Bull. Natl. Mus. Nat. Sci., Ser. A, **35**(2), pp. 113–124, June 22, 2009

A New Subspecies of *Zoothera dauma* (Aves, Turdidae) from Iriomotejima, Southern Ryukyus, with Comments on *Z. d. toratugumi*

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Abstract A new subspecies of *Zoothera dauma* (White's ground thrush) is described from Iriomotejima, southern Ryukyus. So far as is known, the new subspecies is a resident and confined to the island. The validity of *Z. d. toratugumi* of the Japan mainland is also examined and it is recommended that *Z. d. toratugumi* be treated as a junior synonym of *Z. d. aurea*.
Key words : Aves, Iriomotejima, new subspecies, Turdidae, *Zoothera dauma*

Iriomotejima, or Iriomote Island, is the largest island of the Yaeyama Group, southern Ryukyus, and the second largest next to Okinawajima for the whole Ryukyu Islands. It lies approximately 24°20.00′N 123°48.75′E, about 18 km west of Ishigakijima, and is a rough paralleogram in shape; it is about 29 km long and 23 km wide, with a circumference of 130 km and an area of 289 km^2. There are three separated peaks rising to 470 m (Mt. Komidake), 441 m (Mt. Tendouyama) and 420 m (Mt. Kozadake) above sea level, respectively. Most of the interior is more or less mountainous and covered with subtropical rain forest. The coastal area is mainly mangrove swamp interspersed with open fields, human habitation and cultivation. Two large rivers (the Nakamagawa and Urauchigawa rivers) flow across the island and provide varied habitats for land and water birds.

The geological history of the island is not well understood, but can be dated back to the Miocene at least on the basis of plant fossils (Saito *et al.*, 1973), and it presumably represents a remnant of the old Asiatic Continent. The occurrence of several reptile and amphibian species of which range share with Taiwan, together with the endemic Iriomote cat *Prionailurus bengalensis iromotensis*, also suggests a historic land connection with the continent (Ota, 1998). However, many flat smaller islands (e.g. Hatomajima, Haterumajima) are of elevated coral reef origin and will not have been connected with the continent as larger, mountainous islands (Ishigakijima, Iriomotejima) presumably once were.

Zoothera dauma has long been known to occur on Iriomotejima since Kuroda (1925) reported an adult female taken on 6 November 1921. He attributed this specimen, together with another specimen from Taiwan, to *Oreocincla* [= *Zoothera*] *dauma horsfieldi*, considering that these two specimens were a migrant or vagrant from "Java and Lombok" where *Z. d. horsfieldi* is a resident. The breeding status of *Z. dauma* on Iriomotejima is now however beyond any doubt, as shown by a juvenile specimen, a bird of the year (unsexed, collected on 12 July 1936), which looks like an adult but retains juvenal feathers on the crown. The breeding form is also resident or at least not wholly migratory as specimens have been collected in January and March. We describe this below as a new subspecies.

In addition to the form described herein, Iriomotejima, as well as some other islands in the Ryukyu chain (e.g. Okinawajima, Ishigakijima), is visited by *Z. d. aurea* from the north on migration or in winter. There has been no authentic

(specimen or photographic) published record of *Z. d. aurea* from Iriomote previously, but the National Museum of Nature and Science, Tokyo (hereafter NSMT) has one and the Yamashina Institute for Ornithology, Abiko City (hereafter YIO) has 4 specimens of *Z. d. aurea* taken between November and January. The two forms are at once distinguished by the difference in plumage as diagnosed.

Materials and Methods

A total of 118 specimens were used in this study: Japan 74, Korea and Quelpart Island 8, Manchuria 11, mainland China 1, Taiwan 18, Laos 1, Himalayas (*Z. d. dauma*) 4, S. India (*Z. d. neilgherriensis*) 1.There was an additional Iriomote specimen in Kuroda's collection but that has been lost (see Paratypes). In addition several specimens of *Z. d. horsfieldi* were examined and two of them previously measured by one of the authors (H. M.) in the Zoological Reference Collection, NUS, Singapore, although no direct comparison with other specimens available was then made.

All measurements are in mm. Wing length is measured from the chord. When the measurements of left and right wings differ, they are averaged (except for holotype). When the wing tip is worn, it is indicated by "+" marked after measurements. Exposed culmen and entire culmen (given for type specimens only) lengths are taken from feathers and from the skull, respectively. Males generally average larger but only slightly (as for example in *Z. d. aurea* from Japan wing chord, av. 156.1 and 153.2, *SD* 4.0 and 2.2, $n=15$ and 18, males and females, respectively, Mann-Whitney U-test $P=0.02$, tail length, av. 98.1 and 96.3, SD 3.1 and 6.1, $n=14$ and 19, $P=0.18$, exposed culmen, av. 25.4 and 25.0, *SD* 1.3 and 1.3, $n=15$ and 19, $P=0.36$, tarsus length, av. 33.6 and 33.8, *SD* 1.0 and 1.1, $n=14$ and 19, $P=0.65$) so that, except for wing lengths (Table 1), the measurements of males, females and unsexed specimens are combined (Table 2).

Breeding specimens (as postulated from the collecting dates of mid April through end July) are, however, separated from non-breeding specimens (with collecting dates from August through early April), because (a) wintering birds from Japan and Taiwan are a composite population if *Z. d. toratugumi* is recognized and (b) although apparently immature birds were excluded from the study, non-breeding specimenss may include some first-winter birds which are not easily distinguished. The breeding season of *Z. dauma* is generally from mid April to end July, although a few wintering birds may remain in urban areas, where they do not breed, until end of April or rarely early May.

Zoothera dauma iriomotensis subsp. nov.

[Japanese name: Kotora-tsugumi]

Holotype. NSMT no. 15219, adult (1st nuptial?) male collected on 11 March 1967 at Ohara, southeastern coast of Iriomotejima, by Kimiyuki Tsuchiya. Wing chord 145.5^{+} (right) 146.1 (left), tail 94, exposed culmen 24, entire culmen 27.5, tarsus 35.5; no. of rectrices 13 (right 2nd outer rectrix missing).

Paratypes. (a) ACMB (Abiko City Museum of Birds, Abiko City) no. 8711, adult male found dead by striking window on 14 January 1984 at Sonai, northwestern coast of Iriomotejima, and preserved for specimen by Mamoru Shoyama. Wing chord 144.3, tail 92, exposed culmen 25.5, entire culmen 27.5, tarsus 33.5; no. of rectrices 14.

(b) YIO no. 42840, unsexed juvenile of the year collected on 12 July 1936 at Sonai, Iriomote-jima, by Hyojiro Orii. Wing chord 138.8, tail 85, exposed culmen 25, entire culmen 29, tarsus 32; no. of rectrices 14.

Besides these two paratypes, there was a specimen (Kuroda Coll. no. 6585, adult female collected on 6 November 1921 at Sonal, Iriomotejima, by Hyojiro Orii) which was lost in World War II but was described and depicted in color by Kuroda (1925). Wing chord 140, tail 97, exposed culmen 23.5, entire culmen 31.5, tarsus 33, no. of rectrices 14.

Table 1. Individual wing lengths (taken from the wing chord in mm) of *Zoothera dauma* from localities in eastern Asia. Mean is given in the parentheses. BR=breeding specimen as taken from mid April through end July, NB=nonbreeding specimen taken from August through early April, U=unsexed specimen, +=wing tip somewhat worn. When the measurements of the right and left wings differ, they are averaged.

Japan	8♂BR	151	152.8	153	153	154.4	155.3	161	165		(155.7)
mainland	17♂NB	150	150	150	150.3	150.7	152.1	152.5	153.1	153.6	
		153.8	154.3	155.3	156.3	158.5	159	160	162.5		(151.4)
	6♀BR	150.5	151.3	154.8	155	155.5	156.5+				(153.9)
	10♀NB	150.8	151.1	151.2	151.5	151.8	152	153.4	154.6	154.8	
		155.5									(152.7)
	2U BR	149.5+	160.5								(155.0)
	7U NB	151	152.7	153	154.6	156.4	157.8	162.5			(155.4)
Ogasawara Is.	1♂BR	160.6									
Hachijo I.,	4♂NB	146.3	153.8	154.5	157.8						(153.1)
Miyake I.	2♀BR	150.1	151.3								(150.7)
	2♀NB	151.7	155.5+								(153.6)
Ryukyu Is.	6♂NB	156	156.8	157	157.3	158.5	159				(157.4)
(*Z. d. aurea*)	4U NB	159.4	159.8	160.3	162						(160.4)
Manchuria	4♂BR	159.5	161.5	161.5	165						(161.9)
	4♂NB	154.8	156	163	164						(159.5)
	1U NB	163									
Korea	1♂NB	160.2									
	3♀BR	153	155.8	160.5							(156.4)
Quelpar I.	2♀BR	152.5	153.5								(153.0)
China	1♀NB	158.2									
Taiwan (*Z. d. aurea*)	9♂NB	155.5	156	157	158	158.5	159.5	161.3	162.5	164.5	(159.2)
	5♀NB	152.5	154	158	158	160.3					(156.6)
Laos (*Z. d. aurea*)	1♂NB	163									
Nepal, Himalayas	2♂NB	139.3	142.9								(141.1)
(*Z. d. dauma*)	2U NB	140.8	149.5								(145.2)
Iriomotejima	2♂NB	144.3	145.8								(145.1)
(*Z. d. iriomotensis*)											
Taiwan	2♂BR	138.5	142.5								(140.5)
(*Z. d. horsfieldi*)	2♀BR	139	140								(139.5)
Sumatra	2♂BR	137	141								(139.0)
(*Z. d. horsfieldi*)											
S. India	1U NB	128.8									
(*Z. d. neilgherriensis*)											

Table 2. Measurement (in mm) of *Zoothera dauma* from localities in eastern Asia. In this table male, female and unsexed specimens are combined for comparison (see text). All specimens are supposedly adults but non-breeding specimens may include some first-winter birds. Ranges, means and sample sizes are shown. See Table 1 for abbreviations.

	Wing length		Tail length		Exposed culmen		Tarsus length	
	Range (Mean)	*N*	Range (Mean)	*N*	Range (Mean)	*N*	Range (Mean)	*N*
Japan mainland								
BR (8♂ 6♀2U)	149.5^{+}–165 (155.0)	16	89–109.8 (95.1)	16	23–27 (25.5)	16	29.5–34.5 (32.9)	16
NB (17♂ 10♀7U)	150–162.5 (154.2)	34	85–106 (95.7)	34	22–27.5 (25.4)	34	30–36 (33.5)	33
Ogasawara, Hachijo I. and Miyake I.								
BR (1♂ 2♀)	150.1–160.6 (154.0)	3	101–109 (104.7)	3	23.5–26.5 (25.0)	3	34–35.5 (34.8)	3
NB (4♂ 2♀)	146.3–155.5^{+} (153.3)	6	91–102 (95.7)	6	23.5–27 (25.1)	6	33–35.5 (33.7)	5
Ryukyu Is. (*Z. d. aurea*)								
NB (6♂ 4U)	156–162 (158.6)	10	95.5–112 (102.2)	10	22.5–28 (24.9)	10	32.5–36 (34.2)	10
Manchuria								
BR (4♂)	159.5–165 (161.9)	4	95–102 (98.5)	4	24–25 (24.4)	4	33.5–35 (34.3)	4
NB (6♂ 1U)	154.8–164 (160.2)	5	88–97 (92.5)	5	24.5–28 (26.2)	7	31–36 (32.7)	7
Korea								
BR (3♀)	153–160.5 (156.4)	3	88^{+}–92.5 (89.8)	3	26	1	33–34 (33.5)	2
NB (1♂)	160.2	1	108	1	24	1	34	1
Quelpart I.								
BR (2♀)	152.5–153.5 (153.0)	2	93–100 (96.5)	2	24.5–29 (26.8)	2	32–34.5 (33.3)	2
China								
NB (1♀)	158.2	1	102	1	26	1	34.5	1
Taiwan (*Z. d. aurea*)								
NB (9♂ 5♀)	152.5–164.5 (158.3)	14	93–104 (99.1)	14	25–28 (26.0)	12	32–37 (34.3)	13
Laos (*Z. d. aurea*)								
NB (1♂)	163	1	106	1	26	1	33.5	1
Nepal, Himalayas (*Z. d. dauma*)								
NB (2♂ 2U)	139.3–149.5 (143.1)	4	81.5–94 (86.8)	3	24–26.5 (25.0)	4	31–33 (32.3)	4
Iriomotejima (*Z. d. iriomotensis*)								
NB (2♂)	144.3–145.8 (145.1)	2	92–94 (93.0)	2	24–25.5 (24.8)	2	33.5–35.5 (34.5)	2
Taiwan (*Z. d. horsfieldi*)								
BR (2♂ 2♀)	138.5–142.5 (140)	4	81^{+}–96^{+} (88.8)	4	24–25.5 (24.8)	3	32–34 (33.5)	4

Table 2. (Continued)

	Wing length		Tail length		Exposed culmen		Tarsus length	
	Range (Mean)	*N*	Range (Mean)	*N*	Range (Mean)	*N*	Range (Mean)	*N*
Sumatra (*Z. d. horsfieldi*)								
BR (2♂)	137–141 (139.0)	2	94–101.5 (97.8)	2	26–26.5 (26.3)	2	32–34 (33.0)	2
S. India (*Z. d. neilgherriensis*)								
NB (1U)	128.8	1	84.5	1	27	1	–	–

Diagnosis. Most similar to *Z. d. horsfieldi* breeding in Taiwan (referred to as Taiwanese *horsfieldi* hereafter), but separable by narrower black scaling on the upperparts, especially on the rump and upper tail-coverts, with more strongly brownish ("dark ferruginous") color of the upperparts. The subterminal band of feathers of the underparts is also somewhat more brownish especially on the breast and the under tail-coverts buffy. In Taiwanese *Z. d. horsfieldi* the black scaling on the upperparts is broader and more conspicuous, especially on the rump, the color of the breast somewhat darker and less ferruginous, and the under tail-coverts whitish. Wing length is somewhat longer in Iriomote birds (144.3–145.8) than in Taiwanese (138.5–142.5) and Sumatran (137–141) *Z. d. horsfieldi*.

Zoothera d. aurea of the Japan mainland is distinctly larger (wing length 149.5^{+}–165), the dorsal color golden fulvous rather than ferruginous, and much wider white tips on the outer rectrices.

Description. The designations of colors of the type specimens is made by reference to the color standards of Smithe (1975). Dorsal view is shown in Fig. 1. Forehead to crown and nape Antique Brown (37) with light (Chamois 123D) central shafts and scaled Jet Black (89) tips. Sides of nape and neck a little paler with whitish base becoming Orange Yellow (18) towards tip, fringes scaled Jet Black (89). Mantle and scapulars Raw Umber (23) with broadly edged Jet Black (89). Rump somewhat lighter (Antique Brown 37) with narrowly edged Jet Black (89). Upper tail-coverts Raw Umber (23) with narrowly edged Jet Black (89). Tail (14 [13 in holotype] feathers) Natal Brown (219A) on two central pairs, becoming darker to Hair Brown (119A) or Sepia (119) on outers, but the outermost pair is as pale as the centrals and the 2nd outermost pair is intermediate. No buff tips to rectrices (holotype) or small (less than 3.5 mm) Buff (124) tips at the outer 2nd to 5th tail feathers (paratypes). Lesser and median coverts blackish (Sepia 119 to Hair Brown 119A) with yellowish (Buff 24 or Clay Color 123A) tips and shafts very narrowly edged black (Blackish Neutral Gray 82). Greater coverts lighter (Raw Umer 23) on outer web and blackish (Dusky Brown 19) on inner web, but the tips pale (Buff 24). Alula Buff (124) with blackish tip (Dark Brownish Olive 129). Primary coverts dark (Sepia 119) on inner web to tip of outer web, but Cinnamon (39) or Clay Color (123b) on base of outer web. Primaries, secondaries and tertiaries mainly Hair Brown (119A) including shafts, but broadly edged Cinnamon (123A) on outer web, and a subterminal Clay Color (123B) band from inner primaries to secondaries, forming a light-colored band on the wing.

Ventral view is shown in Fig. 2. Lesser coverts to wrist region white, median coverts white with broadly blackish tips (Sepia 119), greater coverts black tipped white, merging with a broad subterminal Buff (124) band from secondaries to inner primaries; forming two conspicuous whitish bars on underwing. Lores to eye whitish (Pale Horn Color 92) with thin whitish (Cream Color 54) eye-ring. Ear-coverts, chin and throat yellowish (Cream Color 54). Visible part of feathers on

Fig. 1. Dorsal view of *Zoothera dauma* specimens. From left to right; ACMB no. 8711 (paratype), NSMT no. 15219 (holotype), YIO no. 2865 and 2864 (*Z. d. holsfieldi* from Taiwan), and NSMT no. 13831 (*Z. d. aurea* from Iriomotejima).

Fig. 2. Ventral view of specimens. Arrangement is the same as Fig. 1.

breast and flank Warm Buff (118) merging with whitish bases, and with relatively broad black crescents, but lower flanks and center of belly whitish with slightly smaller black crescents. Undertail-coverts Pale Horn Color (92) occasionally with small blackish crescents. Ventral tail Drab (27) or Olive-Brown (28). Bill blackish (which has a small hook at tip), with yellowish base of lower mandible. Legs and feet yellowish.

The wing formula of ACMB no. 8711 (paratype) is 4>3>5>2>6 with the difference between 4th and 3rd 1.8 mm, 3rd and 5th 1.3 mm, 5th and 2nd 3.7 mm, 5th and 6th 11.4 mm, respectively. The wing formula of holotype appeared to be similar, but could not be confirmed due to the abrasion of primary tips.

Population size, ecology and conservation. Before World War II there were only two specimen records of the present form (Hachisuka and Udagawa, 1953). There are now 4 specimen records including a lost specimen of Kuroda. Until about 1950 the forested interior of Iriomotejima was virtually impenetrable due to a high incidence of malaria, tsutsugamushi disease and other local fevers; no adequate ornithological study has been undertaken even now. For this reason no information is available as to the population size, ecology and vocalization of the bird. The past specimen records are apparently no indication of population size, although some species are considered rare or even endangered because of the lack of information.

A greater part of the island was designated as a national park in 1972 and specially protected wildlife reserves have also been established within the park to conserve the habitat and its fauna and flora.

Discussion

Consideration on eastern Asiatic Zoothera dauma

The present new subspecies is no doubt most similar to Taiwanese *Z. d. horsfieldi*. Previously Japanese authors (e.g. Kuroda, 1925; Yamashina, 1941; OSJ, 1942) attributed both the Iriomote and Taiwanese birds to *Z. d. horsfieldi* based on the subspecific characters that (a) smaller size than *Z. d. aurea* (Yamashina (1937) gave wing length 138–144, tail 91–97, tarsus 33–35, exposed culmen 24–26.5 mm for 4 specimens of' Taiwanese *Z. d. horsfieldi*), (b) the color of the upperparts ("russet brown" in *Z. d. horsfieldi* and "ochreous or golden olive yellow" in *Z. d. aurea*), (c) wing formula (2nd primary falls between 5th and 6th in *Z. d. horsfieldi* but between 4th and 5th in *Z. d. aurea*), (d) number of rectrices (14 in Z. *d. horsfieldi* and *Z. d. aurea*, 12 in *Z. d. dauma*), and (e) tip of outer tail feathers (no or little whitish tip in *Z. d. horsfieldi* and large whitish patch in *Z. d. aurea*). The Japanese authors, however, had no specimen of topotypical *Z. d. horsfieldi* and compared their specimens only with the description (p. 153) and color plate (pl. 10) of Seebohm (1881) (cf. Kuroda, 1925), nor did they compare the Iriomote and Taiwanese specimens for any difference.

Mees (1977), on the other hand, assigned the breeding form of Taiwan to *Z. d. dauma*, largely disregarding the subspecific characters mentioned above but fully taking into consideration the geographic distance separating Taiwan and Indonesia with some elaboration on wing formula. In our opinion the argument that two populations that are widely separated geographically *must* be different species or subspecies cannot be accepted as valid, although related populations are often found in geographic neighbors.

The examination of our series of specimens has essentially verified the subspecific identification by the Japanese authors of the Iriomote and Taiwanese birds except for the differences in the color and black markings of the upperparts (see diagnosis above). Our measurements of 4 Taiwanese *Z. d. horsfieldi* match well with those of Yamashina (1937) except we measured the tail shorter. The white tips on the outer tail feathers are almost absent in the Iriomote specimens and much reduced and obsolete in 2 Taiwanese specimens (other 2 specimens have the tails badly abraded and had only 11 rectrices each).

Two subspecific characters deserve special

comment. Firstly, wing formula. Mees (1977) elaborated the differences in wing formula between *Z. d. dauma* and *Z. d. horsfieldi*. He showed that 5th primary is only slightly longer than 2nd with 3rd and 4th being longest in *Z. d. dauma* of the Himalayas, whereas the 5th is much longer, distinctly longer than 2nd and subequal to 3rd and 4th in length in *Z. d. horsfieldi* (in Java).

In one of our paratypes (ACMB no. 8711) the condition appeared to approach that given for *Z. d. horsfieldi* by Mees (1977). Our holotype here was not helpful due to the abrasion of tips of the primaries. In *Z. d. aurea*, wing formula is rather variable individually, but usually 3rd and 4th are longest, 2nd more or less shorter than 3rd and 4th; and 5th usually distinctly shorter than, but sometimes subequal to, 2nd. Vaurie (1959) also states "2 slightly >5". In one of our specimens of *Z. d. dauma* from Nepal (rectrices 12), 3rd is longest, 2nd somewhat shorter than 4th, and 5th somewhat shorter than 2nd (i.e. 5<2<4<3, but the differences between 2–5 and 2–4 were 2–5 mm). In other specimens of *Z. d. dauma*, however, 5th is somewhat longer than 2nd as described by Mees and Vaurie ("2<5").

Thus there are subspecific differences in wing formula, but as a subspecific character this must be considered with caution. Nevertheless, both Iriomote and Taiwanese breeding birds belong to *Z. d. horsfieldi* group, not *Z. d. dauma* group, in this character.

Secondly, the number of rectrices. There is a general agreement (e.g. Baker, 1924; Robinson, 1928; Kuroda, 1933, etc.), and also supported by our observation, that *Z. d. dauma* from the Himalayas always has only 12 rectrices, whereas *Z. d. aurea* of the Asian Continent and *Z. d. horsfieldi* of Indonesia always have 14 rectrices. In the meantime, Deignan (1938) has shown that individuals with 12 and 14 rectrices were found in the same region in northern Thailand and both the 12- and 14-rectrixed birds were attributed to *Z. d. dauma* as these two kinds of birds are "separable by no character except the number of tail-feathers". He then concluded that the number of rectrices is "not invariable" in at least *Z. d. dauma*. His paper will be commented upon later.

Mees (1977) advanced Deignan's argument further to state that "the apparent increase in number of rectrices from always 12 in the western part of the range to always (?) 14 in the eastern part is too gradual to be useful as a character to base subspecies on" and added "*Z. d. toratugumi* from Japan also has either 12 or 14 rectrices" but without detailing his evidence.

To be sure, a few cases of Japanese birds having only 12 rectrices have been reported (e.g. Kuroda, 1925; Ishigaki specimen which was lost by the war) but none of these including Mishima (1961) has been substantiated by us. Mees's statement is apparently inaccurate and misleading. In our study, of 70 specimens of the Japanese birds (except *Z. d. iriomotensis* which also has 14 rectrices) that we examined the tail, 52 specimens were with 14, 9 with 13, 3 with 12, 3 with 11, one with 10, one with 9, and one with 6 restrices, respectively, i.e. an overwhelming majority had 14 or 13 rectrices. Furthermore, at least 2 specimens with 12 and other 2 specimens with 11 rectrices were likely 14-rectrixed because they were missing unpaired rectrices (tails of the other 5 specimens were badly damaged or abraded so that whether they are 14- or 12-rectrixed birds is unknown).

The only case of probably 12-rectrixed Japanese bird (but the specimen not examined by us) is a specimen reported by Mishima (1961) where the pair of 2nd outer rectrix was lacking. It is interesting to find that 6 out of our 9 specimens with 13 rectrices lacked one of 2nd outer rectrices (the other specimens lacked one of central rectrices) and a 12-rectrixed Nepal bird (*Z. d. dauma*) is also lacking the pair of 2nd outer rectrix. The 12-rectrixed state appears to be ancestral rather derived as many birds and most oscines have 12 (6 pairs) rectrices (see Van Tyne and Berger, 1976).

Of the 8 specimens taken from northern Thailand and studied by Deignan (1938), 6 specimens are 12-rectrixed and included at least one breeding specimen. They can safely be attributable to

Z. d. dauma as they were by Deignan. The 2 remaining specimens, on the other hand, are 14-rectrixed and wintering birds. Mees (1977) listed 3 specimens of 14-rectrixed birds from Thailand including 2 from Deignan's material, all being wintering birds. Although these two specimens have also been referred to *Z. d. dauma* by Deignan, their identification and validity are open to question as they might be migrants from a 14-rectrixed population breeding elsewhere in Thailand or Vietnam.

Zoothera d. dauma and *Z. d. aurea* (also controversial *Z. d. angustirostris*) are very similar in plumage characteristics and separable only by size, number of rectrices, tail pattern, and/or wing formula. A single type-specimen of 14-rectrixed *Z. d. angustirostris* was taken from Khun Tan with collecting date only as 1914 (Gyldenstolpe, 1916), but Gyldenstolpe is said to have had 2 additional specimens taken from the same range of hills in May, whereas Deignan had a breeding specimen of 12-rectrixed *Z. d. dauma* taken with a nest and young from Doi Hua Mot in the same mountain range (see aiso Riley, 1938, Deignan, 1945). This was the basis for Deignan (1938) considering, that *Z. d. angustirostris* and *Z. d. dauma* were one population with either 12 or 14 rectrices. Deignan, however, did not hint in any way the increase of 12 to 14 rectrices is gradual or clinal as Mees (1977) implied. If it is clinal, various geographic populations having 12 and 14 rectrices at different frequencies must be known. If, on the other hand, the 12- and 14-rectrixed birds do indeed breed in the same mountain range, we must regard them as different species rather than to represent a gradual cline.

We consider, in accordance with Deignan (1938) and some other authors, that eastern Asiatic *Z. dauma* may be comprised of 3 groups of subspecies and forms, each characterized by a set of subspecific characters that have already been discussed (Papuan-Australian subspecies are extralimital in this paper): (a) nominotypical *dauma* group includes *Z. d. dauma* (Latham, 1790), *Z. d. major* (Ogawa, 1905), and *Z. d. socia* (Thayer and Bangs, 1912) if it is recognizable, also includes much darker *Z. d. neilgherriensis* (Blyth, 1847) and *Z. d. imbricata* Layard, 1854; (b) aurea group includes *Z. d. aurea* (Holandre, 1811) only; *Z. d. toratugumi* (Momiyama, 1940) is not recognizable, see later in this paper, and *Z. d. hancii* (Swinhoe, 1863) and *Z. d. miharagokko* (Momiyama, 1940) are also junior synonyms; and (c) *horsfieldi* group includes *Z. d. iriomotensis* nov. subsp. and *Z. d. horsfieldi* (Bonaparte, 1857) including Taiwanese breeding form; and *Z. d. affinis* (Richmond, 1902) is probably a junior synonym, see Deignan (1938). The wing formula of *Z. d. major* is intermediate between those of nominotypical *dauma* and *horsfieldi* groups (5th more or less longer than 2nd) but unlike that of *aurea* group; the white patch in the tail is rather large in *Z. d. major* but paler and indistinct (examined 5 adult specimens). The status of *Z. d. angustirostris* (Gyldenstolpe, 1916) is uncertain.

The *horsfieldi* group is 14-rectrixed as is the *aurea* group but is distinguishable from the latter notably by the color of the upperparts more or less ferruginous brown (in the nominotypical *dauma* and *aurea* groups the color of the upperparts is ochreous or golden yellow olive, although immatures might be slightly brownish), a tendency which culminates in *Z. d. iriomotensis*. As noted already, we could not compare Taiwanese and Indonesian *Z. d. horsfieldi* side by side. However, the photographs kindly supplied us by Mr. Mohammad Irham showed that Taiwanese *Z. d. horsfieldi* is very similar, if not identical, in color and black scaling to Indonesian specimens. The two forms are apparently indistinguishable in measurements (Tables 1 and 2) and we believe that Taiwanese *Z. d. horsfieldi does* not warrant treatment as a different subspecies.

Certain recent authors (e.g. Ishihara, 1986; White and Bruce, 1986; Brazil, 1991) have raised *Z. d. major* and *Z. d. horsfieldi* to monotypic species, emphasizing a certain distictiveness or peculiarities but without showing a general guideline, whatever it might be, for recognizing species; distinctiveness alone is, in our opinion, insufficient for raising a population to species

rank. Furthermore, such a taxonomy as recognizing *major* and *horsfieldi* as full species while retaining nominotypical *dauma* and *aurea* in the same species (Sibley and Monroe, 1990; Clement and Hathway, 2000) would probably make *Z. dauma* a paraphyletic taxon at the least.

Validity of Zoothera dauma toratugumi *(Momiyama)*

In connection with the present study we have examined the taxonomic status of *Z. d. toratugumi.* Momiyama (1940) described two subspecies of *Z. dauma*, *Turdus aureus* [=*Z. d.*] *toratugumi* from the mainland of Japan and *T. a.* [=*Z. d.*] *miharagokko* from Hachijojima, Izu Islands, as separable from *Z. d. aurea* of the Asiatic Continent; *miharagokko* has not been recognized by subsequent authors.

Vaurie (1959) considered *Z. d. toratugumi* only a moderately well-differentiated subspecies but recognized it, stating that it is more richly colored on an average, with black spotting above which on average is denser and with a shorter average wing length, 154–163 (av. 160) mm as against 161–173 (av. 168) mm in *Z. d. aurea*. Ripley (1964) also recognized it, but as a checklist compiler he probably followed Momiyama or Vaurie without examining and measuring specimens himself.

Momiyama (1940) diagnosed *Z. d. toratugumi* as "nearest to *T. a. aureus* [=*Z. d. aurea*] Holandre, but the wing is somewhat shorter, 149–163 mm as against 160–174 mm in the typical form [=*Z. d. aurea*]". An inventory of Momiyama's collection now in the YIO indicated that he probably had only two very poor breeding specimens of *Z. d. toratugumi* although he examined 47 specimens, and he did not cite the source of the measurements he gave for *Z. d. aurea*. Although Momiyama believed that the continental *Z. d. aurea* is accidental in Japan (stating it was recorded only once from Shikoku), both the continental "*aurea*" and Japanese "*toratugumi*" do occur in Japan on migration and in winter (cf. Vaurie, 1959; OSJ, 2000) so that if *Z. d. toratugumi* was to be recognized his type series was in fact a composite. Momiyama included Hokkaido, Honshu, southern Manchuria, Korea and Quelpart (Jeju) Island in the breeding range of *Z. d. toratugumi* but not Shikoku, the type locality, where presumably the specimen was judged to have been a migrant.

Momiyama's measurements of holotype differ from ours to a variable extent; only for the exposed culmen do ours agree with his, but, of course, certain measurements, especially tail length, do not always yield constant results even measured by the same person. His holotype measurements were as follows (with ours in parentheses): wing 155.5, 158.2 in flat (153.5 right/155 left wing); tail 108 (94); tarsus 33.5 (34.5); exposed culmen 25.0 (25.0); entire culmen 31.0 (28.0); height of both mandibles at nostril 7.6 (not measured by us).

Our measurements of wing length (Table 1) are smaller than those given by Vaurie (1959); ours were taken from the wing chord, whereas Vaurie measured the flattened wing. Vaurie measured only males but did not say whether or not they were all breeding specimens.

Four breeding males (of *Z. d. aurea*) from Jalamte, northwestern Manchuria, have somewhat longer wings (av. wing length 161.9 mm) than 8 breeding males (of "*Z. d. toratugumi*") from the Japan mainland (av. 155.7) (Table 1) and appear to support Vaurie's conclusion. However, one breeding male (160.2) and 3 breeding females (av. 156.4) from Ringanpo, northern Korea, fill the gap between the Manchurian and Japan mainland birds. Meanwhile, 2 breeding females (av. 153.0) from Quelpart I., Korea, seem much the same as 6 breeding females from Japan mainland (av. 153.9) (16 females including 10 non-breeding averaged 153.1). For unknown reason, a vast area of mainland China lacks a breeding population of *Z. dauma*; in China it breeds only in northwestern Manchuria, Tien Shan, western China bordering the Himalayas and southeastern Tibet (Cheng, 1976; Meyer de Sehauensee, 1984).

In the Ryukyu Islands, where both *Z. d. aurea* and *Z. d.* "*toratugumi*" occur only on migration

and in winter, the wing measurements (6♂♂ av. 157.4, 4 unsexed av. 160.4) are somewhat larger than those of birds from the Japan mainland (25 ♂♂ av. 154.7, 16♀♀ av. 153.1 and 10 unsexed av. 154.6 when breeding and non-breeding are combined). The longest wing lengths we measured of breeding males in Japan were 160.6 (5 May 1989, Chichijima, Ogasawara Is., Morioka specimen) and 161.0 (15 Apr. 1926, Toyama, Honshu, YIO no. 42766), which closely approach the average for Manchurian birds.

A side-by-side comparison of the Manchurian, Korean and Japanese specimens does not show any consistent difference in plumage color or black marking on the upperparts (as far as we determine they seem identical), except that some breeding males (especially July birds) from Honshu were considerably paler due probably to seasonal color fading.

The results of our examination of specimens shown above might indicate that northern continental birds tend to have somewhat longer wings (and hence possibly slightly larger body size also) than Japanese birds in adaptation to migration over longer distances. However, the differences in the mean values of measurements only with overlapped ranges are of little taxonomic usefulness because means are in no way helpful in identifying individual specimens. We therefore advocate that it is best not to recognize *Z. d. toratugumi*.

Acknowledgements

We are greatly indebted to the authorities of the Yamashina Institute for Ornithology, (YIO), Abiko City, and of Museum of Nature and Human Activities (MNHA), Hyogo, for allowing us to use the specimens under their care and to Dr. Takeshi Yamasaki, YIO, and Dr. Yasuo Ezaki, MNHA, for various help in the course of study. Mr. Ken-ichi Tokita, Abiko City Museum of Birds, kindly loaned a specimen and Mr. Mohammad Irham, Museum Zoologicum Bogoriense, Bogor, kindly sent photographs of museum specimens of *Z. d. horsfieldi* from Java. Dr. David R. Wells, U.K., gave a lot of valuable suggestions. Finally but not least our indebtedness is due to Mr. Edward C. Dickinson, Eastbourne, U.K., for his useful comments on the manuscript and encouragement in this study. This study is partially supported by a project of National Museum of Nature and Science, “Studies on the Geography and Evolution of Biodiversity in Japan”, and Grants-in Aid (no. 21370039) from the Ministry of Education, Culture, Sports, Science and Technology.

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