

LETTER

FROM

MR. WALLACE

ON THE GEOGRAPHICAL DISTRIBUTION OF BIRDS.

Batavia, March 1859.

MY DEAR MR. SCLATER,—Your paper on "The Geographical Distribution of Birds"* has particularly interested me, and I hope that a few remarks and criticisms thereon may not be unacceptable to you. With your division of the earth into six grand zoological provinces I perfectly agree, and believe they will be confirmed by every other department of zoology as well as by botany. On the number of species you give to each province I can say nothing, you being in so much better a position than myself for arriving at a correct conclusion; but in the areas of the several provinces I believe you have made some very important errors, which of course affect materially the proportionate richness in species of the several provinces. Those I will take the liberty of pointing out, as well as of defining, as closely as possible, the limits of each division.

1. The PALÆARCTIC Region I would extend over all Africa north of the great Desert, for I think none of the peculiar forms of Tropical Africa are found there. For its southern limits farther eastwards I take the parallel of 30° N. lat. as an average from Suez to the east boundary of Afghanistan, then turning north, to exclude the Punjab, follow the Himalayas to Birmah, then bend a little south, and then north again to where the 30th parallel crosses the Yung-ling Mountains on the west of China, and follow

* See Journ. Proc. Linn. Soc. ii. p. 130.

the same parallel across China to Chusan. This is, I think, as fair a give-and-take as can be chosen with our imperfect knowledge. Now for the area:—

	Square miles.
Continental Europe and Asia	14,850,000 (Humboldt.)
Deduct Continental part of "Regio Indica" (Arabiam North Africa).....	2,630,000
	<hr/> 12,220,000
Add for islands	280,000
	<hr/> 12,500,000

—instead of 14,000,000 given by you.

2. *ÆTHIOPIAN* Region. In this you make a very large area, which must certainly be a mistake. You give 12,000,000 square miles. Now Balbi gives only 8,500,000 for all Africa and Madagascar; and, if we estimate the part of Arabia taken from Asia as equal to the part of Africa given to Europe, this will be the true area. But I would suggest that such an anomalous tract as the Sahara coming between two regions should be given to neither; it should in fact be considered as a Sea. It is certainly quite as unproductive of animal life as the sea, perhaps more so; and it gives quite an erroneous idea of the productiveness of Tropical Africa to add this immense desert to it. I take, therefore, Africa south of the Sahara and, after reaching the Nile as far north as the 1st Region, following a diagonal across Arabia from Mount Sinai to the eastern extremity. A careful measurement gives me the area of this with Madagascar as 6,500,000 square miles.

3. *INDIAN* Region. Of this we have already defined the north limit, and I would add a tract of Arabia on the western shores of the Persian Gulf. Its south-eastern limits I draw between the islands of Bali and Lombok, and between Celebes and Borneo, and the Moluccas and the Philippines. Barbets reach Bali, but not Lombok; *Cacatus* and *Tropidopygus* reach Lombok, but not Bali: this I think settles that point. *Cacatus*, *Trichoglossus*, and *Scythrops* in Celebes, and not in Borneo, settle the other. No doubt many Indian forms reach Celebes; but we must remember the proximity, and in the course of ages the only wonder is there has not been more intercommunication.

A careful estimate of these islands, with Formosa, &c. added to the continental portions, gives an area of only 3,100,000 square miles.

4. AUSTRALIAN Region. You have rather over-estimated this: with the Moluccas, &c., North Guinea, New Zealand, and the Pacific Islands (except the Sandwich, which I think should go with America), I cannot make an area of more than 2,600,000 square miles. In the island of Batchian I have found *Podargus*, *Certhia*, and *Paradisica*, which shows that the several subdivisions of this region are very closely connected.

5 and 6. NORTH and SOUTH AMERICAN Regions. I put the limit between these at 22° N.; on the coast it may be further north, on the table-land farther south, but this will be near the mean. This gives for the North American region 5,500,000 square miles, South American region with West Indies 5,600,000 square miles, making a total which agrees with Balbi.

Now, taking my corrected areas and your number of species, the proportionate richness or square miles to each species is as follows:—

Zoological Regions.	Proportionate richness.	
	WALLACE.	SCHLATER.
1. Palearctic, area 12,500,000, sp. 650	$\frac{1}{19,300}$	$\frac{1}{21,000}$
2. Ethiopian, area 6,500,000, sp. 1250	$\frac{1}{5200}$	$\frac{1}{5200}$
3. Indian, area 3,100,000, sp. 1500	$\frac{1}{2066}$	$\frac{1}{2066}$
4. Australian, area 2,600,000, sp. 1000	$\frac{1}{2600}$	$\frac{1}{2600}$
5. North American, area 5,500,000, sp. 600	$\frac{1}{9166}$	$\frac{1}{9166}$
6. South American, area 5,600,000, sp. 2250	$\frac{1}{2488}$	$\frac{1}{2488}$

From the above estimate it results that the Indian region is in proportion to its area the richest in species of birds; and when we consider how much less known it is than South America, we may expect that the proportion will increase. In Birmah, Cochin China, and China, the ornithology of extensive regions is absolutely unknown; while in South America there is scarcely a spot which has not been repeatedly and thoroughly explored. Though no one is more profoundly impressed than myself with the vast and inexhaustible riches of South America in every department of natural history, and pre-eminently in birds, yet I

am also convinced that a considerable portion of its great apparent superiority to all other countries is due to the universal spread of the Spanish and Portuguese races over every part of its vast interior, which is thus absolutely as free as Europe to the researches of naturalists, who have not been slow to take advantage of it. No other part of the Tropical world is in this condition. In three-fourths of the African and Indian regions, the naturalist only penetrates at the risk of his life; and, even where this is safe, I can speak from personal experience of the great difference between these regions and those of South America as to the inducements to a traveller to prolong his stay. In these countries we have absolutely no community of ideas, feelings, or wants with the population; whereas, even in the most remote districts of South America, one is always in contact with men of European race and feelings, and with at least a remnant of the usages and wants of European civilization. South America too possesses a physical superiority to every other region, which would lead us to expect a vast richness in its natural productions. Nowhere else in the Tropics are such vast and fertile alluvial plains, such mighty forests, such gigantic rivers, such an extensive and lofty range of mountains. There is no such compact mass of intertropical land as South America. There is no mountain range but the Andes, both sides of which are in the Tropics. This long succession of temperate plateaux, together with the southern extremity of South America, adds immensely to the diversity of its fauna, combining in fact all the varied physical features and stations of the Old World in a space of barely one-fifth its extent. It thus happens that in many cases the natural productions of South America will bear comparison not only with any one of the other regions, but with all the rest of the world, especially if we leave out Australia as an altogether peculiar region, having no more connection with the old than with the new continent.

There is perhaps no fact connected with geographical distribution more extraordinary, and at first sight inexplicable, than the division of such an apparently homogeneous tract as the Indian Archipelago between two provinces which have less in common than any other two upon the earth. To the geo-

grapher and geologist, there is absolutely nothing to mark the division between the two regions.

Borneo differs more from Java than does the former from Celebes, or the latter from Timor. The Philippines strikingly resemble the Moluccas in their physical features; Borneo has much resemblance to New Guinea, yet their zoological productions differ greatly. Between the Indian and Australian zoological regions, as above defined, I believe there is absolutely no true transition—that is, no species are common to the two, which we cannot easily account for by the various accidents and migrations which in the course of ages must have tended to mingle the productions of islands so close to each other. I believe that these two regions are as absolutely distinct as South America and Africa, and it is only because they are separated by straits of from 20 to 100 miles wide, instead of the Atlantic, that they have become slightly connected by the interchange of a few species and genera.

Thus I account for *Gallus* reaching Celebes and Sumbawa, for *Cervus* in the Moluccas, *Mayapodius* in North-western Borneo, a Woodpecker in Celebes, &c. There is, however, an important physical feature which gives us the true key to the separation of the two regions: it is, that the islands of the Indian region are all connected by a shallow sea, while they are separated from the Australian region by an unfathomable ocean. Of this connexion to the Philippines I am not certain, except as far as Palawan, which is joined to Borneo by a 50-fathom bank. Mindanao is also closely connected by islands to Borneo.

Now look at the map of the Archipelago, and consider that Borneo and Java have species in common by hundreds, Borneo and Celebes only by units, and we shall be forced to believe that the two former have been connected at no very distant epoch, while the two latter have been ever separated, or at least during a long geological epoch, and probably more widely than at present. Here then is the key to the problem:—Sumatra, Java, Borneo, and the Philippines are parts of Asia broken up at no distant period (an elevation of 50 fathoms would in fact join them all again); Celebes, Timor, the Moluccas, New Guinea, and Australia are remnants of a vast Pacific continent in part

marked out by coral islands (see Darwin), but broken and separated at a more distant period, as shown by the fewer species common to the several islands, and the number of distinct sub-faunas into which the region is divided. Celebes is in some respects peculiar, and distinct from both regions, and I am inclined to think it represents a very ancient land which may have been connected at distant intervals with both regions, or perhaps with some other continent forming a direct connexion with Africa. It may also at one time have had a connexion with the Philippines. All this is indicated by a peculiar genus of Ramnants in Celebes (*Anas*); by a genus of Apes found in Celebes, the Philippines, and Batahan, more nearly allied to the African Baboons than to any of the Archipelagian species; by the extraordinary *Babirusa* of Celebes, a type of more African than Indian form, and by several anomalous and peculiar birds and some *Hymenoptera* of Celebes determined by Mr. Smith to be identical with African, as others with Indian and Chinese species. Here is a wide and most interesting field of research, in which I have long been working, and which I hope by the assistance of my collections to do much to elucidate.