Measurements and shape of the Slender-billed Vulture *Gyps tenuirostris*

Peter J. Mundy

Mundy, P. J., 2022. Measurements and shape of the Slender-billed Vulture *Gyps tenuirostris*. *Indian BIRDS* 18 (3): 82–85.
Peter J. Mundy, National University of Science and Technology, P.O. Box AC939, Ascot, Bulawayo, Zimbabwe. E-mail: peter.mundy@nust.ac.zw.
Manuscript received on 25 March 2021.

Abstract

The Slender-billed Vulture *Gyps tenuirostris* has, until recently, been regarded as a subspecies of Indian Vulture *G. indicus* when Rasmussen & Parry (2001) proposed it as a full species. I examined 16 specimens of Slender-billed Vulture, 22 of Indian Vulture, and 22 of White-rumped Vulture *G. bengalensis* in three museums, and compared them on several parameters. In this study, I re-assigned five Indian Vulture specimens to Slender-billed Vulture, apart from reverting a past re-identification of White-rumped Vulture back to Indian Vulture. Post this re-assignment, I revisited the morphometrics of these three species. According to sizes, weights, wingspans, and number of rectrices (14), Slender-billed- and Indian Vultures are the same as each other, and both are about 10% larger than White-rumped Vulture (which has 12 rectrices), and 28% heavier in weight. But in four measures the Indian Vulture is about the same size as the White-rumped Vulture (bill length, bill volume, tarsus, and middle toe). The comparable bill sizes of these three *Gyps* species in Asia raises the question of their inter-specific relationships and how they did co-exist; particularly as much of the Indian Subcontinent had two sympatric species before their population plummeted—in fact during the same time period.

Introduction

First named by G.R. Gray in 1844 (Gray 1844–1849) as *Gyps tenuirostris*, the Slender-billed Vulture, the species has been considered as a subspecies of the Indian Vulture *G. indicus* for much of its existence. Ali & Ripley (1978) gave it some characteristics which are relevant today, and eventually Alström (1997) described it well in the field, followed by Rasmussen et al. (2001), both papers with a good series of photographs of wild birds. But it fell to Rasmussen & Parry (2001) to propose it as a separate species from the Indian Vulture. It is described at some length by Rasmussen & Anderton (2012), who contrast the plumage colour, shape and colour of the neck, head and bill, nostril shape, amount of feathering ventrally, etc., between Slender-billed- and Indian Vultures. It has since been accorded species status (Naoroji 2006; Johnson et al. 2006; del Hoyo & Collar 2014), as the 16th species of Old-World vulture. Johnson et al. (2006) had provided, in their Table 2, many measurements from up to 41 specimens of Slender-billed and Indian Vultures. In addition, their methods for measuring the culmen and wing lengths are insufficiently explained, and these are key measurements. There still remains some ignorance and confusion over the sizes and tail of Slender-billed, and this paper is aimed at clarifying and correcting these details. Not only is the dataset presented here larger (albeit all museum specimens), but I have also sought to compare the three species of *Gyps* that were once common in Asia, including White-rumped Vulture *G. bengalensis,* with each other, and were, presumably, inter-specific competitors.

Materials and methods

So far, I have examined specimens of three Asian *Gyps* species in museums as follows: Natural History Museum (Tring, England): 12 Slender-billed, 21 Indian, 14 White-rumped; Muséum National d'Histoire Naturelle (Paris, France); 2 Slender-billed, 1 Indian, 4 White-rumped; and University Museum of Zoology (Cambridge, England): 2 Slender-billed, 0 Indian, 4 White-rumped. Each specimen was measured by me according to my routine methods (Mundy 1982; Mundy et al. 1992), which I believe to be the standard methods. Certain dimensions are known to get smaller ('shrink') as specimens in museums age (Mundy 1982); I took them all at face-value, with no adjustments for the specimen's age since death[1]. The labels of the specimens showed the species, and often, the sex, and occasionally other information such as weight, body length, and wingspan.

Routinely, I also counted the number of rectrices, being careful to note any in moult (therefore missing). Among the *Gyps* species there are two complements, namely, 14 and 12 (Sharpe 1873; Mundy 2002).

Each specimen was described according to the characteristics that had been listed by Rasmussen & Parry (2001). Six mis-identifications were noted and the correct species proposed (and already included in the lists above) for the three species. I must emphasise that this paper deals only with the handling of museum (i.e. dead) specimens; I have not seen any of the species alive or in the wild.

Results

As expected in this sample of 60 specimens, several birds (n=12) had the wrong ages on their labels. All *Gyps* have a standard progression from the first (juvenile) plumage, through transition (immature) plumages, to the final and definitive (adult) plumage. Quite a few (n=15) had no collection dates, or even the name of the original collector. Among this sample, the earliest stated collection date was 1846 (#13/Acc/25/d/2 at Cambridge, Slender-billed Vulture) and the most recent, of a nestling Indian Vulture, was 1934 (#1949.Whi.1.540 at Tring). Most (n=35)

[1] I had measured the difference at 1.7% shorter in the wing in 47 museum specimens versus 366 captured African White-backed Vultures *Pseudogyps africanus* in southern Africa, *t*-test, $P < 0.01$, PJM unpubl., although age ratios were different.

of the specimens had been collected in the second half of the nineteenth century, and therefore have had plenty of time to suffer from shrinkage.

The sex of a specimen, as stated on the label, is sometimes a statement that can be queried (Rasmussen & Prŷs-Jones 2003). Here, among the Slender-billed Vultures, there were six stated males, no females (!), and ten were not sexed. Among Indian Vultures, there were five males, ten females, and seven not sexed. Among White-rumped Vultures, there were eight males, three females, and eleven not sexed. Altogether, there are 19 males, 13 females, and 28 not sexed (between males and females, $\chi^2 = 1.125$, 1 df, $P>0.25$), an equal sex ratio.

Each of the Paris and Cambridge museums had two Indian Vulture specimens that I re-assigned to Slender-billed: I had the confidence to re-assign these by attention to the stated characteristics for Slender-billed Vulture (Rasmussen & Parry 2001): long slender bill, with the skull starting at several mm from the proximal end of the cere; mostly black bill and cere, and naked black head and neck; rounded nostrils; tibias covered in downy feathers with no appearance of feathered 'leggings'.

I also re-assigned a labelled Indian Vulture at Tring to Slender-billed Vulture. Secondly, a young immature at Tring, labelled as Indian Vulture and re-identified as White-rumped Vulture by P.C. Rasmussen, had a wing length of 660 mm, a tail of 252 mm, and the tail was very worn with eleven rectrices and three others lost in moult (in my opinion). I proposed that this bird (no. 11a. 8a) was an Indian Vulture by size and complement of 14 rectrices. Dorsal (Pic. 1a) and ventral (Pic. 1b) photos of it are included below; the defining characteristics are noted in the caption. These six specimens are listed in Table 1.

© Natural History Museum, Tring

124. (a) dorsal and (b) ventral views of specimen 11a.8a in the Tring Museum. Note the long and lanceolate ruff feathers (denoting a young immature), but rounded coverts with broad buffy edges; and broad streaking on the underside.

Table 1. My re-assignments of six museum specimens

Museum	Specimen No.	Locality	Collector	ID.	Re-assigned ID.	Reasons
Cambridge	13/Acc/25/d/1	India	Jerdon	Indian	Slender-billed	Characters
Cambridge	13/Acc/25/d/2	India	Blyth	Indian	Slender-billed	Characters
Paris	–	Cochinchina	Germain	Indian	Slender-billed	Characters & locality
Paris	–	Cochinchina	Germain	Indian	Slender-billed	Characters & locality
Tring	1955.6.N-20:183	NE of Bankok [sic]	Mouhot	Indian	Slender-billed	Characters, nostril & locality
Tring	11a.8a	India	–	Indian re-labelled to White-rumped by P.C. Rasmussen, now back to Indian: Size/rectrices (see **124**).		

The measurements of five parts, and the number of rectrices for each of the three species, are shown in Table 2. The few weights are shown separately (Table 3) because they are not my measurements. I have used the new totals according to my re-assignments.

Table 2. Measurements of three species of Asian *Gyps* vultures, in mm.

Species	Wing (mm)	Tail (mm)	Bill (mm)	Tarsus (mm)	Middle-toe (mm)	Rectrices (n)
Slender-billed N= 13 – 16.	625.1 ± 11.0 (604 – 643)	234.8 ± 6.1 (227 – 251)	47.9 ± 1.4 (45.3 – 50.0)	107.6 ± 6.2 (96.4 – 117.4)	107.4 ± 5.1 (99.4 – 117.4)	13.4 ± 0.8 (12 – 14)
Indian N= 19 – 20	629.6 ± 15.3 (600 – 660)	238.4 ± 9.2 (221 – 258)	45.8 ± 2.0 (42.6 – 49.5)	98.7 ± 5.8 (87 – 109)	100.3 ± 4.1 (91.6 – 106.2)	13.7 ± 0.6 (12 – 14)
White-rumped N = 14 – 19	581.8 ± 10.2 (566 – 602)	214.5 ± 7.0 (205 – 235)	46.3 ± 1.5 (44.0 – 48.9)	95.4 ± 5.4 (86.9 - 108.4)	97.3 ± 4.2 (88.7 – 103.5)	11.9 ± 0.4 (11 – 12)

Notes: Data are given as mean ± s.d. (range); Sample sizes varied with different parameters.

Table 3. Weights (kg) of three species of Asian *Gyps* vultures, from labels on museum specimens, and from literature.

	Source	N	Av. (± s.d.)	Range
Slender-billed	Museum label	1 immature	5.64	
Indian	Museum labels	5 adults	5.40 (± 0.67)	4.54 - 6.35
	Grubh (1988)	5	5.84	5.54 - 6.25
	Total	10	5.62	
White-rumped	Grubh (1974)	29	4.39 (± 0.43)	3.50 - 5.56

I have lumped both males and females together in their measurements (Table 2), as sexing on museum labels can be questioned, and sexes are anyway said to be 'similar' (Ferguson-Lees & Christie 2001; Rasmussen & Anderton 2012). Thus the wing and tail lengths of Slender-billed and Indian Vultures are statistically similar (Student's *t*-test, P>0.3 and P>0.1 respectively). Note that the few recorded weights that we have (Table 3) are also similar between these two species. But they differed in measurements of bill length (P<0.01), tarsus (P<0.001), and middle toe (P<0.001), and in each case, those of the Slender-billed were longer than those of the Indian Vulture. These similarities and differences are in agreement with Johnson et al. (2006: Table 2), except that the actual sizes differ, sometimes quite markedly (wing, tail, tarsus, and middle toe). The tarsus is a tricky measurement due to the callous, but adding the tarsus to the 'pes digit 3' (Johnson et al. 2006) gives about the same length as tarsus + middle toe by me. The size ratios in four parameters (wing, tail, bill length, tarsus) for Slender-billed and Indian, over White-rumped, average 1.08 and 1.05 respectively (Table 2). Finally, Table 2 notes the numbers of rectrices for each of the three species. For Slender-billed, the average was 13.4, ranging from 12 (two birds) to 14, four were considered to have 13 feathers; Indian averaged 13.7 feathers ranging from 12 (one bird) to 14 with four considered to have 13. Among White-rumped, the average was 11.9 feathers ranging from 11 (two birds) to 12.

Table 4. Average bill measurements of three species of Asian *Gyps* vultures

Species	Length (mm)	Width (mm)	Height (mm)	Volume (cm^3)
Slender-billed Vulture[1] n = 16-21	47.9	19.82	29.64	28.14
Indian Vulture[1] n = 13-17	45.8	20.88	30.93	29.58
White-rumped Vulture[2] n = 7	46.3	21.8	30.5	30.78

[1] from Johnson et al. (2006: Table 2)
[2] from own measurements on museum specimens

On the labels, four wingspans for Indian Vulture were noted, averaging 2.24m (±0.09) (all were measured in feet and inches), and one Slender-billed Vulture had a span of 2.27m.

A few labels showed weights in pounds and ounces; one weight for Slender-billed was 5.64kg (labelled as 12 pounds and seven ounces), and five adults of Indian Vulture weighed on average 5.40kg, ranging from 4.54 to 6.35kg (Table 3). Meanwhile, Ali & Ripley (1978) have quoted weights of *Gyps* vultures from Grubh (1974, 1988). Thus, another five Indian Vultures weighed between 5.54 and 6.25kg, averaging 5.84kg (Grubh 1988) but erroneously stated as 5.515kg by Ali & Ripley (1978). Taken together, ten Indian Vultures (all adults or subadults) averaged 5.62kg in weight. Again, Ali & Ripley (1978) quoted from Grubh for White-rumped Vulture (both sexes as though they were similar, but ages not stated): 29 birds weighed on average 4.39kg, ranging from 3.50 to 5.56kg (Table 3). There were no weights stated on museum labels. It could be noted in passing that average weights of vultures increase through the age classes from juvenile to adult (Mundy 1982).

Bill measurements—length, width, and height—for the three species are shown in Table 4. From them a 'bill volume' can be computed (as length x width x height) in cm^3. All three measure about the same as each other, with that for the White-rumped Vulture actually being the largest, though possibly not statistically so (a *t*-test could not be done on those species without individual measurements). Although the Slender-billed Vulture has a long bill, yet it is smaller in both width and height as befits its more slender shape.

In summary, then, and according to these specimens, Slender-billed and Indian Vultures are the same size as each other, though having some different proportions in bill, tarsus and middle toe. Taken together, Slender-billed and Indian Vultures are about 10% longer than White-rumped Vulture in wing and tail, and also in tarsus and middle toe for the former. Both are 28% heavier than White-rumped (a 10% linear increase is about 33% as a cubic, i.e., weight increase). It must be cautioned, however, that Indian Vulture is very close in size to White-rumped Vulture in bill, tarsus, and middle toe; in fact on average it has a shorter bill length (45.8mm versus 46.3mm respectively), though not significantly so (*t*-test, P>0.3).

Discussion

Following literature (Ali & Ripley 1978; Ferguson-Lees & Christie 2001; Rasmussen & Anderton 2012), I have assumed that sexes are the same in measurements, but this has not been proved. I have also assumed that the sizes of the specimens, as measured recently, are still equal to the sizes when collected, up to about 150 years ago; this is unlikely to be strictly true. But taking these measurements at face-value, both Slender-billed and Indian Vultures are the same size, and they are only marginally larger (10%) than the White-rumped Vulture. Indeed, Clark (1994) gives the wingspans of Indian and White-rumped Vultures as the same, i.e., 205–229/220cm respectively, which cannot be correct, given the difference in wing lengths (see Table 2). Finally, I have assumed that the six weights on the museum labels, all in pounds and ounces, are correct; I have simply converted them to metric. With all three species being held in captivity

Table 5. Comparison of stated sizes in mm of Slender-billed Vulture by various authorities

Authority	Sex	Wing (mm)	Tail (mm)	Tarsus (mm)	Culmen (mm)
Stuart Baker (1928)		590 – 630	237 – 256	About 110	66 – 68
Ali & Ripley (1978)	♂♀	590 – 630	237 – 256	c. 110	66 – 68
Ferguson-Lees & Christie (2001)	♂♀	590 – 630	237 – 256	c. 110	
Naoroji (2006)	♂♀	590 – 630	237 – 256	c. 110	
Johnson et al. (2006)[1]		637.7 ± 13.3 (15)	241.45 ± 10.19 (20)	114.88 ± 5.86 (19)	69.76 ± 1.66 (17)

Note: [1] In their Table 2, Johnson et al. (2006) use mean ± SD (n)

(for breeding purposes), the potential is there for detailed and precise descriptions of the various age classes, as was done by Mundy (1982) for some African species. Not only with the changing shapes and colours of feathers, but also with moulting patterns and body sizes, very accurate observations can be made, and are indeed encouraged from these institutions.

Can measurements in the literature, perhaps taken by different persons and usually without the precise method being stated, be compared at face-value? Stuart Baker (1928) gave the first set of measurements for Slender-billed Vulture (called *G. nudiceps* by him) though without providing the sample sizes; they are almost entirely within the ranges given in my Table 2. For White-rumped Vulture, however, his wing size is much shorter, and his tarsus is much too long (108–124mm) and, indeed, the longest of all three species. This is surely a mistake, but it has been copied by everyone subsequently! The 'culmen' length according to Stuart Baker (1928) is very much longer than my bill length (= rhamphotheca proper, and diagonally as the tip to dorsal/distal cere)—how was it measured? Johnson et al. (2006) simply state: 'culmen length from the caudal edge of the cere', though P.C. Rasmussen told me it was measured 'horizontally' (PC Rasmussen, *pers. comm*.); thus their measurement for Slender-billed Vulture is 70mm compared to 66–68mm by Stuart Baker (1928), and 75mm by me (culmen + cere in those few specimens where I also measured the cere). Normally, bill length in birds of prey is measured 'to the cere' (Bibby 1985), but excluding it. Table 5 compares the stated sizes from several authorities, and it can be seen that three of them have simply copied Stuart Baker (1928); at least Naoroji (2006) admits that. Measurements from Johnson et al. (2006) are the longest, except for the tail, and also longer than mine in Table 2.

The comparable sizes of these three *Gyps* species of Asia, particularly in relation to their bill lengths and volumes, raises the question of how they do in fact co-exist (Schoener 1965). Before they all declined so drastically, both, Slender-billed and Indian Vultures were sympatric with White-rumped Vultures (though not perhaps with each other) (Naoroji 2006), and would therefore have shown some inter-specific competition. Very little research has been done on this aspect in India, but see Grubh (1979), and Naoroji (2006).

Regretfully, nobody mentions the number of tail feathers—except for Brown & Amadon (1968), who simply state that *Gyps* has 14 tail feathers but 'twelve in one sub-group'; and Naoroji (2006). As shown in Table 2, both, Indian and Slender-billed Vultures have 14 rectrices, and the White-rumped and African White-backed have 12. This is a key feature though not quite invariable. That feature is a striking difference between the larger birds that nest on cliffs, "true griffons" in my terminology (Mundy 2002), with 14 rectrices, and the (usually) smaller species with 12 rectrices that nest in trees. I have called these *Gyps* and *Pseudogyps* respectively. But so far, genetic analyses do not support this terminology (e.g., Johnson et al. 2006), whilst supporting the distinctiveness of Slender-billed and Indian Vultures. From the results presented above, the Slender-billed Vulture is a griffon with 14 tail feathers; but then it nests on trees, which griffons almost never do. Naoroji (2006) gives photographic evidence of Indian Vulture nesting in a tree. And there are several other characteristics that distinguish Slender-billed- from Indian Vulture (Rasmussen & Anderton 2012), and indeed all other *Gyps* species, e.g., shape of nostril, so that in my view the Slender-billed Vulture is something of an enigmatic species.

Acknowledgements

I thank the Curators of bird specimens at the Tring, Paris, and Cambridge Museums for permission to examine the skins under their care, and especially Mark Adams for photographing specimen 11a.8a for me. Allan Cook, Marsha Schlee, Kees Rookmaaker, and Pamela Rasmussen helped me in various ways. I thank Frank Rheindt for initial guidance on this script, Alex Berryman for critically reading it, and two anonymous referees for further constructive comments.

References

Ali, S., & Ripley, S. D., 1978. *Handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka. Divers to hawks.* 2nd (Hardback) ed. Delhi: (Sponsored by Bombay Natural History Society.) Oxford University Press. Vol. 1 of 10 vols. Pp. i–lviii, 1–382.

Alström, P., 1997. Field identification of Asian *Gyps* vultures. *Oriental Bird Club Bulletin* 25: 32–49.

Bibby, C. J., 1985. Measurement, p. 342. In: Campbell, B. & Lack, E. (eds). *A dictionary of birds*. 1st ed. Calton (England): T & AD Poyser. Pp. 1–670.

Brown, L. H., & Amadon, D., 1968. *Eagles, hawks and falcons of the world.* 1st ed. Middlesex, UK: Country Life Books. Vol. 1 of 2 vols. Pp. 1–431.

Clark, W. S., 1994. 50. Long-billed Vulture *Gyps indicus*, p.127. In: del Hoyo, J., Elliott, A. and Sargatal, J. (eds). *Handbook of the birds of the world*. 1st ed. Vol. 2 of 16 vols. Barcelona: Lynx Edicions. Pp. 1-638.

del Hoyo, J., & Collar, N. J., 2014. *HBW and BirdLife International illustrated checklist of the birds of the world. Volume 1: Non-passerines.* Barcelona: Lynx Edicions. Vol. 1 of 2 vols. Pp. 1–903.

Ferguson-Lees, J., & Christie, D. A., 2001. *Raptors of the world.* 1st ed. London: Christopher Helm. Pp. 1–992.

Gray, G. R., 1844–1849. *The genera of birds: Comprising their generic characters, a notice of the habits of each genus, and an extensive list of species referred to their several genera.* London: Longman, Brown, Green and Longmans. 3 vols. Pp. (1844–1849).

Grubh, R. B. 1974. The birds of Gir Forest. (The ecology and behaviour of vultures in Gir Forest). Bombay, India, University of Bombay. Pp. 1–96.

Grubh, R. B., 1979. Competition and co-existence in Griffon Vultures: *Gyps bengalensis*, *G. indicus* and *G. fulvus* in Gir forest. *Journal of the Bombay Natural History Society* 75 (3): 810–814 (1978).

Grubh, R. B., 1988. A comparative study of the ecology and distribution of the Indian White-backed Vulture (*Gyps bengalensis*) and the Long-billed Vulture (*Gyps indicus*) in the Indian region. *Proceedings of the 19th International Ornithological Congress* 19: 2763–2767.

Johnson, J. A., Lerner, H. R. L., Rasmussen, P. C., & Mindell, D. P., 2006. Systematics within *Gyps* vultures: a clade at risk. *BMC Evolutionary Biology* 6 (65) D.O.I.: https://doi.org/10.1186/1471-2148-6-65.

Mundy, P. J., 1982. *The comparative biology of southern African vultures*. 1st ed. Johannesburg: Vulture Study Group. Pp. 1–298.

Mundy, P. J., 2002. When is a vulture a griffon? *Vulture News* 46: 20–23.

Mundy, P., Butchart, D., Ledger, J. & Piper, S. 1992. *The vultures of Africa*. 1st ed. Randburg and Halfway House (South Africa): Acorn Books and Russel Friedman Books. Pp. 1–464.

Naoroji, R., 2006. *Birds of prey of the Indian Subcontinent.* 1st ed. London: Christopher Helm. Pp. 704.

Rasmussen, P. C., & Anderton, J. C., 2012. *Birds of South Asia: the Ripley guide: field guide.* 2nd ed. Washington, D.C. and Barcelona: Smithsonian Institution and Lynx Edicions. Vol. 1 of 2 vols. Pp. 1–378.

Rasmussen, P. C., & Parry, S. J., 2001. The taxonomic status of the "Long-billed" Vulture *Gyps indicus*. *Vulture News* 44: 18–21.

Rasmussen, P. C., & Prŷs-Jones, R. P., 2003. History *vs* mystery: the reliability of museum specimen data. In: Collar, N. J., Fisher, C. T., & Feare, C. J., (eds.). *Why museums matter: Avian archives in an age of extinction. [Bull. B. O. C. 123A (Suppl.): 1–360.]*. Tring, UK: British Ornithologists' Club. Pp. 66–94.

Rasmussen, P. C., Clark, W. S., Parry, S. J., & Schmitt, J., 2001. Field identification of 'Long-billed' Vultures (Indian and Slender-billed Vultures). *Oriental Bird Club Bulletin* 34: 24–29.

Schoener, T. W., 1965. The evolution of bill size differences among sympatric congeneric species of birds. *Evolution* 19: 189–213.

Sharpe, R. B., 1873. On a new species of Turkey Vulture from the Falkland Islands and a new genus of Old-World Vultures. *Annals and Magazine of Natural History* (4) XI (62): 133 (February).

Stuart Baker, E. C., 1928. *The fauna of British India, including Ceylon and Burma. Birds.* 2nd ed. London: Taylor and Francis. Vol. V of 8 vols. Pp. i–xviii, 1–469.