

Ageing Palm-nut Vultures: A Preliminary Guide

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<http://dx.doi.org/10.4314/vulnew.v86i1.1>

Abstract

Significant knowledge gaps currently exist for the Palm-nut Vulture *Gypohierax angolensis*, particularly pertaining to the ageing of both nestlings and free-flying birds. Although the most reliable ageing scheme involves the detailed examination of a bird in the hand, a method based on more easily observable morphological characteristics is required. The captive breeding and rearing of an individual of this species presented an opportunity for the use of retrospective photography as a primary data source in this regard. Further cross-matching with additional images of free-flying wild birds was necessary for the development of descriptions considered more useful for field purposes. While this study ascertained that adult plumage is attained in the late fourth year, and provided much of the supplementary detail, it should be considered as preliminary. Further data pertaining to the nestling stages and general behavioural characteristics is required. Facilities that breed this species should thus be encouraged to collect and collate relevant mensural and photographic data going forward.

Introduction

A recent evaluation of each of the ten resident African vulture species by Thompson *et al.* (2021), along with previous work carried out by Carneiro *et al.* (2017), has highlighted significant current knowledge gaps for the Palm-nut Vulture *Gypohierax angolensis*. Although it has so far been established that the incubation period lasts for 46-48 days, the nestling period for 90-91 days (Steyn 1982, Mundy *et al.* 1992, Harris *et al.* 1994, Goodwin 2019), and post-nestling dependence is between 60 and 180 days (Thiollay 1978, Mundy *et al.* 1992, Harris *et al.* 1994, Goodwin 2019), a particular paucity of data remains regarding the ageing of both nestlings and free-flying birds (Goodwin 2019). Available references broadly state that adult plumage is attained at anywhere between three and five years, with intermediate stages (Mundy *et al.* 1992, Goodwin 2019). A

practical ageing guide is needed for observations made in the wild.

While the most reliable ageing scheme is based upon the detailed examination of a bird in the hand, this is hardly achievable, necessitating a method simply based on easily observable morphological characteristics (Piper *et al.* 1989). The relatively recent captive breeding and subsequent rearing of an individual of this species at the International Centre for Birds of Prey (ICBP) in Gloucestershire has now provided an opportunity for collation of relevant preliminary data to fulfil this requirement.

Methods

During early 2018, a pair of Palm-nut Vultures bred within a specially designed enclosure at ICBP, and the egg was artificially incubated following guidelines provided by Goodwin (2019). The resultant neonate was genetically sexed as female

(via the shell membrane), and hand raised for display purposes. Photographs used as a primary data source were taken at hatch date and subsequently on an ad hoc basis at irregular intervals (H. Cale pers. comm.). Precise hatch date, along with dates aligned to each subsequent photograph provided an opportunity to retrospectively track development of external morphological characteristics over the period in question. Limited data provided in Harris *et al.* (1994) and Goodwin (2019) was used as a supplementary source of information for this purpose. The apparent pale hue to the eyes, cere, gape, and exposed skin in many of the photographs of the captive subject (due to lack of carotenoids in the diet; Blanco *et al.* 2014), made it necessary to cross-match these with equivalent images of free-flying wild birds from reliable sources with known background. This also catered for apparent colour variation introduced by different light conditions experienced in each locality. Subsequent development of descriptions could be considered more useful for field purposes. Data was then compiled for both nestling and free-flying categories to produce a rudimentary ageing guide, roughly based on the format of Piper *et al.* (1989). Relevant nomenclature was obtained from Piper *et al.* (1989) as well as Proctor & Lynch (1993).

Unique age categories were formulated as necessary to best fit available data. Nestling stages were divided into 15-day increments to make up six categories (N1 - N6) to align with the nestling period of 90 - 91 days as recorded by Harris *et al.* (1994). For free-flying birds, the age category was broken down into calendar years, (Y1 to Y4). Due to complexity, these were described by distinct ranges within each class, signified as either 'early', 'mid', or 'late' in each subsequent year, as applicable. The adult category (AD) was included for completeness.

Results

After review and necessary cross-matching of available images, it was ascertained that adult plumage is attained late in the fourth year as previously suggested by Mundy *et al.* (1992). Descriptions were formulated for each assigned age category as presented below. General characteristics for the late stage of each category are further summarised in Tables 1 and 2.

Nestling Categories

N1: From Hatching to 15 days

In the first ten days the down of the semi-altricial neonate is a fluffy chocolate-brown, while the facial skin is bluish and the eyes dark (Goodwin 2019). The cere and gape are ivory to yellowish in colour and the legs pale yellow. The bill is black and remains so for the entire nestling period. By day 15, down and blue facial skin have begun to fade slightly, while the eyes take on a more brownish hue, albeit remaining relatively dark. The egg tooth is still present at this stage (Figure 1a,b).

N2: From 16 to 30 days

From day 16 there is progressive lightening of down colour, as well as general yellowing of the facial skin, more so on the cere and gape. The legs remain a pale yellow. Growth is relatively steady and by day 30 the first coverts are starting to pin.

N3: From 31 to 45 days

By day 35 the nestling has developed pale yellow facial skin, gape and cere, and shows significant feather growth on the dorsal wing coverts, scapulars, crown, and forehead. By day 45, the bird appears somewhat scruffy. At this stage it is around two-thirds of adult size and feather growth has progressed to include all the coverts, upper and lower breast, entire head (including auriculars), scapulars, and some of the dorsal neck area. While the eyes are brown, and the legs pale yellow, the forehead, crown and nape start to take on a lightly streaked appearance (Figure 2). The

remiges, rectrices and tertials have also pinned at this stage (Harris *et al.* 1994, Goodwin 2019).

N4: From 46 to 60 days

At day 50 the bird is almost fully feathered, appearing an almost uniform chocolate brown, except for some wispy streaking on the forehead, crown, lower throat, and nape, along with slightly scalloped dorsal wing coverts, and some white downy remnants showing from under the wrist region. The rectrices, along with darker remiges and tertials are well developed by day 60 and the nestling is fully feathered, apart from the upper throat area. The eye is a slightly lighter brown and the pale-yellow facial skin around the eye and in the malar region begins to take on a pinkish hue. The gape and cere remain a pale yellow, along with the legs (Harris *et al.* 1994, Goodwin 2019).

N5: From 61 to 75 days

By day 65, the nestling is roughly adult size and now fully feathered, with rectrices, remiges and tertials growing at a steady rate. Wing colour graduates from lighter brown scalloped marginal coverts, through darker brown greater coverts, to dark brown remiges and tertials. The wispy streaking is clearly visible on the forehead, crown, auriculars, throat and nape from close quarters. The

eye retains the same brown colouration, while the facial skin around the eye and in the malar region attains a slightly more pronounced pinkish hue. The gape and cere remain pale yellow, as do the legs (Harris *et al.* 1994, Goodwin 2019).

N6: From 76 to 90 days

Days 76 to 90 show increasing wing and body growth and the nestling begins to exercise prior to fledging. At 90 days, the young bird is ready to leave the nest. By this stage it has reached adult size, being slightly sleeker in appearance (Figure 3). All brown juvenile feathering is complete, with streaking still visible on the forehead, crown, throat, and nape, from relatively close quarters. The dorsal wing coverts and scapulars are distinctly scalloped, albeit slightly pointed, and the relatively short brown rectrices together form a distinctly wedged tail. Viewed dorsally, the outstretched primaries, secondaries and tertials have all darkened distinctly. At this stage the bird has developed a pale yellow cere and gape and pinkish facial skin around the eye and in the malar region. The legs are a pale yellow, eyes are a lighter brown, and the bill has remained black over the entire nestling period (Harris *et al.* 1994, Goodwin 2019).

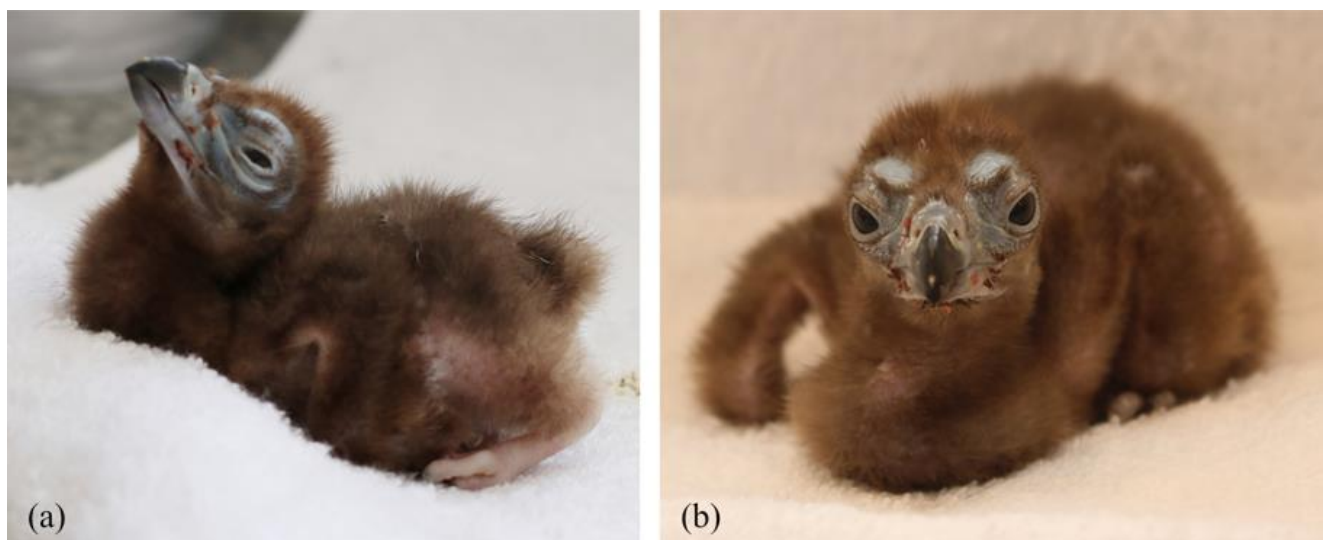


Figure 1: Neonate (a) and nestling at day 15 (b) Photographs: Holly Cale/ICBP.



Figure 2: Nestling circa day 45. Note the pale facial skin of the captive bred individual. Photograph: Holly Cale/ICBP.



Figure 3: First year bird (right) soon after fledging after circa 90 days in the nest. Note the amber eye of the accompanying adult male. Photograph: Dave Ellinger.

Free-Flying Categories

Y1: First Year

As observed by Thiollay (1978) and Harris *et al.* (1994), the young bird may remain dependent on the adults for up to six months post-fledging and is often observed in their company (Figure 3). Appearance remains much as per the previous description as at 90 days, although the legs tend to fade to a paler yellow with time. The bird initially appears sleeker than the adult, with a relatively uniform plumage at a distance, albeit retaining the characteristic scalloped dorsal wing coverts. The streaking on the crown, forehead, throat, and nape also remains evident from relatively close quarters (Harris *et al.* 1994, Goodwin 2019).

Y2: Second Year

Little additional change is evident by the early second year, although the eyes do begin to lighten gradually to a honey colour. At this stage the juvenile exhibits obvious feather wear, taking on a

rather mottled ‘patchwork’ appearance. While the bird retains the same pale yellow on the cere and gape, the pink facial skin around the eye and in the malar region becomes more definitive. The legs are pinkish, and the bill remains black at this stage. In flight, the dark ventral wings may also exhibit wear or broken remiges, while the greater primary and secondary coverts are pale. The short tail is wedge-shaped, with the rectrices beginning to show wear at the tips (Figure 4). Moulting of the remiges, rectrices and scapulars, along with both primary and secondary greater coverts subsequently begins while the bird retains an otherwise brown appearance overall. From the early to late second year, the rectrices gradually moult to form a white tail with a distinctive broad black band and white tip, while collectively the new primaries display a white ‘window’. Both features mentioned above are particularly conspicuous on the dorsal aspect whilst in flight.



Figure 4: Estimated early second year bird (a) and in flight (b). Note the worn plumage. Photographs: (a) Dave Ellinger (b) Geoff Moores.

Y3: Third Year

By early in the third year, further significant change has become evident. Once initiated, this is relatively rapid and proceeds sporadically after initial subtle replacement of the brown breast and crural plumage with intermittent white feathers. The eyes, cere and gape transition to a distinctive yellow, along with the legs, while facial skin around the eye and in the malar region is pinkish. Bill colour gradually transitions from black to ivory, albeit retaining a diminishing grey portion on the culmen (Figure 5). Over the period of a further few months, the lower breast begins to appear distinctly patchy, while the upper breast turns almost completely white. The forehead, crown and nape exhibit some white streaking, with increasing areas of white plumage in the crural area, lower breast, and abdomen (Figure 6). Further marked change is evident by the mid-third year, when overall areas of white plumage are interspersed with only remnant brown feathers over much of the body. Although the forehead, crown and lower breast remain relatively brown, the dorsal marginal coverts and upper tail coverts increasingly tend to be white, along with the flanks, rump and back. The ventral wing coverts are almost wholly white, apart from the immediate wrist area, while the primaries are also substantially white proximal to this location. These now also show a relatively large black distal portion, which highlights the white portion as a distinctive 'window'. The black secondaries have also gradually moulted in by this stage and the rectrices appear irregular, being black with a white tip on the outer pair, graduating

towards largely white at the centre. While the bill has transitioned further to ivory, the legs remain pinkish, the facial skin pink, and the cere and gape yellow (Figure 7).

Y4: Fourth Year

In the early fourth year, overall areas of white plumage increase substantially with relatively sparse areas of brown plumage remaining on the forehead, crown, nape, lower breast, belly, flanks and crural areas. At this stage, the dorsal wing coverts are interspersed with an increasing number of white replacements, along with the first of the black on the last row, giving the bird a distinctive 'patchwork' appearance. The cere and bill have transitioned further to an overall ivory colour, with remnants of grey at the tip of the culmen. While the eyes are yellow, the pink facial skin around the eyes and in the malar region is more pronounced. The legs are also pinker in appearance. Ventral wing coverts are almost completely white, and the largely white, black-tipped primaries are moulting in from the first primary outwards. The secondaries remain black, and the rectrices are irregular in appearance at this stage (Figure 8). From mid to late fourth year, coverage of white plumage increases steadily on the coverts, crown, nape, back, lower breast, belly, flanks and crural areas. The remaining primaries also moult in at this stage, along with the rectrices, which form a distinctive short black wedge-shaped tail with a broad white tip. The final brown feathers replaced during the transition are those few remnants on the dorsal coverts, neck, crown, and forehead.



Figure 5: Early third year wild bird. Note the distinctive yellow eye. Photograph: Yolande Visser.



Figure 6: Early to mid-third year captive bird. Note the obvious difference in colouration between the two subjects. Photograph: Holly Cale/ICBP.

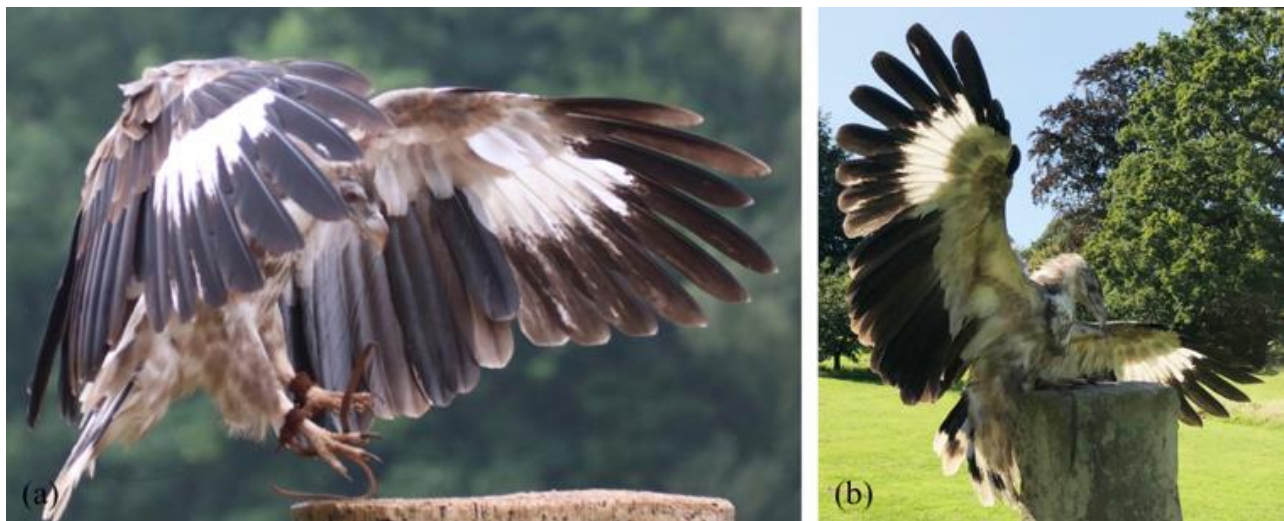


Figure 7: Mid-third year bird in flight (a) and the same captive bird later in the third year (b). Photographs: Holly Cale/ICBP.

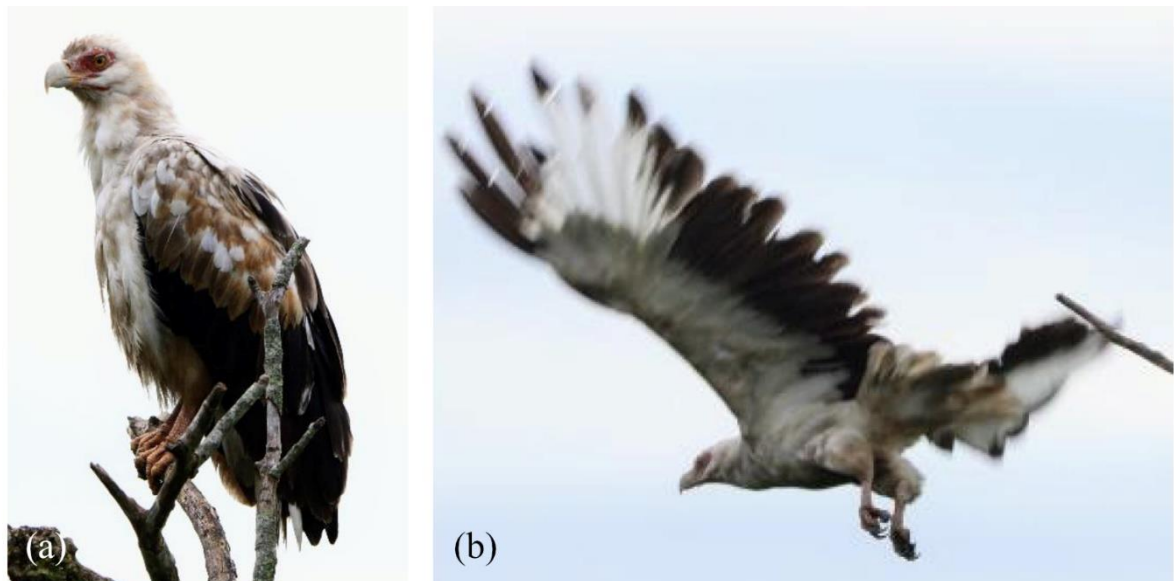


Figure 8: Early fourth year bird perching (a) and in flight (b). Photographs: Yolande Visser.

AD: Adult

In adult birds the plumage on the dorsal and ventral head and body are wholly white, including all wing coverts, apart from those of the last row on the dorsal wing, which are black (Figure 9). The secondaries and tertials are distinctly black, while the primaries are largely white with distinct black tips. A further distinguishing feature is the particularly short black wedge-shaped tail with a broad white tip (Steyn 1982, Mundy *et al.* 1992, Goodwin 2019). In a sample of 177 museum

specimens, wing lengths ranged from 387 - 466mm and tail lengths from 168 - 252mm. Sexes are mostly alike; however, the female is slightly larger. Based on one reliable record, a female weighed 1.83kg, while a male weighed 1.52kg (Mundy *et al.* 1992, Goodwin 2019). Under natural conditions, adult female birds tend to exhibit lemon-yellow eyes, while those of the male often take on an amber hue (Figure 3, Figure 10). The bill and cere are ivory and the bare skin around the eye and in the malar region display orange to deep pink skin that

may change hue according to emotional state, or the amount of carotene consumed. The legs are also pinkish in appearance (Mundy *et al.* 1992, Harris *et al.* 1994, Goodwin 2019). Wild adult birds of both sexes develop a yellowish to almost orange 'flush' on the white dorsal wing coverts and breast while breeding (distinct from occasional staining acquired from bathing in muddy water). This colouration becomes richer in the period leading up to courtship and incubation, fading with the moult

towards the end of the breeding cycle. It is generally darker in the female, which also tends to display a deeper pinkish appearance to the facial skin than that of the male during this period (Harris *et al.* 1994, Goodwin 2019). No definitive techniques have so far been reported for age determination in adults (Mundy *et al.* 1992, Goodwin 2019), although longevity is known to exceed 27 years in captivity (Bigalke 1934, Goodwin 2019).



Figure 9: Adult in flight. Note the diagnostic white primaries with black tips and white-tipped tail.
Photograph: Geoff Moores.



Figure 10: Adult pair. Note the difference in eye colour. Male above, female below. Photograph: Dave Ellinger.

Table 1: Summary of general characteristics for late stages of nestling age categories.

Characteristic	N1	N2	N3	N4	N5	N6
Crown	brown down	brown down	brown feathers	brown feathers/ wispy streaking	brown feathers/ wispy streaking	brown feathers/ wispy streaking
Eye	dark brown	brown	brown	brown	brown	brown
Bill	black	black	black	black	black	black
Cere & gape	ivory	pale yellow	pale yellow	pale yellow	pale yellow	pale yellow
Facial skin	bluish	pale yellow	pale yellow	pinkish	pinkish	pink
Dorsal region	brown down	brown down	brown feathers	brown feathers/ wispy streaking	brown feathers/ wispy streaking	brown feathers/ wispy streaking
Dorsal wing coverts	-	feathers pinned	brown feathers	scalloped	scalloped	scalloped
Rectrices	-	-	feathers pinned	brown/well developed	brown/well developed	dark/fully developed
Remiges	-	-	feathers pinned	well developed	dark/well developed	dark/fully developed
Ventral region	brown down	brown down	brown feathers	brown feathers	fully developed	fully developed
Legs	pale yellow	pale yellow	pale yellow	pale yellow	pale yellow	pale yellow

Table 2: Summary of general characteristics for the free-flying age categories.

Characteristic	Y1	Y2	Y3	Y4	AD
Crown	brown	brown/white streaking	brown/white streaking	white/brown remnants	white
Eye	honey	yellow	yellow	yellow	yellow/amber
Bill	black	grey/ivory	largely ivory	ivory	ivory
Cere & gape	pale yellow	yellow	yellow	yellow	ivory
Facial skin	pink	pink	pink	rich pink	rich pink
Dorsal region	mottled brown	mottled brown (worn)	mottled brown/white	white/brown remnants	white
Dorsal wing coverts	mottled brown	mottled brown (worn)	mottled brown/white	white/some black last row/ brown remnants	white/last row black
Rectrices	brown	irregular black/white	irregular black/white	black/white tip	black/white tip
Primaries	dark brown	black/white	black/white	white/black tip	white/black tip
Secondaries	dark brown	dark brown/black	black	black	black
Ventral region	light brown	patchy brown/white	mottled brown/white	white/brown remnants	white
Legs	pinkish	pinkish	pinkish	pinkish	pinkish

Discussion

Although the captive breeding and rearing of a female Palm-nut Vulture provided an opportunity to begin to address the subject of ageing in this species, available data was limited. A paucity of information regarding nestling growth has highlighted the need for further research in this respect. Nevertheless, available photographic data, along with additional information gleaned from Mundy *et al.* (1992), Harris *et al.* (1994) and Goodwin (2019) provided sufficient basic detail for inclusion of both nestling and free-flying categories as identified. Additional factors for consideration included differing photographic light conditions, and the fact that captive raptors often display a pale hue to the eyes, cere, gape and exposed skin, due to lack of natural carotenoids in the diet (Blanco *et al.* 2014). This potential issue was largely overcome for free-flying categories via cross-matching of the

primary photographs with separately sourced images of wild birds at an equivalent stage of development. A further consideration was the fact that primary data was collated from photographs of only a single female individual. While slight variations may occur between individual birds, this is unlikely to significantly affect results presented as the sexes are largely alike in this species (Mundy *et al.* 1992, Goodwin 2019).

While this ageing guide enhances current knowledge of the Palm-nut Vulture, it should be considered as preliminary, as further data pertaining to the nestling stages and general behavioural characteristics is required. As the most accurate and consistent ageing technique for the nestling is the measurement of wing length (Piper *et al.* 1989), facilities that breed this species should be encouraged to collect and collate relevant mensural and photographic data going forward.

Acknowledgements

Holly Cale is particularly thanked for sharing primary photographic data for the individual bred at ICBP. Jemima Parry-Jones is also thanked for providing permission for use of this data. Dave Ellinger, Geoff Moores, and Yolande Visser are further acknowledged for the use of their photographs of wild birds.

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