

ART. XXVII.—Our Migratory Birds.

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IN the Northern Hemisphere the migration of birds in the autumn and spring is so common an occurrence that it has been known from time immemorial, but it is only of late years that the migrations have been followed in detail.

All the migrating-birds of the Northern Hemisphere breed in their most northern district and fly south before the cold of winter comes on. The land- and water-birds do not fly far, only into warmer or subtropical regions; but the shore-birds, such as the curlews, plovers, sandpipers—known as the *Limnicolæ*—wander much further, and travel down the shores of the Pacific and Atlantic Oceans, often crossing the equator into the Southern Hemisphere before halting. One such stream leaves eastern Siberia and, passing through China and Japan—where it picks up the southern snipe and the red-capped dotterel—continues to fly through the Malayan Archipelago into Australia and Tasmania, those birds which do not die on the way returning annually to their breeding-ground in Siberia and Kamtchatka. This statement may seem at first startling, or even incredible, but we must remember that a bird could easily travel from Kamtchatka to Tasmania in a month; so that, after the breeding-season was over in the Northern Hemisphere, there would be ample time for globe-trotting if the bird felt so inclined.

In the Southern Hemisphere a corresponding migration occurs: swifts, swallows, cuckoos, and quail migrate in Australia and Tasmania; while in South America swallows, humming-birds, and several others, including some shore-birds, after breeding in Patagonia, travel annually to Paraguay and Brazil. However, as the area of land in the temperate and cold zones in the Southern Hemisphere is small, these migrations are insignificant when compared with those of the Northern Hemisphere, and have attracted but little attention.

Stragglers from these migrating flocks often lose their way and turn up in unexpected places, while non-migratory birds sometimes get blown out to sea by gales of wind and become involuntary stragglers.

In addition to these there are some birds which may be called wanderers, or occasional wanderers—that is, birds

which at irregular intervals become restless and trek* in numbers to some other district, which rarely lies north or south of the land which they have left. These excursions are well known in the Northern Hemisphere, and even in New Zealand we occasionally see wandering flocks of parrakeets. These stragglers and wanderers must be carefully distinguished from the true migrants which voluntarily perform two journeys a year with great punctuality.

The first notice that New Zealand participated in these southerly migrations was by the Rev. W. Colenso, who stated, in 1842,† that our shining cuckoo (*Chalcococcyx lucidus*) was migratory. Now, at the time this statement was made the furthest distance across the sea which migratory birds were known to fly was from Norway to Scotland and across the eastern Mediterranean from Egypt to the Greek islands, in each case a distance of about three hundred miles, which necessitates some eleven hours of continuous flying. When, therefore, it was said that the shining cuckoo, or bronze cuckoo, of New Zealand traversed more than three times that distance of ocean it is no wonder that the statement was received with incredulity, and it was thought that colonial naturalists had made a mistake. This appeared to be the more probable because until quite lately New Zealand was thought to be an oceanic island—that is, an island which had never been connected with the mainland—and oceanic islands have no migratory birds. The only exception to this rule is, perhaps, Bermuda, for, according to Dr. A. R. Wallace, this island has “several regular migrants.”‡ But he does not distinguish clearly between migrants and stragglers, and appears to think that all these birds have been blown out to sea, and have not come voluntarily, in which case they cannot be true migrants.

But, however this may be, Dr. Wallace had somewhat changed his opinion about New Zealand in 1880, when he published his “Island Life,” for in that book he calls it an “anomalous island,” without explaining his meaning of the term, and says nothing about our migratory birds.

In his “Geographical Distribution of Animals,” published in 1876, Dr. Wallace says, “Resident ornithologists believe that *Zosterops cerulescens* has found its way to New Zealand within the last few years, and that the two cuckoos now migrate annually, the one from Australia, the other from some part of Polynesia, distances of more than a thousand miles. These facts seem, however, to have been accepted on

*A useful word, meaning a voluntary movement without any intention of returning.

† “Tasmanian Journal,” vol. ii., p. 227.

‡ “Island Life,” p. 258.

insufficient evidence, and to be in themselves extremely improbable. It is observed that the cuckoos appear annually in certain districts and again disappear, but their course does not seem to have been traced; still less have they been actually seen arriving or departing across the ocean. In a country which has still such wide tracts of unsettled land it is very possible that the birds in question may only move from one part of the islands to another.* As this opinion has never been recalled, or even modified, it seems desirable to set out more fully than has yet been done the evidence for the regular migration of birds to and from New Zealand, as it is a question of considerable importance.

But first let me enumerate some cases of stragglers which have managed to cross the Tasman Sea and reach New Zealand. Of the shore-birds, or waders, we have the red-capped dotterel (*A. ruficapilla*), the Australian curlew (*Numenius cyanopus*), the little whimbrel (*Mesoscolopax minutus*), the grey sandpiper (*Heteractitis brevipes*), and the greenshank (*Glottis nebularius*), a specimen of which has been for many years in the Otago Museum.† There is also the Australian snipe (*Gallinago australis*) and the grey phalarope (*Crymophilus fulicarius*). Of swimming-birds we have only two reported cases of the tree-duck (*Dendrocygna eytoni*) and one of the Australian darter (*Plotus novæ-hollandiæ*).

Of truly land-birds there are the Australian kestrel (*C. cenchroides*), the yellow wattle-bird (*Acanthocera carunculata*), the tree-martin (*Petrochelidon nigricans*), the Australian roller (*Eurystomus pacificus*), and the white-backed swift (*Micropus pacificus*). Possibly there may be a few others, but their cases are not fully proved.

That stragglers of swimming-birds are so few is not surprising, for they can alight on the sea, and, after resting, can rise again and regain the land from which they were blown. Such is not the case with birds whose feet are not webbed; they must fly on or be drowned. Possibly some of the perching-birds may rest for a time on steamers or sailing-vessels, but this would not be possible for the wading-birds. The kestrel and the swift have been seen only once; but the tree-martin and the roller have been shot several times in New Zealand.

None of these birds have been seen to arrive across the ocean, and we know them to be stragglers only because they are very rare with us but common in Australia. None of them have been known to breed here, and they are often single birds; from which it follows that they have not been

* "Geographical Distribution of Animals," vol. i., p. 452.

† It was bought by me in the market in 1874.

long in New Zealand, perhaps less than a year before they were seen.

The case of the white-eye (*Zosterops carulescens*), alluded to by Mr. Wallace, is rather different. The date of its first occurrence in Otago is doubtful, but in 1856 it appeared on both sides of Cook Strait in considerable numbers. Before then it was unknown, both to the Europeans and the Maoris, the latter calling it "tau hau," which means "a stranger." In 1860-61 it had spread all over the South Island and the southern parts of the North Island, but it did not reach Auckland until 1865. It has also spread to the Chatham Islands, Snares, Auckland Islands, and Campbell Island. Evidently it is a new arrival, for the restless habits of the bird forbid us from thinking that it had remained for many years in Otago without spreading northwards. I should call the white-eye a wanderer, and not a straggler, for, unlike the others, it crossed the ocean in sufficiently large numbers to establish itself both in New Zealand and afterwards in the outlying islands. Several others of our birds—especially some of the herons, rails, and ducks—are also found in Australia; and these, we must assume, were at one time wanderers like the white-eye. They also, at different times, crossed over the sea and became naturalised; but long before the settlement of the country by Europeans.

These facts show us that the passage across the Tasman Sea is possible, even for some small land-birds. The distance as the crow flies is about a thousand miles, and it would take a bird twenty-four to thirty-six hours to accomplish the distance, flying at its ordinary speed.

We have next to see what is the evidence for thinking that some of our birds are regular migrants; and I will take first the shore-birds. Of the living stream, already mentioned, which passes every year through the Malay Archipelago to Australia, a small branch, consisting of three or four species, leaves New Guinea for New Zealand. Of these the godwit (*Limosa nova-zealandiæ*) is the best-known case. These birds breed in eastern Siberia from June to the end of July, and then leave. In September, and again in April, they are found in China, some of them passing the winter in the Island of Formosa. Others arrive in August or September in Australia, Fiji, New Caledonia, and the New Hebrides from the north, and depart again northwards early in May. Stragglers go to Samoa and Tonga. In New Zealand many birds arrive during October, November, and December, spread as far south as Stewart Island, and leave at the end of March or the beginning of April. Some also visit the Chatham Islands; but they are not known to breed either in New Zealand or in Australia. In New Zealand they arrive

in small parties, which evade observation, but they leave the North Cape district in large flocks, which have several times been seen to depart. This evidence of migration is sufficiently strong, but in addition we have that of the change of plumage. The godwit is one of those birds which have different plumages in summer and in winter. In the Siberian summer, during breeding-time, the birds have their summer plumage; but in New Zealand they are nearly always in their winter plumage, although it is summer with us. A few exceptions in summer plumage have been noticed, and it is probable that these are birds which remained behind when the great April exodus took place.

The turnstone (*Arenaria interpres*) also breeds in the Northern Hemisphere, but not so far north as the godwit, and it is found in its breeding-dress in India and Ceylon. In early autumn it leaves its more northern breeding-grounds, and some pass through the Malay Archipelago and New Guinea to Australia and Tasmania. In New Zealand it arrives in November and leaves in March or April, almost all the birds being in winter plumage. But, as in the last case, a few remain and take on their summer plumage, although it has never been known to breed here. Stragglers occasionally spread from Fiji through eastern Polynesia, but there is no regular migration eastward of Fiji. The evidence in this case is not so good as in the last, because the birds are not so numerous, and they have never been seen to leave New Zealand.

The knot (*Tringa canutus*) is another northern bird which, after breeding in Siberia, travels southwards across the equator. Its summer plumage is very different from its winter plumage, which it assumes in September and retains until May. In Canterbury, New Zealand, it appears in November and leaves in about April, thus remaining all through our summer. Generally the birds are in their winter plumage, but there are two specimens in the Canterbury Museum in summer plumage. One of these was shot on the 2nd April and the other in November, 1899, the latter being in company with others in which the summer plumage is just beginning to show. They were shot at Lake Ellesmere. Mr. John Gould also mentions a bird from Queensland, shot on the 2nd September, 1861, as changing into summer plumage. It seems, therefore, that some birds have changed the seasons for moulting and put on their breeding-dress in our summer, and I think it probable that these birds breed in New Zealand, although they are not known to remain here through the winter.

The brown-eared sandpiper (*Heteropygia acuminata*) also breeds in Siberia and Alaska, and, from the former country,

passes through Japan and China to the Malay Archipelago, where it spreads into Australia, New Caledonia, and New Zealand. In Australia it is distinctly migratory, while in Tonga it is only a straggler, as it does not visit the islands every year. In New Zealand it is doubtful under which heading it should be placed, for our information about its habits is too scanty, and we do not at present know whether it is or is not an annual visitor to us.

The spotted plover (*Charadrius dominicus*)* is another Siberian bird which migrates regularly to Australia, has spread over Polynesia, and, according to Dr. Graffe, has become a resident at Tongatabu. In the Northern Hemisphere it takes on its summer plumage in April, and changes into the winter plumage in August or September. It is a common bird in New Caledonia and Fiji, and Mr. E. L. Layard says that in the former island he found, on the 20th April, 1877, a female followed by a couple of chicks a few days old. But he also says the old birds attain their full breeding-plumage in May, which is the same time as in the Northern Hemisphere. It would seem from this that the breeding of the bird in the island was what might be called "accidental," and, as the birds have not been long enough to change the time of breeding or of moulting, it is probable that all are migrants, but that some delay moving northwards until they have attained the breeding-plumage.

Something the same probably happens in Australia, as Mr. Gould says that the uniform black under-surface, which is the complete breeding-plumage, is seldom seen there. And all the specimens in the British Museum from the Malay Archipelago, Australia, and Polynesia are in the winter plumage.

In New Zealand the bird is rare, having been only recorded a few times in the North Island, while for the first time in history it made its appearance in the South Island last summer. Mr. W. W. Smith says that he has seen a good many in the Ashburton River bed, the first he had noticed for eighteen years. There is a specimen in the Canterbury Museum which was shot at Lake Ellesmere in November, 1900; and I saw another specimen which had been shot at the Bluff, in Southland. Two specimens shot near Auckland early in December, 1880, were in winter plumage, but showing signs of being about to put on their summer dress.† The specimen in the Canterbury Museum is in winter plumage, as also is the one shot at the Bluff; and Mr. Smith says that the plumage of the birds in the Ashburton

* This is called *C. fulvus* by many authors.

† Trans. N.Z. Inst., vol. xiv., p. 265.

River bed varied but slightly. But Sir W. Buller has received a specimen from Mr. C. H. Robson which had partially assumed the summer plumage. Mr. Robson also found a pair breeding at Portland Island on the 9th January, and, as he says that the birds undergo little or no change of plumage from winter to summer* (which is a mistake), I presume that the birds he saw were also in the winter or non-breeding plumage. This is very remarkable, for with introduced European birds, such as the starling, linnet, and redpole, the change of plumage goes with the breeding-season, as it did in Europe; both, on coming into the Southern Hemisphere, have changed together.

We cannot, therefore, think that the birds breeding at Portland Island were true residents, for if they had been long in New Zealand it is probable that they would have acquired their summer plumage in the breeding-season.

This concludes the list of migratory shore-birds. It is a very short one in comparison with that of Australia; but if only one species migrated regularly to an island so far away from the mainland as New Zealand it would still be very remarkable.

I will now proceed to examine the evidence for the migration of our two cuckoos.

The shining cuckoo, or bronze cuckoo (*Chalcococcyx lucidus*), appears in the northern parts of New Zealand regularly in the latter half of September, and early in October it is found in Wellington and in the South Island. It breeds in New Zealand, and during the first and second weeks in January all the old birds leave the southern portions of the country, but they do not leave the north until the end of January, or perhaps later. Some, at least, of the young birds leave considerably later than their parents, as they have been shot in the South Island in April. The times of appearance and departure of the old birds are wonderfully regular in both Islands. In the Chatham Islands the birds come and go at about the same dates as in New Zealand. Here we have distinct evidence that the birds travel from the north to the south, and then back again to the north. They have not been seen to leave the Islands, but it is impossible that they could remain during the winter and yet escape the eyes and snares of the Maoris, for there are no "wide tracts of unsettled land" for them to go to, as Mr. Wallace suggests, either in New Zealand or in the Chatham Islands. Also, although the birds have not been seen to leave, Mr. T. H. Potts told me that he once saw the arrival of a shining cuckoo at the Chatham Islands. It was so tired when it

* Trans. N.Z. Inst., vol. xvi., p. 308.

landed that it allowed him to pick it up in his hands, although under ordinary circumstances it is a very shy bird. Also, Dr. E. P. Ramsay has in his collection a specimen which was taken at sea between New Zealand and Lord Howe Island.

Outside of New Zealand we have little information. The species is found in Norfolk Island, where it also breeds, but elsewhere it has only been obtained at Cape York, in North Queensland, where it is very rare; and it is probable that its winter home is in New Guinea.

Mr. E. L. Layard said that it occurred in New Caledonia, but according to the authorities of the British Museum his specimens belong to the allied species *C. plagosus*, which migrates from north to south in Australia, but does not come to New Zealand.

The long-tailed cuckoo (*Urodynamis taitensis*) arrives in New Zealand at the end of October or beginning of November, and leaves in January or February, but its movements are not so easily traced as those of the shining cuckoo, for it is generally silent in the day-time. As in the last case, the young birds linger longer than their parents, and are occasionally seen as late as the first week in April. These birds retain their young spotted plumage much longer than the young of the shining cuckoo, but no specimen showing the change into that of the adult has as yet been shot in New Zealand, and neither old nor young have been recorded from the Chatham Islands.

Mr. E. L. Layard says that this bird is very rare in New Caledonia. He only obtained four specimens, all of which were purchased in the streets. The first was on the 23rd March, 1879, the second on 15th March, 1881, and the other two on 15th April, 1881.* As these birds were in their immature plumage, he thinks that they were born in the island.

Through the kindness of His Excellency Sir G. O'Brien, Governor of Fiji, I have received from Mr. C. W. Woodford, Resident Commissioner of the British Solomon Islands, a letter in which he says that he obtained immature males of the long-tailed cuckoo in April and May, 1887, and that he has seen the bird several times in the Solomon Islands during the last three years, the last time being in May, 1900. He is of opinion that the bird is a migrant, but cannot say so positively. He also, like Mr. Layard, thinks that the birds must have been born on the islands in which they were found. But the hypothesis that the young birds leave New Zealand early in March, and, passing through New Caledonia, reach the Solomon Islands early in April, would fit the facts very well.

* *Ibis*, 1882, p. 523.

The evidence is therefore strong that both our cuckoos leave New Zealand in the autumn and travel north-west to New Guinea and the Solomon Islands, but we still want evidence of the spring migration to the south.

We have also migrations on a minor scale confined to New Zealand, but very little notice has been taken of them up to the present. Both the wry-bill plover (*Anaryhynchus frontalis*) and the little sand plover (*Thinornis novæ-zealandiæ*) breed in the South Island and pass the winter in the North Island; while the pied stilt (*Himantopus picatus*) seems to perform some sort of migration, for it is found near Napier in the summer, but not in the winter. However, it breeds in both Islands, and its movements have not yet been made out.

The banded dotterel (*Ochthodromus bicinctus*) has been suspected of migrating from New Zealand to Tasmania in the autumn, for it is common in Tasmania in the winter and leaves in the spring. The species occurs all through eastern Australia, as well as in Lord Howe and Norfolk Islands. In New Zealand it breeds in August and September, and is equally abundant in the South Island all the year round, showing no signs of migrating, and, as Mr. Handly reports that it is also common in Marlborough throughout the year,* I think that it may be safely affirmed that it does not pass regularly to and fro between Tasmania and New Zealand.

There are several other birds which do not migrate in New Zealand, although they belong to genera, or even to species, which migrate in other parts of the world. The pectoral rail (*Hypotaenidia philippensis*) does not migrate with us, although it does so in Australia, being a summer visitor to New South Wales and South Australia, arriving there in August and retiring northwards in February. The New Zealand snipe (*Gallinago aucklandica*) and the brown dotterel (*Ochthodromus obscurus*) do not migrate, and it was so formerly with our quail (*Coturnix novæ-zealandiæ*), although all these belong to genera which migrate in other parts of the world. In the cases of the New Zealand quail and snipe, their powers of flight were so much reduced that they were incapable of migration. But it is different with the pectoral rail and grey dotterel. These fly well, but have lost the migratory instinct.

Now, what is this migratory instinct? And what are the reasons which induce, or have induced, birds to migrate? The principal cause of the migration of birds in the Northern Hemisphere is, obviously, the food-supply, which for insect-eating birds differs much in the summer and winter. In the

* Trans. N.Z. Inst., vol. xxviii., p. 363.

winter insects hibernate, and the birds have to go to warmer latitudes. But when the spring comes on the insects in high latitudes come out, and the birds go back again to feed upon them. As this is the breeding-season they naturally breed in high latitudes. There are, however, several migratory birds in the tropics which never go to cold climates, but regularly change their quarters twice a year; and most of these migrations may be due to the fruits of different trees ripening at different times. In North America there are some birds which do not return by the same route which they follow when flying south, and these deflections also seem to be due to different fruits, on which they feed, becoming ripe at different seasons of the year in different places.

But change in the food-supply is not an adequate explanation of all cases of migration. For example, swifts migrate in Central America, while swallows remain all through the year. Ducks certainly do not leave their winter quarters for want of food; and our godwit would find just as much food on the shores in winter as it does in summer. In New Guinea three or four species of bronze cuckoo are residents, and, if they can find food all the year round, so also could the migratory species which go to Tasmania and New Zealand; and certainly insects in New Zealand, even in summer, are much less plentiful than they are in New Guinea or Australia. Evidently our two migratory cuckoos are not attracted here by the abundance of insect life. It is probable that these migrations may be due to the habit of resorting each year to the same place to breed, a habit which is common to many birds, whether migratory or not. Probably they like the site of their old nest, and have grown accustomed to it; it has protected their young in former years, and they have found sufficient food in the neighbourhood. They do not like new experiments, and year after year they return to build their nests in the same places that they did before. Instances are known of this taking place although the surroundings of the nest had been greatly altered by cultivation; thus showing that the return to the ancient breeding-place had become an instinct. No doubt this love of home must be taken into account, as well as the food-supply. It is this that explains the two cuckoos coming to New Zealand; while in the case of the *Limnicolæ* we must suppose that they return annually to the feeding-ground of their forefathers, and that this also has become an instinct. How strong this migrating instinct is we can judge from the fact that swallows not unfrequently leave their late broods of young ones to perish in their nests while they fly south.

The shore-birds retain the same specific characters, no matter where they wander, because all breed together in the

north. But the case of the bronze cuckoos is different. These mix together in New Guinea in the winter, but separate to breed, and have, through this, become differentiated into different species. This is another illustration of the effects of isolation in forming species by preserving variations, for we cannot suppose that the slight differences in colour between the species are special adaptations to their surroundings; and they cannot be recognition marks, as the birds separate long before they begin to pair.

As a rule the migratory birds in the Northern Hemisphere follow the land, either the shore-line or the interior, according to their habits. But in their movements some have to cross the Mediterranean Sea, which blocks the way. This they do in three streams—one crosses the Straits of Gibraltar, another passes through Sicily and Malta to Tripoli, and the third goes by the islands of the Ægean Sea to Egypt. There are also other cases of trans-oceanic migrations. Skylarks, field-fares, and redwings pass backwards and forwards between Norway and Britain. Other birds cross the North Sea; others the English Channel; and, of course, many shore-birds must pass from island to island in the Malay Archipelago. But the boldest flight of all is to New Zealand and the Chatham Islands, probably from New Caledonia, a distance of a thousand miles or more. Why should they do this? How do they know that they will find land after so long and weary a flight? They are not blown out to sea, but go voluntarily, and they must know that there is land ahead of them. How did they acquire this knowledge?

Stragglers which have lost their way from a migrating flock and gone to some other country do not start new lines of migration. Birds never fly to sea at random and, having discovered new land, come back and tell their comrades of it. If this were the case we should find that oceanic islands, like the Azores and Madeira, were visited by migratory birds. These wanderers have no tradition behind them of the new route, and they cannot travel it again. Stragglers either perish or, if sufficiently numerous, establish themselves in the new country as residents.

We have examples of this in the swallow, which is resident in Tonga, and the spotted plover, which has established itself in New Caledonia and in Tonga. In New Zealand, also, the spotted plover has been known to breed, and, if undisturbed, might perhaps establish itself with us. *Heteractitis incanvus* migrates annually from Alaska to Mexico, and has sent stragglers to Hawaii and southern Polynesia, and has become a resident in Fiji.

In all these cases the stragglers do not return. They either die out or establish themselves in the new locality.

The reason is obvious. As these islands have never formed part of a continent they never could have been either the breeding-places or the feeding-ground of migratory birds. No birds visit them instinctively, and if any bird happens to wander to one of them it has no hereditary instinct directing it how to return. This is why oceanic islands have no migratory birds.

The Polynesian whimbrel (*Numenius tahitiensis*) must breed in some of the Polynesian islands, for it is not known elsewhere, except as a straggler in British North-west America. It is closely related to the American whimbrel, and no doubt it is descended from some stragglers of that species which, long ago, found their way to the Hawaiian islands.

The only possible explanation of oversea migration seems to be that the birds are following old land-lines. The shore-birds follow the old shore-line; the land-birds follow the old land. Migration must have commenced when the two lands were contiguous, or nearly so, so that in no part of the course was an island so far off as to be invisible from those next to it. Gradually the land sank, but the force of habit kept up the migration. During the life of each bird the changes would be too small to be perceptible, and it would only be after many generations that the birds would find themselves flying over a trackless ocean. That migration is really an instinct we know from the fact that in the Northern Hemisphere the birds start on their flight to the south before there is any real necessity for it. The young cuckoos, which, of course, have never seen their parents, do not leave until two months after the old ones have gone, and, as they have none to lead them, their southern flight must be due to inherited memory.

But how do they find their way? What is the sense which directs them during their flight? This is a question which it is at present impossible to answer. Nevertheless, it is a matter of fact that they do find their way. The faculty, whatever it may be, is not an uncommon one in the animal kingdom. We see it exercised to a small extent by bees and ants and many other insects. Sea-snakes and turtles return to the same place to breed, although during their absence from the land they must have swum many miles in many different directions. Penguins, petrels, and other sea-birds have the same faculty; as also have seals, several of which perform long oceanic migrations. It is also well known that some domesticated animals can return to their homes after having been taken long distances. And savages, after following their quarry for several hours, or even for days, can always find their way home again through dense forest.

But this faculty is not unerring, even with migratory birds, as is shown by the number of stragglers which have lost their way. Most of these no doubt perish at sea, for they have often been known to take refuge on ships; and perhaps none regain their route after having once lost it.

There still remains one more question to ask. Why should some of the shore-birds and cuckoos migrate to us and not swallows, which are certainly quite as capable of undertaking the journey? Possibly the geological history of birds may help us to answer this question.

Remains of several kinds of *Limnicolæ*—three sandpipers and two rails—have been described from the Upper Cretaceous rocks of North America, so that they are among the oldest of carinate birds. In the gypsum of Montmartre, in France—which belongs to the Oligocene period—a godwit (*Limosa*) has been found, together with a few land-birds, one of which is a cuckoo. The first known swift (*Cypselus*) is from the Miocene, and we do not find swallows or martins (*Hirundo*) until the Pleistocene. Now, is this association of our two principal migratory birds—the godwit and the cuckoo—in the Montmartre gypsum, and the absence of the remains of swifts and swallows from all Oligocene rocks, merely a coincidence, or are the facts connected? Is it because swifts and swallows did not live with cuckoos and godwits in Oligocene times that they do not now accompany them in their migrations to New Zealand?

No doubt negative palæontological evidence must be used with great caution, but it seems to me probable that the godwit and cuckoo migrated to New Zealand at a time when no swallows were in existence, and that the original land bridge had been completely broken down before the first of the swallows arrived in Australia from Asia. I therefore suppose that migration to and from New Zealand commenced in the Eocene period, when the land stretched away to the north-west nearly to New Guinea—a time when, although New Zealand was not actually joined to the mainland, it must have approached pretty close to it.

In conclusion, I may perhaps be able to make some useful and practical deduction from this slight investigation. Can we introduce swallows and other insect-eating migratory birds into New Zealand with success?

It will be evident from what has been said that the naturalisation in New Zealand of migratory birds is impossible unless they abandon their migrating habits, for we cannot give them a new instinct and teach them how to cross the sea. Small flocks of the tree-martin of Australia have been seen several times in New Zealand, and no doubt they also often came before there were any settlers to record their

appearance; yet the species has not become naturalised, nor has it established a regular migration, and, we may feel sure, will never do so. They have to leave the Islands in the winter for want of food, and they never return. However much we may try to introduce swallows, we shall never succeed until we can induce flies to remain out all the winter. It is the same with all insect-eating birds—like nightingales, which cannot support themselves in the winter in the absence of insect life. There are non-migrating insect-eating birds, like the hedge-sparrow and the robin, which are able to eke out an existence on seeds when no insects are about, and of these the hedge-sparrow has succeeded with us. But, in my opinion, it is idle to attempt to introduce into New Zealand any bird that has inherited strong migratory instincts. About twenty-eight years ago some thirty lapwings or peewits (*Vanellus cristatus*) were turned out at Auckland, and they were never seen again. They could hardly have died for want of food, for that is abundant; they must have flown out to sea, making, as they thought, for their old breeding-grounds in England, and all, no doubt, perished. So, I am afraid, it always will be, and attempts to introduce migratory birds into New Zealand will always end in failure.
