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The Geographical Distribution of Animals

Alfred Russel Wallace (1823–1913) was a British biologist and explorer whose theories of evolution, arrived at independently, caused Darwin to allow their famous joint paper to go forward to the Linnean Society in 1858. Considered the nineteenth century's leading expert on the geographical distribution of animals, Wallace carried out extensive fieldwork in areas as diverse as North and South America, Africa, China, India and Australia to document the habitats, breeding, migration and feeding behaviour of thousands of species around the world, and the influence of environmental conditions on their survival. First published in 1876, this two-volume set presents Wallace's findings, and represents a landmark in the study of zoology, evolutionary biology and palaeontology which remains relevant to scholars in these fields today. Volume 1 focuses on the classification of species, migration processes, factors influencing extinction, and the characteristics of a range of zoological regions worldwide.

The Geographical Distribution of Animals

With a Study of the Relations of Living and Extinct Faunas

Volume 1

Alfred Russel Wallace

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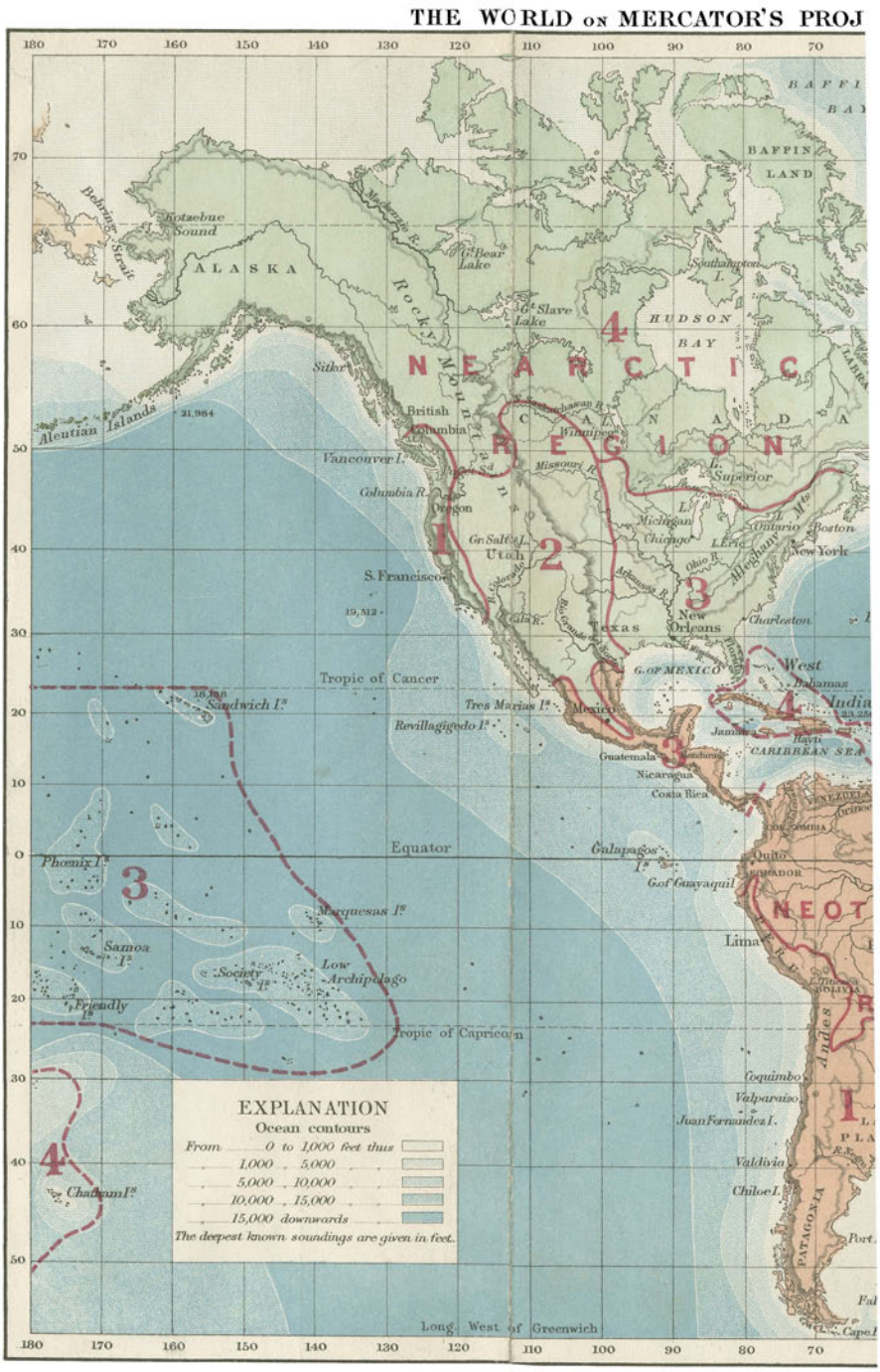
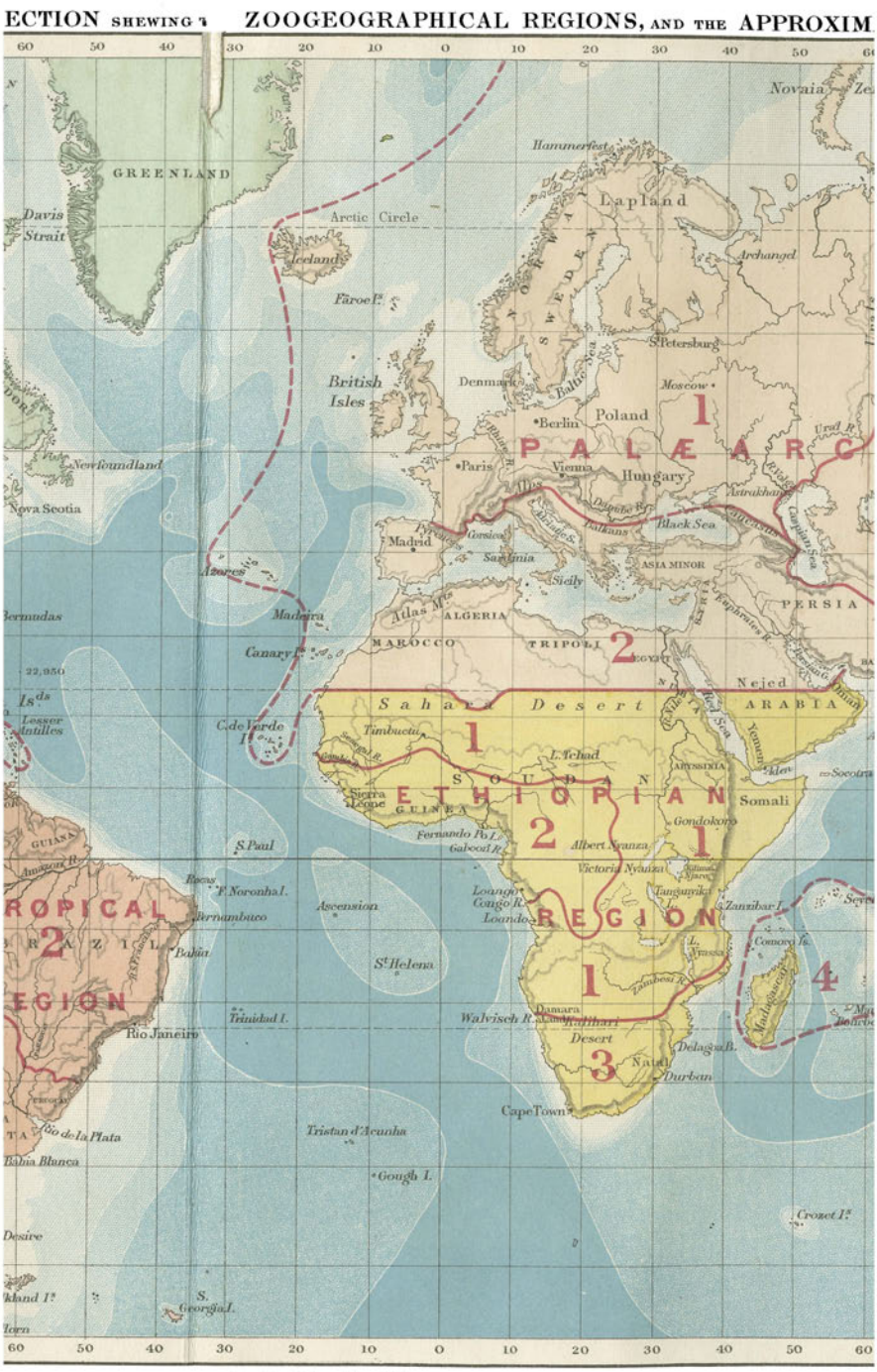
THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

VOL. I.





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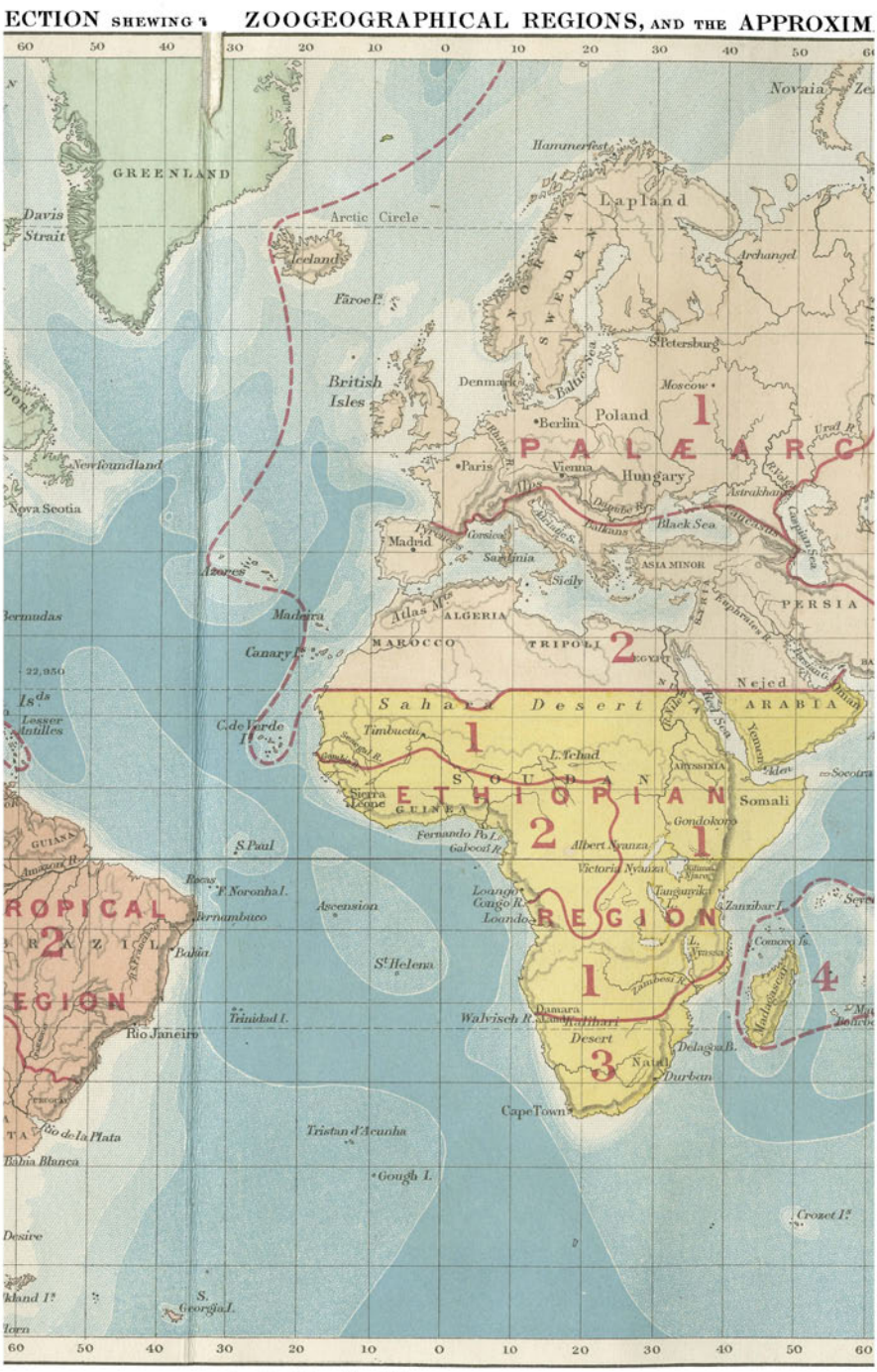

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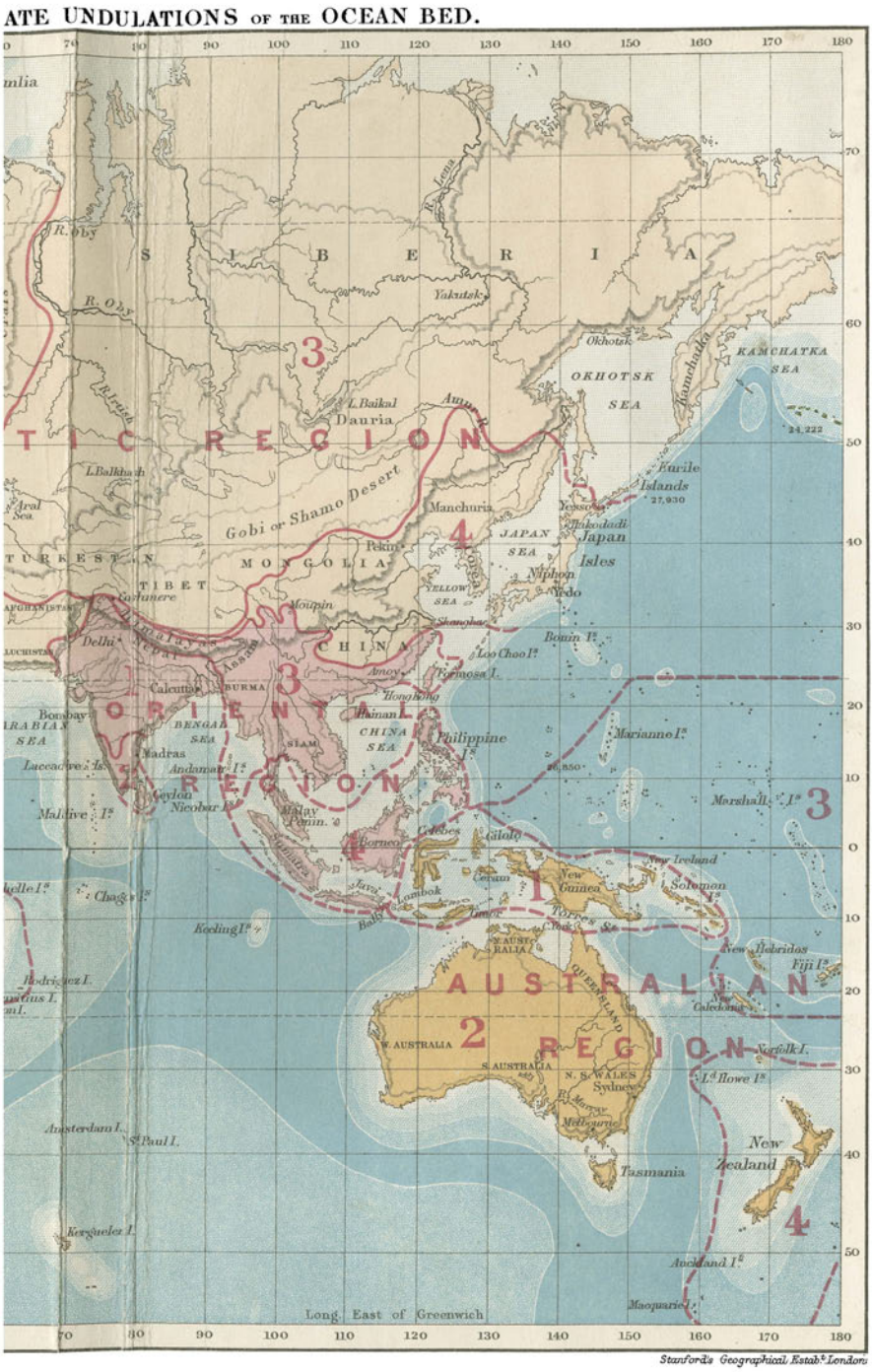

THE GEOGRAPHICAL

DISTRIBUTION OF ANIMALS

WITH A STUDY OF
THE RELATIONS OF LIVING AND EXTINCT FAUNAS
AS ELUCIDATING THE
PAST CHANGES OF THE EARTH'S SURFACE.

BY

ALFRED RUSSEL WALLACE,

AUTHOR OF "THE MALAY ARCHIPELAGO," ETC.

WITH MAPS AND ILLUSTRATIONS.

IN TWO VOLUMES.—VOLUME I.

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PREFACE.

THE present work is an attempt to collect and summarize the existing information on the Distribution of Land Animals; and to explain the more remarkable and interesting of the facts, by means of established laws of physical and organic change.

The main idea, which is here worked out in some detail for the whole earth, was stated sixteen years ago in the concluding pages of a paper on the "Zoological Geography of the Malay Archipelago," which appeared in the *Journal of Proceedings of the Linnean Society* for 1860; and again, in a paper read before the Royal Geographical Society in 1863, it was briefly summarized in the following passage:—

"My object has been to show the important bearing of researches into the natural history of every part of the world, upon the study of its past history. An accurate knowledge of any groups of birds or of insects and of their geographical distribution, may enable us to map out the islands and continents of a former epoch,—the amount of difference that exists between the animals of adjacent districts being closely related to preceding geological changes. By the collection of such minute facts, alone, can we hope to fill up a great gap in the

past history of the earth as revealed by geology, and obtain some indications of the existence of those ancient lands which now lie buried beneath the ocean, and have left us nothing but these living records of their former existence."

The detailed study of several groups of the birds and insects collected by myself in the East, brought prominently before me some of the curious problems of Geographical Distribution; but I should hardly have ventured to treat the whole subject, had it not been for the kind encouragement of Mr. Darwin and Professor Newton, who, about six years ago, both suggested that I should undertake the task. I accordingly set to work; but soon became discouraged by the great dearth of materials in many groups, the absence of general systematic works, and the excessive confusion that pervaded the classification. Neither was it easy to decide on any satisfactory method of treating the subject. During the next two years, however, several important catalogues and systematic treatises appeared, which induced me to resume my work; and during the last three years it has occupied a large portion of my time.

After much consideration, and some abortive trials, an outline plan of the book was matured; and as this is, so far as I am aware, quite novel, it will be well to give a few of the reasons for adopting it.

Most of the previous writings on Geographical Distribution appeared to me to be unsatisfactory, because they drew their conclusions from a more or less extensive *selection* of facts; and did not clearly separate groups of facts of unequal value, or those relating to groups of animals of unequal rank. As an example of what is meant, I may refer to Mr. Andrew Murray's large and valuable work on the Geographical Distribution of Mammalia, in which an immense number of coloured maps are

used to illustrate the distribution of various groups of animals. These maps are not confined to groups of any fixed rank, but are devoted to a selection of groups of various grades. Some show the range of single species of a genus—as the lion, the tiger, the puma, and a species of fox; others are devoted to sections of genera,—as the true wolves; others to genera,—as the hyænas, and the bears; others to portions of families,—as the flying squirrels, and the oxen with the bisons; others to families,—as the Mustelidæ, and the Hystricidæ; and others to groups of families or to orders,—as the Insectivora, and the opossums with the kangaroos. But in no one grade are all the groups treated alike. Many genera are wholly unnoticed, while several families are only treated in combination with others, or are represented by some of the more important genera.

In making these observations I by no means intend to criticise Mr. Murray's book, but merely to illustrate by an example, the method which has been hitherto employed, and which seems to me not well adapted to enable us to establish the foundations of the science of distribution on a secure basis To do this, uniformity of treatment appeared to me essential, both as a matter of principle, and to avoid all imputation of a partial selection of facts, which may be made to prove anything. I determined, therefore, to take in succession every well-established family of terrestrial vertebrates, and to give an account of the distribution of all its component genera, as far as materials were available. Species, as such, are systematically disregarded,—firstly, because they are so numerous as to be unmanageable; and, secondly, because they represent the most recent modifications of form, due to a variety of often unknown causes, and are therefore not so clearly connected with geographical changes as are the natural groups of species termed genera; which may be considered to represent the average and more permanent

distribution of an organic type, and to be more clearly influenced by the various known or inferred changes in the organic and physical environment.

This systematic review of the distribution of families and genera, now forms the last part of my book—Geographical Zoology; but it was nearly the first written, and the copious materials collected for it enabled me to determine the zoo-geographical divisions of the earth (regions and sub-regions) to be adopted. I next drew up tables of the families and genera found in each region and sub-region; and this afforded a basis for the geographical treatment of the subject—Zoological Geography—the most novel, and perhaps the most useful and generally interesting part of my work. While this was in progress I found it necessary to make a careful summary of the distribution of extinct Mammalia. This was a difficult task, owing to the great uncertainty that prevails as to the affinities of many of the fossils, and my want of practical acquaintance with Palæontology; but having carefully examined and combined the works of the best authors, I have given what I believe is the first connected sketch of the relation of extinct Mammalia to the distribution of living groups, and have arrived at some very interesting and suggestive results.

It will be observed that man is altogether omitted from the series of the animal kingdom as here given, and some explanation of this omission may perhaps be required. If the genus *Homo* had been here treated like all other genera, nothing more than the bare statement—"universally distributed"—could have been given;—and this would inevitably have provoked the criticism that it conveyed no information. If, on the other hand, I had given an outline of the distribution of the *varieties* or *races* of man, I should have departed from the plan of my work for no sufficient reason. Anthropology is a science

by itself; and it seems better to omit it altogether from a zoological work, than to treat it in a necessarily superficial manner.

The best method of illustrating a work of this kind was a matter requiring much consideration. To have had a separate coloured or shaded map for each family would have made the work too costly, as the terrestrial vertebrates alone would have required more than three hundred maps. I had also doubts about the value of this mode of illustration, as it seemed rather to attract attention to details than to favour the development of general views. I determined therefore to adopt a plan, suggested in conversation by Professor Newton; and to have one general map, showing the regions and sub-regions, which could be referred to by means of a series of numbers. These references I give in the form of diagrammatic headings to each family; and, when the map has become familiar, these will, I believe, convey at a glance a body of important information.

Taking advantage of the recent extension of our knowledge of the depths of the great oceans, I determined to give upon this map a summary of our knowledge of the contours of the ocean bed, by means of tints of colour increasing in intensity with the depth. Such a map, when it can be made generally accurate, will be of the greatest service in forming an estimate of the more probable changes of sea and land during the Tertiary period; and it is on the effects of such changes that any satisfactory explanation of the facts of distribution must to a great extent depend.

Other important factors in determining the actual distribution of animals are, the zones of altitude above the sea level, and the strongly contrasted character of the surface as regards vegetation—a primary condition for the support of animal life. I

therefore designed a series of six maps of the regions, drawn on a uniform scale, on which the belts of altitude are shown by contour-shading, while the forests, pastures, deserts, and perennial snows, are exhibited by means of appropriate tints of colour.

These maps will, I trust, facilitate the study of geographical distribution as a science, by showing, in some cases, an adequate cause in the nature of the terrestrial surface for the actual distribution of certain groups of animals. As it is hoped they will be constantly referred to, double folding has been avoided, and they are consequently rather small; but Mr. Stanford, and his able assistant in the map department, Mr. Bolton, have taken great care in working out the details from the latest observations; and this, combined with the clearness and the beauty of their execution, will I trust render them both interesting and instructive.

In order to make the book more intelligible to those readers who have no special knowledge of systematic zoology, and to whom most of the names with which its pages are often crowded must necessarily be unmeaning, I give a series of twenty plates, each one illustrating at once the physical aspect and the special zoological character of some well-marked division of a region. Great care has been taken to associate in the pictures, such species only as do actually occur together in nature; so that each plate represents a scene which is, at all events, not an impossible one. The species figured all belong to groups which are either peculiar to, or very characteristic of, the region whose zoology they illustrate; and it is hoped that these pictures will of themselves serve to convey a notion of the varied types of the higher animals in their true geographical relations. The artist, Mr. J. B. Zwecker, to whose talent as a zoological draughtsman and great knowledge both of animal and vegetable forms we are indebted for this set of drawings, died a few weeks after he

had put the final touches to the proofs. He is known to many readers by his vigorous illustrations of the works of Sir Samuel Baker, Livingstone, and many other travellers,—but these, his last series of plates, were, at my special request, executed with a care, delicacy, and artistic finish, which his other designs seldom exhibit. It must, however, be remembered, that the figures of animals here given are not intended to show specific or generic characters for the information of the scientific zoologist, but merely to give as accurate an idea as possible, of some of the more remarkable and more restricted types of beast and bird, amid the characteristic scenery of their native country;—and in carrying out this object there are probably few artists who would have succeeded better than Mr. Zwecker has done.

The general arrangement of the separate parts of which the work is composed, has been, to some extent, determined by the illustrations and maps, which all more immediately belong to Part III. It was at first intended to place this part last, but as this arrangement would have brought all the illustrations into the second volume, its place was changed,—perhaps in other respects for the better, as it naturally follows Part II. Yet for persons not well acquainted with zoology, it will perhaps be advisable to read the more important articles of Part IV. (and especially the observations at the end of each order) after Part II., thus making Part III. the conclusion of the work.

Part IV. is, in fact, a book of reference, in which the distribution of all the families and most of the genera of the higher animals, is given in systematic order. Part III. is treated somewhat more popularly; and, although it is necessarily crowded with scientific names (without which the inferences

and conclusions would have nothing solid to rest on), these may be omitted by the non-scientific reader, or merely noted as a certain number or proportion of peculiar generic types. Many English equivalents to family and generic names are, however, given; and, assisted by these, it is believed that any reader capable of understanding Lyell's "Principles," or Darwin's "Origin," will have no difficulty in following the main arguments and appreciating the chief conclusions arrived at in the present work.

To those who are more interested in facts than in theories, the book will serve as a kind of dictionary of the geography and affinities of animals. By means of the copious Index, the native country, the systematic position, and the numerical extent of every important and well established genus of land-animal may be at once discovered;—information now scattered through hundreds of volumes.

In the difficult matters of synonymy, and the orthography of generic names, I have been guided rather by general utility than by any fixed rules. When I have taken a whole family group from a modern author of repute, I have generally followed his nomenclature throughout. In other cases, I use the names which are to be found in a majority of modern authors, rather than follow the strict rule of priority in adopting some newly discovered appellation of early date. In orthography I have adopted all such modern emendations as seem coming into general use, and which do not lead to inconvenience; but where the alteration is such as to completely change the pronunciation and appearance of a well-known word, I have not adopted it. I have also thought it best to preserve the initial letter of well-known and old-established names, for convenience of reference to the Indices of established works. As an example I may refer to *Enicurus*,—a name which has been in use nearly half a

century, and which is to be found under the letter *E*, in Jerdon's Birds of India, Blyth's Catalogue, Bonaparte's Conspectus, and the Proceedings of the Zoological Society of London down to 1865. Classicists now write *Henicurus* as the correct form; but this seems to me one of those cases in which orthographical accuracy should give way to priority, and still more to convenience.

In combining and arranging so much detail from such varied sources, many errors and omissions must doubtless have occurred. Owing to my residence at a distance from the scientific libraries of the metropolis, I was placed at a great disadvantage; and I could hardly have completed the work at all, had I not been permitted to have a large number of volumes at once, from the library of the Zoological Society of London, and to keep them for months together;—a privilege for which I return my best thanks to Mr. Sclater the Secretary, and to the Council.

Should my book meet with the approval of working naturalists, I venture to appeal to them, to assist me in rendering any future editions more complete, by sending me (to the care of my publishers) notes of any important omissions, or corrections of any misstatements of fact; as well as copies of any of their papers or essays, and especially of any lists, catalogues, and monographs, containing information on the classification or distribution of living or extinct animals.

To the many friends who have given me information or assistance I beg to tender my sincere thanks. Especially am I indebted to Professor Newton, who not only read through much of my rough MSS., but was so good as to make numerous corrections and critical notes. These were of great value to me, as they often contained or suggested important additional matter, or pointed out systematic and orthographical inaccuracies.

Professor Flower was so good as to read over my chapters on extinct animals, and to point out several errors into which I had fallen.

Dr. Günther gave me much valuable information on the classification of reptiles, marking on my lists the best established and most natural genera, and referring me to reliable sources of information.

I am also greatly indebted to the following gentlemen for detailed information on special subjects :—

To Sir Victor Brooke, for a MS. arrangement of the genera of Bovidæ, with the details of their distribution:

To Mr. Dresser, for lists of the characteristic birds of Northern and Arctic Europe:

To Dr. Hooker, for information on the colours and odours of New Zealand plants:

To Mr. Kirby, for a list of the butterflies of Chili:

To Professor Mivart, for a classification of the Batrachia, and an early proof of his article on "Apes" in the Encyclopedia Britannica:

To Mr. Salvin, for correcting my list of the birds of the Galapagos, and for other assistance:

To Mr. Sharpe, for MS. lists of the birds of Madagascar and the Cape Verd Islands:

To Canon Tristram, for a detailed arrangement of the difficult family of the warblers,—Sylviidæ:

To Viscount Walden, for notes on the systematic arrangement of the Pycnonotidæ and Timaliidæ, and for an early proof of his list of the birds of the Philippine Islands.

I also have to thank many naturalists, both in this country and abroad, who have sent me copies of their papers; and I trust they will continue to favour me in the same manner.

An author may easily be mistaken in estimating his own work. I am well aware that this first outline of a great subject is, in parts, very meagre and sketchy; and, though perhaps overburthened with some kinds of detail, yet leaves many points most inadequately treated. It is therefore with some hesitation that I venture to express the hope that I have made some approach to the standard of excellence I have aimed at;—which was, that my book should bear a similar relation to the eleventh and twelfth chapters of the "Origin of Species," as Mr. Darwin's "Animals and Plants under Domestication" does to the first chapter of that work. Should it be judged worthy of such a rank, my long, and often wearisome labours, will be well repaid.

MARCH, 1876.

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