which comes on only once in twenty-four hours. Prof. Kennedy found that the total stand-by losses can be reduced in some cases to 8 per cent. of the total fuel; below this he had not yet succeeded in going, and he thought it was often considerably more than 10 per cent. He was of opinion that the greater waste of fuel occurred beyond the boilers, as it is more easy to get a good evaporation per pound of coal than a small consumption of water per indicated horse-power. Heavy causes of loss are by the condensation in steam pipes and by leakage. These are probably greater in electric light stations than in most other places, because security requires the use of a very elaborate system of steam pipes. Of steam traps Prof. Kennedy has not much that is favourable to say; he refers to them as the "apparatus which we call by courtesy steam traps," and says they require more looking after than the whole of the rest of the machinery put together. He thought also that sufficient attention is not paid to the proper covering of the pipes, including their flanges. He thought the use of super-heated steam might be found very largely to reduce this particular cause of waste. The cost of oil, water, and stores he puts down as averaging about one-fifth the cost of coal alone. Discussing the losses between the indicated horse-power developed and the records of the consumers' metres, the President said that the loss in the engine itself might be taken as about 10 per cent. of the full power of the engine, and remained very nearly constant at all powers so long as the speed was constant. The efficiency of the dynamo at full load might be as much as 95 per cent., so that the ratio of electrical indicated horse-power of a first-class steam-engine and dynamo might be 85 per cent. at full load, whilst at half load it would be about 76 per cent. This was assuming that the engine drove the dynamo direct, and he considered that direct driving with equal running engines was the proper method of proceeding. The losses between the dynamo terminals and the consumers' lamps in a low tension system are simply losses in the leads; in a high tension system they cover the losses in general, which are much smaller in the leads and in the transformers as well. Prof. Kennedy did not consider it desirable, however, to enter into a discussion on the respective merits of the two systems, but stated that as far as the figures to which he had access were concerned, he found that in the case of a low tension system where the maximum proportion of loss in the feeders is allowed to reach 20 per cent. or thereabouts, the actual average loss of energy throughout the whole year amounts to about 10 per cent. This was of course entirely due to ohmic resistance of the feeders themselves and of the network. He had no corresponding figures for the alternating current system, but he had reason to believe the total losses both in mains and transformers in the high tension system are not less than 25 per cent. the energy generated, but he thought it certain that this figure will be very considerably reduced in cases where banked transformers are employed with low tension distributing mains. In any case, however, he hardly thought that it could be expected that the total losses would ever be so low as with the low tension system.

In conclusion Prof. Kennedy referred to the ease and accuracy with which electrical measurements may be made with continuous currents, a fact which he thought had helped very much in the extremely rapid progress made during the last few years in matters electrical. In the case of the Westminster Electric Supply Corporation, the unaccounted for quantity as between the energy developed at the dynamo terminals and the readings of the metres of consumers has been reduced to 1·8 per cent. Unfortunately alternating current measurements are much more difficult and troublesome, and Prof. Kennedy thought that the fact had, to a certain extent, hindered their adoption. There were, however, he considered alternating current watt-metres practically free from error due to circuit induction and capable of giving results with quite sufficient accuracy under the actual conditions of station practice. He believed that very great improvements in the economy of alternating current working will date in every case from the time when the station commences to make accurate determinations of the true energy generated and the way in which it has been expended.

At the conclusion of the address a vote of thanks was proposed by Sir Frederick Bramwell, as the Senior Past President, and seconded by Dr. William Anderson, the Junior Past President. It was carried by acclamation, and responded to by Prof. Kennedy in a short speech.

The next business was the reading of a paper by Mr. Edward W. Anderson, of Erith, in which was described the Grafton high speed steam-engine. The design of this novel engine was illustrated by many large cartoons hung upon the wall of the theatre. As we have said, without the aid of illustrations we can only hope to give a general idea of the design of this engine. It consists, firstly, of a foundation casting, the engine being of the vertical type. Upon this casting is erected a second, forming a standard and also a cover for the whole mechanism, the engine being of the enclosed type and the crank shaft running in an oil bath, upon the system common with single-acting engines of this type. The upper casting has a cylinder formed in it by means of two loose liners, one placed in from each end till the liners nearly meet; the space thus left between them forms the admission port, and, as its width is the circumference of the cylinder bore, its length is only required to be very small in order to get a large area of opening. Communication with the steam pipe is effected through an external annular channel in the casting directly surrounding the space between the two liners or admission port. At a little distance from the steam port the upper liner has a circle of holes drilled through it, which holes open into a similar external annular channel connected with the exhaust branch. The liners are open at both their ends, forming a cylinder, without covers, in which two cast-iron pistons reciprocate. The lower of these is an ordinary trunk piston and has a connecting-rod attached working upon the centre throw of the crank shaft below. The upper piston serves both for a piston and for a valve. It is essentially a short cylinder having a strong diaphragm across the middle of its length, and just below the diaphragm a circle of holes is cut through the rim of the piston, and these holes communicate, therefore, with the space between the two pistons. The diaphragm in the upper piston has a hemispherical recess; this receives the steel ball attached to the crosshead. The latter spans the cylinder and acts on the two outer throws of the crank shaft by means of a return connecting rod attached to each end. The advantages claimed for this engine are:—That the waste spaces to be filled by steam are reduced to a minimum, as the steam is cut off close to the bore of the cylinder, and the long steam passages between the cylinder and the slide valve are done away with; the weight of the piston and that of the piston-valve, instead of being wholly unbalanced, act in the same line and for the most part in opposite directions so as nearly to balance each other, the result being that the unbalanced moment is small. The valve, instead of having a moving part that is idle as regards the transmission of power, performs the same function as an ordinary piston in rotating the crank shaft. The friction of the valve is also no greater than that of an ordinary piston valve of the same dimensions and stroke. The engine described was single-acting and non-compound, but the author said there was no reason why a combination of engines ranged side by side should not be made to work compound if desired. An experiment carried out on a 12-inch engine, working with an initial pressure of 100 lbs. per square inch at 603½ revolutions per minute, indicating a mean of 36·77 horse-power, gave a consumption of 28·2 lbs. of feed water per indicated horse-power per hour.

A discussion followed the reading of the paper. The general opinion appeared to be that the invention was one of great ingenuity, but no fresh points of importance were brought forward.

Mr. Joy, in his paper, dealt with the hydraulic reversing gear, which he described in his paper read before the recent meeting of the Institution of Naval Architects, and which we referred to in our report of that meeting in our issue of March 22.

The summer meeting will be held in Manchester during the first week in August.

WHAT ARE ZOOLOGICAL REGIONS?[1]

THE subject which I now propose to discuss, is the purport and use, and therefore the essential nature, of what are termed zoological regions. This seems necessary because, although such regions have been more or less generally adopted for more than thirty years, there has of late grown up a conception as to their nature and purport which seems to me to be altogether erroneous, and which, if generally adopted, is calcu-

[1] A paper read at the 500th meeting of the Cambridge Natural Science Club, March 12, by Dr. A. R. Wallace, F.R.S.

lated to lead to confusion, and to minimise, if not to destroy, whatever advantages may be derived from their use.

The time has therefore come when this question must be discussed and, if possible, settled, and, in the hope of leading to such a settlement, I propose to point out what seem to me to be the essential characteristics of such regions, considering them to be established for the purpose of facilitating the study of geographical distribution as one phase of the problem of evolution. In order to come at once to the question at issue, I will first summarise the statements or assumptions which seem to me to imply a misconception of the nature and uses of zoological regions. These fall under two heads :—

(1) It is asserted that the same regions will not answer to show the distribution of all groups of land animals. Some of the classes, or orders, or sometimes even the families, require us to establish different sets of regions—regions which may differ both as to their number and their limits—in order to represent and study the distribution of such groups.

(2) As a guide to what constitutes a region, it is laid down that areas which have few peculiarities in the higher groups—such as families, even though of continental extent, rich and varied in genera and species, and having a large number of peculiar types, are not of regional status. The criterion of a region is said to be the exclusive possession of peculiar groups of higher rank than genera ; and this without any regard to proportionate area, or to the poverty and monotony of the fauna as a whole.

Now the first of these assumptions—that the same set of regions will not serve for the study of the distribution of all animals—raises the whole question of the nature and practical utility of zoological regions, and is a proposition which the chief purpose of this article is to disprove : it must therefore be considered in some detail.

In the first place, it implies that the students of any particular group—reptiles, beetles, butterflies, land shells, &c.—should each mark out the globe into regions exhibiting the chief features of the distribution of its families, genera, and species, and that any other division, arrived at by the study of other groups, will be of little or no use to them. But if this is true, it must be carried further ; for not only do the various classes and orders of animals differ considerably in their distribution, but many of the tribes and families. To take the case of the mammalia, which, for distributional study, has always been treated as a whole, how different is the distribution of the Edentata from that of the Ungulata. In the former group South America is so rich that it is of more importance than all the rest of the globe, while in the latter it is so poor that even when joined with North America it would hardly equal either of the other continental regions in importance. But if we constructed a set of regions to correspond with the distribution of each of these orders, we should not bring out the facts more clearly than can be done by means of the regions most usually adopted for the whole class, while we should lose the advantage of easy comparison with each other, and with the remaining orders of the class, as well as with other classes of animals. But *comparative* distribution is the one essential feature of our study, without facilities for which the bare facts are uninstructive and of hardly any scientific value.

This point has been very clearly brought out in the case of birds, in a work specially devoted to the geographical distribution of one family—the plovers. These birds are, as a whole, cosmopolitan, so much so that Mr. Seebohm tells us "they have not even a remote connection" with the usually adopted zoological regions ; and he adds : "These birds only recognise three regions—Arctic, Temperate, and Tropical." Again, after describing the distribution of the chief genera during the breeding season, he says : "The inevitable conclusion is that the Charadriadæ *do* pay considerable attention to the climatic or isothermal regions, but appear practically to ignore the Sclaterian regions."

These very positive statements would lead a reader to conclude that here, at all events, the regions established by Dr. Sclater for birds as a whole are of no use. Yet we find that in the great work above referred to—the "Geographical Distribution of the Charadriadæ"—Mr. Seebohm rarely uses these three climatal regions, but throughout the book gives the distribution of the species of each genus in terms of the six Sclaterian regions. And if we consider the habits of these birds, so many of which get their food on sea-shores and tidal estuaries, while all of them have great powers of flight, and many of them migrate along the coasts of all the continents, it is really surprising to find so many of the genera and species which are nevertheless strictly limited to certain of the Sclaterian regions. Owing, no doubt, to the peculiarities of habit just referred to, about half the genera are cosmopolitan, being found in all the six regions during some part of the year ; but, even of these, certain groups of species are often confined to one or two regions.

When we turn to the non-cosmopolitan genera, however, we find some very instructive facts, which well serve to illustrate my main contention as to the sufficiency of one set of regions. The following table gives the distribution of these genera, taken from Mr. Seebohm's volume :—

Ædicnemus (Stone Curlews)	All regions except the Nearctic.
Lobivanellus (Wattled Lapwings)	All regions except the Nearctic and Neotropical.
Vanellus (Lapwings)	All regions except the Nearctic and Australian.
Cursorius (Coursers)	Palæarctic, Oriental, and Ethiopian regions.
Glareola (Pratincoles)	All regions except the Nearctic and Neotropical.
Ibidorhynchus (Ibis-billed Oyster-catcher)	Palæarctic only.
Phalaropus (Phalaropes) ...	Palæarctic and Nearctic, migrating or straggling into most of the other regions.
Limosa (Godwits)	All regions except the Ethiopian.
Ereunetes (Snipe-billed Sandpipers)	Palæarctic and Nearctic.
Phegornis (Short-winged Sandpipers)	Australian and Neotropical
Rhynchæa (Painted Snipes) ...	The four Tropical regions.

Now we have here to notice two points :

(1) That in most of these genera not only are they absent from one or more of the Sclaterian regions and present in others, but in the regions where they do occur they are usually widely dispersed, thus showing that their range is defined and limited by the very same barriers which so well mark out the general range of land birds.

(2) We also find that the use of the old-established and widely accepted six regions of Dr. Sclater, enables us very clearly and concisely to describe or to tabulate the comparative distribution of the genera and species of this great family of wading birds, which have been thought to be such erratic wanderers that the author of a work devoted to them declares that—"the zoological regions of Sclater have nothing whatever to do" with them.

Now this case of the plovers is perhaps as strong as any that can be brought to prove that different groups require different sets of regions ; and it at once brings us to the question at issue, which is, whether anything would be gained by establishing a set of Charadriine regions. The climatic regions—which Mr. Seebohm suggests as more natural in this case—would not bring out such facts as the absence of Ædicnemus from the Nearctic and of Limosa from the Ethiopian regions ; the limitation of Glareola to the eastern hemisphere, and of Phegornis to the Australian and Neotropical regions, unless the Sclaterian regions were also used as sub-regions—thus introducing complication in place of simplicity, and gaining, so far as I can see, no advantage whatever.

But further, if the plovers are to have their own regions and sub-regions, there are probably 50 or 100 of the orders and families of the animal kingdom which would equally require to be so treated ; and as in all these cases the new regions must have separate names, it is quite clear that by far the larger part of them would remain for ever unknown, except to their inventors.

A little consideration will, I think, convince us that this plan, of practically unlimited distinct sets of regions, would be a positive hindrance to any intelligent study of the distribution of animals, a study which derives its chief interest and importance from its relation to the theory of organic evolution, and which must therefore include the *comparative distribution* of the various classes, orders, and minor groups. But how will it be possible to make the necessary comparison if the distribution of the groups to be compared is given in terms of as many distinct

sets of regions all differing in their names and in their boundaries? It would be like comparing the structures of different animals as described in the works of a number of anatomists each of whom had a different classification and a different set of technical terms, so that before a single comparison could be made the terms used in one description would have to be translated into the terms used in the other. In the study of geographical distribution, should this system prevail, the student would find it necessary to adopt some one set of regions for his own use, and then endeavour to translate the facts given by each specialist into terms of that set before he could obtain any clear conception or accurate knowledge of their comparative distribution.

An idea seems to be prevalent among biologists that there is some *law* of distribution, that may differ for different groups, and that may require different regions to exhibit it or to conform to it. This, however, is a mere supposition; but, if it is a correct one, we shall certainly not be likely to discover the "law" by recording the facts of distribution in such a way as to render a *comparative* study of them as difficult as possible. Laws of distribution can only be arrived at by comparative study of the different groups of animals, and for this study we require a common system of regions and a common nomenclature.

It appears to me, however, that the "law," or at all events the general principles on which the diversities of distribution among land animals depend, is already fairly well understood. What we require is to be able to work out the details in the different groups, and thus explain certain difficulties or anomalies. To detect anomalies it is essential to compare the distribution of the different groups by means of a common system of regions. If we construct regions to fit each group, the student of each separate group will be apt to forget that it presents any anomalies which require explanation

Before leaving this part of the subject it may be well to give a short account of the reasons which led to the original establishment of the six Sclaterian regions for the purpose of facilitating the study of the geographical distribution of animals; in order to show that they are not arbitrary divisions, but are founded on a large body of observations. It is evident, in the first place, that many of the ordinary divisions of the geographer serve well to define the areas characterised by special groups of animals or plants. The South European, the Malayan, the Brazilian, or the South African faunas and floras, are constantly referred to, because those districts are really characterised by distinct assemblages of animals and plants, and this undoubtedly depends partly on their possessing peculiarities of climate resulting in peculiarities of vegetation—as forest, prairie, desert, or woodland; partly in their being limited by more or less effective barriers, climatic or geographical; and partly on their past geological history and on the more recent changes of physical geography they have undergone. But such areas as these are too small and too numerous to enable us to express the broader features of the distribution of animals, and the larger or primary geographical divisions—which were those used by the older naturalists—are often unsuitable and misleading, because they are *not* coincident in their boundaries with those more permanent natural barriers which have mainly determined the zoological specialities of different parts of the globe. Yet some of the divisions of the geographer are such well-defined and ancient areas that they *do* nearly coincide with characteristic assemblages of animals; and thus the geographical units, Europe, Asia, Africa, North America, South America, and Australia, can be easily modified into six zoological regions, which do represent with considerable accuracy the broad features of animal distribution. These modifications may be briefly enumerated in order to show how the limits of the regions have been arrived at.

Beginning with Europe, we see at once that it is zoologically homogeneous, since a large proportion of the species and all the larger genera range over the whole of it. But the same genera, in the case of the higher animals, at all events, prevail in North Africa, mingled only with a few desert types, and we therefore, for zoological purposes, add this area to Europe. It is interesting to note that we have a clear explanation of this identity, in the proofs that quite recently — that is, during the Pleistocene period—Europe and North Africa were connected both at Gibraltar, and from Sicily and Malta to Tripoli, as indicated both by submarine banks which still unite them, and by the fossil hippopotami and elephants of the Maltese, Sicilian, and Gibraltan caverns. But further, if we go eastward from Europe into Siberia and Central Asia, we find the same genera and many of the same species of mammals and birds ranging all the way to the shores of the Pacific. To such an extent is this the case that about fifty-six species of British passerine birds range to Central and North-East Asia, while no less than fifty-three species (or representative subspecies) of land-birds are common to Great Britain and Japan. Europe and North Asia are therefore parts of one zoological region, the reason being that there is not, nor has been in recent geological times, any effective barrier between them, while in climate they are sufficiently alike.

Here, then, we have roughly marked out our first great zoological region—the Palæarctic, or northern old-world region. Southward its limits are undefined, and where there are no well-marked barriers, such as the Himalayas or the desert, there will always be a greater or less width of border-land between two conterminous regions.

Now this Palæarctic region is, fortunately, the only one that differs very largely from the ordinary geographical quarters or divisions of the globe. For when we go to Africa we find that, leaving out the northern portion, which we have seen to be essentially European, the remainder constitutes a very distinct and compact area zoologically—the land of giraffes, zebras, hippopotami, baboons, and antelopes—which has been termed the Ethiopian region. Then we have southern or tropical Asia, together with the larger Malay Islands, which we know must recently have formed a part of it, constituting the Indian or Oriental region, and corresponding almost exactly with tropical Asia. Then we come to Australia, which forms the nucleus of another well-marked region, including with it, however, most of the Pacific Islands, with New Guinea and the Moluccas. Turning now to the western hemisphere, we have South America and North America, which, with slight modifications, form two well-defined regions—the Neotropical, including all South America with the tropical portion of North America and the West Indian Islands; the Nearctic, comprising the remainder of North America.

Now, I do not think that any one has denied that these are truly natural divisions of the earth from a broad zoological point of view. The controversy respecting them has turned wholly on whether they are of equal rank. This point, however, will be referred to later on. We are now dealing with the question of the need of other modes of dividing the earth's surface in order to exhibit and to study the distribution of certain groups of animals. I have already urged that to do so would defeat the very object aimed at, and render the study of geographical distribution very much more difficult. I have shown how readily the Sclaterian regions enable us to describe or tabulate the distribution even of a group which has been said to "pay no attention to them whatever"; and I have now just pointed out that these six regions are, admittedly, natural, which can only be because during the more recent geological periods they have formed single more or less continuous areas, while separated either by geographical, climatal, or biological barriers from the adjacent areas.

Now the only real interest of the study of geographical distribution lies in its giving us a clue to the causes which have brought about the very divergent and often conflicting distribution of the various species, genera and higher groups, and by thus being able to explain most of the anomalies of distribution. These causes we can trace, in many cases, either to geographical or climatal changes in the past, which temporarily removed the barriers that now exist or interposed others that are now absent; or, on the other hand, to the recent extinction of groups in certain regions where they formerly abounded; or, again, to the very different powers of dispersal possessed by different organisms, which enable some groups to spread easily where others are stopped by an insurmountable barrier. Now it is usually this last phenomenon, of varying powers of dispersal, that has led the students of certain groups to urge that the old-established regions do not serve their purpose. But when a group can more or less easily traverse the barrier between two regions, however permanent that barrier may be, the fact enables us to explain the exceptional distribution of that group, but it does not render the established regions less natural, or require a fresh set of regions, which would certainly not be natural in any broad sense, to explain them.

Again, it will usually, perhaps always, be found that even in the groups appealed to as requiring a new set of regions, a portion of the species, and even of the genera, are limited to the

older regions. I have already shown that this is the case with the almost cosmopolitan plovers, and it also occurs in another instance where it has been very strongly urged that the Sclaterian regions will not apply. I allude to the distribution of insects in the Oriental and Australian portions of the Malay Archipelago. Here, in the case of birds and mammals, there is a most abrupt and striking change on passing from Borneo and Java to the Moluccas and New Guinea; but in insects this is not conspicuously the case, and it has been said that the whole Archipelago, from Sumatra to New Guinea, and even to the Solomon Islands, is characterised by one uniform insect-fauna. This, however, is by no means a correct statement. There are undoubtedly many genera common to the whole Archipelago, as might be expected from the great similarity of climate and the uniformly forest-clad nature of the islands, together with the power of crossing narrow seas possessed by all winged insects. Yet, both among butterflies and beetles, especially the latter, there are a considerable number of genera confined respectively to the Indo-Malayan and Austro-Malayan divisions of the Archipelago, giving to the fauna of each a characteristic facies.

Now if we adopt for insects, as has been proposed, a single Malayan region including the whole of the Archipelago, we should be apt to lose sight of the two distinct elements it contains, the one due to an ancestral diversity corresponding to that which still exists in all the higher animals, the other dependent on a comparatively recent process of intermigration between the two portions of what are fundamentally distinct insect faunas; while it is not clear what corresponding advantage would be obtained by the student of geographical distribution.

From the point of view I have now endeavoured to set forth, we may, I think, draw the conclusion that the six Sclaterian regions are natural zoological divisions, because they are separated by barriers of considerable antiquity and permanence, which have led to their being characterised each by well-marked assemblages of the higher animals. Further, when groups of organisms which from their exceptional powers of dispersal, or from any other cause, have been able to extend themselves beyond these barriers, that is no reason whatever for establishing new regions—which would *not* be marked out by equally important barriers—since the divergencies in the distribution of the various classes or orders, as exhibited by means of a common series of regions, is one of those interesting problems of distribution which can only be solved by comparative study. Not only, therefore, is one set of regions all that is required to exhibit the distribution of the various terrestrial organisms; but, for all purposes of comparative study it is immeasurably superior to the establishment of numerous sets of special regions, constructed so as to accord with the distribution of special animal groups.

We now come to the second objection—the supposed inequality of the six Sclaterian regions. Some of them are said to be really only sub-regions, while others are said to be so diverse as to be rendered more equal if divided into two regions.

This question of equality is decided almost exclusively by one characteristic, and one that seems to me to be not the most important for the purpose we have in view. This character is the possession of peculiar groups of the rank of family or order, taking no account either of the richness and variety of life-development, or of the geographical extent of the area in question. From this point of view Australia is sometimes said to be equal to all the rest of the world, both on account of its rich development of the marsupial order, but especially because in the duck-bill and spiny ant-eater it possesses a distinct sub-class of mammals. From another point of view, however, Australia, Africa, and South America are united in one primary region, because they alone possess one of the sub-classes of birds—the Ratitæ.

New Zealand and Madagascar have each been proposed as regions, the first on account of its Apteryx and moas, with its isolated lizard-like Hatteria; the second for its peculiar families of Lemurs and Insectivora, and equally peculiar families and genera of birds. In contrast with these, we have the proposal to unite the rich and extensive Palæarctic and Nearctic regions to form one region only, because they do not possess a sufficient number of peculiar families and genera of mammals and birds, although the new region thus constituted is perhaps twenty times as rich as New Zealand in varied forms of life.

Those who adopt these views appear to me to attach a very exaggerated importance to the possession by a limited area of some remnant of an otherwise extinct group, which has been preserved owing to its long-continued isolation in a district where it has been secure from the competition of higher forms—almost always, therefore, in an island. Such survivals are exceedingly interesting; but I cannot see what they have to do with the division of the whole land-area of the globe into zoological regions, whose sole purport and use is to facilitate the study of the geographical distribution of all land animals.

The conception of zoological regions expressed in the views I am now combating seems to me to be altogether erroneous, and to lead to results which are neither useful nor instructive, and far less natural than that which takes account of a variety of characters as the best guides to an approximate equality. I urge, therefore, that zoological regions, to be at once natural and useful in the highest degree, must be founded on a combination of essential features, as follows:—

(1) They should be founded upon, and approximate to, the great primary geographical divisions of the earth, which there is reason to believe have been permanent during considerable geological periods.

(2) They should be rich and varied in *all* the main types of animal life.

(3) They should possess great individuality; whether exhibited by the *possession* of numerous peculiar species, genera, or families, or by the entire *absence* of genera or families which are abundant and widespread in some of the adjacent regions.

Tested by these conditions the six Sclaterian regions seem all that can be desired—subject of course to modification in details. If we make some allowance for the inevitable poverty of the temperate as compared with the tropical regions—due both to present and to past conditions of climate—they present a greater amount of equality than might be expected. The Neotropical region is somewhat the richest—very much the richest in birds and insects—and this may be traced to its possessing so enormous an area of tropical forest-clad land, together with the greatest of the mountain ranges situated wholly within the tropics—the Andes, and two other isolated mountain groups of great extent and antiquity in Brazil and Guiana; while the Nearctic is the poorest—due perhaps to its rather limited area, its large extent of arid lands, but more especially to its extreme climate, a severe winter prevailing to considerably south of the parallel of 40° N. Latitude.

The subdivisions of the primary regions is far less important; and with the same facts before them, naturalists arrive at different conclusions. I would suggest, therefore, that for the present, at all events, no definite named subdivisions should be attempted, but that the continental portion of each region be subdivided by the use of the terms north, south, east, west, and central, with their combinations where required. By the use of these terms the range of a genus or species within the regions may be defined with sufficient accuracy, and in a manner at once intelligible to every student.

The conclusions to which this discussion has led us may now be briefly summarised as follows: Zoological regions are those primary divisions of the earth's surface of approximately continental extent, which are characterised by distinct assemblages of animal types. Though strictly natural, in the sense already pointed out, they have no absolute character as equal independent existences, since they may have been different in past ages, but are more or less conventional, being established solely for the purpose of facilitating the study of the existing geographical distribution of animals in its bearing on the theory of evolution. There is thus, in my opinion, no question of who is *right* and who is *wrong* in the naming and grouping of these regions, or of determining what are the *true* primary regions. All proposed regions are, from some points of view, natural, but the whole question of their grouping and nomenclature is one of convenience and of utility in relation to the object aimed at.

It is because I think that the future progress of a branch of biological study in which I take great interest will depend on our arriving at some uniformity of view as to this question of zoological regions, that I have devoted so much space to its discussion.