

## **Age- and sex-differentiated plumages in the two colour morphs of the Variable Buzzard *Buteo polyosoma*: a case of delayed maturation with subadult males disguised in definitive adult female plumage**

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The polymorphic plumage of Variable Buzzard *Buteo polyosoma* has generated a long and complicated controversy regarding the species' taxonomic classification (Vaurie 1962). Initially described as *Falco polyosoma* Quoy et Gaimard 1824, it has subsequently been referred to variously as *Haliaeetus erythronotus* King 1827; *Aquila braccata* Meyen 1834; *Buteo varius* Gould 1937; *Buteo unicolor* Lafresnaye & d'Orbigny, 1837; *Buteo erythronotus* Taczanowski, 1877; *Buteo tricolor* d'Orbigny (p.106 in Hellmayr 1932); *Buteo melanosthetus* (os) Philippi, 1899; *Buteo poecilogaster* Philippi, 1899; *Buteo macronynchus* Philippi, 1899; *Buteo ater* Philippi, 1899; *Buteo pictus* Philippi, 1899; *Buteo aethiops* Philippi, 1899; and *Asturina aethiops* Philippi, 1899. The number of synonyms is due, in part, to the fact that different plumage patterns were thought to represent different species.

Since Gurney's (1879) description of *Buteo poecilochrous*, a long debate has ensued as to the species' relationship with *B. polyosoma*. This is to some extent understandable since several plumages of these taxa are virtually identical and there is an overlap in some measurements. Furthermore, they occur at the same altitudes—albeit in different habitats—in the Bolivian altiplano during the austral winter (Cabot & Serrano 1986, Cabot 1991). The two were for a long period differentiated on the basis of the relative distances between the tips of the third- and fifth-outermost primaries (Stresemann 1925), a feature subsequently disproved, leading to them being regarded as conspecifics (Farquhar 1998). Cabot & de Vries (2003) analysed the morphology and ecological behaviour of the two, proving their clear separability using other measurements and that they behave as species under the Biological Species Concept, although DNA studies have revealed their close similarity (Riesing *et al.* 2003), indicating that recent parapatric differentiation at high altitude in the Andes culminated with the retreat of the ice-packs at the close of the last glacial period, as suggested by Haffer (1967) and Dorst & Vuilleumier (1986) for birds of this region. These two species have the lowest known wing-loads of their genus (Cabot & de Vries 2003), an adaptation to the low atmospheric pressure in high-altitude ecosystems.

The plumage of *Buteo polyosoma* (and *B. poecilochrous*) was studied by Vaurie (1962), who established that adults of *B. polyosoma* are of five different types. He also noted sexual dimorphism and that adult females have a red back, whilst males



have a uniform grey back, although some possess a red patch as in females. The types defined by Vaurie (1962) are as follows. Type A: head, thighs and undertail-coverts dark brown or dark slate, with mantle and rest of underparts chestnut and unbarred. Type B: crown, nape and mantle the same colour as type A, but underparts white with narrow dusky-brown or grey bars that vary in intensity from broad and dense to unappreciable. Type C: body plumage including underwing-coverts grey (from pale slate to virtually black), with 50% having scattered reddish feathers on the mantle. Type D: upperparts grey and underparts and underwing white, with some showing some chestnut at the upper border of the mantle. Type E: crown and nape as in types A and B, but with variegated underparts: ventrally grey and brown, transversal pectoral band chestnut and rest of underparts and thighs having slate- and white-coloured bars.

Pávez (1998) was first to describe the plumages of the pale phase of *B. polyosoma* and to relate different plumages to age. His study was based on plumage changes in captive Chilean birds from the first year and his results established that: (1) definitive adult plumage is reached more or less in the sixth year; (2) plumages are related to an age-dependent pattern of markings and coloration; (3) males between third and fifth years show some transitory characters, such as a reddish mantle, which correspond to definitive female plumage; and (4) definitive adult plumage is sexually dimorphic: males have a uniform grey back, females a brick-red patch.

Here we describe, for the first time, sex- and age-related plumage changes in the dark morph, and also include a more specific description of colour patterns for the entire distribution of the pale morph, as described by Pávez (1998) for Chilean birds. Finally, the colour phases are established for the different ages (1–6 years).

## Material and methods

We examined 160 specimens held at the Natural History Museum (Tring), Museum of Natural History (Stockholm), Zoological Museum (Copenhagen), Landes Museum (Linz), Museum d'Histoire Naturelle de Genève (Geneva), Museo Regionale di Scienze Naturali (Turin), Institut Royal des Sciences Naturelles de Belgique (Brussels), Muséum National d'Histoire Naturelle (Paris), Estación Biológica de Doñana (Seville), Museo Nacional de Ciencias Naturales (Madrid), Museo Ecuatoriano de Ciencias Naturales (Quito), Museo de Ciencias Naturales "Mejía" (Quito), Museo de la Escuela Politécnica Nacional (Quito), and Museo Nacional de Ciencias del Instituto Técnico Superior "Bolívar" (Ambato, Ecuador). Specimens were available from Colombia (two), Ecuador (20), Peru (seven), Bolivia (24), Argentina (49), Chile (29) and the Falklands (21); four were of unknown origin. Four specimens of *Buteo polyosoma exsul* from the Juan Fernández Islands were examined as comparative material.

Some controversial and undated skins were identified and sexed on the basis of secondary length, wing length, wing depth and the shape of the wingtip, as per the



range of values given by Goodall *et al.* (1951), de Vries (1973), Cabot (1991) and Cabot & de Vries (2003). The Stresemann criteria for distinguishing the species from *B. poecilochrous* were not used, as they are not diagnostic (Farquhar 1998, Cabot & de Vries 2003). Birds were classified according to similarities in plumage marks and coloration, enabling us to create a fixed number of categories that included all plumage types. Overall, these categories were relatively homogenous, despite the high degree of individual and geographical variation within plumages. In uniformly coloured areas of plumage, differences lie in ground-colour tones, as well as in their extent and distribution. Markings also vary in size, density and distribution. The age-related sequence of plumages was established from those birds that presented intermediate characteristics, denoting the change from one plumage category to another as feathers are replaced. The sequence of plumage changes was established by the simultaneous presence of old and new feathers, which were identified by wear on their distal edges or by differences in tone when the ground colour was similar. Changes in size, colour and distribution of markings were also taken into account, especially on the underparts.

Moult patterns were not subject to close scrutiny. Captive birds in southern Iberia moulted in mid May and late September. Nevertheless, these periods may not correspond to moulting periods in their country of origin (Peru). Like Pávez (1998), we detected no protracted moult in the species. Neither were we able to discover how much individual variation—as occurs in large eagles—there is in the time birds take to acquire adult appearance.

Specimens were photographed dorsally, ventrally and laterally and the images, once classified by age and sex, permitted comparative analysis between skins housed in different museums. Descriptions of the plumages of 12 live birds (three juveniles, two subadults and seven adults) in private zoos and raptor centres were made by means of twice-annual visits over three consecutive years to monitor changes. Live birds were sexed using molecular techniques (Ellegren 1996). The most distinctive plumage characteristics of the two morphs, including sexual differences, are given in Table 1.

### **Dark morph**

**First-year:** variable but sexes alike. Entirely dark chocolate-brown to uniform blackish brown, sometimes with cheeks paler and tinged tawny; crown and nape feathers have white bases visible on nape; mantle usually uniform; upperwing-coverts and scapulars have profuse and contrasting ochre or grey-ochre markings; secondaries dark-barred and distally pale-fringed; outermost primaries with blackish-brown tips, and ochre or creamy notches, especially on inner web; rump and uppertail-coverts dark chocolate-brown with concealed pale ochraceous or tawny spots; underparts with whitish to ochre-tawny spots, principally on mid and rear underparts, decreasing in size and merging into pale, scattered spotting on thighs and undertail-coverts; lesser and median underwing-coverts dark brown with



TABLE 1

Diagnostic characters according to age and sex in pale and dark phases of *Buteo polyosoma*.

AGE	DARK PHASE	PALE PHASE
First-year	Appearance wholly brown to blackish brown; upperparts marked ochre or grey-white; underparts sparsely pale or white spotted. Tail: above greyish brown with usually 14–18 close, narrow, irregular dark bands.	Malar stripe and upperparts dark brown with tawny-ochre markings; supercilium, cheeks and underparts pale ochraceous with dark streaks on throat and breast-sides; rest of underparts and thighs have brownish diamond-shaped marks which progressively decrease in size, merge and become more widely spaced towards tail; tail more brownish than in first-year dark phase.
Second-year	As first-year but darker and more blackish, less brown; more uniform; scattered marks on upperwing-coverts, tail has same pattern but slightly greyer than in previous plumage.	As first-year but mid and rear underparts reticulated or boldly marked with rufescent-brown to rusty-orange bars, which decrease in size, becoming more widely spaced and diffuse towards undertail-coverts and thighs.
Third-year	Male: upperparts and head dark brown; mantle pale reddish tawny admixed brown; throat brown and rest of underparts uniform brown suffused reddish; concealed pale marks on uppertail-coverts; tail washed white or greyish with bold narrow blackish undulating lines and broad subterminal black band, occasionally incomplete. Female: brick-red mantle, some feathers on upper mantle have dark centres and dark shafts on lower mantle; underparts similar to male but brick red.	Male: top and sides of head blackish brown, dorsal patch reddish tawny admixed brown; below whitish with underparts unmarked or with scant streaks on breast-sides; rest of underparts and thighs barred rusty-brown, stronger towards flanks, with finer and more widely spaced barring nearer tail. Tail as dark phase of same age but lacks greyish wash and has finer transverse black lines. Female: darker, with obvious brick red dorsal patch extending towards nape and from neck-sides towards flanks; underparts more barred.
Fourth-year	Male: wholly bluish grey to dark slate-grey with faint brown wash and slight reddish dorsal coloration admixed grey; reddish pectoral band. Female: darker slate-grey with rich, pure and intense brick red dorsal patch; below also brick red except throat, thighs and undertail-coverts.	Male: upperparts grey, with slight brownish tinge; top of head also grey and lower half white; brick red mantle; below white, finely barred dark chestnut to grey from mid breast to vent and thighs. Female: underparts as male, although somewhat more barred and has reddish-chestnut flanks and spots either side of breast.
Fifth-year	Male: entirely grey with scattered reddish-and-grey feathers on back and central chest. Female: darker, with grey bib from chin to mid breast; rest of plumage similar to fourth-year birds.	Male: similar to fourth-year birds, with small or poorly defined dorsal patch consisting of just a few reddish feathers; central vent and thighs with fine grey bars or vermiculations. Female: blackish-grey barring finer than in fourth-year; grey spots on breast-sides, and greyish flanks.
Sixth-year	Male: all grey with sometimes just a few vestigial red feathers on the mantle and, very occasionally, the breast. Female: essentially as previous year.	Male: as fifth-year but white below with grey vermiculations on thighs and flanks. Female: essentially as fifth-year.



pale dots; uppertail greyish or blackish grey, with closely spaced irregular brownish bars or extensive mottling.

**Second-year:** sexes alike. Like first-year but darker, from brownish to extremely dark sooty black. Incipient dimorphism usually detectable: males normally uniformly darker than females; markings restricted to median and greater upperwing- and uppertail-coverts; underparts in both sexes have scant pale spotting largely restricted to flanks; underwing almost lacks markings. Some show a pale wash on cheeks; tail greyer and with same pattern of dark barring as in previous plumage.

**Third-year:** sexes differ. **Male:** crown, head-sides, nape and hindneck blackish brown; crown and nape feathers have visible white bases; mantle reddish or reddish brown with some two-toned feathers having dark brown centres and reddish fringes forming a more or less consistent and homogeneous patch; rest of upperparts brownish black with concealed cinnamon-tawny scapular marks, and secondaries and primaries have dark barring on outer webs; outermost primaries have black tips, but inner primaries and secondaries may be fringed white distally; uppertail-coverts blackish with concealed pale spots; underparts reddish brown except throat, thighs, vent and undertail-coverts, which are uniform blackish brown; underwing-coverts also blackish with a few small dots; tail whitish, washed grey, especially on sides, with bold transversal black lines and a more or less complete broad subterminal black band; below a fine pale grey band and feathers finely fringed white distally. **Female:** usually like male but darker and reddish areas brighter; mantle uniform and brighter brick red, this colour sometimes extending from crown to scapulars and dorsal patch, and may also include neck-sides. **Remarks:** specimens in moult from second- to third-year show great individual variation in number of old brown feathers mixed with new reddish ones on dorsal patch and underparts. Aside of flight-feathers and tail, some females at this age and the next year can be extensively erythristic.

**Fourth-year:** sexes differ. **Male:** head and upperparts mid grey to uniform dark slate-grey, frequently with almost imperceptible brownish tones; nape feathers have visible white bases and black tips, forming conspicuous black-and-white nuchal spot; dorsal reddish patch consists of two-toned feathers, with grey centres and chestnut fringes, on hindneck and upper mantle; lesser and median upperwing-coverts uniform grey; greater coverts, secondaries and primaries grey with irregular close dark barring. Primaries and secondaries pale-tipped with blackish subterminal coloration visible in flight on upper and lower surfaces as a broad blackish distal band that follows outline of wing and remains evident in subsequent plumages; underparts uniform grey with a transversal reddish pectoral band; lesser and median underwing-coverts uniform pale grey, sparsely spotted; greater underwing-coverts pale greyish with black barring; tail as previous plumage but whiter and has a



black, complete subterminal band. **Female:** upperparts dark slate-grey to slate-grey, similar to previous plumage, but has dorsal patch more intense and purer; underparts extensively reddish except throat, neck, thighs and belly, which are uniform slate-grey. Undertail-coverts, wing and tail as male and remain as such in subsequent plumages.

**Fifth-year:** sexes differ. **Male:** as previous plumage but greyer, lacking brownish tones, ground colour varying from lead or blue-grey to uniform blackish slate; the few grey-and-red feathers in upper mantle not forming a defined patch; rump blackish and upper- and undertail-coverts have white distal fringes; underparts uniform grey with scattered reddish feathers that may or may not form a defined transversal upper breast-band; lesser and median underwing-coverts with scant pale grey spotting and same barring as on greater underwing-coverts. **Female:** upperparts similar to fourth-year plumage but with a shorter, reddish dorsal patch from base of hindneck to mantle or mid scapulars; underparts have a uniform grey bib, paler on throat; below, a broad uniform red band restricted to mid breast; flanks with mixed grey and reddish tones; belly, thighs and undertail-coverts same blackish-grey colour.

**Older than five years:** sexes differ. **Male:** appears all uniform grey, sometimes with a few grey-and-red feathers on mantle and, more rarely, in mid chest, which are lost in subsequent years, although some persist in oldest live birds. **Female:** grey areas darker than in male in all plumages. Red-and-grey pattern similar to fifth-year with no obvious changes. **Remarks:** Exceptionally, an adult female from Colchagua (Cordillera, Chile, BMNH 1844.44.10.7.1) did not have thighs and lower chest uniform grey, as is usual in *B. polyosoma*, but instead showed faint, fine and well-spaced whitish bars over steel grey on belly and thighs, typical of definitive plumage of dark-morph *B. poecilochrous* (Gurney 1879, Cabot & de Vries unpubl.). This unusual bird has subsequently been reidentified (twice as *B. polyosoma* and once as *B. poecilochrous*) and was discussed by experienced taxonomists such as Hellmayr (1932) and Vaurie (1962). Farquhar (1998) also found, amongst the specimens he examined, a male dark-morph *B. polyosoma* with barred rear underparts.

### *Pale morph*

**First-year:** sexes alike. Upperparts dark brown; feathers on crown, nape and hindneck pale-bordered, affording streaked appearance, with white feather bases to crown and nape (visible on latter); mantle usually more uniform or feathers have pale fringes; upperwing-covert and scapular feathers have pale fringes coarsely marked with ochraceous yellowish to tawny cinnamon; rump brown with ochre or tawny spots; uppertail-coverts white with cinnamon-coloured marks; secondaries and primaries browner than dark morph; supercilium and cheeks pale cream to



rusty, frequently with short, fine dark streaks; malar stripe dark brown; underparts creamy to ochraceous; some fine dark streaks on chin; feathers on neck-sides and upper breast have some dark shaft-streaks and a tear-shaped base, central parts more uniform; mid and rear underparts clearly delimited by dense V-shaped rusty to rufous or mahogany marks, browner on sides of mid underparts, which radiate, decrease in size and become less pointed on rear underparts and thighs; a few small dark marks on undertail-coverts; underwing-coverts beige with dark markings. Uppertail grey-brown, paler, but with same barred pattern as first-year dark morph.

**Second-year:** sexes alike, as preceding plumage. Upperparts similar, with profuse pale marks and feathers on dorsum broadly fringed pale ochre to cinnamon, especially on mantle-sides, where markings apparently more rufous or cinnamon in females; in some, median and lesser upperwing-coverts and scapulars are extensively marked tawny cinnamon or admixed brown; rump brown with ochre or tawny spots and uppertail-coverts cinnamon; throat faintly whitish, but underparts similarly or less marked; mid and rear underparts reticulated or have coarse rusty to ferruginous bars; markings diminish towards tail and merge into barring on thighs and vent; slight barring on undertail-coverts. Uppertail more greyish, but sometimes washed cinnamon and has same markings, the ultimate dark bar distally more obvious and slightly broader.

**Third-year:** sexes differ. **Male:** head, nape and sides dark brown or blackish, crown and nape feathers with white bases (visible on latter), and rest of upperparts brown-grey, with a pale chestnut patch on mantle sometimes extending onto scapulars; occasionally reddish feathers with dark centres, usually on upper mantle, with dark lines along shafts on lower mantle; upperwing-coverts and scapulars have markings as in rest of previous plumage; rump brown with ochre marks and uppertail-coverts cinnamon; underparts whitish with unmarked, uniform bib, or some dark lines on sides; mid and rear underparts have rusty-orange to brown-mahogany barring, tending to ferruginous, which decreases in size and in intensity near tail; thighs similarly barred. Tail white with broad black subterminal band bordered below by a narrow greyish band; distally bordered white with fine, well-spaced black transversal lines above, varying in number. Underwing-coverts whitish with some dark markings. **Female:** crown blackish brown with darker back; mantle with intense brick-red patch, which in some reaches from nape to scapulars; also extends to neck-sides, forming reddish patch either side of bib, extending to flanks and underwings, which appear reddish or cinnamon-tinged, admixed grey; rest of underparts similar to male, although more ferruginous and more heavily marked.

**Fourth-year:** sexes differ. **Male:** similar to preceding plumage; upperparts grey, from silvery to bluish lead grey without brownish tone; visible white bases to feathers on nape; dorsal patch more intense brick red. In some, patch restricted to



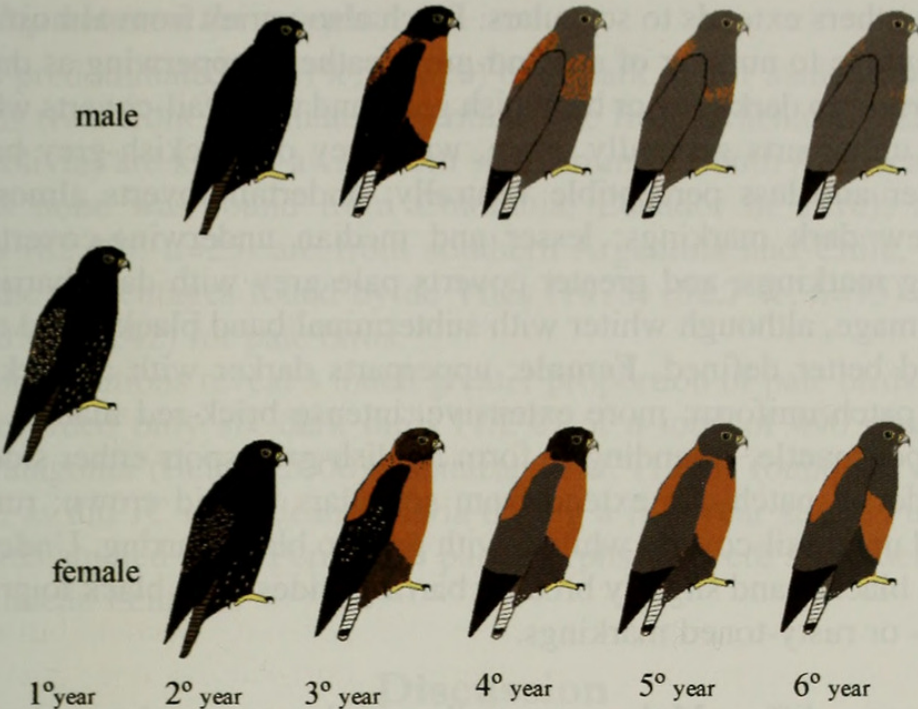


Figure 1. Dark-phase plumage patterns in *B. polyosoma* according to age and sex. Numbers correspond to calendar year.



Figure. 2. *B. polyosoma* pale-phase male plumage patterns according to age. Numbers correspond to calendar year. (l) = late.



mantle, but in others extends to scapulars. Patch also varies from almost uniformly reddish to grey due to number of red-and-grey feathers; upperwing as dark morph, although paler; rump dark grey or brownish grey, and uppertail-coverts whitish with grey barring; underparts generally white, with grey or blackish-grey barring and becoming finer and less perceptible ventrally; undertail-coverts almost uniform white with few dark markings; lesser and median underwing-coverts whitish, almost lacking markings, and greater coverts pale grey with dark barring; tail as preceding plumage, although whiter with subterminal band blacker and transversal lines finer and better defined. **Female:** upperparts darker with a black crown in some; dorsal patch uniform; more extensive, intense brick-red mantle, with dark streaks on upper mantle, extending to form reddish-grey spots either side of chest; in some red dorsal patch can extend from scapulars to mid crown; rump darker slate-grey and uppertail-coverts whitish with grey to black barring. Underparts like male but with blacker and slightly broader barring; sides have black to grey barring with chestnut- or rusty-toned markings.

**Fifth-year:** sexes differ. **Male:** essentially similar to previous plumages but upperparts paler grey with visible dark shafts; feathers on nape have white bases and black tips forming a visible patch; small red patch restricted to upper mantle or a few irregularly distributed red-and-grey feathers; underparts with grey markings either side of bib; mid and rear underparts and thighs with transverse dark lines or, sometimes, almost imperceptible vermiculations, becoming more obvious on lower breast-sides; flanks have transverse lines and grey markings; lesser and median underwing-coverts purer white, greater underwing-coverts white to greyish with blackish barring. **Female:** dorsal plumage similar to previous year; less barred on underparts; flanks with grey markings and barring as male.

**Older than five years:** sexes differ. **Male:** upperparts totally grey or with scattered red-and-grey feathers on mantle; underparts tend to be more uniform with age and gradually lose transverse lines on chest and thighs, although faint vermiculations almost always detectable. **Female:** little change, except a gradual loss in intensity and width of transverse lines on underparts, which are always more obvious in males.

**Remarks:** in both dark and pale morphs, some have a white or ochraceous forehead, or a spot either side of bill base. To a greater or lesser degree, some have secondaries and tips of innermost primaries with a white or whitish fringe. Some juveniles of both morphs have uniformly blackish tips to outermost primaries, whilst others exhibit some pale spotting on inner webs or spots on inner and outer webs that form contrasting pale brown barring.

The sequences of age-related plumage changes, from juvenile to definitive adult, in both sexes are summarised in Fig. 1.



### ***Relationship between the morphs***

Pale birds predominated (86.1%; n=129) over dark in our sample; only four dark-phase birds (two from Tucumán, Argentina, one from Colchagua, Chile, two from La Paz, Bolivia) are known away from southernmost South America (in European collections none was found from Colombia, Ecuador or Peru); all other dark specimens (82.4%; n=25) are from southern Argentina and Chile. This approximates to the percentages found by de Vries (1973) (82.7 %, n=75) and by Vaurie (1962) (90%, n=242) for pale birds.

Field observations reveal a much greater proportion of pale birds. Bellati (pers. comm.) recorded only six dark birds (1.2%) of a total of 490 observed in non-Andean Patagonia (Bellati 2000). Donázar *et al.* (1993) found only pale birds in Patagonia, as did JC in Andean Bolivia during a five-year study. Furthermore, all 13 live birds studied from Peru were pale morphs, as were six observed in March 2003 in Andean Ecuador.

## **Discussion**

### ***Morphs, delayed plumage maturation and plumage change***

All plumage types of all birds examined can be classed as belonging to either pale or dark morphs. Such coloration is not uncommon in *Buteo* (Brown & Amadon 1968) and has been recognised in *B. polyosoma* (Reynolds 1935, Housse 1945, Woods 1988). The rufous morph suggested by Goodall *et al.* (1951) and Johnson (1965) on the basis of dark-morph specimens with extensively chestnut body plumage does not exist.

Pale-phase birds—also referred to as ‘normal-phase’ birds (Jiménez 1995)—are more abundant, both in the wild and in museums. Dark birds are rare over much of the species’ distribution. The relatively numerousness of dark-morph birds in collections is explained by the large number of specimens in the Natural History Museum (Tring), in which the Falklands and the southern tip of South America—where dark birds are commoner (Reynolds 1935, Woods 1988)—are particularly well represented. Other European museums have a majority of birds from Argentina and Chile, i.e. the region where a large percentage of southern birds winter. Another factor is the possible bias shown by collectors towards rarer dark birds, as a means of equalling numbers in a series of both colour morphs.

Age- and sex-related plumage changes in pale birds were briefly mentioned by Reynolds (1935) and subsequently described by Housse (1945) and Goodall *et al.* (1951), who calculated 3–5 years as the time needed to reach definitive plumages. Our results and those of Pávez (1998) have established a period of six years. This is long considering the size and weight (c.1 kg: Cabot 1991, Jiménez 1995) of the species.



Delayed maturation only occurs in the phylogenetically closest species that constitute the oldest cluster within *Buteo* (Riesing *et al.* 2003). Along with *B. polyosoma*, these species are: *B. poecilochrous* (Cabot & de Vries unpubl.), *B. albicaudatus* (Lehmann 1945, Torres Barreto 1986) and *B. melanoleucus*. Papers on plumage change in *B. polyosoma* published in Spanish have been all but ignored, unlike publications in English by European and North American authors based on analyses of incomplete series' of skins that do not provide evidence for the existence of sequential plumage variation. Thus, Vaurie (1962), Brown & Amadon (1968) and Farquhar (1998) discussed plumage, age and sexual dimorphism in *B. polyosoma* without being aware of its sequential pattern of plumage change.

This process of plumage change concludes with a sexually dimorphic terminal plumage, somewhat unusual in *Buteo*. Prior to this, subadult males pass through a stage in which they acquire coloration and patterns resembling the final female plumage of their respective phases. Acquisition of adult female markings by subadult males also occurs in *B. poecilochrous*, a polyandrous species in which up to four males may cooperate in chick-raising (Solís & Black 1985, Coello 1997). However, no cases of polyandry have been recorded for *B. polyosoma* anywhere in its vast range (Jiménez 1995).

The following features stand out in this process of delayed maturation. Both morphs coincide in the following: retention of juvenile characteristics during the first two years of life, with incipient sexual dimorphism occurring in the second year onwards; and immature males (third and fourth years) imitate definitive adult female plumage of their respective morphs. Conversely, female erythrism reaches its peak at this age, as if female plumage always tends to differ from that of males. Fifth-year or older birds show marked sexual dimorphism (unusual in this genus): thus, males lose their female characteristics whilst females retain plumage patterns similar to subadults.

Fifth-year Chilean males show similar reddish dorsal coloration to females (Pávez 1998). We have observed southern males—presumably of this age group—with uniform white underparts and extensive reddish dorsal areas. Nevertheless, throughout the rest of the species' range birds of this age tend to have less reddish dorsal coloration and in live, fourth-year Peruvian males the reddish dorsal area is relatively small. This seems to indicate that the process of delayed maturation varies between geographically distinct populations. Such variations can be linked to obvious differences in size, given the direct relationship between longevity and body size. The largest birds occur in the southernmost part of the species' range, and the smallest in coastal Peru and Ecuador (de Vries 1973, Fjeldså & Krabbe 1990, Cabot & de Vries 2003).

The two morphs differ in regard to sexual dimorphism in body plumage. Pale-phase birds of both sexes have virtually identical underparts but different dorsal plumages, whilst dark-phase birds maintain differences in upperparts and underparts.



Vaurie (1962) and de Vries (1973) assumed that birds with white tails (and a black subterminal band) were sexually adult, although, as we have seen, this characteristic is reached as early as the third year. Reynolds (1935), who claimed to have climbed to hundreds of nests, mentioned that it is not unusual to find breeding pairs in which one bird still has the brownish coloration mixed with white or red of the following plumage stage. This indicates that sexual maturation is not delayed until the sixth year. Mate selection remains mysterious, and we should note that it is surprising that white-tailed males (3–5 years old) should moult through an incomplete, dullish reddish-brown female plumage, and that in these same age-classes females should become very prominent in their brilliant reddish-brown colours.

### *Vaurie's phases*

Vaurie (1962) established five adult plumage types, four of which coincide with those described here. Types B and D of Vaurie's classification correspond to definitive adult male and female pale-morph plumages respectively (Pávez 1998), whilst types C and A coincide with definitive dark-morph male and female plumages (over five years old). Vaurie (1962) was correct in establishing these categories in his heterogeneous sample, despite the existence of delayed maturation with several successive age-classes appearing before a definite plumage phase had been recognised. Likewise, no accurate criteria existed then for separating *B. polyosoma* from *B. poecilochores* in the hand. This we see in Vaurie's type E (birds with reddish backs and breasts, and reddish and grey-barred with white rear underparts and thighs). Vaurie's type E does not correspond to any plumage phase in *B. polyosoma*, rather it represents a dark-phase *B. poecilochores* female prior to the acquisition of definitive plumage. In its final adult plumage *B. poecilochores* loses the transverse chestnut pectoral band and retains the white-grey or whitish black, strongly barred, mid and rear underparts and tibial feathers (Gurney 1879, Lehmann 1945, Johnson 1965). Such confusion between *B. polyosoma* (uniform underparts) and *B. poecilochores* (strongly barred) is also obvious in Fig. 196, Plate 62 of Ferguson-Lees & Christie (2001). The final characteristic plumage of a dark-phase adult female is shown in Fig. 184, Plate 18 (Thiollay 1994), although the uniform grey bib and rear underparts are less extensive than in real life.

Brown-headed specimens in Vaurie's type A represent subadult dark-phase females, 3–4 years old, which will eventually moult to a grey head and bib, uniform grey and unbarred rear underparts, with a transverse chestnut pectoral band, but this is not definitive plumage.

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#### References:

- Bellati, J. 2000. Comportamiento y abundancia relativa de rapaces de la Patagonia extraandina Argentina. *Orn. Neotrop.* 11: 207–222.
- Brown, L. & Amadon, D. 1968. *Eagles, hawks and falcons of the world*. McGraw-Hill, New York.
- Cabot, J. 1991. Distribution and habitat selection of *Buteo polyosoma* and *B. poecilochrous* in Bolivia and neighbouring countries. *Bull. Brit. Orn. Cl.* 114: 199–209.
- Cabot, J. & Serrano, P. 1986. Data on the distribution of some species of raptors in Bolivia. *Bull. Brit. Orn. Cl.* 106: 170–173.
- Cabot, J. & de Vries, T. 2003. *Buteo polyosoma* and *Buteo poecilochrous* are two distinct species. *Bull. Brit. Orn. Cl.* 123: 190–207.
- Coello, M. 1997. Biología reproductiva y hábitos alimenticios de *Buteo poecilochrous* en el páramo de la Reserva Ecológica Antisana, Ecuador. Thesis. Pontificia Univ. Católica del Ecuador, Quito.
- Chapman, F. M. 1926. The distribution of bird-life in Ecuador. *Bull. Amer. Mus. Nat. Hist.* 55.
- de Vries, T. 1973. The Galapagos Hawk. An eco-geographical study with specific reference to its systematic position. Ph.D. thesis. Free Univ. of Amsterdam.
- Donázar, J. A., Ceballos, A., Travaini, A. & Hiraldo, F. 1993. Roadside raptor surveys in the Argentinean Patagonia. *J. Raptor Res.* 27: 106–110.
- Dorst, J. & Vuilleumier, F. 1986. Convergences in bird communities at high altitudes in the tropics (especially the Andes and Africa) and at temperate latitudes (Tibet). Pp. 120–149 in: *High-altitude subtropical biogeography*. Oxford Univ. Press, New York.
- Ellegren, H. 1996. First gene on the avian W chromosome (CHD) provides a tag for universal sexing of non-ratite birds. *Proc. Roy. Soc. Lond. B* 263: 1635–1641.
- Farquhar, C. C. 1998. *Buteo polyosoma* and *B. poecilochrous*, the "Red-backed Buzzards" of South America are conspecific. *Condor* 100: 27–43.
- Fjeldså, J. & Krabbe, N. 1990. *Birds of the high Andes*. Zool. Mus., Univ. of Copenhagen & Apollo Books, Svendborg.
- Ferguson-Lees, J. & Christie, D. A. 2001. *Raptors of the world*. Christopher Helm, London.
- Goodall, J. D., Johnson, A. W. & Philippi, R. A. 1951. *Las aves de Chile, su conocimiento y sus costumbres*. Platt Establecimientos Gráficos, Buenos Aires.
- Gurney, J. H. 1879. Note upon three American raptorial birds apparently new to science. *Ibis* 3: 171–178.
- Haffer, J. 1967. On the dispersal of highland birds in tropical south and central America. *El Hornero* 10: 437–438.
- Hellmayr, C. E. 1932. The birds of Chile. *Field Mus. Nat. Hist., Zool. Ser.* 19.
- Housse, R. 1945. *Las aves de Chile, en su clasificación moderna*. Ed. Universidad de Chile, Santiago.
- Jaksí, F. M., Silva S., Márquez P. & Contreras, L. C. 1991. Food habits of Gurney Buzzard in pre-Andean ranges and the high Andean Plateau of northernmost Chile. *J. Raptor Res.* 25: 116–119.
- Johnson, A. W. 1965. *The birds of Chile and adjacent regions of Argentina, Bolivia and Perú*. Platt Establecimientos Gráficos, Buenos Aires.
- Jiménez, J. E. 1995. Historia natural del Aguilucho *Buteo polyosoma*: una revisión. *Hornero* 14: 1–9.



- Jiménez, J. E. & Jaksí, F. M. 1991. Behavioral ecology of Red-backed Hawks in central Chile. *Wilson Bull.* 103: 132–137.
- Lehmann, F. C. 1945. Rapaces colombianas: subfamilia Buteoninae. *Rev. Univ. Cauca* (6): 81–114.
- Pávez, E. F. 1998. Observaciones sobre el patrón de coloración en machos y hembras de Aguilucho (*Buteo polyosoma*, Quoy y Gaimard, 1924). *Bol. Chil. Orn.* 5: 21–23.
- de la Peña, M. R. 1995. *Guía de aves argentinas*, vol. 2. LOLA, Buenos Aires.
- Philippi, R. A. 1942. La verdadera situación sistemática de los Accipitridae descritos por R. A. Philippi. *Hornero* 8: 179–189.
- Quoy, J. R. C. & Gaimard, J. P. 1824. Buse Polyosome. P.92 in Freycinet, M. L. (ed.) *Voyage autour du monde*, vol. 3. Paris.
- Reynolds, P. W. 1935. Notes on the birds of Cape Horn. *Ibis* (13) 5: 65–101.
- Riesing, M. J., Kruckenhauser, L., Gamauf, A. & Haring, E. 2003. Molecular phylogeny of the genus *Buteo* (Aves: Accipitridae) based on mitochondrial marker sequences. *Mol. Phyl. & Evol.* 27: 328–342.
- Solís, C. & Black, J. 1985. Anidación de *Buteo poecilochrous* en Antisana. *Rev. Geogr., Quito* 21: 132–142.
- Stresemann, E. 1925. Raubvogelstudien, X. Die weisschwänzigen Bussarde Süd-Amerikas. *J. Orn.* 73: 309–319.
- Swann, H. K. 1922. *A synopsis of the Accipiters (diurnal birds of prey)*. Revised edn. London.
- Thiollay, J.-M. 1994. Family Accipitridae (hawks and eagles). Pp. 52–206 in del Hoyo, J., Elliott, A. & Sargatal, J. (eds.) *Handbook of the birds of the world*, vol. 2. Lynx Edicions, Barcelona.
- Torres Barreto, A. 1986. *Cetraria Neotropical colombiana, manual de volatería experimental con rapaces suramericanas*. Itto. Colombiano de Cultura Hispanica. Bogotá.
- Vaurie, C. 1962. A systematic study of the Red-backed Hawks of South America. *Condor* 64: 277–290.
- Woods, R. W. 1988. *Guide to birds of the Falkland Islands*. Anthony Nelson, Oswestry.

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## **Recent observations of Dull-coloured Grassquit *Tiaris obscura* in Mato Grosso reinforce its status as an austral migrant to south-west Brazil**

*by Andrew Whittaker & Braulio Carlos*

*Received 25 September 2003*

On 16 September 2000, at Coxipó de Ouro, Cuiabá, Mato Grosso, whilst leading a bird tour, AW heard an unknown call in response to his imitation of Ferruginous Pygmy-owl *Glaucidium brasilianum*. Tracking this call to some low, dry thorny scrub bordering taller gallery forest, he located two unfamiliar dull-coloured Fringillidae. AW recommenced the owl imitations and the birds approached even closer, permitting excellent views at 5–6 m through 10 x 42 binoculars in perfect light. The following field marks were noted: two small c.10.5–11.0 cm nondescript





Cabot,  
Jose

and Vries, Tjitte de. 2004. "Age- and sex-differentiated plumages in the two colour morphs of the Variable Buzzard *Buteo polyosoma*: a case of delayed maturation with subadult males disguised in definitive adult female plumage." *Bulletin of the British Ornithologists' Club* 124, 272–285.

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