

cases must be left for consideration when they arise, and that a higher co-efficient may be then allowed in those instances where the reasons given appear to the Board of Trade to justify it.

“ We are, &c.,

(Signed)

“ JOHN HAWKSHAW,

“ W. YOLLAND,

“ W. H. BARLOW.

“ The Secretary of the Board of Trade, &c.”

This Report has since been acted upon by the Board of Trade in the printed paper issued by them in reference to railway structures.

It will be observed that a co-efficient of  $6\frac{1}{2}$  tons per square inch is assigned to steel, that of iron being 5 tons per square inch.

This increase of the co-efficient will effect important economy in structures, especially in bridges of large spans, and will also tend generally to increase the employment of steel for railway and shipbuilding purposes.

The labours of your Committee having ended in such a satisfactory manner, there is no necessity to reappoint them.

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*Report on the Geographical Distribution of the Chiroptera.*  
By G. E. DOBSON, M.A., M.B.

[A communication ordered by the General Committee to be printed *in extenso* among the Reports.]

IN his work on the Geographical Distribution of Animals, published scarcely two years ago, Mr. Wallace writes:—“The genera of Chiroptera are in a state of great confusion, the names used by different authors being often not at all comparable, so that the few details given of the distribution of the bats are not trustworthy. We have therefore made little use of this order in the theoretical part of the work.” And again: “The bats are a very difficult study, and it is quite uncertain how many distinct species there are; the genera are exceedingly numerous, but they are in a very unsettled state, and the synonymy is exceedingly confused. The details of their distribution cannot therefore be usefully entered upon here.”

These remarks furnish a suitable preface to this paper. The recent publication of my work on the Chiroptera renders them, I hope, no longer applicable, and I purpose now to set forth in greater detail the results of my inquiries into the geographical distribution of these animals than the space at my disposal in the introduction to the work referred to has permitted.

Mr. Wallace points out the pre-eminent importance of the distribution of Mammals in determining the limits of zoological regions; but also remarks that, “there are two groups which have quite exceptional means of dispersal—the bats which fly, and the cetacea, seals, &c., which swim. The former are capable of traversing considerable spaces of sea, since two

North American species either regularly or occasionally visit the Bermudas, a distance of 600 miles from the mainland."

I do not think that the occurrence of two American species of bats in the Bermudas affords much proof of the general capability of the species of Chiroptera in traversing considerable spaces of sea, for it is exceedingly probable that the few individuals which have been noticed there have been carried thither by storms (to which cause is evidently due the great number of straggling species of birds which have been found there), or have been imported into the island while hybernating in the holds of vessels, or are the descendants of such accidentally imported individuals. However, even if it be granted that the Chiroptera possess great powers of dispersal, it is certain that quite nine-tenths of the species avail themselves of them in a very limited degree indeed, and it is significant that the distribution of the species is limited by barriers similar to those which govern it in the case of other species of mammals. This is well shown by the small number of species which are known to inhabit more than one of the recognised zoological regions, which amount to 22 only out of 400. The following list includes these species, and shows also their distribution.

1. <i>Pteropus hypomelanus</i> .....	Australian and Oriental.
2. <i>Macroglossus minimus</i> .....	Oriental and Australian.
3. <i>Rhinolophus ferrum-equinum</i> .....	Ethiopian and Palæarctic.
4. <i>Vesperugo serotinus</i> .....	All regions except the Australian.
5. <i>Vesperugo noctula</i> .....	Ethiopian, Oriental, Palæarctic.
6. <i>Vesperugo maurus</i> .....	Oriental and Palæarctic.
7. <i>Vesperugo abramus</i> .....	Oriental and Australian.
8. <i>Vesperugo Kuhlîi</i> .....	Oriental and Palæarctic.
9. <i>Nycticejus crepuscularis</i> .....	Nearctic and Neotropical.
10. <i>Atalapha noveboracensis</i> .....	Nearctic and Neotropical.
11. <i>Atalapha cinerea</i> .....	Nearctic and Neotropical.
12. <i>Harpiocephalus harpia</i> .....	Oriental and Australian.
13. <i>Vespertilio adversus</i> .....	Oriental and Australian.
14. <i>Vespertilio capaccinii</i> .....	Oriental and Palæarctic.
15. <i>Vespertilio daubentonii</i> .....	Palæarctic and Oriental.
16. <i>Vespertilio muricola</i> .....	Oriental and Australian.
17. <i>Vespertilio lucifugus</i> .....	Nearctic and Neotropical.
18. <i>Kerivoula hardwickii</i> .....	Oriental and Australian.
19. <i>Miniopterus schreibersii</i> .....	Oriental, Australian, Ethiopian, and Palæarctic.
20. <i>Taphozous nudiventris</i> .....	Ethiopian, Oriental, and Palæarctic.
21. <i>Rhinopoma microphyllum</i> .....	Ethiopian, Oriental, and Palæarctic.
22. <i>Nyctinomus brasiliensis</i> .....	Neotropical and Nearctic.

Estimating the total number of known species of Chiroptera at 400, it follows that  $5\frac{1}{2}$  per cent. only wander beyond their respective zoological regions, or, in other words,  $94\frac{1}{2}$  per cent. are characteristic. It is also noticeable that more than two-thirds of these wandering species belong to the family Vespertilionidæ, which has by far the widest geographical distribution, and includes the least specialised forms.

The following table exhibits the numbers of families, genera, and species inhabiting each zoological region; and shows that in the regions situated principally within the tropics (as the Oriental and Neotropical regions) the number of species is more than three times that of those lying chiefly in the temperate zones (as the Nearctic and Palæarctic regions).

	Palearctic			Ethiopian			Oriental			Australian			Neotropical			Nearctic		
	Families	Genera	Species	Families	Genera	Species	Families	Genera	Species	Families	Genera	Species	Families	Genera	Species	Families	Genera	Species
Pteropodidæ ...	—	—	—	1	3	18	1	5	20	1	7	33	—	—	—	—	—	—
Rhinolophidæ ...	1	2	5	1	3	11	1	3	28	1	3	6	—	—	—	—	—	—
Nycteridæ .....	—	—	—	1	2	8	1	2	3	—	—	—	—	—	—	—	—	—
Vespertilionidæ.	1	7	25	1	6	28	1	6	47	1	7	18	1	5	24	1	5	14
Emballonuridæ..	1	2	2	1	5	18	1	5	13	1	4	7	1	8	26	1	1	1
Phyllostomidæ...	—	—	—	—	—	—	—	—	—	—	—	—	1	31	55	—	—	—
Total . . .	3	11	32	5	19	83	5	21	111	4	21	64	3	44	105	2	6	15

In considering the geographical distribution of each family of the Chiroptera and the range of its genera and species, I think it well to commence with the Vespertilionidæ and Emballonuridæ, as these alone are to any extent cosmopolitan in their distribution.

Of the sixteen genera of Vespertilionidæ five (*Antrozous*, *Nycticejus*, *Atalapha*, *Natalus* and *Thyroptera*), are peculiar to America, but these are represented by nine species only. Of the remaining eleven genera, eight are peculiar to the Eastern hemisphere, and of these *Nyctophilus* and *Chalinolobus* (subgen.) are limited to the Australian region; *Synotus*, *Otonycteris*, and *Plecotus* (subgen.) to the Palearctic. A second species of *Plecotus* (the type of a well-defined subgenus *Corinorhinus*) is found in the Nearctic region only. Two genera alone, *Vesperugo* and *Vespertilio* are cosmopolitan; but of the fifty species of the former, eleven only inhabit America, and the few American species of the latter genus are closely related to one another. A single species of Vespertilionidæ—*Vesperugo serotinus*—is alone known with certainty to extend into both hemispheres, although it is probable that *V. abramus* and *V. borealis* may be found hereafter to have as wide a distribution.

Although the genera of Emballonuridæ are much more equally distributed in number between the two hemispheres, half of the whole being American, a single genus alone, *Nyctinomus*, is common to both, and it is worthy of note that, of the twenty-one species of this genus, four only inhabit America, and these are all closely related to one another, and very far removed from any of the Old World species. *Furia*, *Amorphocheilus*, *Rhynchonycteris*, *Saccopteryx*, *Diclidurus*, *Noctilio*, and *Molossus*, represented by twenty-six species, are peculiar to the Neotropical region, while the remaining genera with thirty-seven species are limited to the Eastern hemisphere. Of these *Mystacina* with a single species is found in New Zealand only. *Coleura* appears to be limited to East Africa and the Malagasy subregion, but the species from these subregions are very distinct. *Emballonura* extends from Madagascar to the Malay Archipelago, and throughout the larger islands of the Polynesian subregion, but has not been recorded from any part of the adjacent continents.

The Neotropical genera of this family are, on the whole, more closely related to each other than to any of the old world genera; nevertheless there are certain peculiar forms of limited distribution in the Eastern hemisphere, which seem to have their nearest allies among neotropical species. Thus, the very remarkable species, *Cheiromeles torquatus*, which has not been found beyond the Indo-Malayan subregion, appears to be

closely related to some of the species of the Neotropical genus *Molossus* than to any of the Old World forms; and the same remark applies to *Nyctinomus australis*, which is characteristic of the Australian region.

Although the Emballonuridæ have as wide an eastwardly and westwardly distribution as the Vespertilionidæ, yet they are far exceeded by the latter family in their northern and southern range. While the Vespertilionidæ extend in the Northern hemisphere as far as the isothermal of 32° Fahr. or thereabouts, the Emballonuridæ are rarely found north or south of the isothermal of 55°.

The Rhinolophidæ are limited to the Eastern hemisphere, and within these limits the species have much less extended bounds than even those of the preceding family. No species has as yet been recorded with certainty from the Polynesian subregion, from Tasmania, or from New Zealand. With the exception of *Rhinolophus ferrum-equinum*, which extends throughout the Ethiopian and warmer parts of the Palæarctic region, the species of this family inhabiting each of the zoological regions comprised within the area of its distribution are distinct and characteristic. No species of the subfamily *Phyllorhininæ* extends into the Palæarctic region; *Cælops* is limited to the Oriental region, and *Rhinycteris* to the Australian; these last two genera, however, include but a single species each. The very remarkable forms *Phyllorhina commersonii* and *Ph. cyclops* belong to the Ethiopian region, but the former species alone extends into the Malagasy subregion.

The Nycteridæ are limited to the Ethiopian and Oriental regions, one species only passing slightly beyond the limits of the latter region, and none have as yet been found in the Malagasy subregion of the former. The Ethiopian species of the genus *Megaderma* are more closely related to each other than to the Oriental species. The distribution of *Nycteris* is remarkable: six species are limited to the Ethiopian region, the seventh is found in Java, and differs from all the rest in the large size of the second lower premolar.

The Phyllostomidæ present the only instance of a family of Chiroptera limited to a single zoological region. None of the species are known with certainty to inhabit permanently any of the countries beyond the recognized limits of the Neotropical region. This family is therefore eminently characteristic of that region. Although Central America and Southern Mexico have representatives of almost every genus of Phyllostomidæ, none of the species have been, with any certainty, recorded from the Southern States of North America, though the mean annual temperature of a great part of these countries equals or exceeds that of many parts of South America where representatives of the family are abundant. It is worthy of note that *Macrotus waterhousii*, which has been alone found as far north as Cape St. Lucas in California, is apparently omnivorous, living indifferently on fruit, insects, and probably on small bats; and *Trachyops cirrhosus* recorded doubtfully from South Carolina and from Bermuda, is evidently, judging from its structure, of the same habits. The power possessed by these species of varying their food evidently renders them more capable of extending their range beyond the limits of their original homes. Few, if any, of the species of this family, in the present state of our knowledge, can be said to be characteristic of any of the Neotropical subregions; but certain species appear to be limited in their distribution within the region.

The Megachiroptera, represented by the single family Pteropodidæ,

present probably more peculiarities in their distribution than any other group of Chiroptera. Like the Rhinolophidæ and Nycteridæ, they are strictly limited to the Old World, and scarcely extend anywhere beyond the tropics. Their limitation to the tropical parts is easily explained by a consideration of the fact that there only is found a continuous supply at all seasons of the tree-fruits on which they subsist; but this does not account for certain peculiarities in their distribution in an eastwardly or westwardly direction. While the family is distributed throughout the Ethiopian, Oriental, and Australian regions (except Tasmania and New Zealand), a single genus only, *Cynonycteris*, extends throughout all these regions. *Epomophorus*, which includes certain species so different from all other Megachiroptera, as to almost necessitate the formation of a distinct subfamily for their reception, is strictly limited to that part of the Ethiopian region included within the continent of Africa. *Cynopterus* is also limited to the Oriental region; a single anomalous species, *C. latidens* (which differs widely from all the other species in the form of its teeth) being found in the Moluccas. *Eonycteris* is, as yet, known from the Indo-Malayan subregion alone; *Notopterus* appears to be limited to the Polynesian subregion; *Harpyia* and *Cephalotes* are characteristic of the Austro-Malayan subregion.

The distribution of the genus *Pteropus* (which includes more than half the whole number of the species of *Pteropodidæ*) is more remarkable than that of any of the other genera of Chiroptera. The Comoro Islands in the Mozambique Channel form its westward limit, thence the species extend throughout the Malagasy subregion, even to the small hurricane-swept island of Rodriguez (from which I have lately described a new species), and northwards through the Amirantes and Seychelle Islands to India, where their westward limit is found at the southern frontier of Baluchistan: from India they extend eastwards throughout the Oriental and Australian regions (except Tasmania and New Zealand), inhabiting Polynesia as far eastwards as Samoa and Savage Island. Although one thousand miles of unbroken ocean divide the Seychelle Islands from the Chagos group (the nearest intermediate land to India), the Indian and Madagascar species (*Pteropus medius* and *Pt. edwardsii*) are very closely allied; while, on the other hand, not a single species crosses the narrow channel between the Great Comoro Island and the African coast, although certainly two species (*Pteropus edwardsii* and *Pt. livingstonii*), and probably a third (*Pt. vulgaris*), inhabit the Comoro group.

The following table exhibits the very remarkable distribution of the species of this genus:—

Regions	Subregions	Number of Species	Remarks
Ethiopian...	1. } African .....	None	All these species very distinct. Very closely allied to one of the Malagasy species. Three very closely allied. Three very closely allied.
	2. }		
	3. }		
	4. Malagasy .....	5	
Oriental ...	1. Hindostan.....	1	All the species very distinct.
	2. Ceylon .....		
	3. Indo-China .....		
	4. Indo-Malaya.....		
Australian...	1. Austro-Malaya ...	15	All the species very distinct.
	2. Australia .....	5	
	3. Polynesia .....	5	
	4. New Zealand.....	None	

TABLE SHOWING THE NUMBERS AND DISTRIBUTION OF THE PECULIAR GENERA AND SPECIES OF THE CHIROPTERA.

	Palearctic				Ethiopian				Oriental				Australian				Neotropical				Nearctic				
	Genera	Percentage	Species	Percentage	Genera	Percentage	Species	Percentage	Genera	Percentage	Species	Percentage	Genera	Percentage	Species	Percentage	Genera	Percentage	Species	Percentage	Genera	Percentage	Species	Percentage	
Pteropodidæ ...	—	—	—	—	1	33	18	100	2	40	18	90	4	57	31	90	—	—	—	—	—	—	—	—	—
Rhinolophidæ...	—	—	2	40	—	—	10	90	1	33	27	96	1	33	6	100	—	—	—	—	—	—	—	—	—
Nycteridæ .....	—	—	—	—	—	—	8	100	—	—	3	100	—	—	—	—	—	—	—	—	—	—	—	—	—
Vespertilionidæ.	2	28	11	44	—	—	24	85	—	—	34	72	—	—	13	72	2	40	20	83	1	20	10	71	—
Emballonuridæ.	—	—	—	—	1	20	16	88	1	20	11	84	1	25	7	100	6	75	25	96	—	—	—	—	—
Phyllostomidæ.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31	100	55	100	—	—	—	—	—
Total .....	2	28	13	42	2	26	76	92	4	31	88	93	6	38	57	90	39	71	100	93	1	20	10	71	—

From the table (p. 162) it may be observed, that of the 39 species, 30 (or nearly 80 per cent.) inhabit the Malagasy subregion, and the Australian region; and that more than 50 per cent. of the whole are found within the narrow limits of the Malagasy and Austro-Malayan subregions.

It is worthy of notice, that of the nine species inhabiting the Oriental region, three only can be considered very distinct, and these are closely related to some of the species from the Malagasy and Austro-Malayan subregions, so that it appears evident that the species now inhabiting the Oriental region, were derived at a comparatively recent period from the above-named subregions.

The sum of the foregoing remarks is well set forth in the second table (p. 163), which exhibits the number of peculiar genera and species of each and of all the families of Chiroptera in each zoological region, and also shows their percentage on the total number of the genera and species. This table also shows that among the Vespertilionidæ and Emballonuridæ only, which are cosmopolitan in their distribution, does the percentage of peculiar species in each zoological region fall below 90, while even in these families it is rarely as low as 70.

We may now proceed to consider to what extent the recognised zoological regions are severally characterised by the possession of peculiar families, genera, or species of Chiroptera.

In the first place, the two primary divisions of the earth, Palæogæa and Neogæa, are well characterised by their Chiropterous fauna: the former by the possession of three peculiar families, the Pteropodidæ, Rhinolophidæ, and Nycteridæ, and by the absence of the Phyllostomidæ; the latter by the absence of the three first-named families, and by the presence of the latter. Although the Vespertilionidæ and Emballonuridæ are common to both hemispheres, one species only is known with certainty to inhabit both the New and the Old World, and all the genera except three are peculiar.

The remarkable poverty of the Nearctic and Palæarctic regions in species, and especially in peculiar species, is well shown in the table. In the Nearctic region the number of peculiar species is but one-tenth of those which are characteristic of the closely connected Neotropical region; in the Palæarctic, one-sixth of those in the Ethiopian, and one-seventh of those in the Oriental region. Moreover, the few species which appear to be peculiar to these two regions do not present such marked differences in structure from the species of the adjoining regions as the peculiar species of other regions; in other words, they are not so characteristically peculiar. This taken into consideration with the comparatively large percentage of non-peculiar species which are found in these and in the adjoining regions, and which extend as a rule into the southern parts only of these regions, shows that the Chiropterous fauna of the Nearctic and Palæarctic regions is mainly, if not wholly, derivative.

This is precisely what we should have expected theoretically; for, knowing that the greater part of the Nearctic and Palæarctic regions was covered with ice at a comparatively recent period, and therefore uninhabitable by a class of animals few of which now extend even in summer as far as the limit of permanently frozen ground, we must suppose that on the cessation of the glacial epoch, these regions derived their Chiropterous fauna from countries lying south of them.

It appears evident, however, that the Nearctic region has derived many of its species from the Palæarctic, probably by way of Behring

Straits, at a time when more dry land existed in the northern parts of the Pacific Ocean. Although *Vesperugo serotinus* is the only species known with certainty to extend from the Palæarctic to the Nearctic region, yet so close is the connection between many other Palæarctic and Nearctic species (between *Vespertilio mystacinus* and *V. nitidus*, *Vesperugo abramus* and *V. hesperus*, *Vesperugo borealis* and *V. propinquus*, e.g.), that it is not necessary to require long separation to account for the few specific differences now noticeable.

Of the eleven species which appear to be peculiar to the Palæarctic region, both the species of Rhinolophidæ are evidently very closely related to Ethiopian forms; and the Vespertilionidæ, with the exception of *Plecotus auritus*, and *Synotis barbastellus*, are also represented by nearly allied forms in either the Ethiopian or Oriental regions.

The Nearctic and Palæarctic regions are therefore more characterised, so far as their Chiropterous fauna, by the absence rather than by the presence of peculiar genera and species.

The remaining four regions, however, present a remarkable contrast in this respect. Each region appears to be as well characterised by its Chiroptera as by any other order of Mammalia.

This is especially noticeable in the Neotropical region, which possesses a very remarkable family, the Phyllostomidæ, nowhere represented beyond its limits; also six peculiar genera of Emballonuridæ (amounting to 75 per cent. of the genera of that family); and two of Vespertilionidæ, making in all 39 genera peculiar to this region.

The Ethiopian region (excluding Madagascar and its islands) is characterised by that very remarkable genus of Pteropodidæ, *Epomophorus*, which stands so far apart from all other genera of this family; also by 71 species of other genera, of which more than 90 per cent. are peculiar.

Madagascar and adjoining islands, included by Mr. Wallace under the name of the Malagasy subregion, although possessing some species (*Phyllorhina commersonii*, *Nyctinomus acetabulosus*, *Taphozous mauritianus*, *Vesperugo minutus*, e.g.) which are also found on the African continent, has other species representing a genus of which the remaining representatives are found in far distant continents. Thus, as I have remarked when treating of the distribution of the Pteropodidæ, the genus *Pteropus* is well represented in Madagascar and adjoining islands, and in the Oriental and Australian regions as far as the Navigator's Islands, although not a single species extends into the continent of Africa. This genus includes by far the largest and most highly organised species of Chiroptera, which in number also amount to more than one-tenth of the whole order; and their remarkable distribution can only be accounted for by adopting the hypothesis of the existence at a comparatively recent date of a continent, or, more probably, of an archipelago of very closely connected islands, in the wide space of ocean now separating Madagascar from India and Australia. It is inconceivable that species to which a narrow channel of less than 200 miles suffices to act as an effectual barrier, could traverse thousands of miles of unbroken ocean in other directions.

Even if we suppose that their presence in Africa is prevented by some cause unknown to us, still it is difficult to imagine species so slow in their flight as those of this genus crossing a channel of even half the width of that separating the Comoro Islands from the coast of Africa. But *Pteropus medius* of India is so closely related to *Pt. edwardsii* of Mada-

gasca, that by many zoologists it would most probably be considered a variety only of the former species—a variety, it is quite conceivable, which might result from separation in a comparatively very short period.

The Malagasy subregion also possesses four other species of *Pteropus* all very distinct from each other, having their nearest allies in the Australian region. One of these species, *Pt. rodricensis*, recently described by me, inhabits the small wind-swept island of Rodriguez, where its means of subsistence must now be very limited. It is difficult to account for the presence of such large and highly-organised species in these small islands, except on the supposition that the islands were not only much larger at some former time, but were also, as I have already remarked, closely connected with a chain of slightly separated islands, uniting them with the Indian and Australian continents.

The Oriental region falls very slightly short of the Ethiopian in the percentage of its peculiar species, and slightly exceeds it in genera. Of 110 species eighty-eight are peculiar; of these eight only are also found in the Ethiopian region, and they also extend into the Palæarctic. The genera *Cynopterus*, *Eonycteris*, *Cælops*, and *Cheiromeles* are characteristic, but the latter three are each represented by a single species only. Of the remaining seventeen genera, two, *Pteropus* and *Emballonura*, are also common to the Malagasy subregion and to the Australian region, and ten are also found in the Oriental and Australian regions. With the exception of such cosmopolitan species as *Miniopterus schreibersii* and *Vesperugo abramus*, the Oriental species extending into the Australian region appear to inhabit only the adjacent parts of that region. The distinctiveness of the Oriental and Australian Chiropterous faunas is well shown by a collection made lately in Duke of York Island and New Ireland, in which, out of twelve species, two only are also known from the Oriental region.

The Australian region comes next to the Neotropical in the number of its peculiar genera; of the twenty-one known, six are peculiar, and of these four belong to the Pteropodidæ, being nearly half the whole number of the genera of that family. This region may therefore be considered the cradle of the Megachiroptera, although the total number of all species falls far short of either that of the Ethiopian or of the Oriental region, yet in the percentage of peculiar forms it holds an intermediate place.

Two of the Australian subregions, the Austro-Malayan and the New Zealand, claim particular attention, the former for the great number of its species, the latter for the opposite reason. Of sixty-four Australian species, fifty-seven are peculiar, and of these nearly half appear to be limited to the Austro-Malayan subregion; while two species only, of which one is peculiar, inhabit New Zealand.

Great Britain, which nearly equals New Zealand in extent, has eight times the number of its species; and Madagascar, which is alone comparable with it in peculiarity of fauna, exceeds it almost in the same proportion.

The poverty of this subregion in species is, therefore, unequalled, and undoubtedly depends to a great extent, if not altogether, on the comparative absence of insects, and probably especially of those species on which bats prey. The peculiar structure of *Mystacina tuberculata*\* appears to indicate that this species seeks its food among the branches and leaves of trees on which Longicorn Coleoptera, which are most abundant among

\* See my paper on this species in P. Z. S., 1876, p. 486.

the New Zealand insects, feed. This remarkable species of Emballonuridæ constitutes a distinct group of that family, but has its nearest allies in the species of the group Molossi. Its fancied relationship to the Phyllostomidæ of the Neotropical region (as set forth by Mr. R. F. Tomes) is altogether illusory, as it depends only on the agreement between it and the species of that family in possessing a third phalanx in the index finger, which is related, as I have shown,\* to the peculiar manner in which the wing is folded in repose, and occurs not only in this species, but also in some of the larger species of Molossi.

A review of the above-stated facts shows :—

1. That the Chiroptera, though possessing exceptional powers of locomotion, and therefore of dispersal, appear to be almost as strictly limited by certain barriers as other orders of Mammalia.

2. That while the geographical distribution of the families, genera, and species of this order on the whole adds further remarkable confirmation of the accuracy of the division of the earth into six zoological regions as defined by Mr. Sclater and subsequently adopted by Mr. Wallace, the peculiar distribution of the most highly organised and distinct, as well as of the largest genus, namely, *Pteropus*, adds additional strength to the views of those who, in consideration of the very peculiar nature of the fauna of Madagascar, feel disposed to form with it and the adjoining islands a seventh zoological region, to which Mr. Sclater's name "Lemuria" has been applied.

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*On Recent Improvements in the Port of Dublin.* By BINDON B. STONEY, M.A., M.R.I.A., M. Inst. C.E., Engineer of the Dublin Port and Docks Board.

[PLATES I., II., AND III.]

[A communication ordered by the General Committee to be printed *in extenso* among the Reports.]

THE trade of few harbours in the United Kingdom has made greater relative progress within the last twenty years than that of Dublin. This, no doubt, is mainly due to the increased prosperity of the country as a whole, but it may also be attributed in great measure to the convergence of the main lines of internal traffic to Dublin, which has thus naturally become more and more the mart and emporium for a great portion of Ireland. During this period of twenty years the tonnage entering the port has much more than doubled. In 1857 it amounted to 880,844 tons, and last year it rose to 1,973,781 tons, while during the current year there is a good promise that it will surpass the 2,000,000 limit. For the sake of comparison I have placed in a tabular form the tonnage of Liverpool and Glasgow, as well as those of the three principal ports in Ireland, for the three years preceding 1858 and 1878 respectively, so as to give fair averages of their respective rates of progress within the last twenty years.

From this table it will be observed that while the tonnages of Liverpool and Glasgow have respectively increased fifty per cent. in the last

\* P. Z. S., l. c.