

BEAUFORTIA

INSTITUTE OF TAXONOMIC ZOOLOGY (ZOOLOGICAL MUSEUM)
UNIVERSITY OF AMSTERDAM

Vol. 38, no. 4

September 30, 1988

GEOGRAPHIC VARIATION IN THE BUZZARD *BUTEO BUTEO* (L.): *JAPONICUS*-GROUP (AVES: ACCIPITRIDAE)

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ABSTRACT

This paper reviews the geographic variation in the *japonicus*-group of *Buteo buteo*. Four subspecies are distinguished, varying in size, plumage design and colour. Of these, three are morphologically distinctive; *burmanicus* distributed in north-eastern Eurasia, *refectus* a disjunct population breeding along the Himalayan mountain range from Kashmir to Tibet, *japonicus* breeding on the main Japanese islands. Buzzards from Bonin Islands, (*toyoshimai*) are recognized but considered marginally separable from those from Japan.

INTRODUCTION

The Common Buzzard *Buteo buteo* (L.) has been divided into three groups (Vaurie, 1961, 1965), of which the *japonicus*-group is the easternmost one. The remaining two are the western Palearctic *buteo*-group, and the central *vulpinus*-group, which extends east to about longitude 96° E. The *japonicus*-group can be distinguished from the other two groups by streaked underside in the adult (instead of barred), extensively feathered tarsus and differences in wing formula. This group has been divided into four subspecies (Stresemann & Amadon, 1979). The populations on Japan proper (Hokkaido south to Kyushu) are known as *japonicus*. In eastern Siberia and northern Manchuria breeds another population, which is usually considered to belong to *japonicus*. How-

ever, Momiyama (1927) suggested that these birds are larger and more richly coloured than those from Japan. Residents on the Japanese islands of Bonin and Daito have been named *toyoshimai* (Momiyama, 1927) and *oshiroi* (Kuroda, 1971), respectively. Along the Himalayas breeds yet another population, described by Portenko (1929) and later re-named *Buteo japonicus refectus* (Portenko, 1935). In the past there was some uncertainty on whether these buzzards bred in the area or were only wintering. Voous & Bijleveld (1964) reported on breeding specimens from the Northwestern Himalaya, and Thiollay (1978) observed breeding of both *Buteo buteo* and *B. hemilasius* in the central Himalayas.

Descriptions and measurements of populations of the *japonicus*-group have been given in many texts, but no one has critically examined

each population in detail, with the possible exception of Portenko (1929). His work has received little attention, possibly due to the use of quadriminoms and his rather questionable taxonomic conclusions. The present paper outlines the plumage types and variation in the *japonicus*-group, and compares the various populations. Further, a morphometric analysis is presented to show geographical variation in dimensions, possible clinal differences and to test for dimorphism in age and sex classes.

The common Buzzard *Buteo buteo* is known for its wide variation in plumage. This intraspecific variation is not confined to differences between populations but it also occurs within populations. This variability has been the source of confusion for the taxonomy concerning this genus. By examining small series, in such birds as the passerines, one may be able to detect an obvious correlation between character and geography. However, this is not the case within *Buteo*. Only by looking at the group as a whole and with large series of specimens can one begin to make a judgment on the relationships between the populations. Such an in-group analysis is not intended to lead to phylogenetic conclusions, since such an analysis may be misleading (Stevens, 1980), but to clarify certain character-states which may be useful in further out-group analysis. This paper is part of a series of papers on the geographic variation of various sub-groups in the genus. By elucidating the basic parameters within the sub-groups, the taxonomy of the genus, especially in the Palearctic and Afrotropics, can be better understood.

METHODS

This study is wholly based on museum specimens. External attributes were noted and up to 12 different continuous variables taken for each specimen. For details on measuring techniques and museums visited the reader is referred to the previous papers (James, 1984, 1986). Additionally, three other museums have been visited: Museum of Vertebrate Zoology, U. C. Berkeley (USA); Senckenberg Museum,

Frankfurt and Muséum National d'Histoire Naturelle, Paris.

A morphometric analysis utilizing museum specimens, especially old ones, introduces inherent potential problems affecting the homogeneity of the data. Fading and 'foxing' in some specimens are prevalent, and duly treated with caution in this study. Damaged skins or those lacking data on collection locality have been omitted from statistical analysis.

The greatest problem encountered was specimens lacking data on collection date or sex. Buzzards, like other raptors, show clear sexual size dimorphism, thus further analysis is hindered by unassigned sex. Because a large percentage of specimens were not assigned to sex, two methods were used to determine unsexed specimens as males or females, which, though different in theory, gave similar results. For some localities where adequate series were available for study, many specimens were unsexed (e.g. 89% for eastern China), therefore a priori assignment of sex was essential. The first method involves the bivariate plotting of the standard Z-scores of wing and culmen lengths, (fig. 1.), which results in two clusters. Specimens collected in Korea by C.M. Fennell are used as a control, since these specimens contain reliable and full specimen information.

As seen in Figure 1, two clusters are quite separable and show little overlap though one female is located right among the males. Scatterplots of other specimens were superimposed on this for verification. Unsexed specimens were consequently assigned to sex if the wing and culmen lengths fell within the established cluster.

In addition Discriminant Function Analysis (DFA) was used to assign sex to unsexed specimens for each locality or region. Unlike many other multivariate methods, DFA is a method for testing preclassified groups and is particularly apt in this case in its predictive capacity to assign unknown objects to appropriate categories. Figure 2 is a frequency diagram from DFA data of Figure 1. Data from eastern China and other areas were analyzed in a similar fashion. Specimens where the indica-

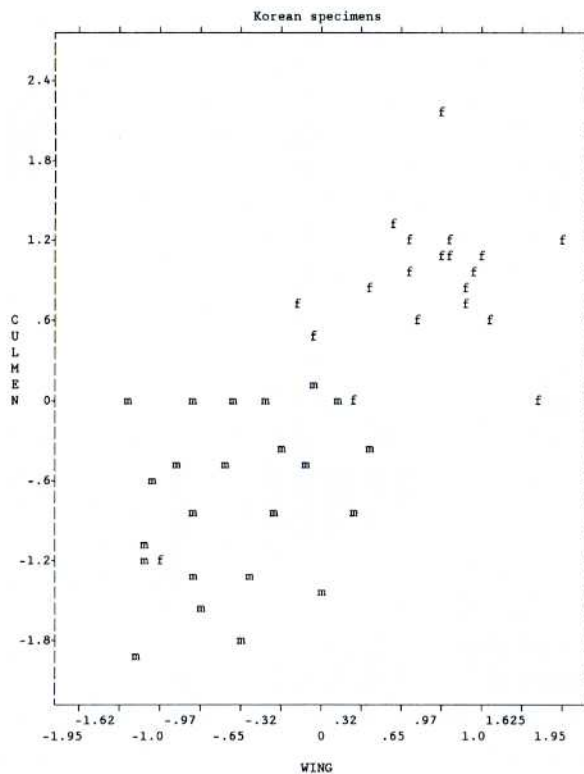


Figure 1. Sex Determination. Bivariate plot of wing and culmen in Korean specimens. Points are standardized scores for males (m) and females (f).

tion of sex on the original label was suspected to be incorrect, were not re-assigned to their probable class.

Colour was judged using the 'Naturalist Color Guide' (Smithe, 1975). Colour-names listed in Smithe (1975) are capitalized with the number presented in parentheses. My subjective determinations of colours are not capitalized and those lying between swatches are hyphenated. Age was determined by wear and moult of primaries (cf: Brooke, 1974; Piechocki, 1963).

Owing to the scarcity of material from the breeding range both breeding and winter birds were included in the analysis. Approximately 1400 *Buteo* specimens have been examined, 286 were identified as belonging to the *japonicus*-group. Data on these specimens are available on request.

Since most of the data are from wintering specimens, it had to be established to which breeding population they belong. Populations of Japan are considered resident. Whether some birds wintering in Japan breed in continental Asia is not known. Birds from Korea and eastern China are assumed to belong to the northern continental population. Winter birds from the Himalaya area can belong to either the northern population or are resident birds of the subspecies *refectus*. Each individual, when possible, was identified and placed in either group.

All statistical procedures were run with SPSSx (1986). Only morphometric variables were used in statistical procedures due to the wide variation in individual plumage attributes. The latter are descriptively presented. Univariate analysis of variance employed the subroutine Oneway under SPSSx and the multiple range test Student-Newman-Keuls (SNK) was used to distinguish homogeneous subsets.

ACKNOWLEDGEMENTS

For helpful comments on earlier drafts I thank T. G. Brom, D. K. James, and K. Mulvany. I thank D. Amadon, K. H. Voous and J. Wattel for critically reviewing the manuscript. I acknowledge the following curators and assistants: I. C. J. Galbraith, G. Cowles, P. Colston and A. Knox (Tring), G. F. Mees (Leiden), G. Rheinwald and K. L. Schuchmann (Bonn), L. Baptista, S. Bailey, and J. O'Brien (San Francisco), N. K. Johnson and D. Bell (Berkeley), C. Erard (Paris), and D. S. Peters (Frankfurt).

RESULTS

Plumage

The characters that most clearly distinguish the *japonicus*-group from the *buteo* and *vulpinus*-group are: (in the belted colour type, see below), pale buff on head and cheeks; three-zoned pattern of the underside with the breast broadly streaked, a light gap about the lower

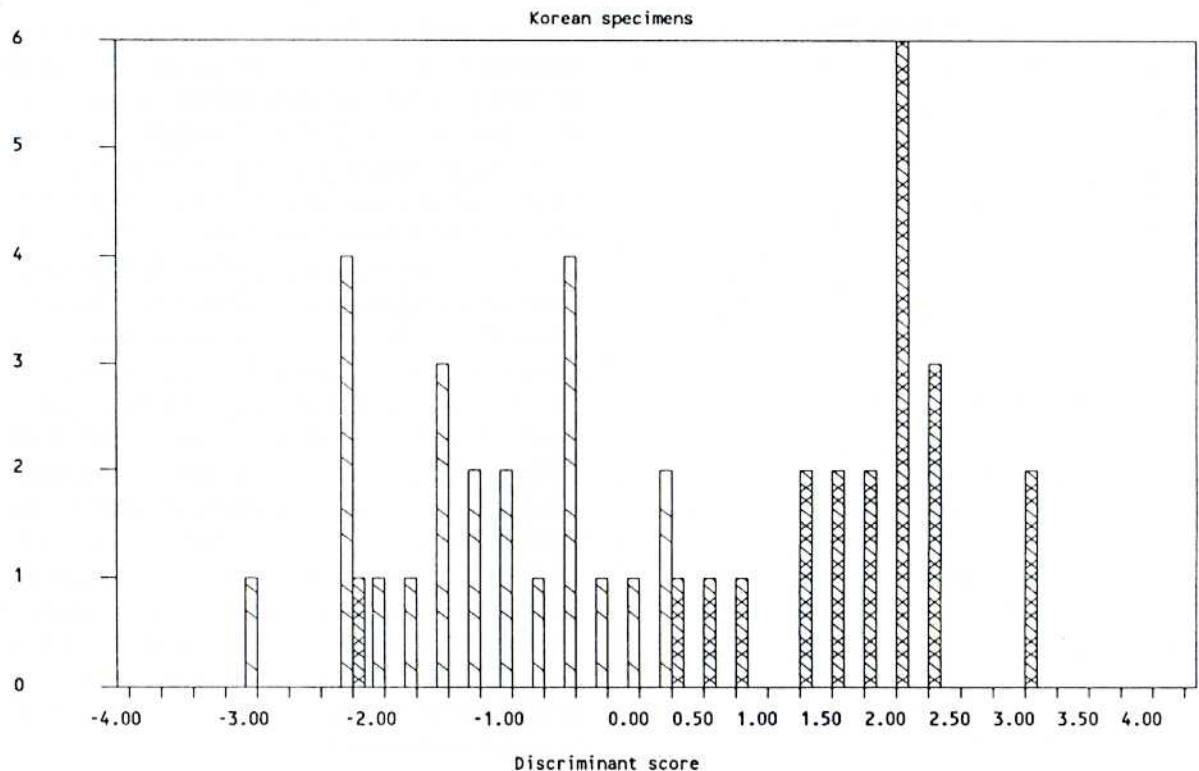


Figure 2. Sex Determination. Frequency diagram of Discriminant scores from Discriminant function analysis data using the same subset of characters for Korean specimens.

breast and upper abdomen, and dark flanks and lower belly; (in both streaked and barred types), sharp bold moustachial streaks; Buff-Yellow (53) to Cream (54) wash all over the underside; unmarked Cream (54) or Buff (24) under tail-coverts; cinnamon-cream and sometimes more rufous colour on the outer web of the primaries at the emargination, usually with dark bars; light patches or windows in the open underwing; Olive-Brown (28) tail with a dark wide subterminal band or chocolate brown tail with obscure dark bands (Figure 3a); feathering of tarsus extends to near or over half the length of the tarsus; length of hind claw usually greater than the length of exposed culmen (equal in *vulpinus* and *buteo* (James, 1984)). Additionally, in *japonicus* the flight habits are said to be like those of a harrier (Wait, 1925) and according to Kolthoff (1932) it hunts in a very different manner from *Buteo b. buteo*. It attacks birds in flight

and the flight is stronger with swift gliding motions.

Plumage character differences within the *japonicus*-group are mostly in colour of feather edges and wash of the underside. Birds from Japan and the Bonin Islands are washed Cream Color (54) and are distinctively paler than those from the mainland which are Buff-Yellow (53), as already noted by Hartert (1912: 1127). According to Vaurie (1961), *toyoshimai* is considerably paler than *japonicus*. I have examined four specimens from Bonin Islands and one from the Seven Islands of Izu, but could not find any distinctive difference in overall paleness between *toyoshimai* and *japonicus* from Japan.

The adult plumage patterns can be categorized into distinguishable colour types with little overlap. Figure 3 shows the variation in plumage. Portenko (1929) described three

colour types; *pallidipectus* (light), *fulvipectus* (marked), and *plumipes* (black). Previously, Riley (1926) mentioned three types, similar to *fulvipectus*, *pallidipectus* and one streaked lightly which probably refers to the immature plumage. Cheng (1964) described three types from China; black, brown and intermediate, but it is difficult to see how they correspond to Portenko's types.

The adult plumage types distinguished here are: (1) *barred type* [= *fulvipectus*] (fig. 3a) — breast heavily streaked, ground colour dark, belly horizontally marked to varying degrees with ground colour slightly lighter than breast. In *refectus* the barring is more extensive, thighs solid Raw Umber (223), sometimes tinged chestnut and the breast and ground colour saturated Cinnamon Color (123A). Voous & Bijleveld (1964) give a detailed plumage description of *refectus*. The Japanese buzzards also show this barred type of plumage, but the barring is contained to the lower belly and the breast is only weakly patterned with broad streaks, which leaves a wide Cream Colored region between the two parts. The buzzards from northeastern Palearctic are more Buff-Yellow (53) and the barring and breast pattern more extensive, although not reaching the saturation of colours as in *refectus*. (2) *belted type* (fig. 3b) — breast streaked mostly on sides of breast and neck, lower belly blotched and flanks solid. This pattern resembles the Rough-legged Buzzard *B. lagopus* (especially the subspecies *menzbieri*). (3) *melanistic form* — wholly Dark Grey Brown (20) to Raw Umber (223), tinged chestnut in varying degrees about the body and more so around the head and cheeks. Immatures tend to show more chestnut at the tips and edges of the feathers. The melanistic form is found in the Himalaya and Tibetan highlands and possibly Sinkiang, but is absent in the USSR (Dementiev, 1951) and Japan.

The immature plumage is very similar to the adult belted type but the pattern of the lower abdomen is comprised of streaks or longitudinal blotches, and on the thighs of shaft streaks or thin streaks (fig. 3c). The feathers on the mantle are usually heavily edged cinnamon-tawny

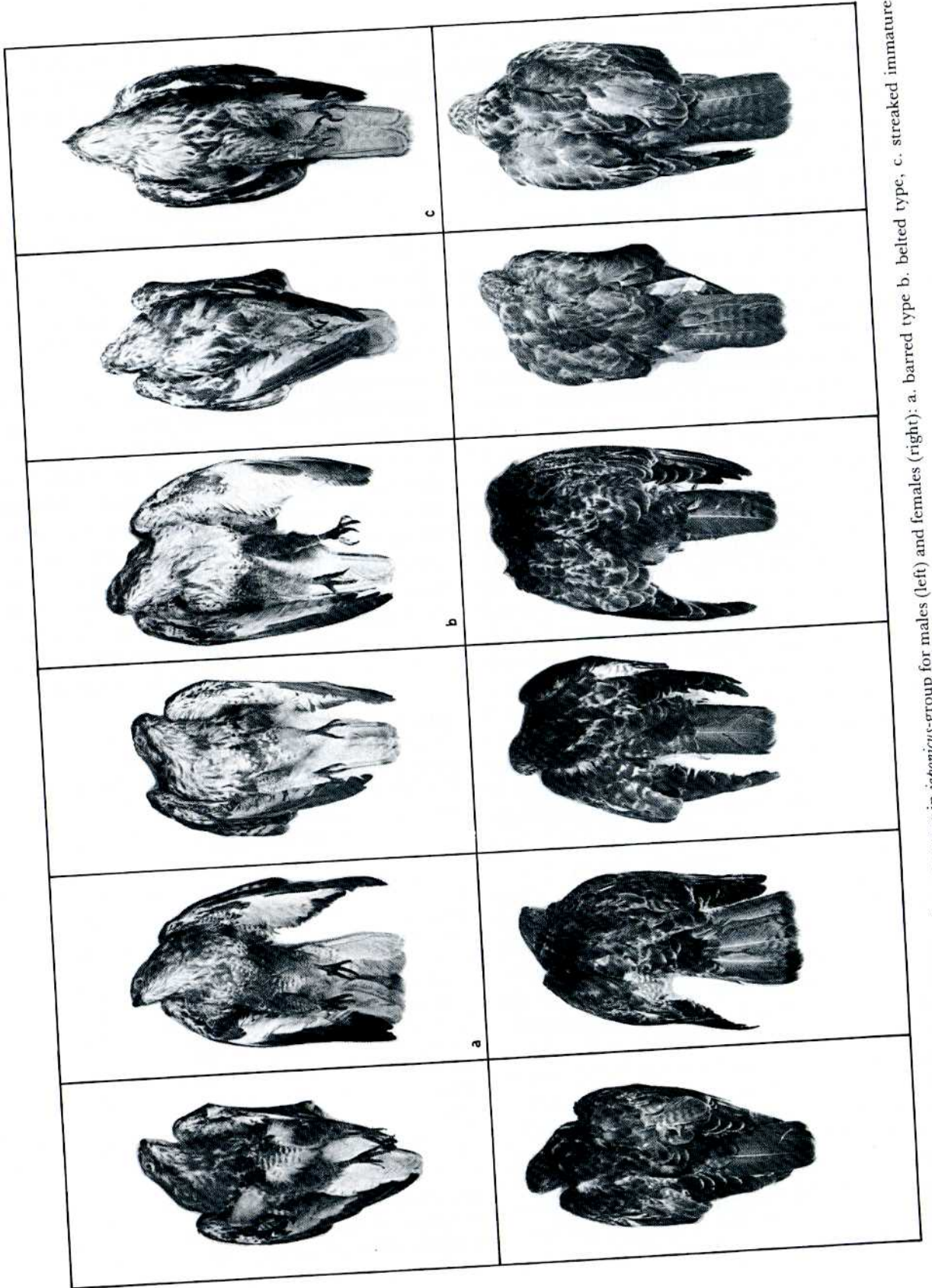
or cinnamon-cream. The tail is usually Olive-Brown (28) with numerous obscure wide bands, but in some cases lacking any clear bands.

Morphometric analysis

The T-Test was employed to check for age and sex dimorphism in the various continuous variables using the continental population. Results are shown in Table 1. In both male and female the tail, wingtip, and wingdepth and their derived values were significantly different between age classes. Immature birds have longer tails, more pointed wingtip and a narrower wingdepth. In all further analyses, adult and immatures values are combined except for those mentioned. A similar test was performed between male and female means, showing statistically significant differences in most values (table 1) which signify that females are larger than males. "Reversed" sexual size dimorphism is well known among raptors, thus the homogeneity of data in a morphometric analysis could be distorted if dimorphism is not taken into account. The variables not found to

Table 1. Results of T-test between age and sex classes in the *japonicus*-group; all populations combined. Values are rescaled to standard z-score and derived values corrected by arsine transformation (Zar 1974).

	age		sex
	Male	Female	
Wing	ns	ns	***
Wingtip	**	***	*
Wingtip/Wing	***	***	**
Tail	***	***	***
Tail/Wing	***	***	ns
Culmen	ns	ns	***
Culmen/Wing	ns	ns	***
Tarsus	**	ns	***
Hclaw	ns	ns	***
Mtoe	ns	ns	**
P10	ns	ns	***
P9	ns	ns	***
P8	ns	ns	***
P7	ns	ns	***
Bare tarsus	ns	ns	ns
Wingdepth	***	**	***
Feathered tarsus	ns	ns	ns



Plumage types in *japonicus*-group for males (left) and females (right): a. barred type b. belted type, c. streaked immature.

be significantly different between the sexes are length of unfeathered tarsus or bare tarsus, and the derived value of the feathered portion of the tarsus (Ftar).

I calculated statistics for weights from specimen labels. These specimens were restricted to those collected by C. M. Fennell from Korea. The weight differences between male and female are highly significant ($F = 31.7$; $P > .000$). The statistics are: Males $\bar{x} = 813.5\text{g}$ $SE = 25.6$, 639-1012; Females $\bar{x} = 1052.8$, $SE = 33.9$, 740-1224.

Results from univariate analysis of variance among populations are illustrated in Table 2. In the analysis *toyoshimai* is excluded because of the small sample size, but descriptive statistics are represented in the table. Horizontal lines depict homogeneous subsets. Melanistic forms are included under *refectus*. Wing and culmen length was used to test if this was permissible. T-test results indicate in males and females, that there is no significant difference in these two variables between melanistic forms and lighter plumages types:

(Males) wing $t = 0.36$, $p > 0.71$, $df = 26$; culmen $t = 0.68$, $p > 0.51$, $df = 20$, (Females) wing $t = 1.73$, $p > 0.10$, $df = 17$; culmen $t = 1.64$, $p > 0.12$, $df = 15$.

In wing length, *refectus* is the greatest and *japonicus* and *toyoshimai* the least. The results show overlap between populations, especially between *refectus* and *burmanicus* females. When considering both sex categories, the group *japonicus* is the most distinguishable, differing statistically from other groups in the variables wing, tail, wingdepth, bare tarsus, feathered portion of tarsus (Ftar) and culmen-wing ratio. Culmen-wing ratio is the only statistic which shows clear separation for both sexes in all groups.

In fig. 4 winglengths are schematically represented by mean, range, and 95% confidence limits for various locations. The eastern continental populations are clearly larger than those of Japan and Bonin Islands. In samples from Korea, the wing averages smaller than those from eastern China. I know of no clear explanation for this. Most of the specimens

from eastern China consist of recently mounted specimens rather than as study skins which may have resulted in disfigurement to the wing. In all other respects of plumage the two samples are similar.

SUBSPECIES ACCOUNTS

Buteo buteo japonicus Temminck & Schlegel, 1844, in F. Siebold, Fauna Japonica, Aves.

The name *japonicus* Temminck & Schlegel, 1844 here is used in preference to *burmanicus* Hume, 1875 (not Oates), which appears in various texts. According to Collin & Hartert (1927), *Falco [sic] buteo japonicus* of Temminck & Schlegel is preoccupied by *Falco tinnuculus japonicus* and the next available name is *Buteo burmanicus*. In reference Collin & Hartert give Stray Feathers 3:30; 1875, and Oates as the author. However, A. O. Hume is the author of this particular article as has also been noted by Bangs (1932).

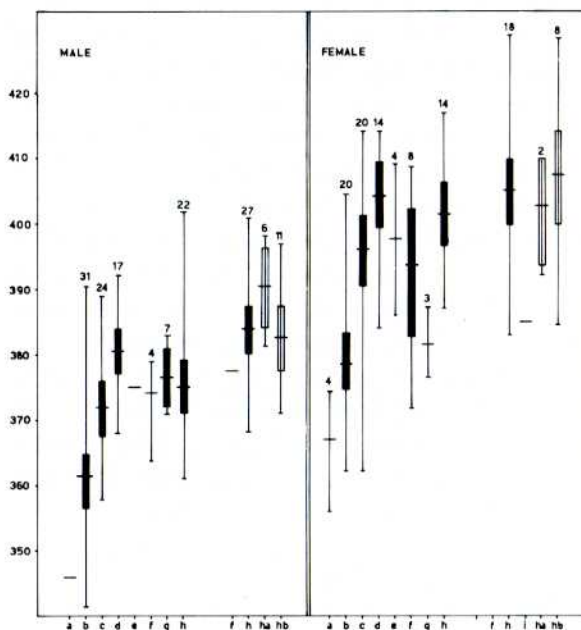


Figure 4. Diagram (\bar{x} , range, 95% CI) for wing lengths by regions. a = Bonin Is., b = Japan, c = Korea, d = Lower Yangtse, e = Baikal/N. Manchuria, f = SE Asia, g = So. China, h = Sino-Himalaya, ha = Kashmir, hb = melanistic morph, i = So. India.

Both Portenko (1929) and Vaurie (1961) pointed out that the former combination was obviously a printer's error. Temminck & Schlegel (1844) used the name *Buteo japonicus* throughout the text and *Buteo vulgaris japonicus* in their plates VI and VIb. Blyth (1866) similarly noted another *lapsus calami* in Temminck & Schlegel (1844), where *Falco poliogenys* (synonym for *Butastur indicus*), was used throughout the text but in Plate 7b it is designated *Buteo pyrrhogenys*. It is evident that in the original publication an error had occurred, due either to *lapsus calami*, or a printer's error, and the error should be corrected and not be given separate status. It does not seem justified to accept the name *burmanicus*, as a replacement. Collin & Hartert (1927) propose the use of the name *burmanicus* Oates, which is attributable to Hume (1875).

This buzzard is resident throughout the main Japanese island chain. I have not examined specimens from Sachalin or the southern Kuriles and it remains unknown whether these birds belong to the race resident on Japan proper or to the continental race. Austin & Kuroda (1953) list *japonicus* as breeding on Hokkaido through Honshu and Shikoku, and wintering throughout this range, south to Ryukyus, Taiwan and south China. They further mentioned that this is an open woodland bird, found mostly in the lowlands below 4500 feet and nesting mostly in pines between May and July. One specimen (BM 97.10.30.212) from Tsushima island, located in the Korean Straits, resembles the pale Japanese population.

The Japanese population is the most distinctive of the populations, most notably in its smaller size (Table 2) and paler colour. Its size and the Cream Color (54) wash of the plumage resemble those from the Bonin Islands. Some specimens, especially adults, are tinted darker and have tinges of tawny on the tail. Culmen length is proportionally larger than in continental forms. The tarsus is feathered to ca. 57% of its length. This value is statistically separable from the continental groups. Noteworthy is that this population has more extensively feathered tarsi than the continental birds which are

restricted to higher altitudes. Other variables which differ statistically are listed in Table 2.

Buteo buteo toyoshimai Momiyama, 1927, Annot. Orn. Orient. 1: 98

This buzzard breeds on the Bonin Islands: Ogasawara, Chichi, and Haha, and according to Vaurie (1961) on the Seven Islands of Izu: Ohshima, Nij-shima, Kohzu-shima, Miyakejima, Mikura-jima, and Hachijoh-jima (Higuchi, 1973).

The original description based on three specimens (Momiyama, 1927) stated this subspecies to be similar to those of Japan, but duller with less brown on the upper side. The underside is buffy white with few brown stripes. The bill is said to be longer and the wing and tarsus shorter. Vaurie (1961) examined three specimens stating that they differ distinctly from *japonicus* by being much paler and smaller and by having more rounded wings, and that one specimen from the Seven Islands of Izu was similar to those from the Bonins.

Momiyama (1927) reported the measurements for: One male wing = 340 mm, culmen = 22.5, tarsus = 66.5; two Females; wing = 365, 368, culmen = 24.7, 26.5, tarsus = 69, 69.5. Vaurie (1961) gave for wing lengths: one male 341, one female 357, and one unsexed 347 mm, and one male from Seven Islands of Izu 356 mm.

I have examined four specimens from the Bonins and one from the Seven Islands of Izu, but could not confirm any difference in overall paleness from those of Japan. The specimens from the Bonins seem slightly paler, but fall within the range of individual variation of the Japanese birds. One from Seven Islands of Izu (MVZ 127047) is much paler than those from Korea but similar to Japanese specimens. The culmen does seem to be relatively larger, but in my data, is not significantly different from those on Japan. This may however appear with more material, as indicated by data on *toyoshimai* given by Yamashina (in litt.): (five males) wing 355.6 (350-363); culmen 23.4 (19.2-26); tail 223.0 (215-250); tarsus 68.5

Table 2. a) Univariate ANOVA and descriptive statistics in *japonicus*-group. Vertical lines indicate homogeneous subsets (SNK). Ratios corrected by arcsine transformation of data during ANOVA. Asterisk denotes only adult values used in analysis, and *toyoshimai* was not included in the analysis.

MALES				FEMALES			
Group	N	Mean	Sd	Group	N	Mean	SD
WING F = 49.40; P > .000				WING F = 27.25 P > .000			
toyoshimai	1	346.000		toyoshimai	4	367.00	8.72
japonicus	31	360.90	9.90	japonicus	21	379.81	12.46
burmanicus	75	375.55	8.55	burmanicus	63	398.13	10.96
refectus	28	383.68	9.44	refectus	19	404.00	11.18
WINGTIP * F = 15.52 P > .000				WINGTIP * F = 6.07 P > .006			
toyoshimai	1	114.000		toyoshimai	2	121.50	2.12
japonicus	10	121.10	6.03	japonicus	7	127.00	7.26
burmanicus	19	131.79	5.92	burmanicus	18	134.33	6.90
refectus	8	134.13	3.98	refectus	7	139.00	4.32
TAIL * F = 4.42 P > .019				TAIL * F = 11.28 P > .000			
toyoshimai	1	195.000		japonicus	8	205.75	5.80
japonicus	11	199.82	6.78	toyoshimai	2	209.50	0.71
burmanicus	19	206.58	7.22	refectus	7	213.43	9.29
refectus	12	208.00	7.26	burmanicus	20	220.50	7.52
CULMEN F = 5.82 P > .004				CULMEN F = 2.51 P > .068			
refectus	22	20.97	0.83	refectus	18	22.93	0.71
burmanicus	72	21.57	0,75	toyoshimai	3	23.30	1,25
toyoshimai	1	21.60		burmanicus	59	23.50	1.03
japonicus	26	21.67	0.86	japonicus	20	23.56	0.91
TARSUS * F = 1.87 P > .168				TARSUS F = 4.14 P > .019			
toyoshimai	1	66.00		japonicus	18	70.89	1.41
japonicus	10	70.04	1.25	burmanicus	52	72.38	2.72
burmanicus	20	71.00	2.37	toyoshimai	4	72.75	4.19
refectus	13	71.60	1.76	refectus	16	73.19	2.23
HINDCLAW F = 0.30 P > .740				HINDCLAW F = 1.02 P > .367			
refectus	23	23.10	1.74	toyoshimai	3	24.40	2.11
japonicus	24	23.33	1.20	refectus	13	24.75	0.96
burmanicus	33	23.37	1.15	burmanicus	29	25.18	1.29
toyoshimai	1	24.30		japonicus	13	25.37	0.97
MIDTOE F = 0.116 P > .891				MIDTOE F = 1.09 P > .343			
toyoshimai	1	33.00		toyoshimai	4	33.00	1.83
burmanicus	28	33.14	1.80	japonicus	15	34.27	1.58
refectus	16	33.25	1.34	burmanicus	27	34.85	2.20
japonicus	18	33.39	1.79	refectus	12	35.33	1.37
WINGDEPTH * F = 7.86 P > .002				WINGDEPTH * F = 6.28 P > .005			
toyoshimai	1	232.00		toyoshimai	2	247.50	9.19
japonicus	10	239.20	5.59	japonicus	7	251.57	7.87
burmanicus	19	247.16	8.70	refectus	7	264.71	13.68
refectus	10	254.20	10.20	burmanicus	18	265.50	7.22
CULMEN/WING F = 40.1 P > .000				CULMEN/WING F = 19.7 P > .000			
refectus	22	0.0545	.0023	refectus	18	0.0568	.0023
burmanicus	72	0.0575	.0021	burmanicus	60	0.0591	.0026
japonicus	26	0.0602	.0023	japonicus	19	0.0622	.0031
toyoshimai	1	0.0624		toyoshimai	3	0.0633	.0025

Table 2. b) Variables that are not significantly different between sex groups, the values for both male and female are combined.

group	N	Mean	SD	Group	N	Mean	SD
BARE TARSUS F = 7.520 P > .001				BARE/WING F = 2.40 P > .094			
japonicus	38	30.13	5.53	japonicus	37	0.082	0.016
burmanicus	81	32.84	5.67	burmanicus	80	0.085	0.015
toyoshimai	5	33.00	3.24	refectus	43	0.089	0.013
refectus	41	34.90	5.02	toyoshimai	5	0.091	0.011
Feather portion of TARSUS F = 5.895 P > .003				TAIL/WING* F = 6.76 P > .002			
refectus	41	51.44	6.78	refectus	20	0.545	0.013
toyoshimai	5	53.77	3.50	burmanicus	39	0.549	0.017
burmanicus	81	53.99	7.54	japonicus	18	0.552	0.017
japonicus	38	57.14	7.68	toyoshimai	3	0.566	0.009

(62.5-75); (ten females) wing 369.1(350-386); culmen 25.5 (22-29); tail 223.1 (207-254); tarsus 70.4(67-75).

My data hardly confirm that *toyoshimai* has more rounded wings. Figure 5 depicts the wing formulas for *toyoshimai*, *japonicus* (Japan), and

nominate *buteo*. From this figure it cannot be concluded that the wings in *toyoshimai* are substantially more rounded than in *japonicus*. If the wings are rounded, then the wingtip would be relatively shorter, but this is only slightly so; *toyoshimai* has a wingtip 33.9% of the length of

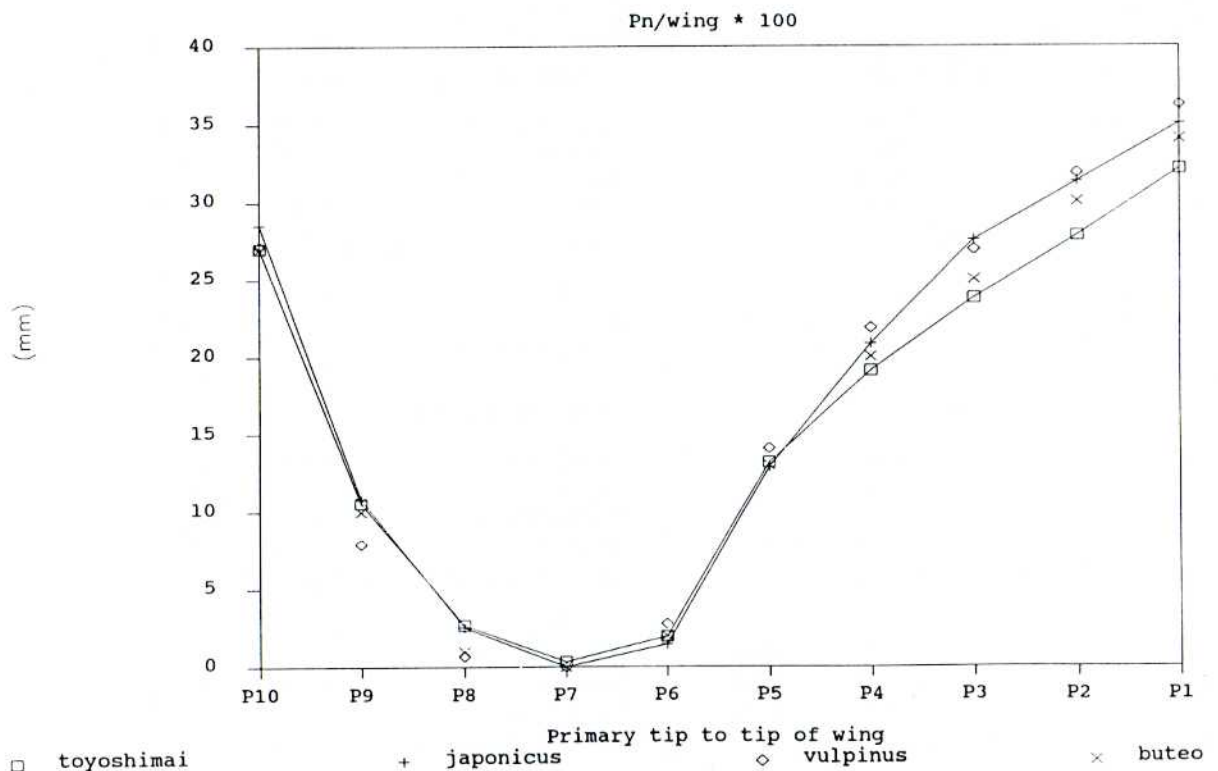


Figure 5. Plot of wing formulas in *toyoshimai*, *japonicus* and *vulpinus*.

the wing whereas *japonicus* from Japan has 34.6%.

On average my measurements indicate *toyoshimai* to be smaller than the Japanese population, but the sample size is inadequate and all except one fall within the range of *japonicus*. Kuroda (1971) reported measurements (in mm) for specimens from Japan as: (ten males), wing chord, 348-368 (average 354.5; tail 187-210 (average 195.6); (six females), wing 363-373 (367.6), tail 205-210 (207.5), which fall within the range for *toyoshimai*.

All five specimens of *toyoshimai* show, in varying degrees, white banding along the underside of the outer four primaries extending to or near the tip. This banding is similar to but not as extensive as that found in the related Madagascar Buzzard *B. brachypterus*. Buzzards from Japan show this to a much lesser extent.

The population of buzzards on the Bonins and Islands of Izu differ from the Japanese race in size and ground colour tinges. However, sample sizes of *toyoshimai* are inadequate to confirm significant differences. This study suggests this race be recognized, but a greater series may show it inseparable from the Japanese population.

Buteo buteo oshiroi Kuroda, 1971, Tori 20: 125, 127 (Minami-daito I., Daito Islands)

I have not seen specimens of this subspecies. Kuroda (1971) remarks that this subspecies is similar to *B. b. japonicus*, but is more reddish, and different from the "larger-sized continental reddish and banded phase". He gave measurements as: wing 330 mm (chord), 340 (extended); tarsus 64; culmen 24.

The Checklist of Japanese Birds (Ornithological Society of Japan, 1974) mentions that the type specimen was captured alive but escaped 14 years later. It also mentions that buzzards are present on the Ryukyu Island chain, Yonakuni and Ishigaki, Amami-oshima, and Kuchino-erabu Island (Morioka, 1975). It is unknown to which subspecies these birds actually belong, but Austin & Kuroda (1953)

mentioned that birds breeding on Japan winter throughout its range, as well as south to the Ryukyus.

This population may indeed be distinctive; smaller and darker than the Japanese race. Whether this population should be included with *japonicus* of Japan is still to be determined.

Buteo burmanicus Hume, 1875, Stray Feathers 3:37

Buteo buteo spp Momiyama, 1927, Annot. Orn. Orient. 1: 98

Momiyama (1927) distinguished this buzzard from those of Japan by having a richer dark brown on head and upperparts, the feathers edged with reddish brown, the underside deeper brown and heavily marked, and the wing on average longer.

This subspecies occurs on mainland Asia, breeding in eastern Siberia west to Chona and Mura Rivers (Dementiev, 1951), in south west Transbaikalia, the Kentei and Shangai (Kozlova, 1932), Manchuria (Cheng, 1964; Ingram, 1909), Mongolia (Piechocki, 1968), and Amur area (Stegmann, 1930, 1931) east to the coast of Okhotsk and possibly Sakhalin. It winters in eastern China, Korean peninsula south to southeast Asia and Burma. It is also known from Sri Lanka, the Malay Peninsula and Bali (Ash, 1984). Some birds possibly winter in Japan proper. The unsubstantiated record of *B. buteo* from Alaska (Gibson, 1983) may belong to this subspecies.

In colour, the mainland birds are distinguished by more tawny tinges, especially on the feather edges and on the inner web of the primaries. This is evident on fresh feathers where the tinges vary from tawny to a cinnamon-tawny or ochre-tawny. The tawny colours appear sometimes on the tail, where they are mainly manifested along the shaft of the central rectrices. Birds from the mainland are clearly larger and have a relatively shorter culmen length than those of Japan. The culmen lengths are not significantly different for any population (Table 2).

From northern Manchuria, I have only seen six specimens, four of which are adults and of

Table 3. Description of specimens taken from the northern breeding range, *B. b. burmanicus*.

1. BM 1909.11.20.27 Male adult: N. Manchuria, Khingam Mts.; 1 June 1908. (Ingram 1909, Ibis 422-469)
 Tawny bird; breast ochre tawny: upper belly few markings, ground colour ochre cream; lower belly spotted; thighs; horizontal markings & splotches; flanks blotched on ochre cream. Tail: tawny-cinnamon, outer edges silver brown, dark wide subterminal band with numerous dark thinner bands.
 wing = 375; culmen = 21.4; hclaw = 24.0; tarsus = 73; %Feath = 57.5
2. BM 1909.11.20.28a Female sub-ad. + 3 eggs: Khingam Mts. 4000', 1 June 1908
 Belted type: breast more thinly streaked; lower belly few splotches; thighs incomplete bars & splotches; tail Olive-brown with obscure bands. In general, more Buff below than previous specimen.
 wing = 397; culmen = 22.4; hclaw = 24.8; tarsus = 73; %Feath = 59
3. CAS 67549 Female adult: Manchuria, Great Khingan Mts. 22 October 1938.
 Belted type: breast broad ochre tawny streaks; upper belly ochre-tawny broad streaks; lower belly dark, marked with splotches; thighs spotted & irregular bars. Tail: solid Olive-brown, very obscure subterminal band; shoulder & back edged cinnamon-tawny.
 wing = 409; culmen = 22.4; tarsus = 72; %Feath = 46
4. CAS 67550 Female sub-ad: Kirin Prov., Harbin. 15 March 1936
 Belted type: similar to #3. Tail chocolate brown, obscure bands; mantle dark, no lighter edges.
 wing = 386; culmen = 23.7; tarsus = 76; %Feath = 55
5. CAS 25447 Female juv.: Manchuria, Mark Car Lum Hill. 21 July 1921
 Thinly streaked: underparts ochre coloured streaks, darker at belly. Thighs thinly streaked; mantle & shoulder edged broadly cinnamon-tawny; Primary inner webs barred & tawny. Tail numerous obscure bands.
 wing = 356+; culmen = 21.4; hclaw = 22.7; tarsus = 72; %Feath = 49, primaries not fully emerged.
6. BM 1955.6.N.20.2147a Female ad: USSR; Siberia, near Lake Baikal, Kuttuk. 25 April
 Barred type: similar to #1 but more rusty (ochre tawny) on lower belly. Breast solid ochre tawny; lower belly shows barring; thighs cinnamon-rufous, incomplete bars. Tail solid except subterminal, olive-brown infiltrated with tawny.
 wing = 399; culmen = 23.0; hclaw = 25.6; tarsus = 73; %Feath = 52

these, three were collected during the breeding season. For a short description of these birds, see Table 3. Korean specimens have a Buff-Yellow (53) wash on the underside. In wing length, they are similar to the northern ones (fig. 4).

I have seen six specimens from Indochina; three males and three females. One male (MP1928.204) is heavily tinged tawny, the abdomen barred, and the tail tawny in colour with clear dark bands. This specimen resembles those from Baikal area (Table 3, 1) more than any other group. Another subadult (MP1974.875) from Indochina has a solid

cinnamon-tawny breast, broadly streaked belly and a light brown tail with obscure bands. I believe this bird to be from the northern population. The rest consists of immature streaked specimens probably coming from the northern breeding range. MP1897.101, sub-adult and probably a male, is tinged chestnut. The wing length is large and culmen small, the tail solid brown with obscure subterminal band, the thighs solid chestnut and the belly is blotched. Because it is a subadult I can only suspect that this bird belongs to the subspecies *refectus*.

Below is a list of the specimens (measurements in mm):

			wing	culm	tar	hclaw	%Feath
MP1928.204 M	ad. N.Vietnam	8 Dec.	379	22.4	72	25.3	57%
MP1936.480 M	im. (Laos)	7 Feb.	377	20.9	69		35%
MP1897.101 -	sad. Indochina	- -	380	20.1	73		38%
MP1974.875 F	sad. Indochina	11 Jan.	391 +	23. +	69	25.6	54%
MP1974.876 F	im. Indochina	19 Mar.	390	23.3	77		44%
MP1974.874 F	im. Indochina	11 Nov.	387	21.3	73		49%

None of the birds are clearly saturated in colour and they do not resemble typical *refectus*. However immatures are difficult to distinguish by colour and plumage alone.

From Burma, only four birds were examined: one was the type specimen of *burmanicus* Hume. This specimen (BM 85.8.17.894) is an immature female, collected by Captain Fielden in Thayetmayo, Burma. The soft parts were recorded as follows: iris very pale brown, leg yellowish, and cere greenish yellow. The underside is streaked darkish, under-tail covert cinnamon-cream unmarked, thighs heavily marked with a colour mixture of tawny, cinnamon, and fuscous. The tail is Olive-Brown (28) and buff-tawny near the shaft. The measurements (in mm) are: wing, 371 +; tail, 200; culmen, 20.6; tarsus, 72; hind claw; 21.8; feather portion of tarsus, 39%.

Judging from the length of the wing and culmen, I suspect that it has been incorrectly sexed, and possibly is a male. At any rate, on size and colour, these birds can be identified as belonging to the northern population. The wing length falls well below those for the Himalayan Buzzard (*refectus*).

I have examined one specimen taken in Afghanistan (BM 79.11.28.137 unsexed immature; wing 410, culmen 21.2 +, tarsus 78). Dementiev (1951) reports on a specimen from Ashkhabad taken in May.

The name *burmanicus* seems to be appropriate for the northern population. Vaurie (1961) suggested the name be used in favour of *refectus*, but in light of the probability that the type does not belong to *refectus*, the latter name should stand representing the high altitude breeding population of the Himalayan range.

Buteo buteo reffectus Portenko, 1935, Orn. Monatsb. 43:152

Buteo japonicus saturatus Portenko, 1929, Izvestia Akad. Nauk. pt. 1: 644-646

Portenko (1929) originally described this subspecies, giving it the name *Buteo japonicus saturatus*, which, according to Peters (1931), is

preoccupied by *Asturina saturata* Sclater & Salvin, 1876. Portenko (1935) duly renamed the subspecies *refectus*. But recently, Amadon (1982) recognized *Asturina*. Portenko's *saturatus*, as a secondary homonym, should not be retained.

Surprisingly few specimens have been reported from the Sino-Himalayan area during the breeding season. All the specimens reported by Portenko (1929) were taken during the non-breeding season, as well as those mentioned by Vaurie (1961) with the exception of two for which he cited Ludlow (1944:374). Based on the lack of firm breeding evidence, Vaurie (1961) did not recognize *refectus*. Voous & Bijleveld (1964) presented a detailed description of four specimens, two breeding, and two non-breeding. Two collected in July, Chini Kanda, northwest Himalaya probably formed a breeding pair. The other two were taken in January, one at Kanchanpur, West Nepal which according to Voous & Bijleveld (1964) resembles those from Chini Kanda, and the other taken at Kathmandu Valley, central Nepal resembles *burmanicus*.

Accounts of occurrences of this subspecies are conflicting and confused. Buzzards have been recorded breeding in the Himalayan region on numerous occasions. Already over one century ago, Tyle (1868) recorded a breeding pair from Pakree which he assigned to *B. vulgaris* [= *buteo*]. In the past most faunistic papers referred to buzzards from Kashmir and northern Pakistan as *B. b. vulpinus* and to those farther east in the northern Himalayas and Tibet as *japonicus* (Blyth, 1866; Sharpe, 1874; Baker, 1928, 1935; Whistler, 1930; Ripley, 1961). Of more recent works some list *japonicus* as breeding in Tibet and the Himalayas (Hartert, 1914; Portenko, 1929; Dementiev, 1951; Cheng, 1964; Voous & Bijleveld, 1964; Vaurie, 1972) and others have reported it only as a winter visitor in the Himalayas (Steinbacher, 1936; Smythies, 1953; Ali, 1961; Vaurie, 1961). However, breeding birds from Kashmir and northern Pakistan have not been assigned to any form, since the range for *vulpinus* in the southeast is generally said to

extend to Issyl-kul (Portenko, 1929; Lemenuev & Gladkov, 1951; Glutz *et al.*, 1971), and west of the Tien Shan mountains (Mendelsohn, 1986).

It becomes clear that buzzards from the northwestern Himalayan region belong to *refectus* and in the past have been incorrectly determined as *vulpinus*. The saturated tawny colours, and heavily barred underside of *refectus* resemble certain specimens of *vulpinus* and *rufinus* more than *japonicus* (Voous & Bijleveld, 1964).

I have examined many specimens from Kashmir, which were taken during the breeding season, and these belong clearly to the subspecies *refectus*. These not only provide addi-

tional evidence on which *refectus* can be recognized, but extend the known range of this race further west. Listed in Table 4 are specimens taken during the breeding season and also during the winter but clearly identifiable as *refectus*. Many of these specimens were originally identified as *vulpinus*.

Furthermore, Thiollay (1978) gave an account of nesting buzzards from Annapura, central Himalayas. He identified one species as *B. hemilasius* and the other was believed to be *B. b. burmanicus*. From his description, I am inclined to correct his identification to *B. b. burmanicus* sensu Vaurie (= *refectus*).

All adults that have been taken during the breeding season in Kashmir and Himalayas,

Table 4. List of specimens identified as *Buteo buteo refectus*.

Museum Number	Sex	Age	Date	Locality
BM 85.8.19.837	Male	ad.	6 June 1871	Kashmir: Gulmerg
BM 85.8.19.838	[= M]	imm.	July 1879	Kashmir: Gulmerg
ZMA 2298	Male	ad.	7 July 1925	Himachal Pradesh
BM 1955.6N20.2149	Male	ad.	± 27 July 1871	Kashmir: "Machel"
BM 1955.6N20.2149a	Male	fled	19 July 1871	Kashmir: "Machel"
BM 82.4.1.15	Male	fled	July 1880	Kashmir: Gilgit
BM 1949.Whi.1.472	Male	juv.	31 July 1921	[Himachal Pradesh]
ZMA 2299	Female	ad.	± 7 July 1925	Himachal Pradesh
BM 1949.Whi.1.475	Female	fled	1 July 1937	Kashmir: Wurdwan
BM 1949.Whi.1.476	Female	fled	27 July 1928	Kashmir: Minimurg
BM 85.8.19.836	-	juv.	July 1879	Kashmir: Gulmarg
BM 85.8.19.844	Female	ad.	8-2-[18]78	Nepal: Nepal Valley
BM 85.8.19.881	[= M]	imm.	autumn 1872	India: West Bengal
BM 85.8.19.877	[= M]	ad.	autumn 1872	India: Darjeeling
BM 85.8.19.866	[= F]	ad.	Nov. 1875	Native Sikkum
BM 1949.Whi.1.470	Male	imm.	16 Nov. 1922	India: Punjab
BM 1949.Whi.1.469	Male	imm.	3 Nov. 1913	India: Punjab, Thelum
BM 1949.Whi.1.465	Male	ad.	31 Dec. '32	Kashmir: near Srinagar
BM 85.8.19.893	Male	ad.	13 Dec. 1877	India: Assam, Shillong
Bm 82.4.1.14	Male	ad.	11 Jan. '79	Kashmir: Gilgit, 5000 ft.
BM 1965.M.1275	Male	ad.	2 Jan. 1926	India: Darjeeling
BM 1949.76.9	Male	ad.	15 Feb. 1946	India: Assam, Manipur
BM 1949.76.7	Female	ad.	5 Feb. 1946	India: Assam, Manipur
BM 1949.76.8	Female	ad.	15 Feb. 1946	India: Assam, Manipur
BM 1908.11.10.11	Female	ad.	28 Mar. 1908	Pakistan: Kohat, 1700 ft.
BM 85.8.19.861	unsexed	imm.	Apr. 1874	Native Sikkum
BM 87.11.1.273	[= M]	imm.	no date	Kashmir: Gulmerg
BM 85.8.19.842	[= F]	ad.	no date	India: Uttar Pradesh
BM 85.8.19.843	[= F]	imm.	no date	India: Himachal Pradesh
BM 85.8.19.880	Male	imm.	date = 1871	India: Darjeeling

and that were examined in this study are of the saturated barred type. Portenko (1929) mentioned only two specimens of the belted type (*pallidipectus*), one from Sikkim in October, and one undated from northwest Himalaya. In my opinion it has still to be proved that an adult belted plumage type does exist in this subspecies. The only black phase specimens examined, which were collected during the breeding season, are two fledglings from Tibet (August) and an adult female taken on 6 June 1936 at southern Tibet, Bimbi La (BM1937.1.17.86). Ludlow (1944:374) reported the latter as breeding. The remaining birds were taken during the nonbreeding season in Chinese Turkestan (two), Sikkim (fifteen), Himalaya (two), and one each at Assam, Darjeeling, Nepal and Sri Lanka.

This buzzard has been reported from Ceylon (Sri Lanka). Wait (1925) listed only *B. b. rufiventer* (usually a synonym for *B. b. vulpinus*) as an extremely rare straggler, but from his description of the bird it is clear that he referred to *burmanicus*. Both Phillips (1953) and Henry (1955) listed *burmanicus* as an uncommon winter visitor. I have examined only two specimens from Sri Lanka, one an adult melanistic (BM 1953.16.2; wing 385, culmen 22.3, tarsus 71.5) and the other an unsexed sub-adult of the belted plumage type, originally labelled *vulpinus* (BM 87.11.1.271, wing 415, culmen 22.5, tarsus 78).

The black specimen presumably belongs to *refectus*. The other is rather puzzling. The ground colour is Clay Color (26) and the ventral plumage points to *refectus*, however, the tarsus is long and the head light. This bird represents a form which I can not clearly separate from *hemilasius* or *rufinus*. I have seen similar specimens, mostly from Turkestan but also some from the Himalayas. They may be like specimens referred to by Whistler (1926) where he could not assign their identity to either *B. b. japonicus* or *B. ferox* (an old name once applied to both *rufinus* and *hemilasius*). These birds in general resemble the *japonicus*-group in plumage pattern, wing and culmen length but have long tarsi.

DISCUSSION AND CONCLUSIONS

Portenko (1929) listed nominate *buteo*, *vulpinus*, and *japonicus* all as separate species, placing *menetriesi* under *vulpinus* and *saturatus* [= *refectus*] under *japonicus*, and for each subspecies he gave a description of the colour varieties. He suggested that colour types show deme variation, where a particular colour variation occurs only in certain localities. His conclusions on taxonomic order and status given, however, are not congruent among the various taxa. Portenko (1929) described specimens he himself considered intermediate between nominate *buteo* and the Steppe Buzzard *vulpinus*, but found no evidence for intergradation of *vulpinus* and *japonicus*. Yet he gives all three taxa specific status. It is clear that Portenko took only a passive stand on the taxonomy of the Palearctic buzzards, moreover he recommended giving these forms specific or subspecific status as a matter of one's own point of view.

This stand is not surprising considering the previous taxonomic treatments in the literature. Meinertzhagen (1954) summarized the major works from 1914 until 1950. To quote Meinertzhagen (1954:354), "the entangled confusion is chaotic". Most authors have either placed all the small Palearctic buzzards under nominate *buteo* (Hartert, 1914; Meinertzhagen, 1954; Voous, 1960; Vaurie, 1961; and Stresemann & Amadon, 1979), some give them all three separate specific status (Sharpe, 1874; Momiyama, 1927; Peters, 1931; Ripley, 1961). Stresemann (in, Stresemann & Amadon, 1979: 272) considered *B. japonicus* a separate species.

Nominate *buteo* and *vulpinus* interbreed in a wide area of secondary intergradation, whereas the distribution of the *japonicus*-group, is essentially allopatric. Although imperfectly known, the breeding range does not seem to overlap with *vulpinus*. In *burmanicus* the western border appears to follow the perimeter of the mid-Siberian plateau. These continental buzzards nest at higher altitudes.

In appearance, *japonicus* resembles *B. hemilasius*, and is easily distinguished from the

buteo and *vulpinus*-groups. Sharpe (1874:183) even stated that *hemilasius* is only a gigantic form of *B. plumipes* [= *japonicus*]. Similarly, Gore & Pyong-on (1971) remarked on the extreme difficulty in distinguishing *B. hemilasius* and *japonicus*, especially in the field. In many respects both species are similar, both show similar plumage patterns and a black plumage phase, the tarsus is heavily feathered in both, and both show light on the inner web of the outer primaries. However, their ranges overlap extensively although they may be ecologically separated (Piechocki, 1968) and the size difference is great. It is not meant here to imply that the *japonicus*-group and *hemilasius* are conspecific, but to stress the differences between the Japanese Buzzard from the Steppe and Common Buzzard.

In order to determine the taxonomic status of two or more sympatric or parapatric taxa, based on the biological species concept, establishing an interbreeding population is clearly the most weighted method (e.g. nominate *buteo* and *vulpinus*). However, in allopatric groups or where no or no certain intermediate phenotypes are found, the specific status remains in doubt, although not necessarily its phylogenetic position. Vuilleumier (1977) outlined some of the problems involved in judging species limits in *Buteo*.

Based on biogeographical evidence, Meinertzhagen (1954) suggested that all three groups be considered under *Buteo buteo* and further included the discontinuous populations of the small African buzzards he thought conspecific with *B. buteo*. Meinertzhagen (1954) remarked that all the Palearctic buzzards may prove to be conspecific. Snow (1978) and Voous (1960) also took a broad view. Vaurie (1961) admitted only slight external differences between the three groups and although they differ geographically, he suggested it undesirable to subdivide them nomenclaturally.

The dissimilarity between the *japonicus*-group and the other two groups, *buteo* and *vulpinus*, is greater than between the latter two. Geographically the former is discontinuous and is subdivided intraspecifically. An overlap in

characters of the *japonicus*-group, especially *refectus*, with *Buteo rufinus* and *B. hemilasius* is present. Although, I believe that *japonicus* will prove to be separable from *Buteo buteo* as a separate species, a clearer understanding of the geographic variation in other *Buteo* forms including both *B. rufinus* and *hemilasius*, actual field observations of buzzards in areas where their distribution overlap, and information on their ecological requirements is deemed necessary before a sound taxonomic decision can be made. I have elsewhere (James, 1986) suggested that the smaller members of the *japonicus*-group resemble in size, plumage pattern, and coloration the Forest Buzzard *B. [oreophilus] trizonatus* of southern Africa and the Madagascar Buzzard *B. brachypterus*. The latter two, and the *japonicus*-group form a category of Buzzard all generally sharing similar characters: extensively feathered tarsus, tri-zoned or 'belted' plumage pattern, barring of the inner webs of the outer primaries, to name but a few. It is not known whether these are shared derived (synapomorphic) or shared primitive (symplesiomorphic) characters.

At this point in time, this study does not attempt to establish the taxonomic position of the *japonicus*-group, but tries to demonstrate the intraspecific geographic variation and determine diagnostic characters, based on morphological resemblance, in order to define comparable phenotypes which may enable a more thorough phylogenetic study. As yet, more information, especially in distribution, behaviour, and ecology is required before a sound taxonomic decision can be made, but it is not impossible that the Palearctic Common Buzzards represent more than one species.

In conclusion, this study has attempted to show that at least three subspecies under the *japonicus*-group can be clearly recognized. The fourth, *toyoshimai*, of the Bonin Islands, may indeed form a separable subspecies, but on the few specimens examined from these islands during this study and by others, it is not adequately distinguished from the population on Japan. The buzzards of the Bonin Islands average smaller and are slightly paler but fall

within the range of variation of the Japanese birds. Characteristic to these birds, however, is the banding of the primary tips. On the Palearctic continent, a larger northern subspecies has been shown to be smaller and differing in colour tinges from the Himalayan population, which exhibit a unique plumage pattern and a black morph which is not known in any of the other members of the *japonicus*-group.

Birds from the Daito and Ryukyu Islands are inadequately known. From a photograph of *oshiroi* (Kuroda, 1971), banding on the primary tips is evident, and, according to the description, is small in size, similar to *toyoshimai* but in coloration it is much redder and not pale.

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Received: June 2, 1988.