

Studies of Socotran birds VI. The taxonomic status of the Socotra Buzzard

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SUMMARY.—The resident, short-winged *Buteo* population on Socotra, despite having been known for over 110 years, has never been formally named. Now that it has been extensively studied in the field and its characters understood, we believe that it should be described. Like all other members of the *B. buteo* superspecies (*sensu* Kruckenhauser *et al.* 2003), it is relatively poorly differentiated genetically from most Old World buzzards, but is closest to *B. (b.) bannermani* of the Cape Verde Islands and the comparatively widespread Long-legged Buzzard *B. rufinus* of the southern Palearctic. It shares morphological features with several other Afrotropical buzzards, especially *B. oreophilus*, and *B. buteo vulpinus*, but is clearly well differentiated from *B. rufinus* and *B. (b.) bannermani* in this respect. Taxonomic judgements concerning this superspecies are inherently problematic because it represents an obviously recent radiation and because of difficulties in establishing which characters might be considered taxonomically informative. We elect to describe this population at species rank to highlight its highly unusual position within the superspecies, both genetically and morphologically. Finally, we present notes on its breeding biology (season September–April), population size (<250 pairs), behaviour (similar to Common Buzzard *B. buteo*), diet (reptiles and invertebrates), moult (November to April) and conservation prospects (the taxon should probably be ranked as Vulnerable according to IUCN criteria).

Exclusively Old World representatives of the genus *Buteo* represent a relatively young and taxonomically complex radiation of raptors (Griffiths *et al.* 2007) that numbers at least nine species (Ferguson-Lees & Christie 2005). Relevant to the following discussion, Common Buzzard *B. buteo* is the most widespread species, occurring across temperate latitudes of the entire Palearctic. One race, *B. b. vulpinus*, breeds from northern and central Europe to Central Asia, and winters in eastern and southern Africa, as well as through southern Asia, and moves through the Middle East in large numbers, including across the Bab al Mandab strait to the Horn of Africa in autumn (Shirihai *et al.* 2000). Another race, *B. b. bannermani*, is endemic to the Cape Verde Islands. Long-legged Buzzard *B. r. rufinus* occurs from central Europe to Mongolia and northern India, with some northern populations migrating as far as sub-Saharan Africa, although only small numbers are observed on passage through the Middle East (Shirihai *et al.* 2000). The smaller *B. r. cirtensis* is largely sedentary through North Africa and Arabia. The exclusively Afrotropical Mountain Buzzard *B. oreophilus* also comprises two subspecies (sometimes treated specifically). Nominate *oreophilus* occurs from Ethiopia discontinuously south to Malaŵi, whilst *B. o. trizonatus* (Forest Buzzard) is restricted to South Africa (Clark 2007), from Transvaal to the Cape Peninsula (Dickinson 2003).

Despite lacking taxonomic recognition, the *Buteo* population on the ancient island of Socotra has attracted considerable interest, equal to or arguably greater than that devoted even to the majority of the archipelago's endemic bird species and subspecies. Our purpose here is to summarise existing and unpublished rationale for recognising this insular population taxonomically, to offer support for the ranking we propose, and to

name this population, at long last. But, first, a résumé of this isolated population's history is warranted.

History and background

A breeding population of buzzards was initially discovered on the main island of Socotra during the course of the H. O. Forbes (British Museum) and W. R. Ogilvie-Grant (Liverpool Museum) expedition of 1898/99, the comprehensive ornithological results of which were published four years later (Ogilvie-Grant & Forbes 1903). This expedition secured four specimens of a *Buteo*, two of which are nowadays held in The Natural History Museum, Tring, and the other two in the National Museum and Galleries on Merseyside, Liverpool (cf. Frost & Siegfried 1970). Ogilvie-Grant & Forbes (1903) listed them as *Buteo desertorum*, although the two Liverpool specimens were labelled as being *Buteo brachypterus*, Hartlaub, 1860, a name nowadays restricted to the buzzard of Madagascar (Dickinson 2003). Earlier visitors to the island had either overlooked the presence of a *Buteo* or had at least failed to collect it (the results of previous ornithological work were limited to lists of specimens, with descriptions of the novelties: Sclater & Hartlaub 1881, Hartlaub 1881). Thereafter, Hartert (1914: 1127) briefly mentioned that the Socotran birds merited taxonomic attention. Two further specimens, both taken by M. T. Boscawen and R. E. Moreau, in March 1934, are also held in Tring, since when only two further visitors to the island have collected birds: G. Popov in 1953 (whose research was principally devoted to desert locusts) and A. D. Forbes-Watson in 1964 (whose remit was almost entirely avifaunal). Neither collected any specimens of the *Buteo*; indeed, Forbes-Watson (1964) wrote in his unpublished expedition report that the buzzards 'had a genius for being wary when one had a gun'. Ogilvie-Grant's experiences had been similar (Ogilvie-Grant & Forbes 1903: 48).

In writing up the results of Forbes-Watson's work, Ripley & Bond (1966) were unable to identify the buzzard to subspecies. Based on an examination of the British Museum material, nevertheless, they considered that the morphometrics of at least three of the four birds were generally within the range of *B. b. vulpinus*, thereby hinting at the possibility of both resident and non-resident (perhaps simply passage migrant) populations. Forbes-Watson's (1964) unpublished report also suggested their identity as *vulpinus*, but admitted the need for additional work, and (*in litt.* 1969, quoted in Frost & Siegfried 1970) thought that two populations might exist on Socotra. However, he admitted that he had not witnessed any obvious migration during the spring he spent on the island. Brown *et al.* (1980) actually mapped both *Buteo buteo* and *B. oreophilus* as occurring on Socotra, presumably in deference to the two-population theory; Frost & Siegfried (1970) had also postulated that one of the British Museum series might be *B. b. vulpinus*. These latter authors considered resident birds to be intermediate between *oreophilus* and *vulpinus*, albeit closer to the latter, and concluded that they might be treated as a separate race of *B. buteo*. However, they refrained from naming it, because they had only been able to examine one adult specimen. It is worth remarking that extensive field observations from at least seven months of the year, since 1993, have produced just one record of *B. b. vulpinus* on Socotra (see Distribution and population size) and none of *B. rufinus* or any other buzzard taxon.

Thereafter, de Naurois (1973, 1987) drew attention to the apparently analogous situation of the buzzards on Socotra and those on the Cape Verde Islands, off the western coast of Africa, which latter had been named as *Buteo b. bannermani* Swann, 1919, and in this he was echoed by James (1986). De Naurois (1973) suggested that these *Buteo* populations might represent relics of a now-extinct pre-Pleistocene African buzzard, which had served as a prototype for *Buteo* populations that had colonised the Palearctic subsequently with the advent of favourable climatic conditions. This was more or less the reverse of the

theory espoused by Moreau (1966). However, de Naurois (1987) subsequently mooted that *bannermani* and the Socotran birds represent residual populations of a continental extinction that occurred as the African mainland became desertified, and suggested (quite correctly) that these insular populations were likely to prove closest to *B. rufinus*. Thus all three might be descended from a single ancestor that had inhabited the Saharan region prior to the last Würmian glaciation (i.e. the final and most extreme glacial epoch of the Pleistocene, which reached its peak c.18,000 B.P.). Thereafter, Hazevoet (1995) elevated *bannermani*, the Cape Verdean population, to species rank under the phylogenetic species concept, and Martins & Porter (1996), in noting Hazevoet's case, suggested that the Socotran population might be best treated similarly. Together with the nesting details presented by Clouet *et al.* (1994), observations made in April 1993 (Martins & Porter 1996) became the first detailed remarks on the Socotran population to be based solely on in-depth field experience. Additional field observations were published by Clouet *et al.* (1998).

Clouet & Wink (2000) subsequently published the results of a small-scale genetic study, using mitochondrial DNA, of the buzzards of the Cape Verdes and Socotra. It found evidence to suggest that *B. buteo* and *B. oreophilus* are close relatives, and that *B. bannermani*, *B. rufinus* and the Socotran *Buteo*, which they referred to as '*B. socotrae*', clustered closely. Because genetic distances between virtually all of the taxa sampled were not large—a finding echoed by Schreiber *et al.*'s (2001) and Kruckenhauser *et al.*'s (2004) studies of *B. buteo* subspecies, and the much broader study of Lerner *et al.* (2008)—the relatively small differences between the latter three were interpreted by Clouet & Wink (2000) as support for either two or three species, with Socotran birds either to be 'named *bannermani* (because of the identical nucleotide sequence) or alternatively *Buteo socotrae* owing to its isolated and remote situation.' Londei (2003) remarked that his field observations of *bannermani* in the Cape Verdes also suggested that the insular population possesses more traits in common with *rufinus* than *buteo*, thereby providing additional support for Clouet & Wink's (2000) conclusions.

Most recently, the molecular study of the genus *Buteo* published by Riesing *et al.* (2003) and Kruckenhauser *et al.* (2004), which also used mitochondrial markers (coupled with analyses of morphometrics and morphology), found that amongst the very recent radiation defined by the *B. buteo* superspecies, Socotran birds again clustered closer to *B. rufinus* (including *B. r. cirtensis*) than *B. buteo*. However, in the Kruckenhauser *et al.* (2004) analysis of morphological and morphometric characters, Socotran and Cape Verdean buzzards grouped with *B. b. rothschildi* of the Azores, presumably as a result of convergent adaptation to dry-country habitats. Kruckenhauser *et al.* (2004) recommended that the *B. buteo* superspecies be treated as three allospecies, namely *B. buteo*, *B. rufinus* and *B. oreophilus*, whilst admitting that (a) it would be defensible under the Biological Species Concept to treat all of the constituent taxa as a single species, and (b) the situation concerning *bannermani* and '*socotrae*' was almost a matter of choice. Because genetic differentiation is apparently small amongst members of the *B. buteo* superspecies, even between taxa traditionally ranked as species (e.g. between *B. buteo* vs. *B. rufinus*, and *B. oreophilus* vs. either of the other two taxa), and because morphologically the Socotran population shares more traits with *B. buteo vulpinus* and *B. oreophilus sensu lato* (especially *B. o. trizonatus*; see Diagnosis and Table 3), we circumscribe it here as a new species under the Biological Species Concept (*sensu* Helbig *et al.* 2002). Although Clouet & Wink (2000) introduced '*socotrae*' as a potential name for this population, and in referring to the Socotran population thus they were followed by Riesing *et al.* (2003) and Kruckenhauser *et al.* (2004), this name is a *nomen nudum* and has no validity because its initial use cannot be considered a valid nomenclatorial act according to the *International code of zoological nomenclature* (ICZN 1999, Arts. 13.1.1, 16.1, 16.4 and 72.3).

***Buteo socotraensis*, sp. nov.**
Socotra Buzzard

Holotype.—The Natural History Museum (formerly British Museum of Natural History), Tring (NHM 99.8.11.10). Adult (unsexed) collected by W. R. Ogilvie-Grant and H. O. Forbes at ‘Elhe’ (locality not precisely traced), on the Hadibu Plain, in the north of the main island of Socotra, on 28 January 1899 (Fig. 1); no other label data.

Paratypes.—The Natural History Museum, Tring. Adult male, NHM 1934.8.12.2, collected 9 March 1934, by Colonel M. T. Boscawen at Momi (altitude c.450 m) on the main island of Socotra; juvenile female, NHM 1934.8.12.3, collected on 9 March 1934, by Colonel M. T. Boscawen, at Momi (altitude as previous), on the main island of Socotra; juvenile female, NHM 99.8.11.11, collected on 22 January 1899, by W. R. Ogilvie-Grant and H. O. Forbes, at Homhil (altitude c.900 m), in the east of the main island of Socotra. No other label data. Measurements of the holotype and paratypes are presented in Table 1.

TABLE 1

Measurements of endemic *Buteo* taxa on Socotra and the Cape Verde Islands, based on specimens held at The Natural History Museum, Tring, taken by GMK according to standard parameters (i.e. flattened wing, bill to skull, and tarsus to last complete scale before the toes diverge), using a metal wing-rule with perpendicular stop at zero (accurate to 0.5 mm) and, for culmen and tarsus, digital callipers (accurate to 0.01 mm).

	Locality	Date (collector)	Age / sex	Wing	Tail	Culmen (tip to skull)	Tarsus
<i>Buteo socotraensis</i>							
NHM 99.8.11.10 (holotype)	Elhe, Hadibu Plain	28 January 1899 (Ogilvie-Grant & Forbes)	Adult unsexed	350 mm	189 mm	33.33 mm	66.34 mm
NHM 1934.8.12.2 (paratype)	Momi	9 March 1934 (Boscawen)	Adult male	366 mm	188 mm	38.19 mm	64.05 mm
NHM. 1934.8.12.3 (paratype)	Momi	9 March 1934 (Boscawen)	Juvenile female	341 mm	190 mm	33.98 mm	63.67 mm
NHM 99.8.11.11 (paratype)	Homhil, east Socotra	22 January 1899 (Ogilvie-Grant & Forbes)	Juvenile female	267 mm (not fully developed)	135 mm (not fully developed)	33.08 mm	74.68 mm
<i>Buteo (buteo) bannermani</i>							
NHM 1919.8.15.148 (holotype)	São Vicente	26 September 1913 (Bannerman)	Female	367 mm	194 mm	38.4 mm	74 mm
NHM 1911.12.23.436*	‘Santiago’ (= Boavista; cf. Hazevoet 1995)	February 1897 (Boyd Alexander)	Female (by label, or immature male: Hazevoet 1995)	385 mm	177 mm	36.9 mm	75 mm

*Identified as Long-legged Buzzard *Buteo rufinus cirtensis* by James (1984, cf. Hazevoet 1995), a species otherwise unknown from the Cape Verde Islands, but its measurements appear to preclude this possibility (see Table 2).

Description of holotype.—Colour codes (in parentheses) follow Smithe (1976). See also Fig. 1. Forehead, crown, nape, ear-coverts and moustachial area pale Fuscous (21) with narrow white streaking on ear-coverts and moustachial area. Chin, throat, breast and upper belly white with Burnt Umber (22) streaking, finest on chin and throat, broadening

on breast and heaviest on belly, where the brown becomes more solid, especially on body-sides and flanks. This streaking is the result of dark (midway between Fawn Color [25] and Clay Color [26]) arrowhead-shaped centres to the off-white feathers. Lower belly off-white barred or vermiculated warm Drab (27), the broadest bars being 8 mm, narrowing to 2 mm at tip of feathers. Undertail-coverts predominately white with very sparse, narrow vermiculations, of a Clay Color (26) and even sparser Burnt Umber (22) shaft-streaks. Thighs and tarsal feathering predominately chestnut-tinged Raw Umber (23), with barely perceptible whitish-buff tips to feathers, closest to Buff (24). Underwing: axillaries white, barred Raw Sienna (136), with Burnt Umber (22) shaft-streaks and variable whitish feather tips; the entire coverts having a rather chequered pattern. Carpal extensive Dark Grayish Brown (20), the outer margin tending to pale Sepia (119). Primaries off-white with Sepia (119) webs and broad tips. Secondaries and tertials off-white with narrow, diffuse Vandyke Brown (121) barring and extensive broad tips, the outermost band (of some 23 mm in width) the darkest; thus forming a distinct band along hindwing. Scapulars, wing-coverts, tertials and back pale Fuscous (21) with dark Burnt Umber (22) shaft-streaks. Mantle Fuscous (21) with some Amber (36) and whitish feather-fringes. Primaries and small tertial Fuscous (21); secondaries and larger tertials pale Fuscous (21) with darker shaft-streaks. Rump pale Fuscous (21); uppertail-coverts brown, closest to Olive-Brown (28) with whitish tips and very pale Amber (36) vermiculations. Uppertail overall Pale Neutral Gray (86) with pale Vandyke Brown (121) vermiculated barring; basal bars 5–6 mm in width, narrowing to 2–3 mm over distal portion, except for subterminal band of 7 mm (Fig. 2). Note, however, that the distal third of all rectrices show warm elements close to Mikado Brown (121c), concentrated on the shaft region, but barely perceptible on the central feathers. Undertail dirty white with narrow pale to very pale Vandyke Brown (121) barring.

Diagnosis.—Because of the relatively few available specimens of the new taxon, the following analysis is complemented by our and fellow observers' field observations since 1993. During seven days in March–April 1993, RFP & GMK *et al.* observed a total of 31 individuals, including three juveniles (Kirwan *et al.* 1996). Subsequently, during nine visits spanning six months between 1996 and 2008, RFP *et al.* observed a total of 181 individuals. Of these 43 were aged (33 adults and ten juveniles). Field descriptions were taken of 12 birds and photographs of 21 (15 adults / subadults and six juveniles). These data were supplemented by reference to other photographs by co-workers and some published images, e.g. in Clouet *et al.* (1994), all of which were studied carefully. Our sample of *B. (b.) bannermani* specimens was also very small and was therefore also supplemented by reference to field photographs. Of the five taxa to which it has been linked taxonomically, *Buteo socotraensis* is slightly larger than *B. oreophilus* and probably slightly smaller than *B. bannermani* (Table 2; cf. Ferguson-Lees & Christie 2001: 693), although the small sample sizes of the first- and last-named must be borne in mind. It is thus a small to mid-sized *Buteo* with brown upperparts and pale underparts, which are barred and blotched brown on the breast, belly and underwing-coverts. Individual plumage variation in both adult and juvenile plumages is less than in any of the other members of the *B. buteo* superspecies, as might be expected in an insular taxon. In adult plumage the brown upperparts are relieved only by pale bases to the outer primaries, which form a diffuse but noticeable panel (Fig. 3), which this species shares with *B. rufinus* and some *B. b. vulpinus*, but not with *B. oreophilus* or *B. bannermani*. The uppertail is narrowly barred as it is in most *B. b. buteo* and some *B. b. vulpinus*. In *socotraensis*, nevertheless, the pale greyish tail, often showing a gingery hue, especially distally, has 10–12 narrow, dark bands, with the subterminal the broadest. In the morphologically most similar taxa, specimens of *oreophilus* at NHM have 6–7 dark bands of equal width to the pale bands, whilst *bannermani* has 8–11 bands, also of equal width to

the pale bands, which are less grey than in *socotraensis*. However, W. S. Clark (*in litt.* 2010) reports that *oreophilus* typically has a dark tail with narrow pale bands and a broad dark tip, thus resembling the pattern in *B. b. buteo*. Furthermore, in *bannermani* it appears that the subterminal band is of similar width to the other bands (see Fig. 2). Adults of the larger *rufinus* have a distinctly orange-toned, unbarred tail.

Below *socotraensis* is white (very slightly tinged buff) with fine brown streaking on throat and heavier dark brown streaking on the breast, belly, flanks and thighs, becoming most solid, albeit variably, there (Figs. 1, 4 and 5). This pattern is quite different from that in all *B. rufinus* (Fig. 6), except some dark birds including *B. r. cirtensis*. The warm brown / chestnut-brown underwing-coverts in *socotraensis* are rather irregularly streaked and chequered dark brown, most intensely on the greater coverts. The large carpal patch is solid dark brown. The variation in the strength or intensity of these underbody and underwing-covert markings is slight (Figs. 7–8). Some individuals possess a whiter throat, upper breast and thighs. The large dark carpal patch is shared with typical *rufinus*, but not by *B. b. buteo* and *B. b. vulpinus* in which it is far less pronounced, especially in those birds that are darker below (Fig. 9). In such birds, unlike *socotraensis*, the chin, throat and upper breast are streaked dark brown, often bordered by a pale horseshoe below; this is a feature apparently never found in *socotraensis*. In this respect, moreover, *bannermani* is patterned more like *B. b. buteo* and *B. b. vulpinus* (Fig. 10). The underside of the primaries and secondaries is similar to that of the other *Buteo* taxa, showing a wide dark band on the hindwing typical of adults.

Juveniles (Fig. 11) differ from adults in having a warm buff suffusion over the breast and thighs on otherwise creamy white underparts, as well as less extensive brown streaking, this being concentrated on the lower breast and breast-sides; the belly itself has barely any streaking and there is only sparse spotting on the thighs. The underwing-coverts are creamy white with a warmer suffusion on the forewing-coverts, which are finely streaked brown; the greater coverts are coarsely streaked brown, creating a diffuse band that extends into a much-reduced dark surround to the carpal patch, compared to the adult. The primaries and

TABLE 2

Range of measurements (in mm) of adult *Buteo* taxa, with means (where recorded) in parentheses: *B. socotraensis* and *B. (b.) bannermani* from NHM specimens (taken by GMK; for protocols see Table 1); all other taxa from Brown *et al.* (1982). The small sample sizes of *B. socotraensis* and *B. (b.) bannermani* must be kept in mind.

Taxon	Wing length (flattened chord from shoulder to tip)	Tail length (from base of central rectrices to tip)	Tarsus length (from notch on heel to lower edge of last complete scale before toes diverge)
<i>B. socotraensis</i> (<i>n</i> = 2, ♂♀)	350–366 (<i>m</i> = 358)	188–189 (<i>m</i> = 188.5)	64.36–66.05 (<i>m</i> = 65.19)
<i>B. (o.) oreophilus</i> (♂♂)	332–336	174–183	61–72 (♂♀)
<i>B. (o.) oreophilus</i> (♀♀)	345–356	180–196	–
<i>B. (o.) trizonatus</i> (♂♂)	318–352	–	–
<i>B. (o.) trizonatus</i> (♀♀)	330–362	–	–
<i>B. b. buteo</i> (♂♂)	350–418	194–223	69–83 (♂♀)
<i>B. b. buteo</i> (♀♀)	374–432	193–236	–
<i>B. b. vulpinus</i> (♂♂)	338–387 (<i>m</i> = 359)	170–207 (<i>m</i> = 185)	69–82 (♂♀)
<i>B. b. vulpinus</i> (♀♀)	352–400 (<i>m</i> = 374)	175–209 (<i>m</i> = 191)	–
<i>B. (b.) bannermani</i> (<i>n</i> = 2♀♀)	367–385 (<i>m</i> = 376)	177–194 (<i>m</i> = 185.5)	74–75 (<i>m</i> = 74.5)
<i>B. rufinus</i> (♂♂)	418–447 (<i>m</i> = 436.6)	224–240 (<i>m</i> = 231.7)	83–92 (<i>m</i> = 85.9)
<i>B. rufinus</i> (♀♀)	450–487 (<i>m</i> = 462.1)	240–289 (<i>m</i> = 261.2)	86–95 (<i>m</i> = 89.8)
<i>B. r. cirtensis</i> (♂♂)	345–384	188–197	72–78
<i>B. r. cirtensis</i> (♀♀)	380–425	196–201	74–79

TABLE 3

Morphological characters useful in separating adults of the key *Buteo* taxa covered in this paper, based on specimen analysis supplemented by reference to literature (e.g. Ferguson-Lees & Christie 2001, 2005), especially for *B. oreophilus trizonatus* (James 1986, Clark 2007), and field photographs, especially for *B. (b.) bannermani*.

Character – Taxon ↓	Overall structure	Tail pattern	Pale panel in upperwing	Breast pattern	Dark carpal patch on the underwing
<i>B. socotraensis</i> (sedentary)	small to mid-sized, with relatively short, compact wings	pale greyish, often with a gingery hue, and 10–12 narrow, dark bands; subterminal broadest	+	no pale horseshoe	usually solid and dark brown, contrasting rather strongly with the coverts, but less so than in <i>B. rufinus</i>
<i>B. o. oreophilus</i> (sedentary)	generally smaller than <i>B. buteo vulpinus</i> , with shorter and narrower wings and tail	olive-brown to pale brown with 6–7 black bands of equal width to the pale bands	–	no pale horseshoe	dark brown and relatively solid, but contrasting little with underwing-coverts
<i>B. o. trizonatus</i> (largely sedentary)	similar to <i>B. o. oreophilus</i> , but reported to be even narrower-winged than the latter with a less rounded wingtip (Clark 2007)	brown washed rufous, either with many narrow dark brown bands (subterminal broadest) or vague dark bands and a clear dark subterminal band	+	pale horseshoe, except very palest birds	dark comma-shaped mark, most of carpal patch is pale
<i>B. buteo vulpinus</i> (migratory)	typically appears relatively compact with broad wings and a rather short tail	cream-coloured to greyish, with many vague dark bands, and the subterminal band broadest and darkest	variable	pale horseshoe sometimes present, but in paler morphs only	dark to blackish comma-shaped mark does not contrast strongly with coverts
<i>B. b. bannermani</i> (resident)	structurally similar to <i>B. b. vulpinus</i>	greyish, with 8–11 dark bands of equal width to the pale bands (including the subterminal band at least on the uppertail), but less grey than in <i>socotraensis</i>	–	pale horseshoe is apparently always present and usually obvious	dark brown to blackish, but seems rather diffuse and small, and offers little contrast with the coverts
<i>B. rufinus</i> (resident and migratory)	relatively large, with long, broad wings, and a long tail	typically orange-coloured and unbarred or virtually so	+	entire breast and throat usually paler than rest of underparts	usually solid black and very prominent, contrasting strongly with the rufous underwing-coverts

secondaries are off-white, narrowly barred darker (more obvious than in the adult) with a broad dark terminal band, but never as broad or clearly defined as in adults. As shown in Fig. 12, juveniles possess narrow orange-buff fringes to the wing-coverts and an orange-buff suffusion to the cheeks, supercilium and nape. In flight, the juvenile lacks the pale panel at the base of the primaries, the wings appearing all brown.

Variation in the series.—The juveniles (NHM 99.8.11.11 and 1934.8.12.3) differ from the adult in having creamy-white underparts, heavily suffused Warm Buff (118), especially on the breast and thighs, (this suffusion gradually fading with age). Ventrally, the dark streaking, between Burnt Umber (22) and Raw Umber (23) is less extensive than on the adult holotype and is concentrated on the lower breast and breast-sides; the belly has barely

any streaking and only sparse, diamond-shaped spotting on the thighs. Undertail-coverts unmarked. The underwing-coverts are predominately Warm Buff (118) with irregular dark markings and a diffuse band across the greater coverts. The dark carpal patch (again Burnt Umber) is greatly reduced. Primaries and secondaries off-white, becoming whiter with age, narrowly barred darker and with a broad dark terminal band. Primary tips Burnt Umber (22). Compared to adults the dark carpal-patch is greatly reduced, the underwing-coverts are much paler with a dark band on the greater coverts, and the barring on the secondaries is more obvious.

Based on our field observations (see Diagnosis), it is clear that there is little variation in either adult or juvenile plumage, apart from the degree and intensity of streaking on the underparts. This ranges from lightly streaked to more heavily so, but most adults conform to the patterns shown in Figs. 5 and 7, and juveniles to that in Fig. 11. The base colour of the tail can vary slightly, with some birds possessing a gingery hue, which can be accentuated when backlit. *B. socotraensis* appears to be less variable in plumage than either *B. buteo* and *B. oreophilus* and probably *B. (b.) bannermani*.

Distribution and population size.—*B. socotraensis* is found only on the main island of Socotra (Fig. 13), where it is a widespread, but not common, resident breeder. Surveys undertaken between 1999 and 2008 suggest that the population is <250 pairs (Porter & Suleiman in prep.). There is no evidence of any movement away from Socotra, doubtless because of the long sea crossing (>100 km from the closest part of Somalia, Cape Guardafui, and c.380 km south of the Yemen coast) that such soaring birds typically avoid. Indeed, migrant broad-winged raptor species are vagrants to Socotra. There is just one definite record of Steppe Buzzard *B. buteo vulpinus* (a dark-morph individual on 26 November 1999: RFP pers. obs.), which is the commonest migrant bird of prey in Arabia (Shirihai *et al.* 2000) and was immediately recognised as distinct from the resident Socotra buzzards. There are too few historical data to determine whether there has been any change in the status or population of the Socotra Buzzard since the first ornithological visits to the island in the 1880s. It is probably the rarest of the island's endemic birds and detailed studies of its population and ecology are urgently required.

Habitat.—Socotra Buzzard is resident in the foothills and plateaux, mostly where there are deep ravines, from sea level to at least 1,370 m, but principally at 150–800 m. It does not appear to be dependent on trees, but steep cliffs would seem to be prerequisite for nesting (RFP pers. obs.). No seasonal altitudinal movements have been observed, and it is reasonable to assume that if there are any, they are not significant. Competition for nesting sites has not been studied, but with Egyptian Vulture *Neophron percnopterus*, Peregrine Falcon *Falco peregrinus* and Brown-necked Raven *Corvus ruficollis* all using similar cliff-edges for nesting on Socotra, this might be a limiting factor to the buzzard population. This could be especially true with respect to Egyptian Vulture as Socotra probably holds the highest concentration of this species in the world, with a population of c.1,700 individuals (Porter & Suleiman in prep.).

Behaviour.—Similar to other Old World *Buteo* species, especially to that of Common *B. b. buteo* and Steppe Buzzards *B. b. vulpinus*. Much time is spent perched on rocks, cliff ledges, trees and bushes, which are presumably used as scanning posts to search for food. In all months, birds have been observed soaring high above plains and hills, sometimes in loose groups of up to five, often with spells of calling. In this respect behaviour is similar to that of *B. b. buteo* and *B. b. vulpinus*. During a total of 25 weeks of observation (spanning seven months in nine years) RFP has never observed *socotraensis* hovering.

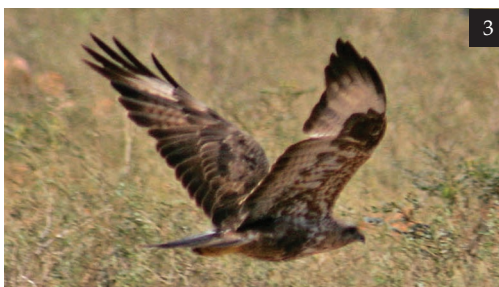


Figure 1. Unsexed adult holotype Socotra Buzzard *Buteo socotraensis* (left; NHM 99.8.11.10) and female holotype of Cape Verde Buzzard *B. (buteo) bannermani* (NHM 1919.8.15.148), held in The Natural History Museum, Tring (R. F. Porter / © The Natural History Museum, Tring)

Figure 2. Uppertail patterns of Mountain Buzzard *Buteo oreophilus* (left), Cape Verde Buzzard *B. bannermani* (centre) and Socotra Buzzard *B. socotraensis* (R. F. Porter / © The Natural History Museum, Tring)

Figure 3. Adult Socotra Buzzard *Buteo socotraensis*, Socotra, 18 February 2006 (R. F. Porter)

Figure 4. Adult Socotra Buzzard *Buteo socotraensis*, Socotra, with centipede, probably *Scolopendra balfouri*, November 2008 (R. F. Porter)

Figure 5. Adult Socotra Buzzard *Buteo socotraensis*, Socotra, October 2007 (R. F. Porter)

Figure 6. Adult Long-legged Buzzard *Buteo rufinus*, Iraq, date unknown (A. F. Omar / Nature Iraq)



Figure 7. Adult Socotra Buzzard *Buteo socotraensis*, in wing moult, Socotra, October 2007 (R. F. Porter)

Figure 8. Adult Socotra Buzzard *Buteo socotraensis*, Socotra, January 2006 (Hanne & Jens Eriksen)

Figure 9. Adult Steppe Buzzard *Buteo buteo vulpinus*, southern Israel, March 1989 (Paul Doherty)

Figure 10. Cape Verde Buzzard *Buteo (buteo) bannermani*, Cape Verde Islands, date unknown (Vaughan Ashby)

Figure 11. Juvenile Socotra Buzzard, *Buteo socotraensis*, Socotra, 28 February 2007 (R. F. Porter)

Figure 12. Juvenile Socotra Buzzard, *Buteo socotraensis*, Socotra, 12 February 2004 (R. F. Porter)

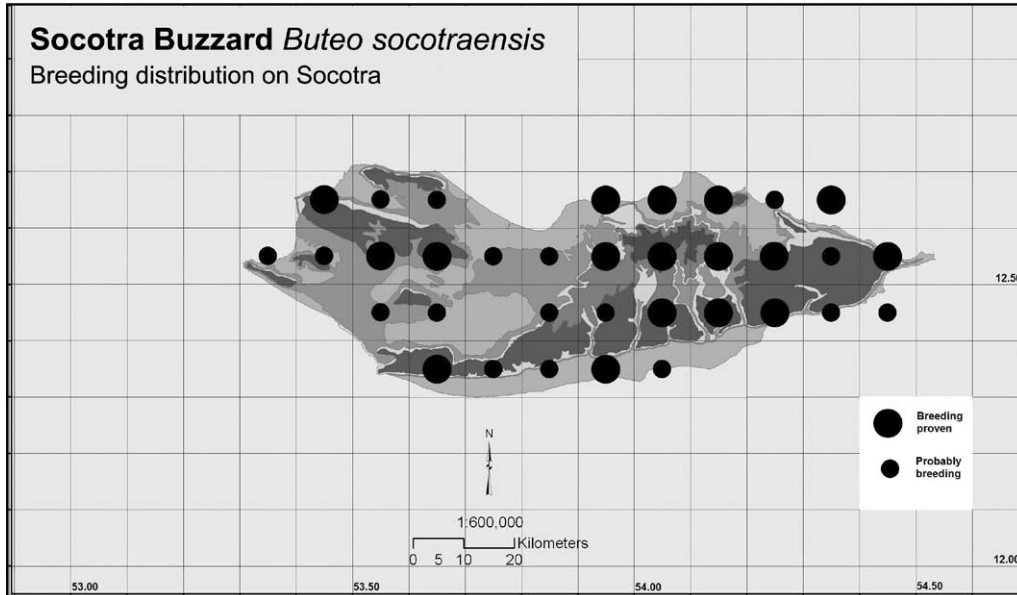


Figure 13. Socotra Buzzard *Buteo socotraensis* breeding distribution on Socotra (Socotra Conservation and Development Programme / BirdLife International)

Breeding.—Data presented here are summarised from Porter & Jennings (in press). Display, notably aerial tumbling and talon grappling, has been observed in October–December and February, and copulation in November. Nest building has been observed in late October and a nest with a chick (c.15 days old), being tended by both adults, was found on 28 October; in this case egg laying would have been in mid September. A nest with two eggs was found on 16 November (egg dimensions were presented by Clouet *et al.* 1998), and nests with young observed in January (young c.1 month old) and in early April, to which adults were bringing food. A juvenile in captivity on 2 March was just a few weeks out of the nest, suggesting egg laying in January; discussions with the ‘owners’ of three other captive juveniles suggested laying dates in October–January. Two other juveniles in captivity had apparently been taken from a nest in November, thus indicating egg laying commences in October. One instance of a pair nest building in April and May was not followed by egg laying. Fully-fledged young, still with a strong parental bond, have been observed from mid February to early April. All the above observations suggest that the breeding season extends from September–April (perhaps into May), with egg laying in September–January. It is probably important for this buzzard to have completed its breeding cycle before the onset of the monsoon winds in late May, which could hamper its ability to hunt and find food for the young. Broods of only one or two nestlings have been recorded on single occasions, but there is one record of a pair with three fledged young, indicating that clutch size can be larger. The few nests observed have been constructed of sticks on a cliff-ledge or crevice, sometimes with a tree, small bush or vegetation for protection or support. Live branches with leaves have been observed being brought to the nest. No tree nests have been reported. Once a pair appeared to be preparing to breed again in the previous season’s nest (Clouet *et al.* 1994). Nests have been noted at 150–650 m. It was suggested by Clouet *et al.* (1994) that nests might be sited to provide shade during the day. Whilst there is no information on the role of the sexes in nest building or incubation, both have been observed tending young in the nest and are present during the post-fledging period. There

is a record of repeated attacks on an Egyptian Vulture by a pair of buzzards, when their nest was approached, and another observer reported an adult becoming agitated by a Peregrine Falcon near a possible cliff nest site.

Food.—Diet almost certainly exclusively comprises reptiles and invertebrates. Individuals are often seen perched on a prominent rock or tree, and the method of foraging appears to be to wait for prey to come into range and then pounce. However, there is no detailed information on the diet of either adults or juveniles, but food being taken and consumed has included a snake, small lizard, locusts, at least once a large centipede (probably *Scolopendra balfouri*) and a large caterpillar (RFP). This 'passive' hunting method is not effective for catching birds. The centipedes in question reach up to 18 cm long and, together with the larger crabs, are the largest terrestrial invertebrates on the island. The head is poisonous and the tail has two pincers, both of which were, in the case observed, apparently removed and discarded by the buzzard. Socotra has a very depauperate mammalian fauna (Cheung & DeVantier 2006), consisting of one tiny shrew, four bats, and two human commensal rodents, House Mouse *Mus musculus* and Black Rat *Rattus rattus*, both of which are found near settlements, where this buzzard rarely occurs. As the rodents are thought to be historically recent arrivals on the island, it has been assumed that the bulk of the buzzard's prey must be lizards, large insects and possibly nestlings; the birds have never been observed feeding on carrion. Clarification of its diet will be an important factor in guaranteeing its survival.

Moult.—Adults in active wing moult have been observed in November–April. By February–March most adults observed had recently moulted their primaries, thus most have freshly moulted flight feathers during the period when most juveniles are fledging. This differs from the moult sequence typical of *B. b. buteo*, which does not commence primary and tail moult until late April / early May, or *B. b. vulpinus*, which commences moulting both the primaries and tail in early May (see Cramp & Simmons 1980, Martins & Porter 1996). However, it must be remarked that in widespread species, differences in moult timing can be expected in different regions and we have attached no taxonomic significance to these differences.

Vocalisations.—The calls of *Buteo rufinus*, *B. buteo*, *B. oreophilus* (*sensu stricto*) and *B. socotraensis* are very similar. Sound-recordings of *socotraensis* were made in 1999–2004 but only one could be assigned to an adult, made in November, which is at the start of the breeding season. Although it transpired that this recording was distorted, it was nevertheless compared with the calls of known adults of the other taxa. Because of the distortion and the small sample ($n=1$), this brief analysis should be treated as highly provisional. It is included to encourage further study and has not been used in the taxonomic assessment of the Socotra Buzzard. Sonogram comparisons suggest the inter-note intervals in *oreophilus* and *rufinus* are very similar, with longer gaps between calls (*c.*5 seconds in the former vs. *c.*3.5 seconds in the latter), whereas such intervals in *buteo* (*c.*1–2 seconds) and *socotraensis* (<1 second) are considerably shorter. Note structure differs between all four taxa, but again *socotraensis* with its much less wavering form is perhaps most similar to *B. buteo*, although it should be added that the latter's note structure is still closer to either *oreophilus* or *rufinus* than to *socotraensis*. Of the four taxa sampled *socotraensis* shows the smallest frequency range, its calls being almost entirely concentrated at around 2.2 kHz, especially compared to *oreophilus* (total range *c.*1–6 kHz) and *rufinus* (*c.*1–4 kHz), although all four, including *B. buteo*, show the same emphasis around *c.*2.0 kHz.

Etymology.—We have employed the name *socotraensis* to reflect the provenance of this new taxon, but have intentionally formed it as an arbitrary combination of letters in the form

of a word to ensure that its spelling remains fixed (ICZN 1999, Arts. 11.3, 26 and 31.2.3). The English name 'Socotra Buzzard' agrees with the recommendation of the IOC (Gill & Wright 2006) that noun usage, because it is already established for other birds endemic to the island group, e.g. Socotra Bunting *Emberiza socotrana* and Socotra Sparrow *Passer insularis*, should be preferred over an alternative adjectival form, in this case Socotran.

Taxonomic rank.—As noted in the introductory paragraphs, various authors have wrestled with the taxonomic position of the Socotra Buzzard. Indeed, it might be stated, with no pretence to originality, that in the Palearctic region the problems posed by Old World *Buteo* in general are amongst the thorniest in avian taxonomy. The results of two genetic studies, although sampling only non-nuclear DNA, have suggested that the insular populations of the Cape Verde Islands and Socotra are most closely related to *Buteo rufinus*, a taxon that has been universally accorded specific rank in all recent literature. Three options therefore are open: (i) to treat all three as members of a single species; (ii) to recognise two, mainland and insular, species; and (iii) to recognise three species. In all three cases, the genetic, morphological and morphometric evidence combined, presented herein and in the papers discussed in the introduction, clearly indicate that Socotra Buzzard is a discrete taxon, and needs to be named under the articles of the Code. We agree with Kruckenhauser *et al.* (2004) that, to some extent, the taxonomic rank given to that name is a matter of personal preference. However, even for those working within the constraints of the Biological Species Concept, we do not consider it to be a reasonable option to treat Socotran birds as conspecific or consubspecific with the Cape Verdes buzzard, *bannermani* because of their level of morphological differentiation and widely disjunct ranges which prohibit genetic interchange.

Nonetheless, one of the authors of this latter study, A. Gamauf (*in litt.* 2009) has pointed out that the genetic data available for Socotran buzzards suggest that they do not form a monophyletic group with *bannermani*, and are of separate origin. In her opinion, it cannot be excluded that they represent a stabilised hybrid population between ancestral *B. rufinus* and *B. b. vulpinus*. The geographic position of Socotra (and the Cape Verde Islands) at the border of the migration routes and winter quarters of these highly mobile raptors does need to be considered. Additional genetic data for both these insular populations are certainly required to reach more robust conclusions concerning their phylogeographic history.

Despite the notable lack of genetic differentiation amongst Old World *Buteo* in general (Kruckenhauser *et al.* 2004, Lerner *et al.* 2008), and even though they are now understood to be a relatively youthful radiation arriving from the New World perhaps via a single dispersal event (Griffiths *et al.* 2007, Amaral *et al.* 2009), recent workers have taken an increasingly expansive view of *Buteo* taxonomy in Afro-Eurasia. Given that Socotra became separated from surrounding landmasses at least 31 MYA (Braithwaite 1987), the colonising proto-*Buteo* population must have arrived over water.

In line with Helbig *et al.*'s (2002) recommendation that decisions on species limits among allopatric taxa be guided by comparisons with degrees of difference in sympatric taxa that behave as species, we offer the following remarks. As long ago as the 1950s, when all of the relevant taxa were generally considered subspecies of *B. buteo*, Rudebeck (1958) had already briefly mooted the possibility that *B. oreophilus* (Mountain Buzzard) and *B. trizonatus* (Forest Buzzard) might be better treated as separate species, rather than subspecies. It was a supposition given a more thorough review by James (1986), even though Dowsett & Dowsett-Lemaire (1993) cited James's reticence to 'split' as part of their rationale for maintaining one species. Clark (2007) further supported Rudebeck's view based on his field and museum observations of differences in plumage and wing shape. According to Kruckenhauser *et al.* (2004) these two taxa are not monophyletic.

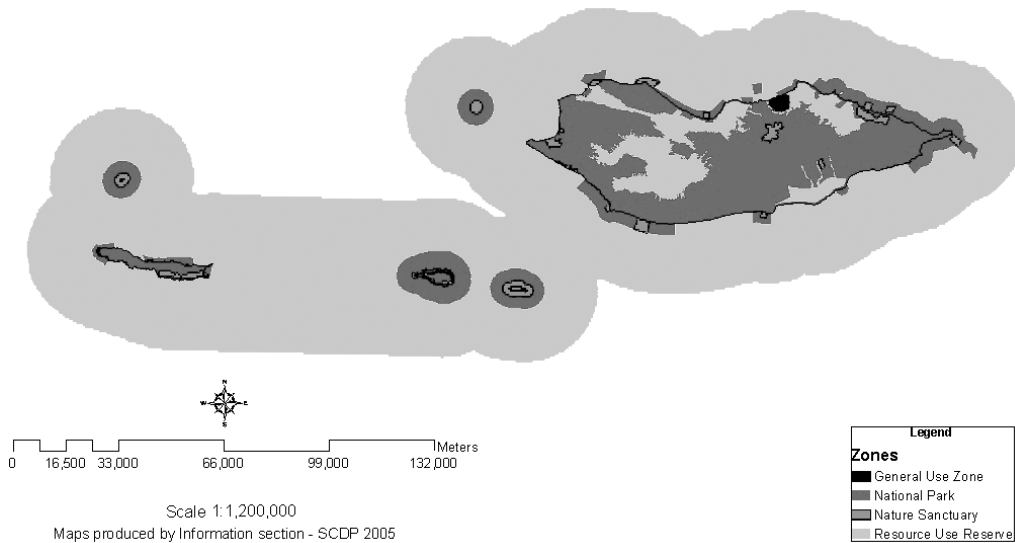


Figure 14. Terrestrial nature reserves and national parks on Socotra created by the government of Yemen in 2000 under the Zoning Plan.

Brooke (1975) then concluded that *Buteo rufofuscus* (Jackal Buzzard) and *B. augur* (Augur Buzzard) are separate species, and although Brown *et al.* (1982) treated them as conspecific, Brooke's view has now been universally adopted. Thus, authors as diverse as Prigogine (1984), James (1986), Sibley & Monroe (1990), Short *et al.* (1990), Dowsett & Dowsett-Lemaire (1993), Kemp (1994), Ferguson-Lees & Christie (2001) and Dickinson (2003) all treated *augur* as a separate species, despite a lack of molecular data at the time to support or dispute this supposition. Incidentally, Amaral *et al.* (2009) recently demonstrated the two to be only very marginally separated genetically. Indeed, recently published mitochondrial and nuclear gene data for *rufofuscus* and *augur* demonstrate them to be firmly nestled within the same clade of Old World buzzards as *B. buteo*, *B. oreophilus* and *B. rufinus*, close to the latter (Lerner *et al.* 2008, Amaral *et al.* 2009), despite dissimilarities in plumage. In this respect, Siegfried's (1970) suggestion that *rufofuscus* might be allied to Palearctic stock represented by *rufinus* appears far-sighted.

In the light of these examples, we consider that the Socotra Buzzard should also be treated as a full species. Its position is unique: genetically it is closest to *rufinus* and *bannermani*, but in plumage nearer to *trizonatus* / *oreophilus* and to a lesser extent *vulpinus*, whilst mensurally it resembles other short-winged taxa, especially *bannermani*.

Conservation.—Given the species' overall small population, probably numbering <1,000 individuals (see Distribution and population size), it seems that *socotraensis* would be accorded the IUCN category of Vulnerable, under criterion D1 (very small population), should the taxon be recognised specifically by BirdLife International. There is no evidence of a decline at present, but should a decrease in numbers become apparent in the future this could trigger its upgrading to a higher threat category. Buzzards are not infrequently taken from the nest in the mistaken belief that they can be sold into the falconry trade. Such birds end up being retained in captivity on the island. How many are taken is unknown, nor is the impact of this activity on the bird's population. However, because of the rarity of this buzzard, any such theft from the wild must be actively discouraged. In this respect, the recent laws governing the removal of biological material from the island should have the effect of diminishing the number of birds taken in future, as these laws will impact the

demand for falcons and thus other raptors. Enforcement of laws to prevent the taking of young birds from nests is the highest priority. The terrestrial nature reserves and national parks created by the government of Yemen in 2000 under the Zoning Plan (Ministerial Decree no. 275) encompass c.75% of the total area of the island (Fig. 14). These protect all the major vegetation types and areas of greatest importance for flora and fauna. Comparing the distribution map for Socotra Buzzard (Fig. 13) and those areas protected under the Zoning Plan reveals there is a legal framework to protect its main breeding and feeding areas within this recently designated World Heritage Site. The enforcement of the Zoning Plan is therefore essential not only for the buzzard but for the other Socotra endemics.

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