bill colour changed at 11 weeks from coral red to light blue-grey proximally, while the distal area gradually blackened. Thereafter the proximal bill's colour became off-white, turning pink at six months of age. Leg colour changed slowly from deep pink through dull black to off-white when the chicks were nine to 12 weeks old, except for the tibio-tarsal joint which remained darker until their release after six months.

Behaviour: Similar to captive *P. minor* chicks *P. ruber* were less agitated during the early stages of captivity when kept in darkened boxes. They too formed bonds of attachment, always between smaller and bigger chicks. We observed food-begging by the smaller chicks but saw no "foster-feeding" reaction by the bigger chicks, as was the case with *P. minor* (Berry 1974). Fresh water was preferred and when the pond was flushed out weekly, it induced bathing and drinking.

Two of the seven chicks were difficult to feed by syringe, a factor which probably contributed to their deterioration in condition and subsequent death. The remaining five fed eagerly from a syringe until they could feed independently. Natural feeding first occurred at seven weeks, while one of the larger, older chicks only became independent of the syringe at 14 weeks of age.

Release procedure: We decided to release the captive flamingoes at an age of 28 weeks when they showed no further significant gain in body mass or increase in vital external measurements. The captives were transported similarly to *P. minor* (Berry 1974) except that each bird's head and neck was also enclosed in soft muslin (Plate 5). The release point was at Fisher's Pan, 130 km east of their place of rearing. Transport injuries were limited to chafing of the upper tibia of two birds.

Before release a numbered monel ring (12.5 mm internal diameter) was placed on the right tibia of each bird. In addition six plastic colour rings were placed on each tibia in combinations of green, red, white and yellow.

Because previous experience had shown that an overnight enclosure at the release point attracts predators, especially black-backed jackal *Canis mesomelas*, the birds were given total freedom immediately after arrival at 10h00. They were released in proximity to several hundred wild *P. ruber* as it was hoped the latter would attract the reared birds, providing them with the stimulation for alertness ne-

cessary to survive in nature. This however was not the case and the hand-reared birds avoided the wild flamingoes, remaining separate and tightly grouped. They attempted flying with only partial success, regrouping each time.

Moreover their failure to join the wild population and their tendency to stay near the pan's edge resulted in two being killed by jackals the night after release. No further rings or carcasses have been recovered since, but this does not necessarily mean that the remaining birds established themselves successfully in nature. We suggest, after experience with the release of *P. minor* and *P. ruber*, that hand-reared flamingoes have little chance of surviving in Etosha National Park under the release conditions so far tried, because of the abundance of predators. It would seem more appropriate to donate such birds to a zoo where they can be used to greater advantage.

4 ACKNOWLEDGEMENTS

We wish to thank Capt. A. Karas who helped locate abandoned nesting colonies on the Etosha Pan by helicopter and the Game Capture Unit of the Divi-

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This work was carried out as an *ad hoc* research project while the senior author was employed by the South West Africa Administration.

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Plate 5: Method of transporting *P. ruber* by vehicle to the release point.