

V.—MISCELLANEOUS.

ART. LIV.—*Some Remarks upon the Distribution of the Organic Productions of New Zealand.* By W. T. L. TRAVERS, F.L.S.

[Read before the Wellington Philosophical Society, 15th August, 1883.]

IN the course of last year's proceedings of this Society I brought under its notice some remarks upon the distribution of the land and wading birds found within the New Zealand zoological sub-region.* Whilst engaged in preparing the paper in which I treated of this subject, I was struck with the fact that the fauna and flora of the main islands of New Zealand present features very similar to those which so much impressed the late Mr. Darwin in connection with the organic products of the Galapagos Islands. That group, as you are aware, is situated under the equator, within five or six hundred miles from the western coast of America. None of the islands composing it are large, and all consist of volcanic rocks of recent origin. The group was first systematically examined by Mr. Darwin during the visit of the "Beagle" in 1835, and he tells us that, seeing that most of its organic products were aboriginal creations, occurring nowhere else, he felt, in viewing them, that both in space and in time he seemed to be brought somewhat near to that great fact—that mystery of mysteries—the first appearance of new beings on this earth. He points out, however, that notwithstanding this dissimilarity, all the organic products of the islands in question showed a marked relationship to those of America, and he concluded, therefore, that whilst the group looked almost like a world of itself, it could only be considered as a satellite of the great continent, whence it had evidently derived a few stray colonists, and had received the general character of its indigenous productions.

But the feature which most impressed him in considering these productions, was, that notwithstanding the general proximity of the several islands to each other, each of them possessed species, both of birds and plants, which were not to be found upon any of the others. As a striking example of this, in the case of the birds, he mentions that each of the three species of mocking-thrush which he found there was peculiar to a particular island or to some particular sub-group of the archipelago, and he adds, that although his attention was not soon enough called to the fact to enable him to determine whether the same rule prevailed in relation to a singular group

* Trans. N.Z. Inst., xv., pp. 178 to 187.

of finches, which formed the greater number of the species of birds found on the islands, he had sufficient reasons for believing that some of the species of the sub-group *Georpiza* were confined to separate islands.

The occurrence of a similar peculiarity in the distribution of a considerable proportion of the birds of New Zealand, struck me whilst engaged in preparing the tables annexed to my former paper, and at the same time drew my attention to the fact that the features which so much impressed Mr. Darwin in connection with the organic productions of the Galipagos, also characterized to a large extent those of New Zealand. In order that you may be enabled to appreciate this peculiarity, I propose to call your attention to some of the more remarkable instances in the case of the avi-fauna and flora.

Beginning with the case of the birds, you will find, on reference to table iii., annexed to my last year's paper, that there are eighteen species peculiar to the main islands of New Zealand, nine peculiar to the North Island, and sixteen peculiar to the South Island. Of the species peculiar to the North Island, there is only one belonging to any genus which contains more than one species and is represented by other species of the same genus in both islands. Of those peculiar to the South Island, there are six belonging to genera which contain more than one species, and are represented by species in both islands, but these six comprize two species of *Nestor* and two of *Apteryx*.

The eight species which remain in the North Island belong to genera not represented by any common form in both islands, and ten of the species peculiar to the South Island are similarly unrepresented; and yet, of the nine species peculiar to the North Island, we have seven which are represented by allied species in the South Island, whilst except the South Island species so represented in the North Island, none of the remaining nine are represented by species in the latter island.

The remarkable character of this distribution becomes even more striking, when attention is called to some of the special instances. Take, for example, the case of *Orthonyx albicilla*, the North Island form of the genus, and compare it with *Orthonyx ochrocephala* of the South Island. To the eye no two birds can be more distinct, and yet in their notes, in their movements, in their mode of feeding and in their nesting, these birds are practically undistinguishable, indicating unmistakably their descent from a common ancestor. Singularly enough, however, the North Island bird is found frequenting the thickets in the rich and varied forest down to sea-level, whilst the South Island one is rarely found outside of the *Fagus* forest, or below an elevation of 500 or 600 feet. Still the curious fact

remains, that whilst the conditions of life under which both birds are placed appear to be identical, so great an amount of modification should have occurred in one or other of the forms, assuming either of them to retain the ancestral characters. Take next the two species of *Turnagra*. Now, whilst in these we do not find the same marked differences in plumage as in *Orthonyx*, there can nevertheless be no confusion of the two, and yet with respect to these birds also, there is absolutely nothing in their habits, or modes of life which would enable us to distinguish between them. The distinction in the next instance,—that of the two species of *Glaucoptis*,—is still less marked, but affords, when we consider their habits of life, even a more peculiar case in connection with the question of distribution. The North Island bird is a little the more robust, of the two, and its wattles are unicolor, varying from bright blue to purple, whilst the South Island bird has the tail, only, blackish at the tip, and its wattles are bicolor, the point of attachment being blue, whilst the rest is red or orange. Wattles are what is termed a secondary sexual character, and why such a variation as that which appears in this case should have taken place, seeing that they are not confined to one sex only, is certainly very unaccountable. As in the other cited cases the habits of three bird species are absolutely identical, this similitude extending so far, that in each, the bird, when feeding upon the leaf of some succulent herb, such as that of the sow-thistle, holds it in its foot after the manner of a parrot.

The differences between the two species of *Apteryx* peculiar to the South Island, and the one peculiar to the North Island, are also well marked, whilst we have, in regard to this genus, the singular fact, that the fourth and remaining species (*Apteryx oweni*) is common to both habitats. This rests, as yet, upon the authority of a single specimen only, alleged to have been found in some part of the Tararua Range. The person by whom the specimen is said to have been obtained, was engaged in surveys which required him to pass some time upon elevated parts of the range, and as he had no apparent motive for practising deception in the matter, and was not sufficiently conversant with the avi-fauna of these islands to see the full significance of his discovery, I am disposed to accept his statement as true until some cogent reasons for distrusting it have been brought forward. The circumstance that two or three specimens of *Stringops habroptilus* have been found in the Kaimanawa Range, lends, as I think, some colour to the probability that *Apteryx oweni* is still an inhabitant of the North Island.

The difference between the species of *Petroica*, and those of *Ocydromus* peculiar to the North Island, and the species of the same genera in the

South Island, are not so marked as in the instances already mentioned, nor would they be likely to excite so much attention. In neither of these is there any form common to both islands.

If we include in this discussion the case of the Chatham Islands, we shall find that there are eight species of birds peculiar to that group and the main islands of New Zealand, and six peculiar to the group itself; that out of the latter one species is represented by separate species of the same genus found in each of the main islands, differing from them, however, in external characters only, and four species allied to, but differing a good deal from species common to both the main islands, whilst one species, of which only two specimens were ever obtained, differs from any member of the family to which it belongs. The first case is that of *Petroica traversi*, the second comprises *Anthornis melanocephala*, *Sphenæacus rufescens*, *Gerygone albofrontata*, and *Rallus dieffenbachii*, and the last is *Cabalus modestus*.

But, besides the peculiarities already noticed, there are others of a still more remarkable character. For example, the North Island possesses two birds which are not found anywhere else within the sub-region of which it forms part, namely, *Pogonornis cincta* and *Heteralocha acutirostris*. The first of these belongs to the *Meliphagidæ*, represented in the main islands and the Chathams by five species altogether, three of which are commonly distributed in the main islands, a fourth being a variety of one of those confined to the Chathams, the fifth being the bird under consideration. Its range even in the North Island, is restricted, although there is nothing in its habits or structure to prevent its being as widely distributed as the other members of the *Meliphagidæ*. The second case, that of *Heteralocha acutirostris*, is even more remarkable, for in its most especial feature, namely, the difference in the bill in the sexes, it is scarcely paralleled by any other bird. Its range, like that of *Pogonornis*, is also very restricted, but there is nothing in its habits or in its apparent wants, or in the general conditions of life in which it is placed, which would appear to render the forests of the South Island an unsuitable habitat.

The South Island furnishes almost equally interesting cases, namely, *Nestor notabilis* and *Notornis mantelli*. There is nothing, *à priori*, against the assumption that the *Notornis* may have originally inhabited the North Island also, and have been extirpated by man. At present it is found only in the south-western parts of the South Island, and is evidently rare, only three specimens having as yet been obtained. It is an interesting fact that another species of this genus, *Notornis alba*, is found in Norfolk Island, one of the distant outliers of the New Zealand zoological sub-region. *Nestor notabilis*, commonly known as the Kea, belongs to the family of the parrots, but is said to have developed the instincts and habits of a bird of prey. It

is found in the mountains of the north-western parts of Otago, and its restriction to this range is remarkable, seeing that *Nestor meridionalis*, with which it is very closely allied, ranges over both islands. I have already alluded to the case of *Cabalus modestus*, found on one of the outliers of the Chatham group, only two specimens of which have ever been obtained.

I now propose to call attention to some of the more remarkable instances in the flora of New Zealand, which are calculated to illustrate the parallelism in distribution of the organic productions of these islands and those of the Galapagos Group, premising, however, that the flora of New Zealand has large affinities with those of Australia and South America. In this connection Dr. Hooker points out that—"Of the 303 New Zealand genera of plants described in his Handbook of 1864, about 252 are common to it and Australia, and 174 to it and South America; and that of the 935 species of flowering plants, 677 are peculiar to the Islands, 222 are Australian, and 111 American." The affinity between the flora of New Zealand and that of Australia is singular enough, seeing the great gulf which lies between the two districts; but in view of the fact that the warm ocean current which runs southward along the coasts of Australia and Tasmania, curls round the southern part of New Zealand, and that Australian birds have frequently been borne across the intervening sea during the strong north-west gales which constantly blow upon the western coasts of these islands, it is far less striking than the fact that so many South American forms are represented in our flora.

In the latter connection I may mention, incidentally, a very singular matter. Amongst the insects of New Zealand is one called *Peripatus*, which has been the subject of elaborate descriptions by Mr. Mosely (one of the naturalists of the "Challenger" expedition), and by Captain Hutton, and which is only found in New Zealand, in Chili, and at the Cape of Good Hope. As this insect inhabits only decayed wood, its distribution is most extraordinary, and can, apparently, be accounted for only upon the supposition of a former land connection between the three localities.

The instances to which I am about to call your attention in connection with the distribution of the flora of the main islands of New Zealand are taken from the "Handbook" already referred to, but are confined, as you will observe, to the *Phanerogams*. I am, of course, aware that in some respects these instances may no longer be strictly accurate in extent, but there is nothing in recent additions to our knowledge to affect the general principle which they illustrate.

The first column in the following table indicates the number of species of each genus which are common to both islands; the second those peculiar to the North; and the third those peculiar to the South Island:—

Genus.	Both Islands.	North Island only.	South Island only.
<i>Ranunculus</i>	6	3	11
<i>Pittosporum</i>	2	6	2
<i>Pomaderris</i>	0	3	0
<i>Carmichaelia</i>	5	0	3
<i>Metrosideros</i>	3	5	1
<i>Ligustricum</i>	1	0	9
<i>Panax</i>	8	1	1
<i>Coprosma</i>	13	9	0
<i>Olearia</i>	8	3	8
<i>Celmisia</i>	4	0	19
<i>Cotula</i>	7	0	4
<i>Raoulia</i>	3	0	9
<i>Haastia</i>	0	0	3
<i>Senecio</i>	4	5	9
<i>Dracophyllum</i>	2	4	5
<i>Veronica</i>	14	6	21

These instances are sufficient for the purpose of illustrating the proposition contained in this paper, but those who choose to verify it further will find abundant evidence of it in the published accounts of our flora. The New Zealand case, however, is not so striking as that of the Galipagos, as will appear from the following account given by Mr. Darwin. He tells us that in James Island thirty out of the thirty-eight endemic species are peculiar to it, as were twenty-two out of the twenty-six found in Albemarle Island, the same special feature also prevailing in Charles and Chatham Islands. He further illustrates this peculiarity in distribution by the case of *Scalesia*, an arborescent genus of the *Compositæ*, confined to the Archipelago, and containing six species, not one of which was found to grow on any two islands, and he adds, to use his own words "the distribution of the tenants of this Archipelago would not be nearly so wonderful, if, for instance, one island had a mocking-thrush, and a second island some other quite distinct genus; or if the different islands were inhabited, not by representative species of the same genera of plants, but by totally different genera, as does to a certain extent hold good; but it is the circumstance that several of the islands possess their own species of mocking-thrush, finches, and numerous plants, these species having the same general habits, occupying analogous situations, and obviously filling the same place in the natural economy of this Archipelago that fills me with wonder. I must repeat, that neither the nature of the soil, nor the height of land, nor the climate, nor the general character of the associated beings, and therefore their action one on another, can differ much in the different islands, and there seems to be no special

difference in the productions of the windward and leeward groups, the only possible natural division of the Archipelago." In attempting to throw light upon the remarkable difference in the inhabitants of the different islands, he points out that, as the Archipelago is free, to a most remarkable degree, from gales of wind, neither the birds, insects, nor lighter seeds, would be blown from island to island, and that the profound depth of the ocean between them and their apparently (in a geological sense) recent volcanic origin, rendered it highly unlikely that they were ever united, a consideration far more important than any other with respect to the geographical distribution of the inhabitants of the group.

But although certainly less striking than that of the Galipagos, the New Zealand case, when carefully examined, and taken with especial reference to the very narrow strait which separates the two islands, and the probability that they were once united, is one of great peculiarity, masked however by the greater extent of the flora, and of the number of orders represented in proportion to the number of genera and species of each.

Without going more at length into this subject, which might be wearisome, I think I have shown sufficient to excite the attention of naturalists, and to induce such observations as may help us to a clue to the special causes, which, under the law of natural selection, have brought about these remarkable results.

ART. LV.—*On the Brown Trout introduced into Otago.*—Paper No. 2.

By W. ARTHUR, C.E.

[Read before the Otago Institute, 13th November, 1883.]

Plates XLIII. and XLIV.

THE first paper of this series I read to this Institute in 1878,* and the results of my observations continued since then I now propose to lay before you. My chief object in so doing is to record the effects (if any) consequent on the acclimatization of trout (*Salmo fario*) in our waters; on their growth, habits, and structure, as bearing on the theory of the variation of species. Dr. Francis Day, late Inspector-General of Fisheries for India, has made public his investigations on trout in England,—carried out about the same time as my first observations,—and which bear out, to a great extent, the fact that the anatomical distinctions laid down by Dr. Gunther in his catalogue, between some of the species of Salmonidæ, are not altogether to be depended on. Professor Huxley also has recently commenced an examination into the distinguishing marks of the young of the British Salmonidæ,—

* See Trans. N.Z. Inst., vol. xi., art. xxiv.