The Distribution and Habits of Madagascar Birds
Summary of the Field Notes of the Mission Zoologique Franco-Anglo-Américaine à Madagascar

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Article V.—THE DISTRIBUTION AND HABITS OF MADAGASCAR BIRDS

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PART I

PREFACE

When my friends, Doctors L. C. Sanford and P. R. Lowe, had persuaded me to take the leadership of a coöperative expedition to Madagascar, my chief anxiety was how work in the field would be carried on after my departure from the island. Owing to other arrangements made long before for the exploration of Indo-China, obliging me to reach that country in the autumn of 1929, I would be unable to devote more than six months to active work in Madagascar. Our means, I hoped, would enable the survey to continue some two years.

As soon as I appreciated Mr. A. L. Rand's unusual capacities, however, my worries were ended. Despite his youth, and the fact that this was his first collecting trip abroad, I was delighted to find in him a clever and already experienced naturalist, as well as a keen and able collector. When I left Madagascar in August, 1929, I knew that our interests were in the safest possible hands. Events proved that I was not mistaken; in two years' time Rand gathered a wonderful amount of material and observations. The other members of the expedition, of course, Messrs. R. Archbold, R. Decary, P. Du Mont, J. C. Greenway, and W. P. Lowe, all did their best and proved most efficient. This I am happy to acknowledge, but the fact remains that Rand is responsible for the greater measure of the success attained. I take this opportunity to express my deepest appreciation of his uncommon activity, skill, and courage, through which the natural history museums of London, New York, and Paris have so greatly benefited.

As Rand himself writes in his introduction, the first stage in the study of the birds of a region is the finding and naming of the forms that occur there. I confined myself to the systematic study of the collection, some zoögeographic sketches, and an account of my own itineraries. Having lived and worked in Madagascar for over two years, Mr. Rand was more than entitled to make use of the data that he had accumulated and to publish himself what he had learned of the habits of the birds and their distribution. Judging from the present work, I am sure no one else could have made better use of the information. Rand gives here an admirable complement to my own list, purposely short and dry, which was but a *mise au point* of Milne-Edwards' and Grandidier's 'Oiseaux de Madagascar.' I am pleased to say that I fully endorse Rand's statements of the distribution, life zones, and affinities of this curious avifauna.

Before the fulfillment of our Mission, very little was known of the detailed distribution and habits of Madagascar birds, or of their geographic variations. These questions have been largely settled or their solution much advanced, thanks mainly to the specimens and notes gathered by Rand. What now remains to be learned can be discovered only by resident naturalists. They will find in the present work a firm basis and an inspiration for carrying on further studies.

J. DELACOUR

INTRODUCTION

The first stage in the study of the birds of a region is the finding and naming of the forms that occur there. The next stage is the study of the distribution of the birds within the region and the correlation of their habits with this distribution.

The avifauna of Madagascar was fairly well known before our expedition went into the field, but many species were very poorly represented in collections. The peculiarity of many of these forms, some of which belong to genera and even families endemic to Madagascar, made specimens very desirable. Alcoholic material was especially needed so that the systematic relationships of these unique groups could be worked out.

The object of the expedition was to secure a collection of birds and mammals as complete as possible, and these were taken at many localities in order to give the range of the species and to show the extent of the geographical variations.

The expedition was in the field about two years, from April, 1929, to May, 1931, and most of the areas important from a distributional point of view were visited. A series of skins was purchased from Mr. Herschell-Chauvin of Tananarive to augment our series from the eastern forest. The collections totaled about twelve thousand specimens of birds in addition to other material, such as mammals, reptiles, amphibians, and fishes.

M. J. Delacour[1] has published the results of the systematic part of the work, and from the study of the material it was found necessary to describe thirteen new forms, including ten subspecies, two species, and one genus.

In addition to the actual collecting of specimens, notes were kept on the types of country visited, habitats, and the relationships of the

[1] 1932, L'Oiseau et la Revue Française d'Ornithologie, pp. 1–96.

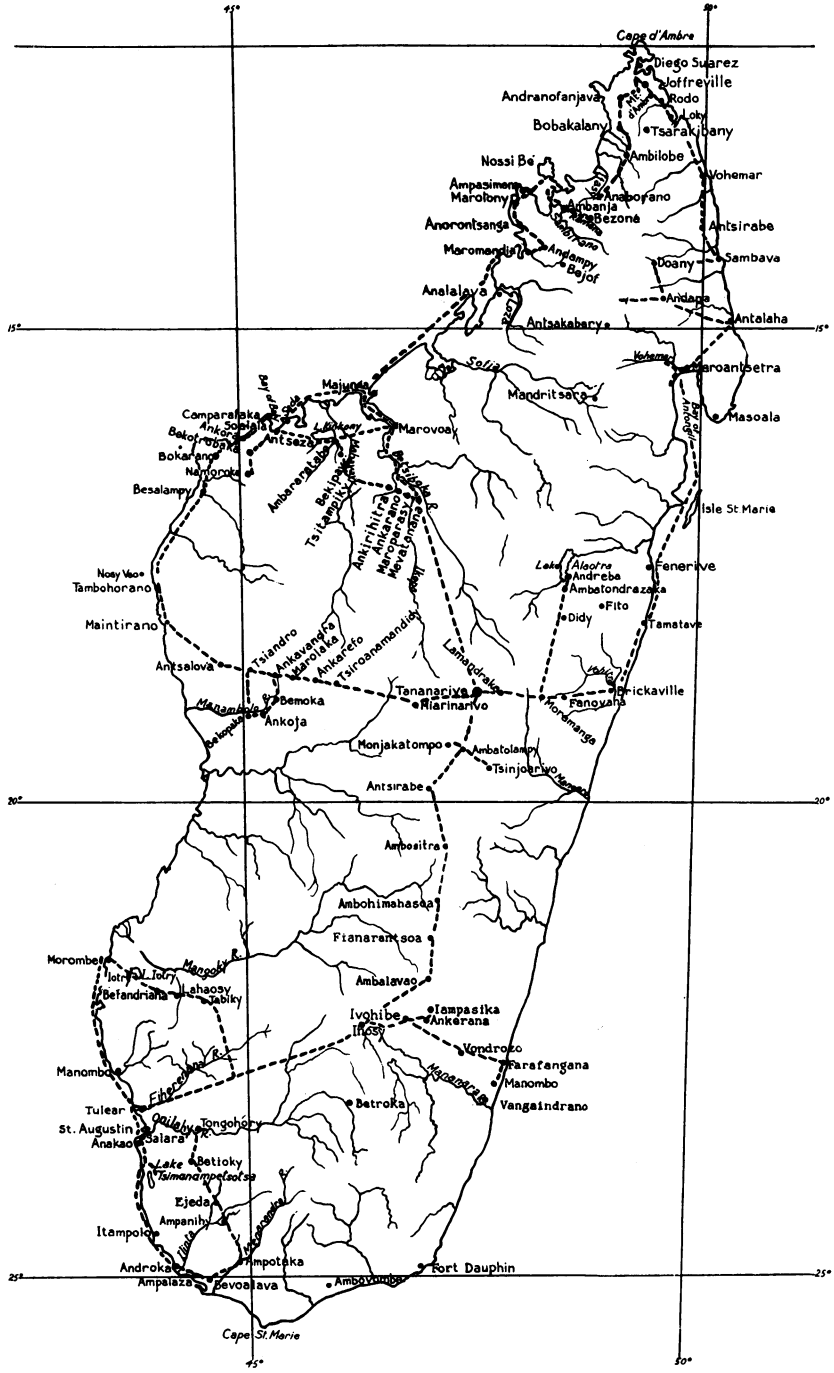

Fig. 1. Map of Madagascar showing routes of the various members of the Mission and the principal collecting stations.

birds to these habitats, and as far as possible observations were made on the habits of the birds themselves. These data are included in the present paper, the first part of which is devoted to a consideration of the correlation between the habits and habitats, the distribution of the birds, a brief summary of the affinities of the avifauna, and a discussion of the migration and the breeding season in Madagascar; and the second an account of the distribution and habits of the species, based on our observations.

I hope that the present paper will help in an understanding of the distribution of bird life in Madagascar. Further work will test the correctness of the areas of distribution that I have outlined. Much work yet remains to be done in many areas that the expedition did not visit. Little work was done in the northwest, particularly at the higher altitudes; the western edge of the central highlands was scarcely touched; a large area in the south was not visited; and the few months spent in the eastern humid forest gave little but an indication of the characteristic bird life. Probably few new forms remain to be discovered, but much is still to be done in defining the limits of distribution of many of the birds.

The study of the life histories of these Madagascar birds, especially those belonging to genera and families peculiar to the island of Madagascar, and concerning which practically nothing is known, is a fertile field of study that as yet has hardly been touched and awaits a resident naturalist.

The account of the formation and organization of the expedition has been given by Delacour[1] but will be repeated briefly here.

The Mission Zoologique Franco-Anglo-Américaine à Madagascar, as it was officially called, was originated by M. J. Delacour, representing the Muséum Nationale d'Histoire Naturelle; Dr. Percy R. Lowe, representing the British Museum of Natural History; and Dr. L. C. Sanford, representing The American Museum of Natural History. Each museum contributed toward the Mission and shared equally in the collection.

Mr. J. F. Archbold generously donated the funds for the share of the American Museum, and Mr. A. S. Vernay those for the British Museum. The Muséum Nationale d'Histoire Naturelle arranged for the customs and railway transport and M. Delacour devoted his time to the actual arranging of the Mission and spent some months in the

[1] 1930, L'Oiseau et la Revue Française d'Ornithologie, pp. 65–68.

field. Later, when funds became exhausted, both Mrs. J. F. Archbold and Mr. Richard Archbold contributed to its support.

The personnel of the party changed considerably during the two years it was in the field. Originally it consisted of M. Delacour, representing the French interests, Mr. W. P. Lowe from the British Museum, Messrs. Richard Archbold, J. C. Greenway, Jr., and myself from the American Museum. (My appointment to the personnel of the Mission was made but two weeks before I sailed from New York, and was due to the death of Mr. C. G. Harrold, one of the original members of the party.) Mr. J. C. White, paleontologist, and Mr. C. S. Webb, a collector of live animals, joined us a short time after our arrival in Madagascar. Messrs. Delacour, Lowe, and Greenway left Madagascar in August, 1929, and M. R. Decary, who arrived some months later, replaced M. Delacour as director of the Mission. Mr. P. A. Du Mont from the American Museum joined the party in January, 1930, and Mr. Archbold was recalled to America in September of that year because of the death of his father.

ACKNOWLEDGMENTS

On behalf of the Mission Zoologique Franco-Anglo-Américaine, I wish to acknowledge the courtesies extended to it by the Madagascar government and its representatives throughout the island, especially for their help in securing porters for us, a service indispensable to us in carrying on our work.

We are also indebted to the British consul, Mr. J. Smith, the American consul, Mr. J. Richardson of Tananarive, and the British vice consul, Mr. A. Rowntree of Majunga, for the favors that they extended to us while we were in the country.

To the late Mr. J. F. Archbold, and to Mr. A. S. Vernay, Mrs. J. F. Archbold, and Mr. Richard Archbold, who made the work possible by their generous support, we are especially indebted.

While in Madagascar we received the assistance and advice of a great number of residents to whom I wish to express my appreciation for their kindness. M. P. Guenette of Tamatave acted as our forwarding agent and allowed us to use his warehouse for storing our supplies. M. J. Tinayre of Maroantsetra placed a motor boat at our disposal and his knowledge of the country was of the greatest assistance to us in collecting in that region. M. A. Mortages of Diego Suarez collected a number of

birds for us and gave us invaluable data on the northwest part of the island.

The men with whom I was associated in the field were responsible in large measure for the successful outcome of the Mission. It is with pleasure that I recall the time spent in the field with them, and I wish here to express my appreciation for their assistance and inspiration. M. J. Delacour, Director of the Mission, permitted me to use this material and has encouraged me in the writing of this report. Mr. Willoughby Lowe, a veteran collector in tropical countries, was an ideal field companion and a real friend. Mr. Richard Archbold, although responsible for the mammal collection, also contributed much to the ornithological results of the Mission. His enthusiasm and energy were inspiring to those associated with him in the field. Mr. Greenway was with us less than four months but during that time proved himself an agreeable and helpful companion. Mr. P. A. Du Mont, a keen bird student, who joined the expedition during the latter half of our stay in Madagascar, proved a valuable addition to the party. Mr. R. Decary ably acted as director of the Mission after the departure of M. Delacour.

In the preparation of this paper, I am greatly indebted to Dr. J. P. Chapin for assistance and advice both before I went to Madagascar and after my return. Mr. Richard Archbold has generously helped to defray the expense of several trips to New York and has aided me in the preparation of the maps necessary in connection with this work. To Dr. A. A. Allen I am indebted for criticism and advice and for a critical reading of the manuscript. To my wife, Rheua Medden Rand, I am indebted for assistance in preparation of the manuscript.

A REVIEW OF MADAGASCAR ORNITHOLOGY

The classic on Madagascar birds is of course Milne-Edwards and Grandidier's great work, 'Histoire Physique, Naturelle, et Politique de Madagascar,' in which four volumes are devoted to birds. A complete synonomy is given, and Delacour in his report in L'Oiseau et R. F. O., 1932, pages 86 to 96, has given a bibliography covering the period since then. The following is a brief note of the principal collectors and reports of Madagascar birds.

The first list of Madagascar birds which we have is that given by Flacourt in his 'Histoire de la Grande Île Madagascar,' published in Paris in 1658. Le Sieur de Flacourt went to Madagascar in 1648 as Commandant of the Royal Troops and Director General of the Com-

pagnie Françoise de l'Orient. His headquarters were at Fort Dauphin and his activities were confined to the southeastern part of Madagascar. In Chapter XL of his history there are about fifty-six species of birds listed under their native names.

Poivre, one of the early French travelers in the East, was appointed Intendant of Mauritius and Reunion in 1767 and was joined there by Commerson, another French traveler; together they made an expedition to Madagascar in 1771. Many of the specimens Poivre collected were deposited in the collection of Réaumur, and at least some of Brisson's descriptions of about thirty-eight species of birds said to have come from Madagascar were based on this material.

Sonnerat, another French traveler, first made a voyage to the Orient in 1768–1773, when he visited Madagascar, and again on a second voyage in 1774–1781, when he spent most of his time in India and China. In his 'Voyage à la Nouvelle Guinée,' published in Paris in 1776, descriptions and plates of a number of Madagascar birds are given, which served as the basis of some of the descriptions of Buffon and Brisson.

In 1833 the French naturalists, Bernier, Goudot, and Rousseau, visited the east and northeast of the island[1] and Goudot was one of the first naturalists to penetrate into the interior, traveling as far as the Hova capital, Tananarive.

Among others, Isidore Geoffroy Saint-Hilaire, Pucheran, and Lafresnaye described new forms from the material brought back by these collectors.

M. Jules Desjardins, Secretary of the Société d'Histoire Naturelle de l'Île Maurice, was active in the study of natural history about 1830, and there are notes of papers he prepared for the above-mentioned society in the Proceedings of the Zoölogical Society of London.[2]

Hartlaub[3] says that about 1835 a new and fortunate era began in the study of Madagascar birds. Victor Sganzin, Commandant of the Island of Sainte Marie, 1831–1832, collected a number of birds and prepared a paper on Madagascar birds with notes of habits, scanty descriptions, and with French and Malagash names, of about eighty-four species.[4] Some of Sganzin's material came into the possession of Jules Verreaux, who apparently prepared a paper on Madagascar birds that was never published, as Hartlaub[5] mentions using a manuscript

[1] Pollen, 1863, Tijdschrift voor de Dierkunde, p. 282.
[2] 1830, p. 45; 1832, p. 111; 1934, p. 57.
[3] 1861, 'Ornithologischer Beitrag zur Fauna Madagascars, etc.,' p. 4.
[4] 1840, Mem. Soc. Hist. Nat. Strasbourg, pp. 1–49.
[5] Lavauden, 1932, Bull. Mus. Paris, p. 629.

of Verreaux's when preparing his work on Madagascar birds. Verreaux himself was never in Madagascar but, during his long residence at the Cape of Good Hope, received many specimens from Madagascar.[1]

In 1848 appeared Hartlaub's paper[2] which was the first methodical list of the birds of Madagascar. The Mascarene Islands are included, but about seventy-four species from Madagascar are listed, and the status of a number of others that have been recorded is discussed. About this time, W. Peters visited southwestern Madagascar and collected a number of birds on his Mozambique voyage, 1842–1848.

Bojer, a botanist, also visited the west coast where, according to Hartlaub,[3] he collected thirty-four species of birds. Some of these specimens probably came from Zanzibar. The travelers Hilsenberg and Jardine also visited Madagascar about this time, and Frau Ida Pfeiffer collected in eastern Madagascar and penetrated into the interior to Tananarive. Frau Pfeiffer sent back fourteen species of birds which were received in Vienna in 1858.[4]

In 1861 Hartlaub's first book on the birds of the Mascarene Islands[5] appeared, in which about 153 species are given as coming from Madagascar, and in the introduction is given a summary of ornithological history. Hartlaub had published a paper of a similar nature the preceding year.[6]

Then began the modern period of zoölogical exploration. Roch and Newton, who were attached to an embassy from the Government of Mauritius to Tananarive, traveled in Madagascar from September to November, 1861. A collection of birds was made along the route and a list of specimens and observations was published in the Ibis.[7]

Mr. Edward Newton made a second trip to eastern Madagascar in 1862, from August to October, and again published his observations.[8] Also in 1862 Charles Meller, Medical Attendant to the Mission from the Government of Mauritius to Tananarive, made a collection on the journey between Tamatave and Hova capital, and Sclater has given us an account of this collection.[9] In this paper there is included the description of the nest and eggs of *Vanga curvirostris* taken by F. Plant, who was then collecting natural history objects in Madagascar.

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[1] See footnote 5, p. 151.
[2] D'Alton u. Burmeister, 1848, Zeitung für Zool. u. Zoot., pp. 149–153, 157–160.
[3] 1861, 'Ornithologischer Beitrag zur Fauna Madagascars, etc.,' p. 5.
[4] von Pelzeln, A., 1858, Naumannia, pp. 496–498.
[5] 1861, 'Ornith. Beitrag zur Fauna Madagascars, etc.'
[6] 1860, Jour. für Ornithologie, pp. 1–16, 81–112.
[7] 1862, pp. 265–275; 1863, pp. 165–178.
[8] 1863, Ibis, pp. 333–350, 452–461.
[9] 1863, Proc. Zool. Soc. London, pp. 160–165.

Francois P. L. Pollen, who was later to go to Madagascar, compiled a list of the known Mascarene vertebrates and a sketch of the zoölogical history up to that time (1863).[1]

The traveling naturalist, Mr. W. T. Gerrard, sent back a collection about this time, which was examined and reported on by A. Newton.[2]

Pollen, with his friend, Douwe Casparius van Dam, collected in Madagascar and the neighboring islands during 1864 and 1865. In Madagascar they collected chiefly near the coast in the northwest, and at Nossi Bé they met M. Lantz[3] of the Saint Denis Museum, who also collected in eastern Madagascar. Schlegel and Pollen, in the systematic account of the results of Pollen's and van Dam's work,[4] frequently refer to Lantz's specimens from eastern Madagascar.

In Schlegel and Pollen's work there are about 190 names listed, but these probably represent less than 150 species. Before the publication of the above complete work, Schlegel prepared a preliminary list of the birds found in Madagascar for the Zoölogical Society of London,[5] in which about 108 species were given.

A. Vinson published his 'Voyage à Madagascar' in Paris in 1865, and in appendix B, by Jules Verreaux, there is a list of 216 species of birds supposedly occurring in Madagascar.

Alfred Grandidier, whose name will ever be connected with Madagascar, traveled in the island from 1865 to 1870. Some of his preliminary reports were published in 1867,[6] and much new western material was recorded, but it was not until some years later that his monumental work on the birds was written in collaboration with Milne-Edwards.

Writing in 1875,[7] Milne-Edwards and Grandidier say that up until 1869 the interior of Madagascar was closed to foreigners, because the Hova were opposed to explorations, only the route from Tamatave to Tananarive being occasionally open to foreigners.

From 1870 to 1875 a number of collections from Madagascar, notably those of A. Crossley, were examined by Sharpe.[8]

Crossley was equipped by C. Ward of Halifax, and the collections were sent to Mr. Cutter, a natural history agent of Bloomsbury. Many of Crossley's specimens were without data, but apparently most of them came from the eastern forest.

[1] 1863, Tijdschrift voor de Dierkunde, pp. 277–345 (birds, pp. 295–331).
[2] 1865, Proc. Zool. Soc. London, pp. 832–838.
[3] Pollen, 1877, 'Recherches sur la Faune de Madagascar, etc.,' I, Leyde, p. 148.
[4] Schlegel and Pollen, 1868, 'Recherches sur la Faune de Madagascar, etc.,' II, Leyde.
[5] 1866, Proc. Zool. Soc. London, pp. 419–426.
[6] 1867–1870, Rev. et Mag. Zool.
[7] 1875, 'Histoire Physique, Naturelle, et Politique de Madagascar, Mammifères,' p. 1.
[8] 1870, Proc. Zool. Soc. London, pp. 384–400; 1871, pp. 313–320; 1872, pp. 866–869; 1875, pp. 70–78.

Mr. Thomas Waters collected in the central and southern parts of the east and Bartlett[1] reported on his collections in 1877 and 1879.

Another important contribution to the study of Madagascar birds appeared in 1877 when Hartlaub published his 'Die Vögel Madagascars und der benachbarten Inselgruppen,'[2] an enlarged and up-to-date edition of his previous work, in which the number of species from Madagascar amounts to about 214.

Humblot was in charge of an expedition to Madagascar for the purpose of zoölogical exploration, which arrived in 1879 and for more than a year collected in the eastern part of the island.[3] He was shipwrecked on Gardafui on his way out and it is possible that he collected a few specimens there that were later recorded from Madagascar.

Between 1879 and 1881 Stejneger published lists of a few Madagascar birds.[4] From 1879 to 1882 appeared the four volumes dealing with birds[5] of the 'Histoire Physique, Naturelle, et Politique de Madagascar,' by A. Milne-Edwards and A. Grandidier. Milne-Edwards, who was professor of zoölogy in the Natural History Museum in Paris, occupied himself with the anatomical part of the work, and Grandidier, who had traveled in Madagascar from 1865 to 1870, did the notes on habits and the bibliographic portion.

This work contains the fullest account of Madagascar birds that we have, and at that time the number of forms known from Madagascar was said to be 238. Synonymy is given for each species and in the résumé is given a summary of the ornithological history and affinities of the fauna.

The Rev. W. Dean Cowan, a missionary to Madagascar, compiled a list of birds to be found in Madagascar, with their native names, in 1881,[6] and again in 1882[7] published some natural history notes and devoted a few pages to the birds. Cowan apparently collected in the central and eastern part of Madagascar and among the birds sent back was the swallow which bears his name.[8]

M. J. Audebert, a traveling naturalist, collected in eastern Mada-

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[1] 1877, Proc. Zool. Soc. London, pp. 292–293; 1879, pp. 767–773.
[2] Halle, 1877.
[3] Humblot, L., 1882, Arch. Miss. Sci. et Lit., pp 153–157; and Milne-Edwards, A., 1882, idem, pp. 159–161.
[4] 1879, Nyt. Mag. for Natur. Christiania, pp. 289–295; 1881, pp. 11.
[5] Vol. XII, 1879, contains the text; volumes XIII, 1876, XIV, 1879, and XV, 1881 are atlases. For the true dates of publication, see Delacour, 1932, l'Oiseau et R. F. O., pp. 87, 88.
[6] 1881, 'List of Madagascar Birds, together with the Native Names among a few of the different Tribes,' Antananarivo.
[7] 1882, Proc. Roy. Phys. Soc., Edinb., pp. 133–150 (birds, pp. 141–143).
[8] Sharpe, R. B., 1882, Jour. Linn. Soc., p. 322.

gascar, one of his most interesting finds being *Pachycoccyx audeberti*, collected near the Bay of Antongil. Later Audebert published two articles on Madagascar birds, one in 1882[1] and one in 1883.[2]

In 1896, E. Oustalet published a paper on the birds of the Mascarene Islands with special reference to Mauritius. This paper treats extensively of some of the extinct species and early descriptions and plates.[3]

Dr. W. L. Abbott, who collected widely in the East, visited Madagascar in 1895 and collected mainly in the central part of the eastern side of the island. This collection was reported on by Richmond.[4]

The Rev. James Wills made a small collection in the eastern central part of the island from 1894 to 1896. This collection was purchased by the United States National Museum and was worked up by H. C. Oberholser.[5] Previous to this, Rev. Wills had sent a number of birds to England, among them being the specimen of *Apus* that Hartert described as new.[6]

In 1899, M. E. Bensch, an administrator at Tulear, described the habits of *Uratelornis chimaera* in captivity,[7] and later sent to Paris that especially interesting bird which E. Oustalet and G. Grandidier[8] described as *Monias benschi*.

During his voyages in 1889 and 1905, Dr. A. Voeltzkow collected a number of birds in western Madagascar as well as in East Africa. This collection was worked up by A. Reichenow[9] and Graf von Berlepsch.[10]

The yacht "Valhalla," on which Mr. M. J. Nicoll was naturalist, stopped at Diego Suarez for a few days in March, 1906,[11] Mr. Nicoll visited the rain forest on the summit of Mt. d'Ambre and collected a few birds. Also in 1906, M. Geary collected a series of birds in southwestern Madagascar which were reported on by A. Menegaux.[12]

'A Naturalist in Madagascar' by Sibree, appearing in 1915, contains notes and recollections of natural history of the island, acquired during nearly fifty years of missionary work in Madagascar, although Sibree apparently collected no specimens. The book includes many interesting notes on the habits of the birds, their native names, and their relation

[1] 1882, Gef. Welt, pp. 383–385, 437–438, 459–460.
[2] Idem, 1883, pp. 343–346, 461–470, 471–503.
[3] 1896, Ann. Sci. Nat. Zool., Paris, (8) III, pp. 1–128.
[4] 1897, Proc. U. S. Nat. Mus., pp. 677–694.
[5] 1900, Proc. U. S. Nat. Mus., pp. 139–153.
[6] 1896, Nov. Zool., p. 231.
[7] 1899, Bull. Mus. Hist. Nat., Paris, XXXX, p. 324.
[8] Idem, 1903, pp. 10–12.
[9] Vögel von den Inseln Ost-Afrikas, in A. Voeltzkow's 'Reise in Ost-Afrika in den Jahren 1903–1905,' II, Stuttgart, 1906–1910, pp. 190–192.
[10] 'Verzeich. der von Dr. Voeltzkow in West Madagaskar gesammelten Vogelarten, etc.,' Frankfort, 1898, pp. 473–478.
[11] Ibis, 1906, pp. 666–712.
[12] Bull. Mus. Nat. Hist., Paris, 1907, pp. 104–113.

to native folk lore. Sibree had already published 'The Great African Island,'[1] in which are included many bird notes, and also an article in the Ibis[2] on bird habits and folk lore.

Mr. F. Wulsin, an American, visited Madagascar in 1915, collecting in the southwest and at Lac Alaotra in the east. Mr. Wulsin also bought, at Tananarive, a series of skins that were said to have been collected in the eastern forests. A list of these specimens was prepared by O. Bangs[3] and several new forms were subsequently described from this material.

A local natural history agent, M. Herschell-Chauvin, is a resident of Tananarive. He has been collecting natural history material in the central part of the eastern forest since before 1923. Most of his recent material comes from the forest of Sianaka in the vicinity of Fito and Didy. These skins were largely prepared by natives and were brought in to M. Herschell-Chauvin. The skins are usually fairly well prepared but of course lack precise data and some of the specimens we examined had evidently been dried over an open fire, probably in a native house, and were thus considerably darkened through exposure to smoke.

M. C. Lamberton, Secretary of the Académie Malgache at Tananarive, has supplied a number of bird skins. These skins, probably collected by natives, come from various parts of the island. In 1927, M. Lamberton described as new[4] an albinistic specimen of *Asio madagascariensis* and published a note on an albino *Coracopsis nigra.*

During our stay in Madagascar (1929 to 1931) we met M. L. Lavauden, who was then "Conservateur des Eaux et Forêts" and "Chef du Service Forestier," and had been taking an active interest in the study of Madagascar birds. With the aid of his assistants scattered over the island, Lavauden has been able to acquire a representative collection from various parts of the island and has published a number of notes in L'Oiseau et la Revue Française d'Ornithologie, Alauda, and the Bulletin of the British Ornithological Club (1928 to 1930), and an account of migration in Madagascar.[5]

G. Grandidier and G. Petit published 'Zoologie de Madagascar' (258 pages) in 1932. This volume is intended as an encyclopedia of the fauna of Madagascar, according to M. E. Bourdelle, who wrote the preface. In the twenty-four pages devoted to birds, some of the commonest and but a few of the more interesting species are mentioned.

[1] London, 1880.
[2] 1891, pp. 194–228, 417–443, 557–566; 1892, pp. 103–119, 261–274.
[3] 1918, Bull. Mus. Comp. Zoöl., Cambridge, pp. 489–511.
[4] 1927, Bull. Acad. Malg., pp. 40–42.
[5] 1929, Jour. für Ornithologie, Festschr. Hartert, pp. 230–235.

The text apparently has been largely taken from Milne-Edwards and Grandidier's classical work with the addition of a few more recently published notes.

THE FIELD WORK OF THE MISSION ZOOLOGIQUE FRANCO-ANGLO-AMÉRICAINE À MADAGASCAR

Monsieur Delacour[1] and Monsieur Decary[2] have already published their itineraries and my own has also appeared[3] but it seems advisable to give here a summary of the routes traveled and the country encountered.

The work was outlined by M. Delacour with the idea of bringing together a representative collection of birds from each part of the country, and our itineraries were planned with that aim in view. The party was divided into several units so that collecting might be done in different parts of the island at the same time. We collected in the southwest, the west, the north, the northeast, the central east, the southeast, and the central part of the island.

The greater part of Madagascar has been opened up and traveled over by white men, and we were seldom more than one day's journey from a white inhabitant. Most of the important points in the south of Madagascar (Tulear, Fort Dauphin, Farafangana, and Mananjary) can be reached by automobile from Tananarive at almost any time of the year. The existing roads, moreover, are being continually extended and improved. An automobile service was maintained between Majunga and Tananarive during the dry season, but during the wet season the section of road between Mevatanana and Majunga was impassable. While we were in Madagascar, a motorboat service was installed on the Betsiboka River from Mevatanana to Majunga, which made communication possible throughout the year. Tananarive and Tamatave have a railway service, which also extends to Antsirabe. The points in the north of the island on the coast are most easily reached by schooner or steamer, though around Diego Suarez there is a considerable amount of road passable for automobiles.

We took advantage of these means of travel as much as possible, although to get to suitable collecting grounds it was usually necessary to have our goods carried by porters while we traveled on foot or in a "filanzana" or palaquin.

Trails of a sort led almost everywhere, so it was seldom impossible

[1] 1930, L'Oiseau et R. F. O., pp. 65–77 and 160–179.
[2] 1932, L'Oiseau et R. F. O., pp. 520–529.
[3] 1932, L'Oiseau et R. F. O., pp. 227–282.

to visit an area because of lack of trails. The smaller trails were being neglected, however, as the work of pushing forward the main roads went on, and bridges were often washed out and trails grown up, but they were usually passable. On the more important trails there were pirogues stationed as ferries over the larger rivers.

On the east coast, where there was no dry season, the rains did not hinder travel, though they did hinder collecting. But in the west, and particularly in the northwest, the rivers and valleys were flooded to such an extent that travel was seriously hindered or even made impossible for a time. The crocodiles that swarmed there at this season and took their yearly toll of natives were not the least of the items in this delay.

Though there were trails nearly everywhere, porters were sometimes difficult to secure, particularly in the north, and this entailed delay; but, thanks to the aid of the Administration, which supplied porters for us, no prospective trip had to be abandoned because men could not be secured. However, we always had forced bearers and they were usually unwilling. Whether they were carrying baggage or resting idly in camp, they were always eager to return to their villages, and sometimes they deserted us. Between Befandriana and Iotry, eleven men did so. Deserters and sick men could usually be replaced from near-by villages, and friendly chiefs sometimes secured an entirely new set of from twenty-five to thirty porters for me overnight. The pay of the men was from three to six francs a day, often less on the trip back when they were carrying no baggage. This payment was arranged by the local administration.

The regulation load per man was twenty kilograms, but as the loads were usually lashed to the middle of a pole and carried by two men, the loads were made up in packages of thirty-five to forty kilograms each. Small, heavy loads, such as cartridges, were carried much more easily than larger, lighter loads such as specimen cases that swayed about. Larger or heavier loads made an extra man or so necessary and the cases of cartridges, weighing sixty kilograms, always had three men to carry them, the third man changing places with one of the others at intervals. Once off the automobile road, distances were reckoned in days and hours. An average day was thirty kilometers, though I did fifty on occasion. The baggage porters, on a good trail, did about four to five kilometers an hour, and my filanzana crew of eight or ten men used to do five to six kilometers an hour, or even better. They often carried at a trot, changing as they ran, and covered ground at a surprising rate of speed. The speed on poor or hilly trails was much

less, of course. Madagascar, though not thickly settled, has the population well scattered over it so that we usually found a village where we stayed and from which we collected. This was a particularly helpful factor in collecting in the rain forests of the east.

Native houses were usually available for shelter, but we would have been seriously inconvenienced without the tents which we carried, for the native houses were sometimes too small or too dirty or too distant from the collecting grounds. In the southwest I often slept out of doors, particularly when we were on the march. But even there shelter is needed in the rainy season and it is always necessary in the east.

Food for the men seldom presented a serious difficulty, though sometimes enough food for a day or two was carried. Their ration was one kilogram of rice a day. In parts of the southwest no rice was grown, but this afforded no particular difficulty since the porters were local men and lived on the corn, manioc, fish, or melons that the country afforded. My personal boys were used to a rice diet, and I found it best to carry rice for them.

In parts of the southwest the lack of water was a problem, and on some trips it was necessary to carry water for the men. Where water was found in this section, it was often so bad as to be almost undrinkable.

The following is a summary of the itineraries of the various members of the party:

UNIT ONE.—Majunga, Nossi Be, Diego Suarez, Tamatave, Tananarive, and Monjakatompo. April 19 to May 23, 1929.

PERSONNEL.—M. J. Delacour, Mr. W. Lowe, Mr. R. Archbold, Mr. J. C. Greenway, Mr. A. L. Rand.

ITINERARY.—The party arrived at Majunga, April 19, 1929, and spent the next day ashore, leaving that evening for Nossi Be, where we arrived the next morning and stayed for one night. On the morning of the twenty-third, we arrived in the magnificent harbor of Diego Suarez and during the day we ascended Mt. d'Ambre by automobile. On April 26, we arrived at Tamatave and spent the day there, going to Tananarive on the next, where we remained until May 10, collecting in that vicinity. We made one automobile trip to Monjakatompo on Mt. Ankaratra, May 3, and another on May 7 to Lamandraka on the upper edge of the eastern forest.

On May 11, we moved to Monjakatompo, just below the forest on Mt. Ankaratra, where we collected. While there, we made one trip

by car on May 17 to Tsinjoarivo, on the upper edge of the eastern forest. On May 18, Messieurs Delacour and Greenway spent a day at Antsirabe. May 23, Messieurs Delacour and Lowe returned to Tananarive to prepare for a trip to Lac Alaotra and into the west of Madagascar, while Archbold, Greenway, and I remained at Monjakatompo until June 2, at which time we left for the southeast.

Description of the Routes and Collecting Stations

Majunga.—This, the first port of call in Madagascar, is at the mouth of the Betsiboka river. The surrounding country is subject to seasonal rains, and April, when we first visited it, is just at the end of the rainy season. The motor road to Tananarive was impassable because of the heavy rains. The motorboat service, which was being installed to connect Majunga with the permanent road from Mevatanana to Tananarive which is not greatly injured by the rains, was not in operation, so we continued by steamer to Tamatave.

At Majunga in April, the vegetation was still green and many flowers were in bloom. Along the shores of the river were extensive mangrove swamps. Much of the country was open brush and grass with here and there clumps of trees or wooded areas. The grassy plains dotted with low palms were a striking feature of portions of the landscape. Farther inland, low steep hills rose abruptly. Birds of the open ground and brush were common.

Nossi Be.—This is one of the most beautiful tropical parts of the island. The boat anchored in a bay facing the mainland. All about the shores rose abruptly; inland, mountains rose tier upon tier. The island was covered with verdure, green grass, or foliage, and though the rains are seasonal, there is enough rainfall to maintain this verdure throughout the year. The climate was hot and damp. On one corner of this island there still remained an area of humid forest in its original condition, though the greater part of the island has been given over to cultivation of cocoa, eylang-eylang, coffee, sugarcane, pepper, and pineapples. Frigate birds were seen sailing about over the bay. The sunset as we left Nossi Be was one of the most beautiful I have ever seen; later when we were collecting on this northwest coast, we learned that beautiful sunsets were characteristic of this part of the island.

Diego Suarez.—The harbor of Diego Suarez is one of the finest in the world. Low hills, some of them with sheer cliffs, rather barren or clothed only with dry forest and brush, rise all about. The broadly cone-shaped Mt. d'Ambre, with grasslands and areas of brush and deciduous woodlands on its slopes, topped with its dark green humid forest, rose back of the town. (We collected in this region later and will consider it more in detail farther on in the paper.)

Tamatave.—The iron hulls rusting on the sands on the beach at Tamatave are mute testimonies of the hurricanes that visit this coast. These hurricanes have broken down many of the ornamental trees about the town, so that we found it rather bare of trees, though there were rows of coconut palms in some places. Tamatave is on the humid coast, and the grass and bushes were very green. The neighboring country was largely of a secondary brush type crossed by some slow sluggish streams and containing marshes filled with vegetation.

TAMATAVE TO TANANARIVE.—This journey was made by rail. The train left before daylight, and with dawn we found ourselves traveling parallel to the coast, among scrub and brush. Through breaks in the vegetation we caught glimpses of the surf on the narrow beach. Near Brickaville, the railroad turned inland and crossed the series of lagoons that run parallel to the coast. The route next passed through an extensive grassy country of low hills which have been likened to frozen waves. Villages, with their accompanying sugarcane and manioc fields, were common along the tracks.

As we approached the mountains, the foothills became irregular and we encountered scattered patches of forest and extensive areas of bamboos and brush. The trail followed the river as it entered the mountains. Villages were fairly common. The natives grew hill rice on the steep slopes. Approaching Fanovana, near midday, we entered a beautiful tropical forest, but, nearing Moramanga, we passed out of that and crossed a flatter, though still somewhat hilly, grassy country. Groves of blue gum trees had been planted along the tracks to insure a supply of fuel for the wood-burning locomotives. The mountains rose ahead of us more steeply than before, and soon we were looking far down at the swamp rice fields of the valley. As we neared the edge of the central highlands another belt of forest was met with, changing to brush on its upper edge, and then to grass, bracken, and heath. Extensive areas on the upper edge of this forest had been planted with mimosa as well as with blue gum trees. The highlands were boldly hilly but darkness soon shut in. Tananarive was reached about eight o'clock that evening.

TANANARIVE (altitude, 1500 meters).—The term often used to describe these highlands, a "chaos of mountains," seemed particularly fitting. Hills rose everywhere in careless profusion. They were bare of trees, the short grass was scanty, and red soil showed through, giving the country a desolate appearance. The areas of brush along the streams and the green of the swamps served to emphasize the desolation of the hills. The lines of blue gum or mimosa trees that had been planted did little to relieve their barrenness. The native houses of sun-baked soil were of the same red color as the hillsides. Many of the valleys had been transformed into swamp rice fields, and these surrounded Tananarive itself. Open-ground and marsh birds were many in number but few in species. Near Tananarive was a fair-sized marsh where water birds were common.

As one approached the forest at Lamandraka, much heath and bracken was found mixed with the grass, giving denser cover. The highlands that one crossed to reach Monjakatompo were much the same, although near Ambatolampy were extensive groves of blue gum and mimosa trees.

MONJAKATOMPO (altitude, 1800 meters).—The mountain of Ankaratra, which reared up to about 2644 meters, appeared as a dark mass above the highlands as we approached it from the north. Monjakatompo, at the base of the mountain, once a bandit village, had been deserted and a government fish hatchery has been established there. The slopes of the greater part of the mountain were grass-covered and supported a growth of heath and bracken. Little grassy swamps were common about the base of the mountain. On the slopes, just above Monjakatompo, was an area of humid forest, an isolated remnant of the forest that once covered the greater part of the central portion of Madagascar. This wooded area was of the humid forest type, with large trees hung with lianas and mosses. Tree-ferns were common

Fig. 2. The humid forest on Mt. Ankaratra (alt. 1700–2000 m., Oriental Province, May, 1929).

Fig. 3. View on Mt. Ankaratra. The scantily grass-covered hills are characteristic of much of the central highlands. A few scattered areas of humid forest are to be seen and a row of planted Mimosa trees mark a trail (alt. 1700 m., Oriental Province, May, 1929).

and in some places there was considerable undergrowth. It was cool here, with mist lying over the lower ground in the morning, the hills rising through it like islands through a snow-covered, frozen sea. In the forest and brush a few species of woodland birds were common, and the birds of the open ground were much like those at Tananarive.

MONJAKATOMPO TO TSINJOARIVO.—Eastward to Tsinjoarivo (altitude about 1000 meters) the country was much like that from Tananarive to Lamandraka. One passed over grasslands, then through heath and bracken to the humid forest on the edge of the eastern slopes. Here the forest was largely of secondary brush that had attained considerable height, with a few scattered trees towering above it. The brush was very dense and tangled and very green.

UNIT TWO.—Tananarive and Lac Alaotra; Tsiroanomandidy to Tsiandro, May 24 to August 28, 1929.

PERSONNEL.—J. Delacour and W. Lowe.

ITINERARY.—Returning to Tananarive, Messieurs Delacour and Lowe remained there until May 27, collecting water birds in the vicinity. They then went by rail to Ambatosoratra near Andreba on Lac Alaotra, where collecting was carried on from May 29 to June 11. They then returned to Tananarive and went on to Tsiroanomandidy, where they collected on June 15 and 16; to Ankarefo, where collecting was done June 18 and 19. Next they went down the Manambolo River by pirogue, arriving at Marolaka June 20; spent June 21 at Ankavandra; June 24 at Bemoka; June 25 and 26 near Ankoja; June 27 to 30 at Bekopaka; they left the river and traveled north, arriving at Antsingy, July 1 and Tsiandro, July 5, where collecting was carried on until July 23. The party then turned eastward, collecting at Ankavandra from July 27 to 30, and came to Marolaka on July 31. August 1 was spent at Ankarefo and August 2 at Mevatanana. The party thereafter returned to Tananarive, where Mr. Greenway met them, and they descended to Tamatave, leaving Madagascar by way of Diego Suarez, Nossi Be, and Majunga. They sailed from Majunga, August 28, 1929.

DESCRIPTION OF THE ROUTE AND COLLECTING STATIONS

This description is taken from M. Delacour's itinerary, published in 1930, L'Oiseau et la Revue Française l'Ornithologie, pp. 65–77 and 160–179.

Lac Alaotra[1] is 40 km. long by 12 km. wide. On the southwestern side the marshes extend it farther. The shores are covered with a border of thick vegetation, which is dominated by the *Papyrus* and reeds which form floating islands; magnificent blue and white water

[1] Specimens from Lac Alaotra are labeled "Andreba."

lilies dot the water. The water is slightly reddish and is nowhere very deep. Hunting was carried on by pirogue. Water birds were very common.

TANANARIVE TO TSIROANOMANDIDY.—One passes over the same red plateau, rough and bare, which descends gradually and the climate becomes warmer. The country, though well watered, is nearly uninhabited. Farther westward one sees more trees in the ravines where the fire has not been able to reach them.

TSIROANOMANDIDY TO ANKAVANDRA.—At Tsiroanomandidy the country is already western in character. The altitude is not more than 600 meters [possibly 1000 meters—A. L. Rand] and it is warmer. In the bottom of the valleys there is real forest with large trees. The high banks of the Manambolo River are likewise wooded. As one goes westward, the country passed through is always the same, a waste of dry herbs. And to think that four hundred years ago all this immense plateau was still wooded. Ankarefo is a village established as a base for exploiting the wood in the neighboring ravines.

At Marolaka, the heights of Antsingy appear beyond the plains of Ankavandra. One leaves the central plateau. The wooded areas in the valleys are larger, and *Propithecus* is encountered. The plain is rather large, but is cut into hills, bordered on one side by the central plateau and on the other by the mountains of Antsingy (or Bemahara); the Manambolo River flows across it. Around Ankavandra there are some wooded areas and ponds. The region is rich and populated. This is near sea level and it is hot: 20 degrees during the night, and 30 degrees during the day. The sun is intense, it being the dry season.[1] The party stopped here to prepare for the descent of the Manambolo River. This journey was made by pirogue.

ANKAVANDRA TO BEKOPAKA.—The river is wide but shallow. At Ankoja we approached the mountains of Antsingy. Beyond Ankoja the river enters the mountains and its banks are high but the slopes are gentle. The country is very well wooded; large calcareous cliffs appear to cut the forest into parallel bands. The next day the party continued down the river, traveling all day through the magnificent gorges of the Manambolo. The perpendicular calcareous walls are channeled with grottoes and ornamented with stalactites; all is covered with vegetation and the beautiful forest lies on all sides. Considerable numbers of birds and lemurs are seen. Near Bekopaka one comes abruptly out of the gorges. The river broadens and runs through a plain cut up into low hills. The greater part of the country has a parklike aspect, with large trees, isolated or in small clumps. Here and there are wooded areas and ponds.

BEKOPAKA.—This region is interesting. Many birds of the wooded areas and open ground are common, the aquatic birds form the principal attraction of the country. On all sides one finds ponds, the shores often shaded with large trees, and the surface of the water dotted with water lilies. Birds are more common than on Lac Alaotra.

On July 1, specimens were sent back to Ankavandra while the party set out northward.

BEKOPAKA TO TSIANDRO.—We passed through a fine humid forest and soon climbed gradually; the country becomes less wooded, drier; palms in groups or as

[1] The dry season is the cooler season.

Fig. 4. Heathlike brushland on Mt. Ankaratra (alt. 1700 m., May, 1929).

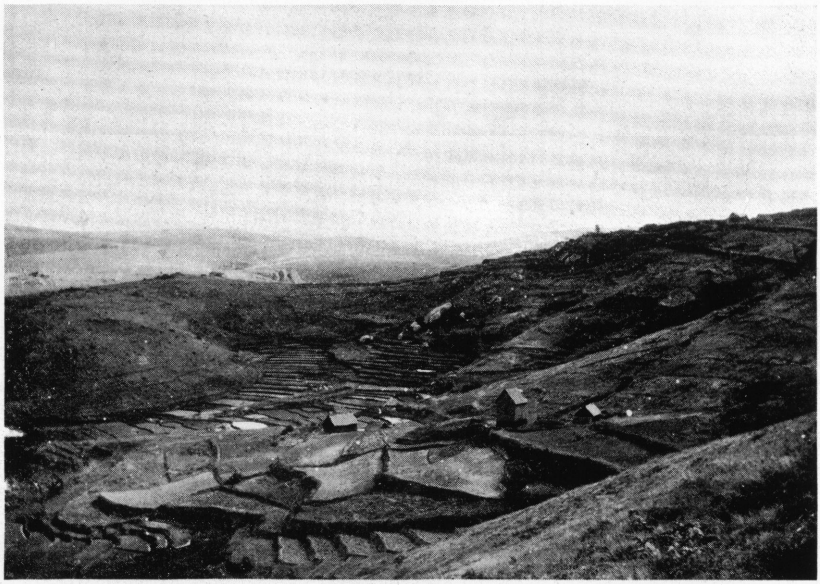

Fig. 5. On the central highlands many of the valleys have rice fields terraced far up their slopes. [Photograph purchased from Madagascar Geographical Service.]

scattered trees become more and more numerous. Passing the night at Beraketra, and continuing northward the next day, we made the camp by a small village near the forest of Antsingy. The route continues north, passing through the forest. The country is strange; jagged rocks present bizarre shapes; streams flow from the rocks and enter them again; some formations give the aspect of ruins, which under the large trees and the lianas recall certain corners of Angkor. The largest trees are mostly leafless for, as on the plateau, it is the dry season. The epiphytes,—orchids, *Platycerium*, and polypodes,—were in complete repose, but the forest was shady for the undergrowth was leafy. There were few ferns, and some slender palms were found. The effect was striking. After some kilometers we left the forest and passed low rocky hills covered with herbs and with isolated trees.

Then we passed through another band of forest, similar to the first, then followed a trail among the rocky, tree-covered hills, finding here and there some clear streams, while other streams were dry. A rather large river formed marshes among the rocks where the curious *Ouvirandra fenestralis* grew in abundance. Tsiandro was reached that evening. We had seen very little animal life during the journey except for *Coua gigas* and lemurs.

TSIANDRO.—This is built at the extremity of a vast plateau at about 700 meters altitude. Hills are all about, of which the highest reaches 1000 meters. There are two villages below them and the plateau, which resembles a plain, is well populated. The black earth is very rich; water is abundant, and excellent rice fields have been formed. Here and there are trees, and the hills are still partly covered with fine forest. The country resembles that which we have just passed through on our way from Bekopaka, and like it is filled with bizarre rocks, rough and pointed, and is sometimes pitted with deep holes. There are enormous trees; certain noteworthy ones with smooth white trunks have lost their leaves but are covered with red flowers, and other show flowers of *Bignonia* (trumpet flowers). A *Bignonia* with a long bare stem bears pretty red bouquets. During the three weeks spent here at Tsiandro, the weather was very fine; temperature, fifteen degrees at night, and twenty-five degrees during the day.

TSIANDRO TO ANKAVANDRA.—The party left Tsiandro, July 25, for Ankavandra. After twelve kilometers the route descended into the lowland, which is a multitude of small hills. The country is in general bare and sterile. The party camped by a village that night and reached Ankavandra about midday the next day. July 27 to 30 were spent at Ankavandra. Here Mr. Lowe saw, in the midst of some thick reeds, a pair of ducks which may have been the rare *Anas bernieri*. It was hot, and in the evening great showers of rain fell, coming from the east.

On July 31, the return journey was resumed over the trail used in entering the country.

UNIT THREE.—The southern part of Madagascar, June, 1929 to April, 1930.

PERSONNEL.—R. Archbold, J. Greenway, and A. L. Rand.

ITINERARY.—After M. Delacour and Mr. Lowe left for Tananarive, May 23, 1929, the rest of the party remained at Monjakatompo until June 3, and then left for Vondrozo in the southeast. We traveled

south over the plateau, passed Antsirabe on June 4; Ambohimahasoa, June 5; Fianarantsoa, June 6; and spent the night of June 7 at Ihosy. The next morning we turned eastward toward the coast past Ivohibe, reaching Vondrozo that evening. Vondrozo itself was in a flat grassy country some distance below the forest. The next day was spent in establishing camp in the forest, about 20 km. west of the village, where we collected until July 31. During our stay there, we used an automobile for transportation, and collected from Vondrozo to 30 km. west. One or the other of us made auto trips to Farafangana and Manombo (southeast) June 24 and July 20 to 22, and to Ivohibe, July 26.

On August 1, headquarters were moved to Ivohibe. Greenway left us there, returning to Tananarive to meet M. Delacour and Mr. Lowe, and accompanied them to Indo-China.

The forest was to the north of Ivohibe. On August 4 porters were ready and I moved to Ankerana, a little village on the edge of the forest, three hours north of Ivohibe, where I collected until August 28.[1] Camp was then moved to Iampasika, a village one day north of Ivohibe, where I collected until September 3, returning to Ivohibe, September 5. During this time Archbold had visited various points in Madagascar from Tananarive to Tulear and had collected a number of birds at Ihosy. He joined me at Ivohibe on September 21, and the next day we moved to Manombo (southeast) by motor car, where we collected until October 11.

On October 12, Archbold and I left Manombo (southeast) for Tulear, where we arrived October 14. A few birds were collected at Ihosy on October 13, when we were delayed by a mishap to the car.

October 15 to 20 were spent in Tulear. We planned to collect in the country north of Tulear between Ankazoabo and Morombe and then south of Tulear about Lac Tsimanampetsotsa, and to Ampotaka. Tulear was used as a base camp. Archbold did not accompany me on this trip, but visited instead various points in Madagascar, went to South Africa and returned in April.

On October 21 I left Tulear for Ankazoabo, where I did not arrive until October 26, having been delayed by automobile trouble. At Ankazoabo I secured porters and started on the route toward Morombe. Collecting was carried on at Tabiky, October 28 to November 18, at Befandriana, November 20 to 25, and at Lac Iotry, November 28 to December 29. At Lac Iotry collecting was carried on both in the Subdesert brush and in the marsh. December 31, I arrived at Morombe

[1] This material was labeled Ivohibe.

on the coast and engaged a schooner to take me to Tulear. I sailed on January 4, 1930, and arrived in Tulear on January 10.

Until February 7, I stayed in Tulear collecting a few birds in the vicinity and waiting for funds. On February 7, pirogues were secured to take me south to Anakao, where I arrived February 8. A day was spent there before porters were ready to move to Lac Tsimanampetsotsa, where camp was made on the east side of the lake on February 13, and collecting carried on there until February 22.

February 23, I moved out to the coast and then traveled south by pirogue to Androka, arriving February 27, having stopped at various points on the coast.

February 28 to March 3 were spent at Androka, collecting about the mouth of the Ilinta River.

On March 4, I left for Ampotaka on the Menarandra River, going to Bevoalava on the coast, then up the river valley, arriving at Ampotaka, March 8. March 8 to 25 were spent collecting about Ampotaka; then I traveled inland to Tongohory, past Ampanihy and Ejeda, Betioky, and arrived at Tongohory, March 30.

March 31 to April 1 were spent descending the Onilahy River to the sea, and on April 4 I went to Tulear, where I met Archbold and Du Mont.

Description of the Route and Collecting Stations

Monjakatompo to Vondrozo.—As we traveled south over the plateau, the country presented the same barren hills and scanty grassland that we found about Tananarive. Here and there the land was more rocky, with scattered low trees, and occasionally there were large marsh-bordered streams. Trees were scarce except for the groves of blue gums and Mimosas. Near Ambohimahasoa there was an area of humid forest resembling that on Mt. Ankaratra. Beyond Fianarantsoa we descended somewhat to Ambalavoa, and the country became even more rocky, though it was still largely treeless. This region was one of the most productive rice growing areas in Madagascar, and the valleys were terraced far up on the hillsides to form the rice fields. Beyond Ambalavao the mountains rose steep and rocky, many of them almost devoid of vegetation. Bird life was scarce.

The road soon entered a broad valley where the country was greener and covered with tall grass, the plains dotted with trees, and the streams fringed with brush and trees. Mountains rose on each side of the valley, some of them with scanty areas of bushes and low trees on their slopes. The people of the region were largely herdsmen. We saw large bands of their cattle on the plains. We spent the night of June 7 at Ihosy, and the next morning turned eastward over the grassy, tree-dotted plains. The ant hills, most of them less than three feet high, were a striking feature of the landscape.

There were few bridges in the region, but one could drive through many of the

Fig. 6. Grassland near sea level in the Humid East district. A few shrubs occur along the valleys, and in places much rice is grown (Vondrozo, July, 1929).

Fig. 7. Edge of the forest near sea level in the Humid East district. Grassland has replaced the forest, probably due to repeated burning. To the left is a shallow grassy marsh (Manombo, S. W., October, 1929).

streams in the dry season and there were ferries over the deeper streams. We were told that during the rainy season it was sometimes necessary to wait a number of weeks in order to cross certain rivers.

The country was in the drainage of the Mangoky River. Its fauna was rather typical of the Subdesert Province, though many widespread forms of the Occidental Province were also common.

Eastward rose the line of mountains that marked the divide between the eastern and western slopes. These mountains were as bare and desolated as the high plateau. A few patches of green trees in the ravines reminded us of the magnificent forest that covered this country before it was destroyed by the natives.

The eastern slopes of the mountains were much the same as the country we had just passed over. At Ivohibe not a native stirred in the midday sun. The blue gum trees cast little shade and swarms of locusts, like wind-borne ashes, drifted by in the pale sunlight.

We went on eastward, across an undulating country of grassland and ant hills with only occasional bushes. Ahead a few patches of forest appeared and we were soon passing through a magnificent rain forest. Beyond the forest, on the east, the country dropped sharply about a thousand feet to the well-watered, nearly treeless plain that stretched from Vondrozo toward the coast, some fifty kilometers away.

VONDROZO.—Camp was made some twenty kilometers by road west of Vondroze, in a clearing on the edge of the road that led through the forest, altitude about 500 meters. The country was hilly; low ridges alternating with shallow valleys. There was a beautiful forest with tall trees forming a canopy overhead, and here and there red-flowering trees were seen where black parrots (*Corocapsis nigra*) and little sunbirds (*Cinnyris sovimanga*) gathered during the day, and lemurs came at night to feed. Buttressed trunks and trailing lianas added to the strange appearance of the forest, and trailing bamboo was luxuriant but not so dense as to prevent forcing a way through it. Much lumbering had been done though only selected trees had been removed, and while this had produced tangles, it had affected the avifauna only slightly. The valleys in the forest were rather marshy and in places areas of palms occurred. The avifauna was typically that of the Humid East, though many species of the northeast did not occur, in spite of the similar-appearing conditions.

To the west of the forest the country was hilly; the forest dwindled to brush and broke up into scattered areas of trees as we passed into the open-grass country. To the east as we descended from the forest to the plain about Vondrozo, the forest stopped abruptly on the slopes. The plain was cut by small meandering valleys; the streams were small, sluggish, and marshy. Much of the country around Vondrozo was covered with luxuriant grass.

The rainy season was said to start in November when the rice was ripe, and the Foudias were red, but during our stay it rained almost daily, the rainfall varying from chilly driving mist to occasional downpours. In the forest it was never very hot, and the mornings were sometimes chilly.

IVOHIBE.—From the forest above Vondrozo, the hilly country rose gradually to Ivohibe, which lay near the base of the second tier of mountains and was protected from the east winds by a spur of mountains. It was a treeless country with many marshes and rice fields. The forest lay on the mountains to the north. There was not even a track for a bullock cart into the mountains so it was necessary to secure porters to continue our trip.

We were not able to secure enough porters at once to carry our baggage, so Archbold remained at Ivohibe and I set out alone for the forest to the north. My route crossed a spur of the mountains, and range after range of them stretched northward, their peaks hidden in the clouds. These mountains culminated in the Massif d'Andringitra, which we did not visit, but which would probably well repay collecting.

To the south of Ivohibe the hills had only scattered areas of trees on their slopes, being covered for the most part with scanty grass on the hard baked ground.

The forest country around Ivohibe was about 800 to 1000 meters in altitude, with Pic d'Ivohibe rising to 2100 meters. The slopes were steeper and more rugged than at Vondrozo, the streams clear and rapid with no palm swamps along them. The forest was a magnificent stand, similar to that at Vondrozo though more luxuriant. Vines and mosses were more abundant and the ground-cover and tangled bamboo were so dense that it was impossible to force one's way through the forest.

My route to the north descended into the valley of the Tantara to the little village of Ankarena, which lay in a wide grassy valley at the foot of the mountains. Swamps and rice fields abounded and the trail gave easy access to the forest. Several birds, such as *Zosterops*, *Neomixis tenella*, and *Leptopterus chabert*, were much more common in this brushland than in similar country at Vondrozo. In the forests, birds were common, but the thick undergrowth made it almost impossible to leave the trail, and as a result hunting was difficult.

Swarms of locusts, in the distance like clouds of smoke, drifted by almost daily. Kites, crows, and cattle herons followed these swarms, feeding on them. The natives caught the locusts to eat, and all the birds, even the smaller ones, fed on them.

I next went farther up the valley to Iampasika, one day's journey north. The mountains rose more steeply and more impressively to the west and the country to the east was more hilly than the country around Ankarena. Much of the forest had been destroyed and most of the country was covered with rather dense secondary brush. There was little open ground and little swamp land. Here and there the river contained rapids and falls.

During most of the time that I spent to the north of Ivohibe the weather was cold and mists often fell. The climate at Ivohibe, since the town was sheltered by a spur of mountains, was much drier and warmer than that of the country to the north. A few birds that were rather typical of the western part of Madagascar were found at Ivohibe, such forms as *Upupa e. marginata* and *Oena c. aliena* occurring.

While we were at Ivohibe in September we saw grass fires nearly every evening on the surrounding hills. The forest had disappeared long since and the fires were burning down into the grass roots and into the edge of the brush.

VONDROZO TO FARAFANGANA AND MANOMBO.—Going eastward from Vondrozo, we crossed the grassy, slightly rolling to hilly plain that sloped very gradually to the sea, here about fifty kilometers away (by road). At first we saw little but grassland, swamps, and rice fields, but as we neared the coast we found areas of traveler's trees on this same plain. Nearer the coast was a belt of volcanic soil. The long grass was scanty and there were many scattered bushes. Next to the sea at Farafangana was an area of sand, more or less covered with water, with grass and shrubs growing on it.

At Farafangana the beach was narrow but the river on the southern edge of the town had made a sand bar at its mouth, so that a lagoon lay across the front of the

Fig. 8. Brushland which has replaced the forest, near sea level, in the Humid East district. This secondary brush resembles some of the savannas in the western part of the island. It is this type of country into which some western birds have spread (Manombo, S. E., October, 1929).

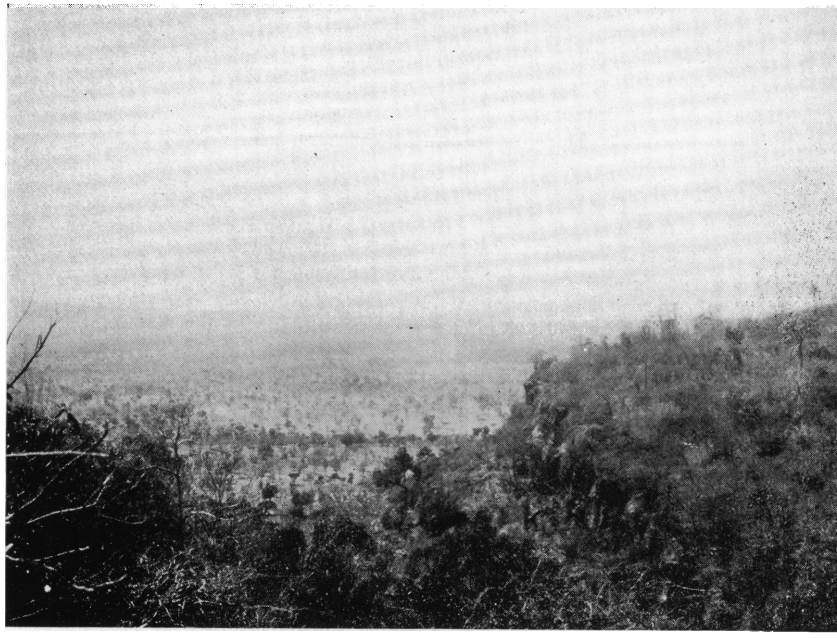

Fig. 9. View from the low hills west of Tabiky. The country in the background is typical savanna with scattered trees in a grassy plain. This is characteristic of both the Occidental and Subdesert provinces. The vegetation on the hills is rather dense low brush (Subdesert Province, Tabiky, November, 1929).

town and the river entered the sea some distance to the north. The sea was rather rough and there was a continuous surf.

As we went south from Farafangana we passed through areas of low traveler's trees and scattered brush and grass. Inland was a rather extensive marshy area with here and there areas of forest. The forest appeared to have been rather recently destroyed over much of this country, and to have been replaced by brush and traveler's trees.

At Manombo the Indian Ocean was only a few kilometers away. The country was low and flat, much of it volcanic soil. There were many sluggish streams and marshes. The forest, though consisting of large trees, lacked the luxuriant growth and dense ground-cover of the forests of the higher altitudes; it was largely on volcanic soil, which showed through in places. The forest was present only in restricted areas, however, and many of the trees had been cut, and tangles of brush had come to take its place.

Bird life was much less varied there than at the higher altitudes and many of the forest forms were missing.

Our next move was into the southwest. Tulear, on the other side of the island, was our immediate objective. We left on October 12 by automobile, went to Ihosy over the route we had already traveled, and then to Tulear.

IHOSY TO TULEAR.—Westward from Ihosy, the road rose sharply over rather barren hills, with scattered areas of deciduous brush here and there. We came next to a rather level, treeless, grassy plateau, dotted with ant hills. The red soil showed through, and some marshes and streams occurred.

Soon steep hills rose from the plain and were passed, then areas of brush and palm-dotted valleys appeared. About 175 kilometers west of Tulear was a low dry forest of deciduous trees and beyond it, an area of open savanna country. The country became better watered as we went on toward the west, and streams bordered with trees and areas of forest were seen here and there. The descent was gradual all of the way. As we neared Tulear, we saw a line of low calcareous hills that ran parallel to the coast and were covered with low dry forest with little undergrowth. The road entered this forest and soon ran along a ravine with steep cliffs on each side. This ravine opened at the Fiherenana River, at the mouth of which Tulear is situated. Most of this country was wooded or covered with brush that was dry and leafless at this period.

TULEAR.—Tulear was on the coast at the mouth of the Fiherenana River. The shore was flat and there were wide muddy tidal flats on which many shore birds were feeding. To the south of Tulear the table mountain showed, some ten kilometers away. There the country was sandy and covered with low subdesert brush.

It seemed best to go next to Ankazoabo, to the northeast of Tulear, and to collect with porters from there to the coast. Archbold decided to go to Tananarive for photographic equipment and then do some photographing in the subdesert brush near Tulear. He planned to meet me in Tulear about Christmas. I returned to Ankazoabo alone, retracing our route to Lambohomakana and then turning north to Ankazoabo.

It was still the dry season, the country was dry and brown, and water was very scarce. Herds of cattle, accompanied by cattle herons, crossed our route daily on their way to waterholes. The passing natives carried gourds of water and the

afternoon wind was strong and hot. When I passed through this country in April at the end of the rainy season, everything was much greener than in October.

ANKAZOABO TO TABIKY.—Having been duly warned of the coming rains which were said to be very severe, flooding the rivers and hindering travel, I started westward, with porters, toward Morombe. The trail lay across grass and savanna country dotted with ant hills about two feet high. Here and there patches of woodland occurred. These wooded areas were very different from the rich rain forests on the other side of the island. During the second day, the trail passed among low hills and bluffs covered with much brush. The rains had not yet arrived and all was dry and brown.

TABIKY.—I collected at Tabiky for about three weeks. The village was in a slight valley on the eastern edge of a savanna plain with here and there rocky limestone areas. To the west rose a steep rocky hill, largely covered with low dry forest and brush. Streams, dry at this season, had cut sharp ravines through the hill.

About Tabiky were occasional marshes and slow streams. On the damper ground in the valley and forming gallery forest along the streams were taller trees that kept their green leaves. On the dry savanna, the trees were smaller and more widely spaced, and the ground was almost devoid of brush, being grass-covered. On the limestone areas and on the low hills to the south was a low dry forest and much thorny brush, almost leafless at this season of the year. The swamps were grassy and in the wet season the natives prepared their rice fields in these areas. The streams in the limestone areas and among the low hills diminished greatly during the dry season, many of them drying up completely, or becoming reduced to a series of pools.

Birds were fairly common in all but the very open savanna and in the lowest, driest brush, though passerine birds were not so well represented as others. Most of the birds were nesting.

Little rain fell there up until November 19, when I moved to the west.

TABIKY TO IOTRY.—On November 19, I started across the low hills, where here and there the brush forest had been burned, resulting in a very open savanna country, with very little grass growing on it. I spent the night of November 19 at Lahaosy, on the edge of an extensive reedy marsh in grassy country. The next day I crossed a range of brush-covered hills running north and south and descended the eastern slope. I traveled along a broad shallow river lined with large trees where I shot at an *Astur henstii* and saw a *Motacilla*, the only one that I saw in the southwest. I went on through a level plain more or less covered with large trees and some brush and arrived at Befandriana.

BEFANDRIANA.—The level country about Befandriana was for the most part wooded plain or dense savanna country. The trees were large, spaced rather far apart and the intervening spaces were often filled with brush. In a few places the trees were crowded together forming wooded areas. Baobab trees were common in the drier areas. The more open country was covered with grass. The river that flowed past Befandriana was broad and shallow. A fair-sized reedy marsh occurred near the town, and water birds were common there. I collected at Befandriana for four days and then went on toward Lac Iotry. The country between Befandriana and Iotry was similar to that just described except that some of the ground was much damper in places where rank herbage grew between the trees, though directly

under the trees the black earth was bare. I next went through a grassy plain with shallow pools of brackish water, and came out on a damp grassy meadow that bordered the marsh at the southern end of Lac Iotry.

LAC IOTRY.—Camp was made in a village near the southern end of the lake which appeared about four or five kilometers long and a kilometer wide. Its western shore rose rather sharply for a few yards but at the southern end on the western side there were extensive areas of marsh, ranging from areas of floating vegetation to beds of reeds and extents of flooded grassland with dead bushes here and there in the water. Water birds were very common. Year after year Lac Iotry had been rising and flooding this flat meadow to the south and the old trail to Befandriana lies today at the lake bottom. The lake water was brackish and undrinkable, though it appeared clear; and one species of fish was common, furnishing an important food supply for the local natives.

To the west of the lake was a type of country different from any hitherto encountered. Near the edge of the lake was a belt of palms and farther back were large bushy trees and baobab trees with the spaces in between filled with some brush. This country was not unlike some of the dry and wooded plain country at Tabiky and the dense brush found there was not dissimilar to that at Tabiky, but the ground here was sandy instead of rocky and was almost bare or lightly covered with dead leaves. However, the open desert brushland found here, with its billows of white sand like snowdrifts, and with its scattered gray-green Euphorbia bushes, was quite distinctive.

Most of the birds in this region were just beginning to breed (December), and few young birds were observed. Because of the great numbers of breeding birds here, this would be an extremely interesting place to study the breeding habits of some of the peculiar Madagascar birds.

I collected at Lac Iotry for about a month. The weather was warm and fine during the first part of December, although there were always dark storm clouds on the horizon to the east and lightning flashed nightly in the eastern sky. About the middle of December the rain overtook me and from then on heavy local showers, usually of short duration, occurred frequently.

LAC IOTRY TO MOROMBE.—On December 30, I left for Morombe on the coast across sandy brush country similar to that near Iotry. Pools of water from the recent shower were seen here and there and a stream had formed a large marsh in a shallow valley about halfway to the coast. Morombe was on the edge of the sand and the sea. The sand beach was quite wide and there was a coral reef a mile off shore. South of Morombe was an area of mangrove trees in which reef herons were accustomed to spend the night.

MOROMBE TO TULEAR.—Schooners were common at Morombe and I engaged passage on one bound for Tulear, the trip taking five days. The boat usually kept inside the reef which was sometimes two miles or so off shore, though in some places the reef was not one-half mile from shore and the water was so shallow that the schooner was stranded at low tide. Coral formations were common and many colored fishes played about among them. We stopped and collected a few birds at several places along the coast.

The coast was all low and in some places sandy; in others, calcareous rocks came to the surface. The beaches were broad and the sea was calm inside the reef.

Fig. 10. Subdesert brush. Here the bushes grow scatteringly on the bare sand, though in some places they are much more densely grouped. During the rainy season water probably collects in the hollow in the foreground, thus accounting for the growth of grass. A few young palms also show in the foreground (Morombe, January, 1930).

Fig. 11. The Subdesert coast. Here the flat sandy country with its xerophytic vegetation comes out to the coast with low dunes next to the sea. The sand between the brush is bare of vegetation. The coral reef which skirts the coast is a mile off shore at this point (Morombe, January, 1931).

Shore birds were common. Inland the country was sometimes sandy with brush-covered dunes, or consisted of limestone outcroppings covered with a low dry forest. Near Manombo (southwest) there were numbers of large brackish pools just inside the dunes, where flamingos were common.

TULEAR.—I found a letter from Archbold awaiting me at Tulear, January 10, 1930, and also a number of specimens he had collected at Marovoay in November, 1929. He had done some collecting there, and also at Majunga, where he took a boat for Durban, South Africa, planning to return in January. I packed the material, turned it over to the government transport service for shipment, and then collected to the south of Tulear over large sisal plantations and into the edge of the brush desert. It was in the middle of the season for *Falco concolor* and I saw a score or more of them some mornings.

TULEAR TO TSIMANAMPETSOTSA.—On February 7, 1931, I started south on the high tide with my baggage in four seagoing pirogues, manned by the Vez, the fisher folk of Madagascar. I intended to collect in the extreme south of the island about Lac Tsimanampetsotsa and about Ampotaka on the Menarandra River. Because of the head winds that we encountered, it took us two days to reach Anakao. The village of Anakao on the coast was on the edge of the sand and brush desert which extended inland a few miles to a range of hills forming a calcareous plateau. At St. Augustin these hills came out to the sea, with bold cliffs showing about the mouth of the bay, but farther south they were farther inland. A few characteristic desert birds such as *Pseudocossyphus imerinus*, *Xenopirostris xenopirostris*, and *Nesillas typica lantzii* were found there. A flock of *Apus apus* was also seen over this inhospitable country. *Coua cursor* was not unusual and *Coua ruficeps* was common.

The native chiefs provided me with porters and I started for Lac Tsimanampetsotsa at dawn. The trail was ankle deep in sand. The Euphorbia shrubs had no leaves, everywhere was gray-green brush, ten to twenty feet high, and there was little shade. Along the coast the people were "Vez," their villages being always within sight of the sea. The beaches there were lined with their pirogues. The sea was their home and from it they drew their sustenance. Away from the coast the people were "Mahafaly." They herded a few cattle, sheep, and goats. About their villages were corn and manioc patches. They commonly grew a juicy melon which was a godsend in this country, for though there was usually water, it was vile to drink, and the natives depended largely on this melon for both food and drink.

LAC TSIMANAMPETSOTSA.—As I approached Lac Tsimanampetsotsa a few areas of low trees appeared, a forerunner of the forest land ahead. Camp was made on the east side of the lake, at the foot of the calcareous plateau, and near the only good water that I found in this part of the country.

Lac Tsimanampetsotsa was a shallow alkaline lake, some fifteen kilometers long and from one to two kilometers wide. To the east of it the limestone rose abruptly a few hundred feet to a rather level plateau. The plateau itself was limestone, the surface eroded and pitted, with here and there sink holes or caves. Loose flakes of the rock lay about and they rang like metal when struck. Baobab trees and other large-trunked trees, and gnarled, twisted, spiny bushes found a footing in crevices and formed a dense wooded cover so difficult to penetrate that I followed trails cut by natives for the purpose of collecting gum. Many of the gum trees tapped by the natives were dead from excessive bleeding. A forest of fairly large

trees with little ground-cover was found on the slopes leading up to the plateau, and the soil there was rocky and bare. The lake itself had little marsh on its edges and at the north end were quite extensive white silt flats. The whole lake bottom was covered with fine silt and when the waters were agitated by the wind, enough of this sediment was stirred up to give the water the color of milk. The natives said

Fig. 12. Didierea brush of the Subdesert Province. This grotesque type of vegetation covers a large part of the arid portion in the extreme south of Madagascar (near Ampotaka, March, 1930).

that no fish or crocodiles lived in it. The water was of course undrinkable. Between the lake and the sea the flat country was covered with low desert forest or open desert brush. There were few birds around the lake, though tracks in the silt showed that many waders had been common a short time before. Birds of the desert type were fairly common but variety was lacking. No rain fell during my stay,

though big fleecy clouds were often banked to the east. It was hot during the day, the trees casting little shade, but the nights were cool.

On February 23, I moved out to a village on the sand to the west of the lake. There were a few areas of low trees there as well as the Euphorbia brush. Some of the country was, in fact, rather open brush country. The fine sand packed well and was covered in places with a scanty herbaceous growth. A few drops of rain fell that evening, though not enough to wet the sand. The natives said that the rains had failed that season and that the crops were drying up.

Fig. 13. Sand bars in a shallow river in the Subdesert Province. In the left background is brushland where corn was grown; beyond that is the river-bottom forest. The calcareous plateau shows in the distance (Menarandra River near Ampotaka, March, 1930).

I left on February 29 by pirogue for Androka, starting before dawn. The pirogues carried a good spread of sail and simply raced along in a good breeze. Such a breeze usually sprang up about three o'clock in the morning from the northwest and changed into the south about ten o'clock in the morning. When the wind changed the natives poled along close to the shore. The reef was not far from the shore and the water inside it was shallow. Inland the country was low and sandy with scattered brush and sparse grass. The brush-covered hills rose several kilometers inland.

To illustrate the scarcity of water in this country, I may mention that it was necessary, one night when we were camping near a few little huts near the coast, to send a man four kilometers for water. Beyond Lanivato (meaning end of the rocks), there was no reef and we did not find one again until we approached Androka.

Fig. 14. Clearing in a river-bottom forest of the Subdesert Province. Where the river furnishes ground water the forest is dense and evergreen, being very similar to some of the forest in the Occidental Province (Ampotaka, March, 1930).

ANDROKA.—This village was at the mouth of the Ilinta River. The tide flooded extensive salt marshes there and at low tide large areas of mud flats were left exposed where shore birds were very common. The country immediately about Androka was level and largely planted to corn, beans, or melons. Farther inland sand dunes clothed with desert brush appeared. I collected there for a few days waiting for

porters, then started for Ampotaka, going to Ampalaza and Bevoalava, along the coast. Near Ampalaza the coast was bordered with bare sand dunes, this being the only place that we saw them. At Bevoalava the country changed from desert brush to a scantily wooded area. At the mouth of the Menarandra River an area of mangrove swamp appeared.

The trail led eastward up the Menarandra River across portions of calcareous plateau above the river and through areas of forest in the valley. *Coua c. pyropyga* and *Coua verreauxi* occurred together in this country, though we found only *Coua verreauxi* at Lac Tsimanampetsotsa. Both species came into the same tree during one midday halt in this vicinity.

AMPOTAKA.—Along the Menarandra River was a forest of rather large, green-leaved trees. Much of the undergrowth had been cut or burned off and everywhere were clearings where the natives grew corn or millet-like grain. Away from the river much of the forest had been burned or cut and replaced by brush. To the north, across the river, the calcareous plateau could be seen, but we did not visit it; to the south the country was flat. Some hours away was a low dry forest of strange spiny plants (*Didierea*) that was said to extend nearly to Fort Dauphin. The nesting season for most of the birds of this region was past and the birds were traveling in mixed feeding flocks. Many young birds were seen.

The weather was cool during the three weeks that I spent there and twice there were heavy showers. Occasional fogs were encountered in the mornings.

AMPOTAKA TO TULEAR.—Our route led inland by way of Ampanihy and Tongobory, then down the Onilahy River to Tulear. From Ampotaka to Ampanihy the route passed out of the river bottom through an area of grassland with scattered bushes, then through typically calcareous plateau country. It next led through a level desolate country of brush and scantily grass-covered land. A few flat-topped hills appeared in the distance. This was a meeting place for the subdesert brush and the savanna country that I encountered near Ampanihy, where the grasslands were dotted with low trees.

AMPANIHY TO TONGOHORY.—I passed through a flat, rather green savanna country beyond Ampanihy, a country with many low ant hills, with occasional scattered areas of brush and wooded plain and with gallery forest along the rivers. This savanna country appeared to extend much the same at the east but toward the west it sloped to a valley that was separated from the sea by the same low calcareous hills we had seen from the other side as we traveled down the coast.

Here and there in the savanna country the trees were replaced by scattered palms and the grass was very luxuriant. As we neared Tongohory the country became somewhat hilly and covered with a low dry brush.

TONGOHORY TO TULEAR.—I descended the Onilahy River by pirogue. Very soon the river flowed between high brush-clad slopes that led up into the calcareous hills. A narrow line of large green trees fringed the river banks and here and there were beds of reeds. The river was shallow and contained many sand bars, on which flocks of ducks (*Dendrocygna viduata* and *Sarkidiornis melanonotus*) often congregated. Near the mouth of the river sand bars and islets of reeds became more and more common and we found many wading birds. At the mouth of the river were numerous mud flats, swarming with shore birds.

The Bay of St. Augustin was the one place along the coast where the hills came

Fig. 15. River-bottom forest killed by fire. Once the forest is destroyed a low scattered brush replaces it while the ground is covered with a very scanty grass, or, in the drier parts, may be almost bare (Ampotaka, March, 1930).

Fig. 16. Porters resting in the savanna. This country is grassy with scattered low trees and usually with denser fringes of brush or gallery forest along the streams. It is much alike in both the Occidental and Subdesert provinces and resembles some brush areas in the Humid East district (near Ejeda, March, 1930).

out to the sea. Everywhere else I found sand desert bordering it, but there the calcareous plateau dropped sharply to the edge of the water, resulting in an impressive bay guarded by frowning bluffs.

Though I reached the bay before noon, I found it necessary to wait until the following morning for the wind to drop sufficiently to allow me to cross to Salara. I spent two days at Salara in subdesert country, similar to that around Anakao, then went to Tulear where I met Archbold and Du Mont and returned to Tananarive with them. The rainy season was just past and the western plains from Tulear to Ihosy, so dry and brown in October, were now green and damp. Even on the central plateau the green color of the grass was somewhat noticeable. The harvest time for the rice was nearly over and the natives were busily engaged in threshing and storing it.

UNIT FOUR.—The northern part of the island of Madagascar, April, 1930 to May, 1931.

PERSONNEL.—Richard Archbold, P. A. Du Mont, A. L. Rand.

ITINERARY.—Returning from the south of Madagascar, we stayed at Tananarive from April 8 to April 11, while we arranged our plans with M. R. Decary. M. Decary planned to collect in the west while we worked in the north of the island. On April 12 we descended to Tamatave by rail. We stayed in Tamatave for a short time waiting for a steamer to take us to Maroantsetra and during our stay collected a few birds on the outskirts of the town.

On April 27, we embarked in a little cattle steamer for Maroantsetra, arriving there April 29, stopping on the way at Fenerive on April 28, where we spent a few hours ashore. April 29 to May 4 was spent in Maroantsetra, where an attack of fever kept me in bed while Archbold and Du Mont collected in the vicinity. On May 5, M. Tinayre kindly provided us with a motor boat to take us up the Vohemar River. We stopped at Bevato (forty kilometers northwest of Maroantsetra), a little village that M. Tinayre had constructed on a lumber concession he had exploited. We collected at Bevato until May 26, when M. Tinayre sent his motor boat for us and we returned again to Maroantsetra. From May 21 to July 11, we collected about the little village of Manombia (twenty kilometers southwest of Maroantsetra), on the coastal plain country at the edge of the sea. On June 12, we returned to Maroantsetra where Archbold left us to return to America.

On June 14, Du Mont and I started on the trail across the mountains to Antalaha, where we made camp June 16, in a little village near the divide, at about 1000 meters altitude, and collected there until July 24. During the period from July 1 to July 5, I returned to Maroantsetra to secure my gun which M. Tinayre had been repairing. July 25 and 26,

we descended to Antalaha, where we collected a few birds, and then left on August 5 for Andapa, on what proved to be our most productive period of forest collecting. August 11 to August 17 were spent collecting at Andapa (altitude about 1000 meters), and August 19 to September 7 were spent in the mountains one day west of Andapa (altitude about 1800 meters), where we collected on the upper edge of the humid forest.

On September 8 and 9 we returned to Andapa and started north across the mountains to Doany where we arrived September 10 and then turned eastward toward Sambava which we reached September 13, collecting a few birds along the route. On September 15, we started northward along the coast, stopping at Vohemar, September 17 to 22; at Vohemar, one day north, September 23 to 27; at Loky, September 28; at Rodo, September 29; and arrived at Diego Suarez, October 1. We collected a number of birds on this trip.

The period from October 1 to October 8 was devoted to packing and shipping our specimens, and on October 9 we moved to Joffreville and then to the forestry station on the summit of Mt. d'Ambre where we collected until November 2. We next descended the western side of the mountain, stopping at Andranofanjava, Bobakalany, and then going southward, establishing our camp in a little village some fifteen kilometers southwest of Tsarakibany at the foot of the Falaise of Ankarana, where we collected from November 7 to November 11.

On November 12 we continued our journey southward toward the Sambirano, stopping at Ambilobe on November 13 and 14; at Anaborano, November 14 to 18; and finally camped in a little village one day south of Anaborano in the humid forest, where we collected from November 18 to 24. On November 25 we moved to Bezona, a half day's journey away, on the Ramena River, where we collected until November 30. We then turned toward the coast, stopping at Ambanja on December 1, and installed outselves at Ambiky on the coast opposite Nossi Be on December 2, where we collected chiefly along the shore until December 11. December 12 to 25 were spent at Nossi Be, where few birds were collected; then we moved to Ampasimena, on the mainland to the south, where we collected until December 30; then moved southward along the coastal trail, collecting near Marotony from December 31 to January 6 and at Anorontsanga from January 8 to 11.

On January 12, we turned inland again and collected at Andampy (Maromandia, one day east) at the base of the mountains, from January 16 to 28. We went next to Maromandia on the coast where we were

guests of M. and Mme. Mahe from January 31 to February 3. We then started south for Majunga by dhow, stopping at various points in the coast and arrived there February 12. We spent from February 12 to 22 at Majunga, and on February 22 left by schooner for Soalala, arriving February 23, where we collected until February 27. On February 28, we moved to Namoroka, stopping en route a half day at Bekotrobaka, where *Foudia sakalava* was very common, and arriving at Namoroka on March 1. We collected there until March 13, when we returned to Soalala on March 15, and then started for Lac Kinkony; we arrived at Antseza, on the east side of the lake, on March 18, and established ourselves in the rest house there. We remained there collecting water birds until March 24. On March 24 we moved to Ambararatabe, on the borders of the Hopy River near Lac Amparikely, where we were the guests of M. A. Michaeloff. We hunted with him through the marshes and forests and on the borders of the Mahavavy River until April 3. April 3 to 5 were spent on the trail to Marovoay. We crossed the Mahavavy River at Bekipay and continued north over savanna country.

On April 8, we descended the Betsiboka River to Majunga, packed our specimens, and then returned to Tananarive where we stayed from April 16 to 22. April 23 to May 2 were spent collecting in the forest at Fanovana, on the railway line to Tamatave. On May 7, we embarked at Tamatave for France, touching at Diego Suarez, Nossi Be, and Majunga.

Description of the Route and the Collecting Stations

Tamatave to Maroantsetra.—We left Tamatave by steamer after dark and the next morning stopped at Fenerive and went ashore. Here the low hills came out to the coast. The country was green and somewhat wooded but was covered largely with secondary brush. The forest was said to be a day's journey inland. We experienced rather rough weather during the rest of the trip along the coast and could see the shores only indistinctly. In the Bay of Antongil the mountains came out steeply to the coast and appeared wooded.

Maroantsetra.—The political provinces of Maroantsetra and Antalaha were said to contain more forested land than any other provinces in Madagascar. They are also in the most humid part of the island and have no well-defined dry season. About Maroantsetra itself was a low flat area on the coast; where the river was sluggish, marsh-bordered ponds occurred. The country near the town was covered with secondary brush. There was considerable sandy beach at the head of the bay, though the sea was usually rough.

We collected a few birds about Maroantsetra but soon moved to the little village of Bevato (forty kilometers northwest) up the Vohemar River, which M. Tinayre

had constructed for his lumbering operations. As we started up the river, there was low and swampy country on each side usually covered with bushes and here and there raphia palms. Soon the banks became higher, with a fringe of reeds. The villages usually had groves of coconut palms near-by, and groves of raphia palms were common. About thirty-five kilometers northwest of Maroantsetra the

Fig. 17. Humid forest at about 50 m. altitude (Oriental Province, Maroantsetra, 40 km. northwest, May, 1930).

mountains began to rise sharply and there the first real forest was seen, and the river became shallower and more rapid.

FORTY KILOMETERS NORTHWEST OF MAROANTSETRA.—The little village of Bevato was nearly at sea level, at the base of the mountains. The forest was all

about. From there we hunted up to about 500 meters altitude. Lumbering had been carried on for certain kinds of trees only, hence little of the forest had been destroyed. The trails that had been cut in lumbering operations made it easy for us to collect in the forest.

The forest at Bevato was very humid; tall trees met overhead and epiphytes were abundant. The ground-cover was not very dense except along the trail where the trees had been cut down, where dense tangles of shrubbery and rank herbaceous growth occurred.

The weather was cool while we were there and we had many fine days during our stay, which M. Tinayre said was unusual for that time of year.

Twenty Kilometers Southwest of Maroantsetra.—The little village of Manombia. There we collected in the flat county next to the coast. Farther south the mountains came to the coast and the flat coastal country disappeared. Some of the forest about Manombia resembled that at Farafangana, occurring on flat country and being of a rather open character. Tall trees met overhead, there was an abundance of palms and a few slender saplings formed the lower strata of the forest. Much leafy ground-cover concealed the ground birds but this growth was not dense and we could easily walk through it. The forest floor was damp but firm and not flooded as we found it in many other similar places. Another type of forest found there was the flooded *Sphagnum* forest, in which the trees were of different species, more widely spaced and not as tall as in the first mentioned type of forest. The ground-cover there was largely wanting and the forest floor was thickly covered with sphagnum-like moss and was flooded in many places. Traveler's tree swamps were also common, where the grass covered the ground, these trees occurring in pure stands. There was little open ground and where it did occur was usually marshy. The streams were sluggish and broad. The sand beach at Manombia was rather broad but farther south it became rocky. Considerable surf was always beating on the coast.

Strangely enough this country lacked many birds such as *Euryceros prevostii* and *Philepitta castanea* that occurred on the wooded mountain slopes near-by, while other species such as *Cinnyris notatus* and *Coracopsis vasa* were much more common there than on the mountains.

Maroantsetra.—Our next objective was the range of mountains that rose on the trail from Maroantsetra to Antalaha.

Arriving at Maroantsetra, June 12, we found the coast boat for Tamatave there, and as Archbold had to be in America by the first of September, he left for Tamatave on this boat. He took our specimens to ship from Tamatave.

Maroantsetra to Two Days Northeast.—On June 14, we started northeast with porters across the brush-covered coastal country to Andranofotsy, then crossed over a small heavily forested ridge to Navana, next across a very swampy coastal area, largely brush-covered, containing rice swamps and some open ground, going on to Mahalevona where we turned inland up the river valley. The heavily forested mountains rose on either side of the trail but the bottom of the valley had been cut over and was now brush covered. Many coffee plantations had been set out in this region.

The next morning we passed beyond the cultivated areas of coffee and soon our trail lay through the forest with but a narrow clearing on either side.

TWO DAYS NORTHEAST OF MAROANTSETRA.—Ambohimarahavavy (altitude about 1000 meters), a little village a mile or so from the divide that separated the watersheds of Maroantsetra and Antalaha, was chosen as our headquarters, and we collected there until July 23. The village was in a mountainous country where the slopes were steep and where there were no palm swamps occurring along the rapid streams. The heavy forest was similar to that on the lower slopes at Bevato; but with lower trees and much tangled ground-cover, especially the trailing bamboo, on the high slopes. The clearings about the village, the hill rice fields, the coffee and vanilla plantations, and the cut-over brush were restricted in area but contained a few birds characteristic of the open country.

The weather during our stay was bad; it was cold and rains or mist were of almost daily occurrence. As housing conditions were very poor, we used tents. The specimens dried over kerosene lamps were in good shape, however.

TWO DAYS NORTHEAST OF MAROANTSETRA TO ANTALAHA.—The route from Ambohimarahavavy followed a river out of the hills and soon the trail ran through a cultivated valley. The forest was pushed farther back on the hilltops and little swamps soon appeared. On the foothills, before we came out onto the flat coastal areas, was a considerable area of low bamboo. There was a motor road on the coastal area and we were fortunate in finding an auto to take us to Antalaha, on the coast about twenty or twenty-five kilometers away. The porters continued on foot with the baggage. The level coastal area there was more or less wooded, with open swamps, but with no real forest.

ANTALAHA.—We spent the time until August 5 in Antalaha, packing specimens and collecting a few birds in the vanilla plantations and brush about town. Once we collected in the low forest and among the traveler's trees on the coast some distance south of Antalaha. The birds were, of course, of the widespread open-ground type and the common forest forms that ranged into the brush.

The country at Antalaha was much drier than in the mountains and we found that from Antalaha north the rainfall was less than it was to the south and inland. Some of the flat coastal area was almost wooded savanna country such as we had found in the west. We saw a hoopoe and also several stilts about a pond to the north of the village, both birds rather characteristic of the western part of the island.

ANTALAHA TO ONE DAY WEST OF ANDAPA.—We decided to collect again in the eastern rain forest, and as the most feasible route into this sort of country led to Andapa and the hills beyond, we started in that direction on August 6, with fifty-one men as porters. During the first day the trail led through low hills interspersed with wide swamps thickly grown with vegetation. There was considerable brush but little forest except for small areas occurring on distant hills. Vanilla plantations were everywhere.

The next day the hills were closer and the swamps smaller. The forest areas were more plentiful than they had been the previous day, coming down in some places to the trail itself. On August 8 and 9, the hills were still closer and steeper than the day before, and were wooded, though there was still much vanilla growing along the trail. The trail occasionally lay through dense forest. We arrived at Mahalavalona in the morning of the fourth day, and found the country along the trail largely covered with brush. The next day we passed through forest for seven hours before reaching the little plateau of Ankaibe where Andapa was situated.

The trail had been surprisingly good all of the way, the first 30 kilometers passable by auto. The government has planned to complete the road to Ankaibe though the very nature of the country presents difficulties.

ANDAPA.—The town of Andapa was situated on the little plateau of Ankaibe, altitude about 500 meters, a small flat basin, from five to ten kilometers across, hemmed in on every side by the mountains. The plateau was the open-brush type of country covered with grass and raphia swamps, and much vanilla was grown there. We found *Apus m. willsi* very common, and saw it swooping low to feed over the vanilla plantations. We spent a few days collecting at Andapa and hunting on the neighboring mountain forest that was similar to that at Maroantsetra, two days northeast, and to that at Bevato, though it had more tangled ground cover, climbing bamboo and moss. Birds were common, and though it was an easy place in which to hunt, we did little collecting there, since our real objective lay in the mountains beyond.

On August 18, we started our climb, and once out of the basin, soon encountered forest of a lower and different type than that found to the east of Andapa. On August 19 we were still passing through the forest which was sometimes low and draped with lichens, and had the ground thickly carpeted with moss. *Indris* was heard calling continually, for the first time since we had left Bevato. From information given us previously by the Chef de Poste, we had thought it would be necessary to camp in the forest here, but we found a new village erected on the upper edge of the forest where the forest gave way to the open brush-covered plateau, and this offered a very satisfactory place for our camp.

ONE DAY WEST OF ANDAPA (altitude about 1800 meters).—Here the country was beautiful. To the north a dark mountain mass arose; to the south, range after range of mountains stretched away, losing themselves in the bluish haze. We found the climate delightful, too. It was damp and rained nearly every day that we were there, but it was cool, even chilly at night so that we always had a roaring fire. There were traces of frost some mornings on the tobacco plants outside the tent. Our camp was situated in hilly country on the edge of a high plateau. Besides the low moss and lichen-draped trees and the forest of taller trees like those found on the forests at lower altitudes, we found open ground stretching away to the west. Each valley had a little swamp with grass or reeds growing in it, and the ridges were covered with low brush, bracken, and grass. Birds were common and the natives with their blow guns were very useful as collectors. Some of our best series of forest birds were taken in this locality.

ONE DAY WEST OF ANDAPA TO SAMBAVA.—On September 8 we returned to Andapa. The easiest route to the coast was said to be along the Loza River but we wished to pass by Doany to the north and see the country there and then go down to Sambava. From Andapa to Doany we climbed over another range of mountains where we spent several hours passing through magnificent rain forest that changed to lower, lichen-clad forest at the higher altitudes, where the mist and the fog prevented us from seeing anything at a distance.

Doany was situated in another basin, which was forestless and covered with scanty grass, as were the surrounding hills. Near the town were several large raphia swamps. The trail from Doany to Sambava followed a river valley and was steep and rocky. Our porters were among the best that we ever had and traveled well,

being on the trail twelve hours some days, counting the time spent at the river crossings.

Much of the country was bare of trees and the areas of forest were usually very restricted and much cut into. On September 12, we emerged into comparatively level coast country with many villages and cultivated areas of vanilla, sugarcane, etc. The coast region was partly covered with grass and partly wooded with low brush and palms. As we came out from Doany the country became much drier, the rains being evidently lighter and more seasonal there. The coastal country resembled the western plains. An *Oena c. aliena*, a bird of the west, was seen along the trail. At Sambava, where we arrived September 13, the country was brush-covered, some of the beaches were broad and we saw numbers of terns.

On September 24, we left Sambava on our way to Antsirabe, passing through much low dry forest where we found *Falculea palliata* common, much to our surprise. At Antsirabe we proceeded by automobile to Vohemar, finding much low forest on the first part of the road. Near Vohemar the land was almost all open grass country that made it one of the richest cattle regions of the island. At Vohemar we met the extremely hospitable Chef de District, who lodged us in the Residence. Near the town of Vohemar was an area of sandy brush, much like those in the south, and here we found *Falculea palliata* again. *Copsychus a. pica*, *Upupa e. marginata*, and *Oena c. aliena* were fairly common. The contrast between the humid forest and this western type of forest was very marked within a short distance in this part of the island.

On September 20, we accompanied the Resident some thirty-five kilometers northwest of Vohemar where work was being done on the road that is part of the road system that will eventually link Diego Suarez and Antalaha. The forest there was low and dry and confined to the river bottoms. Birds were fairly common and were similar to those found at Vohemar. The river was wide and shallow with many sand bars, where wading birds were fairly common. The surrounding hills were bare but to the west a forest was to be seen on the highest hills. The natives said this was of considerable extent and that *Propithecus* occurred there.

We left Vohemar on September 23, planning to spend some ten days collecting on the way to Diego Suarez. The trail crossed bare open plains and palm-covered areas. We found a low dry forest about a half day north of Vohemar, located on a rolling plain. We also found extensive grassy meadows and a brackish marsh with large areas of water in which water birds were very common. We collected here from September 24 to 27 and made trips to the sea coast, an hour away, where we found herons and terns common on the wide flats left by the falling tide. We also found *Foudia sakalava*, another western form, near here. On September 28 we continued our way north and slept that night at Loky. The trail lay over low ground near the coast and passed over a wide expanse of grassy palm-plain. We made an early start the next morning since the Loky River could be crossed only in the early morning because of the wind, and we made our way to Rodo. The hills came out close to the sea; the country was bare with some limestone ridges, clothed with vegetation similar to that of the southwest limestone areas. The hills had some dry gray forest on them and the narrow level coastal belt was covered with brush or palms.

We spent the night at Rodo where we found *Foudia s. sakalava* nesting in the coconut palms in the village. The next day we again passed through palm-plains

Fig. 18. A palm-plain in the Northern Savanna district (near Rodo, September, 1930). [Photograph by P. A. Du Mont.]

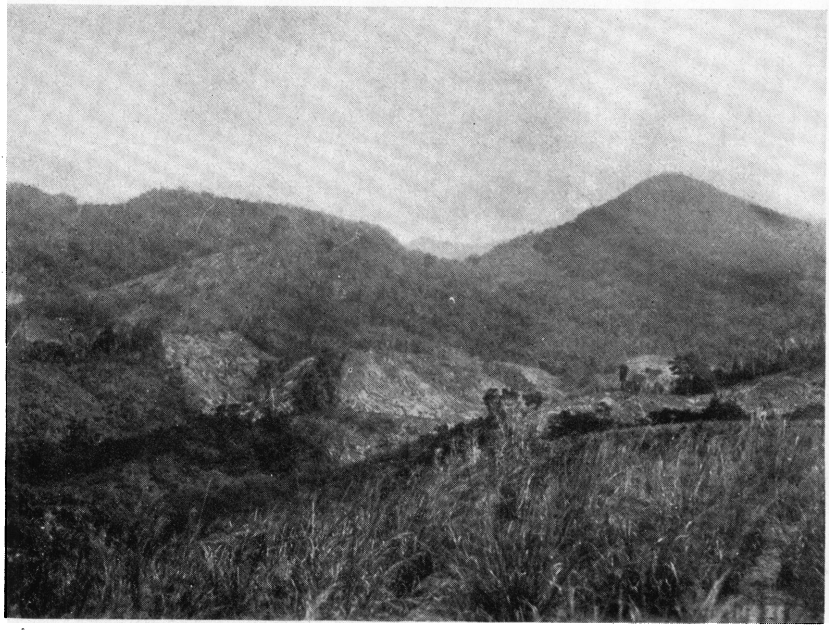

Fig. 19. Showing the destruction of the humid forest in the Sambirano (Bezona, November, 1930).

that were often sandy, and at midday when we turned inland to reach the motor road to Diego Suarez, we passed through brushlands, noted tree-lined rivers occasionally, and crossed some open country.

At Mahagaga a truck was found to take us to Diego Suarez, twenty kilometers away, and we arrived there October 1 and lodged with M. Mortages, whom we had previously met at Joffreville over a year ago. Since that time he had been collecting specimens for the Mission. His help and advice, and his knowledge of the country around Mt. d'Ambre and in the northwest where he had prospected for gold for many years, were of the greatest value to us.

MT. D'AMBRE.—Having shipped our specimens, we engaged a truck to take us to Mt. d'Ambre where we stayed at Joffreville just below the forest until porters were secured. (All through the dry season it is possible to go nearly to Petit Lac in the forest by car, but we could not do this because of the approaching rainy season.) We collected about Joffreville on the grassy slopes and in the low deciduous forest where we found little but widespread forms. On October 13 we moved to the forestry station on Mt. d'Ambre, altitude about 1000 meters, where we camped, and collected until November 2. Mt. d'Ambre rises to 1361 meters. The forest on the summit of Mt. d'Ambre was of a damp, green, rain forest type containing many lianas and mosses. In places in this forest much herbaceous ground-cover occurred, though in other areas the forest floor was rather open. Considerable areas of brushland occurred also in some places in the forest. The rain forest was different from the dry forest of the lower slopes, indeed different from any forest that we had encountered since leaving Sambava. We made a few excursions to the small lakes that were common on the summit of the mountain and to the open ground at the lower edge of the forest.

Birds were fairly common; of particular note were the forest forms, *Atelornis pittoides* and *Pseudocossyphus s. erythronotus*, both of which were common.

MT. D'AMBRE TO FIFTEEN MILES SOUTHWEST OF TSARAKIBANY.—Leaving Mt. d'Ambre we planned to go to Nossi Be, collecting in the wooded regions along the way and passing through Ambilobe and Ambanja. Our immediate objective was the Falaise of Ankarana, not far to the south of Mt. d'Ambre.

As the trail marked on the maps for crossing Mt. d'Ambre was too badly grown up for use when carrying baggage, we found it necessary to descend the northwest slope to the coast land, passing through Andranofanjava and Bobakilany to the little village of Andranotolina at the foot of the Falaise, some fifteen miles southwest of Tsarakibany, where we finally arrived November 6. We found much of the coast land to the west of Mt. d'Ambre to be brush or palm-plain similar to that found on the eastern side of the mountain. Near Bobakilany we found considerable forest such as we had found on the lower slopes of Mt. d'Ambre, differing both in flora and fauna from the forest on the summit of the mountain, being dry and western in character. As soon as we left the rain forest we found *Coua c. cristata* and *Upupa epops marginata*, neither of which was found in the humid forest on the summit. The coast land west of Mt. d'Ambre was very flat with extensive tidal flats and mangrove swamps where we found shore birds common.

FIFTEEN MILES SOUTHWEST OF TSARAKIBANY.—The Falaise of Ankarana that rose abruptly from the coastal plain was of limestone, pitted and weathered to jagged points. The vegetation there was low, often dense brush and woodland. At the

foot of the Falaise, however, was a real forest of quite large trees. The country was dry and in the wooded areas the trees were mostly leafless, the ground covered with dead leaves. A few lianas occurred but there was little ground-cover. Away from the Falaise we found the forest only along the river, where it was greener, or represented by areas of brush. Much of the coastal plain was covered with palm or grass with here and there dried up pools. Water birds may have been common here during the rainy season.

FIFTEEN MILES SOUTHWEST OF TSARAKIBANY TO ANABORANO.—On November 12, we started for Ambilobe. The trail lay through coast land, then passed through a break in the Falaise across a palm-plain that was dotted here and there with ponds and small swamps containing many water birds, including pond herons (*Ardeola*) and black herons (*Melanophoyx*). Here and there we saw mango trees loaded with ripe fruit, as this was the beginning of the mango season.

We reached Ambilobe, November 13, a town situated on the edge of a palm-plain at the foot of the hills, which appeared to be somewhat covered with scanty brush. We left for Anaborano, November 14, the road passing at first over flat grass country similar to that near Vohemar; inland, the mountains rose abruptly and were rather scantily wooded; and several islands loomed up off shore. As the road turned to follow the river Ifasy inland into the hilly country, a low brush forest was encountered. This road had been opened recently and was rather rough for the latter half of the way. It was passable during the dry season only, for when the rains came the valleys were filled with water, and the nearly dry, sandy river beds became swirling floods that swept away the wooden bridges. Consequently, communications would be slow and travel with equipment would be impossible during the wet season. This region, a narrow flat valley draining the northwest slopes of Tsaratanana, was said to be one of the most inundated regions in the northwest of Madagascar and we had been warned to be out of it before the rains should start in December, though in reality they started later this year. At Anaborano we had a beautiful view of the surrounding country; to the southeast rose tier after tier of mountains like great steps, toward Tsaratanana; below, the green marshy valley was contrasted with the gray-brown vegetation on the opposite hills that separated the valley from the coast. We spent a few days collecting there in the low, wet river bottom with its large scattered trees and its herbaceous growth and little ponds and swamps; and also collected on the hills across the valley that were covered with rather low, thick, very dry forest. All of this country was western in character as were the birds found there, but as we found in almost all of the northwest, birds were of widespread species.

As we started southward we entered within a few hours a humid evergreen area of forest and brush near the divide between the Ifasy River and the Sambirano, which marked the limits of the old tribal areas of the Antakara on the north and the Sakalava on the south.

The country that rose to the eastward toward Tsaratanana was hilly and wooded. Some of the country was covered with a humid though not luxuriant forest hung with lianas and epiphytes, but most of it was covered with a low sapling forest containing many traveler's trees and carpeted with much grass. Here we found natives burning the forests in the hidden valleys back from the trails, contrary to the legislation forbidding the practice. Birds were fairly common but we thought there might be better collecting at Bezona, on the Ramena River, a tributary of the Sambirano,

only a half day's journey away, so we moved there November 25. Here the destruction of the forest was striking. The natives were cutting and burning the forest to obtain land for cultivation, planting rice or corn in the ashes for one season, then allowing the areas to grow up to brush again, and perhaps burning them over again. After the land had been burned over several times, the humus was washed away and the sterile soil would support only a sparse covering of grass. This was near the edge of the forestry preserve on Tsaratanana, I believe, though I did not visit that region. We found some quite dense original forest, however, though it was not so wet and luxuriant as that of eastern Madagascar or that on Mt. d'Ambre. The river here was rather rapid. The few marshy bays contained a few water birds.

The bird life of this region contained a few species characteristic of the humid forest, such as *Coua reynaudii*, *Canirallus kioloides*, and *Caprimulgus enarratus*, though on the whole the avifauna was scanty.

Our time in this country was short since the rains were coming. Only light showers had fallen so far but the clouds were coming lower, and the natives were hurrying their burnings, so we started for Ambanja and the coast on November 30. The first part of the trail lay through hilly country, much of it wooded, but soon entered brushland where traveler's palms were common, and near Ambodimanga passed through country covered with brush. Ambanja is in a flat, verdant grassy delta region, hot and humid, which is one of the most fertile regions of Madagascar. Much coffee, vanilla, eylang-eylang, sugar cane, and pineapples are grown there. At Ambanja the Chef de District arranged for a car to take us to the coast where he placed the whale-boat of the Travaux Publics at our disposal. Ambiky, a coastal village opposite Nossi Be, was chosen as our headquarters, and we collected there from December 6 to 11. The flat delta country of the Sambirano graded slowly down to the sea at this place, through abundant mangrove swamps, mud flats, and mangrove islets.

AMBIKY.—We hunted by pirogue along the coast where at low tide extensive muddy flats and sand bars were left exposed. The mangroves covered extensive areas and at high tide we paddled along winding lanes among them. Fish were plentiful and the natives took many in weirs made of raphia leaflet stems bound together with cord into a sort of fence. These weirs could be rolled up and were changed every few days. Many herons and shore birds were common and many sea eagles were seen, some of them frequenting the weirs to feed. To the north the high ground came out to the sea and was scantily brush-covered. To the south also, the hills came out to the coast. Nossi Be and Nossi Komba rose off shore and the natives regularly made the trip in their pirogues. Inland the mountains led up gradually to a high regular mass, the hills passing inland farther south.

NOSSI BE TO ANORONTSANGA.—We crossed from Ambiky to Nossi Be, where we shipped our specimens, then crossed to the mainland south to Ampasimena, where we waited a few days for porters. The country there was rather hilly, and the low brush covering it was scanty. Traveler's trees were common, grass was scarce and red soil was everywhere apparent. Birds of widespread species were fairly common.

On January 3, we moved south along the coast, crossing the mouths of several mangrove-lined bays where we saw or heard sea eagles, and going through extensive coconut groves. South of Marotony we camped for a few days in a large coconut grove. Beyond the narrow flat area next to the sea, which was planted to coconuts,

a low hill rose and ran parallel to the coast. It was covered with a low humid forest in which the trees were close together but not very high. On a few of these were epiphytes. The ground-cover was very scanty in places, though in others the trailing bamboo covered the ground so densely that progress was impossible. In the more open spaces, particularly on the tops of the ridges, there was some scanty grass.

Coua reynaudii was the only bird there characteristic of the Oriental Province. Farther inland the country appeared to be the same open brush type of country that we found at Ampasimena. The beach here was sandy and there were few water birds except for the widespread sand plover (*Charadrius m. tenellus*) and a few crab plovers (*Dromas aredola*). As we moved southward we found the hills coming out to the coast, ending in low bluffs, so that we had to make a detour inland to avoid them. Soon the forest gave way to brush and the country became lower, though hills of the red soil still persisted and the beaches became broader and muddier. We arrived at Anorontsanga that evening and spent a few days there waiting for porters.

ANORONTSANGA.—The country about Anorontsanga was largely brush-covered, with here and there mango groves and coconut groves. There were several grassy swamps near the coast and the natives showed us a little swamp in a pocket in the hills where *Egretta dimorpha*, *Anastomus l. madagascariensis*, *Threskiornis a. bernieri*, and *Bubulcus i. ibis* were nesting, and where *Phalacrocorax a. pictilis* evidently had been nesting, judging from the number of young flying about.

The little swamp, barely one hundred yards across, was like an immense alder tangle with trees from three to six meters high growing in the standing water. Crocodiles were common so that it was impossible to explore all of the swamp, but the natives knew the swamp well, evidently having collected young birds here before, and it was possible to climb about through the trees. Rough bridges had been improvised in places.

On the coast extensive mud and sand flats were exposed by the tide, and water birds were common. Farther up the bay the mangroves formed extensive swamps.

ANORONTSANGA TO ONE DAY EAST OF MAROMANDIA.—We left Anorontsanga on January 13 and moved inland. The peninsula of Ampasimena was largely covered with low open brush and traveler's palms, with red soil showing everywhere; a very poor country. Low forest occurred here and there along the streams and valleys and along the seaward edge of the peninsula. To the south toward Maromandia, the brush itself disappeared and the country became bare and desolate; toward the east the mountains rose dark and wooded. Because of a poor guide from Ankaramy we traveled in a circle and it took us two days to reach Andampy at the foot of the wooded mountains on the edge of the forest.

ANDAMPY, ONE DAY EAST OF MAROMANDIA.—Inland as far as Andampy the country was low, slightly hilly and practically bare of trees. East of Andampy the mountains rose sharply and were wooded. The forest was green and damp, with tall trees meeting over head and with some thick ground-cover of tangled bamboo grass, while in other places, the ground-cover was scanty. This forest resembled somewhat the rain forest of the east coast though perhaps it was not quite so luxuriant.

Birds were fairly common there. Two more species, *Atelornis pittoides* and *Oxylabes madagascariensis*, rather characteristic of the eastern forest, were found; *Coua reynaudii*, *Canirallus kioloides*, and *Nelicurvius nelicourvi* were fairly common.

This forest is probably more or less continuous with that in which we had hunted to the west of Andapa, and so with the rain forest of the east. Since it was similar in character it seemed probable that many more of the forest birds of the east might be found in the northwest, particularly at the higher altitudes. It was a meeting place for eastern and western species, though not many of either occurred and few birds had their center of abundance in this region.

Here we experienced really hard rains for the first time. It poured. The tent was useless. Everything was flooded, and the little streams near the village showed signs of having risen from three to five meters above their usual level. Hunting was hopeless except on the occasional fair days, and the natives said that probably the hard rains had just started.

ONE DAY EAST OF MAROMANDIA TO MAJUNGA AND SOALALA.—On January 30 we left for Maromandia, the trail leading through hilly country largely bare of trees, though we found some brush areas near Maromandia. The soil was red and sterile. Part of the trail lay through the valley of the Manangarivo, which was very fertile and contained many plantations. From January 31 to February 3 we were the guests of M. Mahe, the Chef de Poste, and Mme. Mahe. M. Mahe found a dhow to take us south. Inland toward Bejof there was said to be a humid forest on the trail to Bealanana, but about Maromandia the country was largely covered with brush. Extensive groves of coconut palms had been planted and along the arms of the sea were large mangrove swamps. We left Maromandia for Majunga in a twelve-ton dhow and took ten days to reach there, getting a few birds on the way when we stopped in at Analalava and when we anchored at night and for squalls.

At Maromandia we could see the mountains inland but farther south we lost sight of them and found the rest of the coast with a steep low shore, as far as Majunga. Very little forest and little brush showed during the first part of the trip, though about Analalava the country looked as though it were covered with low brush. Farther south, as we neared Majunga, we saw the edge of a palm-plain and noticed a coastal area of sand and desert brush similar to that in the southwest. Extensive areas of mangroves occurred in many of the bays.

The weather during our trip down the coast was squally, and sudden wind, often accompanied by rain, blew up in the afternoons. One afternoon, the sail blew off and we spent an anxious night at anchor while the skipper went for another sail. We arrived at Majunga, February 12, where we met Mr. Rowntree, the British vice consul, whose hospitality we enjoyed on several occasions, and who supplied us with valuable data.

It seemed best to cover the area about Majunga by going to Soalala, then to Lac Kinkony, and on to Marovoay, so we set out by schooner for Soalala. There M. Godeau, the Chef de la Province, placed several rooms in the Residence at our disposal and we hunted in the surrounding country until February 28. About the bay were extensive mud flats and a few areas of mangroves. Mangroves also bordered the river. Across the inlet and along the river that emptied into it was a sandy area covered with low brush. (M. Godeau told us of this. We did not visit it since M. Decary had already done so.) The country inland varied from level ground to rolling hills and had once been wooded, evidence of this existing in the old blackened tree trunks that were still evident. It was now largely covered with brush and grass, with thickets here and there, some of the brush reaching six meters in height. Open-ground birds and widespread birds of the brush were common.

We left Soalala, February 28, and in three hours reached Bekotrobaka. Our way led us through mangroves, then through brushlands and across open palm-plains with here and there areas of trees. The grassy valleys were filled with water and there were many ducks (*Dendrocygna viduata* and *Sarkidiornis melanotos*) in them. A severe shower fell during the afternoon.

At Bekotrobaka there was a large colony of *Foudia sakalava* nesting in the "mango" and "madeira" trees in the village. The next day we crossed a low line of wooded hills covered with a rather good forest hung with some lianas and with the forest floor more or less leaf-covered. We went on through a wide palm-plain toward the hills (Colline d'Ambongo) that loomed ahead. We made Namoroka, at the foot of the hills, our headquarters and collected there until March 13. The limestone hills rose abruptly from the level plain, which contained sluggish streams, ponds and marshes. The vegetation on the plain was chiefly tall grass and scattered trees, occasionally massed into wooded areas, and the streams were bordered with tall green gallery forest. Much of the swampy land and many of the ponds were probably due to the recent rains, and many of them probably dried up completely during the dry season or at least shrank to a part of their present size, at which time water birds would be much less common.

About the foot of the limestone hills, and in the valleys between, was a deciduous forest with an open leaf-covered forest floor. Walking was difficult over the limestone because of the sharp points and the loose slabs of rock lying about and also because of the tangled vines and bushes, armed with spines, growing there as well as the low trees. The country was much like the calcareous plateau about Lac Tsimanampetsotsa. In the savanna country were many small ponds, areas of marshy ground and flooded rice fields with many water birds. The country was said to be very rich in cattle.

We left Soalala on March 16, for Antseza on the east side of Lac Kinkony. The trail passed through brushlands near Soalala, with occasional larger trees and slender palms, and then through a small area of forest in which we saw several *Propithecus;* out into an open palm-plain with tall grass and scattered palms, in places massed together to form dense stands. These palm-plains were very characteristic of this region and were extremely picturesque but they held few birds. Due to the rains all the marshes and valleys were full of water, and twice it was necessary to secure pirogues to cross flooded valleys that might have been crossed on foot during the dry season.

ANTSEZA.—This village was on an arm of Lac Kinkony which in the dry season had an extensive marsh at its head. Now, because of rains, we were able to travel all over it by pirogue despite the extensive masses of floating vegetation. The tops of many reeds projected from the water and formed reed beds, which made excellent cover for rails, and there were many areas of open water as well. Toward the head of this bay were extensive areas of tall grass (*bararata*). Along the lake shore the water had flooded the palm-plains so that many of the trees stood in the water. The fringe of tall grass growing along the water's edge in the dry season was now out in the lake, and we were able to paddle along in the open water behind it.

Some water birds, rails and jacanas, were very common but there were few ducks. Apparently, the flooded condition had caused them to scatter into the pools in the savanna country.

LAC KINKONY TO AMBARARATABE.—The country was rather flat and grassy

Fig. 20. Flooded palm valley. The periodic rains in the Occidental Province flood large areas such as this. During the dry season footpaths cross this country and cattle feed through it (Ambararatabe, March, 1931).

Fig. 21. Lake Kinkony with its wide beds of floating vegetation (Western Savanna, March, 1931).

with rather dense stands of palms and occasional open forest or brush. The route skirted an extensive marsh of tall grasses "bararata" about an hour away from Antseza.

Ambararatabe was a little village on the bank above the Tsiribahina River on the edge of the palm country. The valley of the Tsiribahina with Lac Amparikely a short distance to the north was from a quarter to a half mile wide. During the dry season, the river was said to occupy only a narrow channel, but at this time the whole valley was flooded and we traveled by pirogues over areas where there were footpaths and cattle pens in the dry season. The valley was covered with a stand of palms, some of them standing close together so that there was no ground vegetation between them, and others so scattered that a luxuriant growth of grass existed between them. The tops of the grass projected above the water during the present wet season. The course of the river was marked by a fringe of "bararata" grass. Some of it was probably from three to five meters high. Along the margin was a narrow border of lily pads and other floating vegetation where we found *Amaurornis olivieri*. The limits of Lac Amparikely were difficult to determine in the flooded valley but it appeared to be about half a mile long and about half as wide. All about it dense vegetation projected from the water and the surface was closely covered with floating masses of vegetation with occasional areas of open water. Various other areas of floating vegetation and open water in the valley indicated swampy conditions or the presence of pools throughout the year. Some water birds were very common but there were few species of ducks. *Thalassornis l. insularis* and *Nettapus auritus* were common and some flocks of *Dendrocygna viduata* were seen along the edges of the water but there probably had been many more during the dry season.

On the north of this valley, between it and the Mahavavy River, was an area of forest with fair-sized trees, all green at this season. A certain amount of low brush and ground-cover occurred but on the whole the forest floor was rather bare. On the banks of the Mahavavy River the forest contained larger trees and the ground was covered in places with low herbaceous growth. The country along the river had been flooded recently and the ground was covered with fine silt, though the present level of the river was more than two meters below the line of the silt. The Mahavavy itself was a rather shallow river, some hundred yards across in this place, with many sand bars, and with banks that rose sharply some two meters or so in height. Crocodiles were very common and their tracks were much larger than those left by a man's foot. To the northwest rose a flat-topped mountain on which sand grouse were said to be very common though we saw very few in this locality. Possibly there was a local movement of these birds, dependent on the rains.

AMBARARATABE TO MAJUNGA.—On April 3, we started for Marovoay, passing along the river to Bekipay, through forest, open grassy valleys, brush, and palm country, then crossing the Mahavavy River at Bekipay and continuing north from there. Shortly after we left the Mahavavy we passed through a small area of beautiful green forest of tall trees hung with many lianas and epiphytes. The forest had a dense undergrowth and the ground was damp, even swampy. Soon we passed through swamps of tall grass where the trail was knee-deep in mud and water for hundreds of yards. Then we crossed a low hilly savanna country, the red soil covered with scanty grass for the most part, though in the valleys the grass was often dense and grew to a height of more than two meters. In some of the deeper

valleys and on some of the hillsides were small areas of low dry forest. Occasionally extensive grassy swamps and swamp rice fields were passed. Near the Betsiboka River we found a low dry forest of brush.

We arrived at Marovoay, April 6. Ankarafantsika appeared as a wooded hill to the east. About Marovoay the country was chiefly savanna, open brush, and rice fields. The tide rose this far up the Betsiboka River, which was about a quarter of a mile wide at this point.

From Marovoay we went down to Majunga, shipped our specimens, then went up to Mevatanana by the motor boat service, and on to Tananarive by auto. The Betsiboka River was wide and shallow with many sand or mud bars on which rice was being planted. Up as far as Marovoay, the country was rather flat but beyond there low wooded hills arose and the river was bordered by rolling savanna country as far as Mevatanana (about 80 meters altitude). There the bare hills rose toward the central plateau with but occasional areas of trees in the valleys. These wooded patches were probably some of the wooded areas that P. de la Bathie referred to as "woods of the western slopes." Their extent was too limited for the occurrence of many forest birds, but probably the fauna was similar to that of the Sambirano and was a mixture of Oriental and Occidental species with a scarcity of both. The central plateau from Mevatanana to Tananarive was mountainous, largely bare and treeless, much like that about Tananarive.

At Tananarive we officially thanked the Governor General for the coöperation of the Administration. We bought some specimens from M. Herschell-Chauvin at this time.

M. Lavauden invited us to see his collection. Though he had sent some specimens back to France, including two *Heliodilus* from the eastern forest, he still had many rare specimens, among them *Mesoenas variegata* and a *Xenopirostris*, both from near Marovoay; *Astur hensti*, *Xenopirostris polleni*, and two *Eutriochis astur*.

UNIT FIVE.—From the time that Du Mont arrived at Majunga, January 27, 1930, until he joined our party, April 5, 1930, he visited various parts of the island and collected a number of birds.

LIST OF LOCALITIES AND DATES

Majunga, January 27
Tamatave, March 22–27
Maroantsetra, March 19
Antalaha, March 7, 8, 10, 11, 12 and 15
Sambava, March 12, 13, 14
Île Ste. Marie, March 4

These localities, except for the Île Ste. Marie, were visited by us between May and September, 1930, and a description of the country there is given in the itinerary (Unit Four).

UNIT SIX.—The western part of the island from Mevatanana to Tsiroanamandidy via Soalala and Maintirano, May 22–July 17, 1930.

PERSONNEL.—R. Decary.

ITINERARY.—Monsieur Decary has published the itinerary[1] of his

[1] 1932, L'Oiseau et R. F. O., pp. 520–529.

journey in the west. Du Mont and I covered part of the northern part of this country, and Messrs. Delacour and Lowe collected in part of the southern portion traversed by M. Decary.

The following data are taken from the labels of specimens collected by M. Decary:

List of Localities and Dates

Mevatanana, May 22, 1930
Maroparasy, May 23, 1930
Ankarano, May 24, 1930
Ankirihitra, May 24, 1930
Tsitampiky (Sitampiky), May 24, 1930
Mahavavy River, May 26, 1930
Ambarinianinga, May 26–27, 1930
Hopy River, May 27, 1930
Ambinda, May 27, 1930
Kinkony (including Antsega), May 28–29, 1930
Soalala (including Point Sada and Bay de Baly) May 31–June 5, 1930
Camparafaka, June 6, 1930
Marolika, June 7, 1930
Andranobory, June 7, 1930
Ankora, June 8, 1930
Anbolidy, June 9, 1930
Ankasakara, June 9, 1930
Bokarano, June 10–12, 1930
Besalampy, June 17–18, 1930
Tambohorano, June 19–23, 1930
Maintirano, Antsalova, and vicinity including Nosy Vao, June 24–July 3, 1930
Bekopaka, July 4–5, 1930
Berakitra, July 7–8, 1930
Ankavandra, July 10–13, 1930
Bongo Lava, July 15, 1930
Ankarefo, July 15, 1930
Tsiroanamandidy, July 17–27, 1930

Fanovana.—Here we spent a few days collecting and waiting for the boat. Fanovana was on the railway line that passed through the forest (altitude about 800 meters). The forest had been much cut over so that we found tangles of brush and luxuriant ground-cover nearly everywhere, though there were a few places where the forest had been left untouched, the trees rising high overhead, hung with many lianas and epiphytes, and there was little ground-cover.

Birds were fairly common here and were typical humid forest forms, though several species that were not found in the northern or southern parts of the Humid East were fairly common here, such as *Dromaeocercus brunneus* and *Oxylabes cinereiceps*.

The forest of Sianaka, the locality from which M. Herschell-Chauvin's specimens came, was said to be similar to the untouched portions of the forest about Fanovana, though more luxuriant and containing larger trees.

Auxiliary Collections

A representative collection of skins of birds of the humid forest was bought from M. Herschell-Chauvin. They were said to have been taken in the forest of Sianaka (central east) where the villages of Fito and Didy are located.

We did not visit this locality but it was said to contain some of the finest forest of the Humid East. Several Madagascar birds are known only from this vicinity (*Mesoenas unicolor* and *Bernieria tenebrosa*).

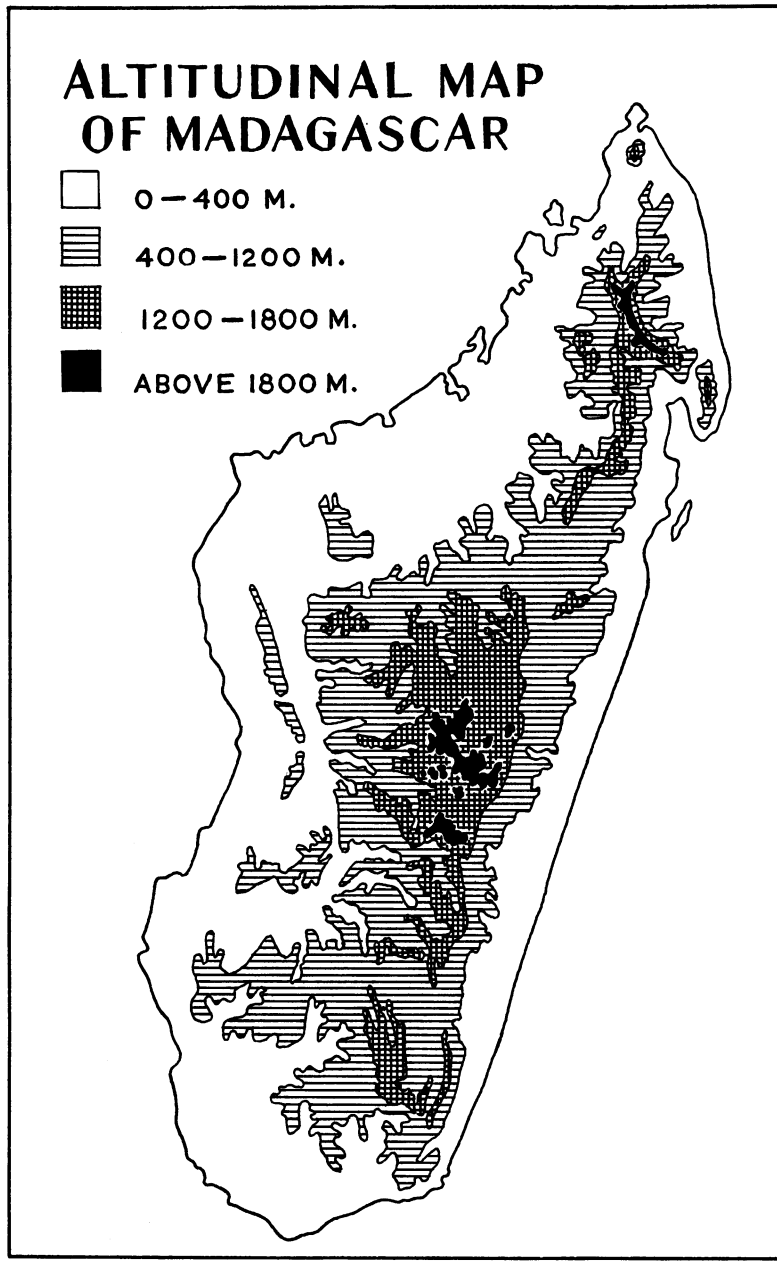
ALTITUDINAL MAP
OF MADAGASCAR
0—400 M.
400—1200 M.
1200—1800 M.
ABOVE 1800 M.

Fig. 22.

AN OUTLINE OF THE TOPOGRAPHY OF MADAGASCAR

TOPOGRAPHY.—Madagascar is oriented north-northeast and south-southeast and is approximately 1600 kilometers long and 560 kilometers wide, with an average width of about 400 kilometers. It has a land surface of some 600,000 square kilometers.

The island is situated off the southeast coast of Africa about 370 kilometers distant at its nearest point. It lies between about 11° 58′ and 25° 38′ south latitude and 43° 22′ and 50° 28′ east longitude.

The central part of Madagascar is an elevated mountain mass extending the length of the island, with an average height of 1700 meters, giving in general an eastern and a western slope. Erosion has cut these central highlands into a multitude of hills. From the central plateau rise various peaks, of which Mt. Tsaratanana (2880 m.), Mt. Ankaratra (2644 m.), and Mt. Andringitra (2659 m.) are the most important. Mt. d'Ambre (1361 m.), in the extreme north of the island, represents the northern limit of the highlands. The highlands are largely of ancient granites and schists and contain a few areas of volcanic rock. The granite has decomposed into a deep covering of soil over the greater part of the plateau.

On the east, the north, and the northwest, the land drops sharply to the sea with a narrow coastal plain bordering it for the greater part. From the Bay of Antongil to Fenerive, however, the mountains come out to the coast. The mountain slopes and the coastal plain are practically all old formations, but on the coastal plain are some younger formations. In the west, south from Ampasimena, the mountains pass inland and the western slopes become wider and more gradual. In the west the slope from the highlands to the sea is gradual, giving broad plains and low hills. The beaches are often broad and wide flats are left exposed by the falling tide. The old formations there are bordered with successive bands of younger rocks of various ages, Triassic, Jurassic, Cretaceous, and Tertiary, the age of the formations decreasing as the lands approach the sea.

In the extreme south the ancient schists slope gradually to the sea with a narrow border of recent formation.

In the east the coast is straight and the beaches narrow and steep. The streams are rather small and broken by falls and rapids. The marshes are usually of limited extent, though there are some exceptions to this, as at Lac Alaotra where wide marshes occur, and in those places where the streams enter the coastal plain and become sluggish and marshy.

In the west the beaches are broad and there are many muddy bays, especially at the mouths of the rivers, which are long and broad. The marshes are of considerable extent.

In the southwest the beaches are quite broad and the coast is bordered with a coral reef. The rivers are broad and occasional ponds are found but there is little marsh.

As Wallace has pointed out,[1] the sea around Madagascar is generally deep beyond the shallow bank on which the island stands. The hundred-fathom bank is only from one to three miles wide on the east but on the west is much broader, and stretches out opposite Mozambique to a distance of about eighty miles. The Mozambique channel varies from less than 500 to more than 1500 fathoms deep, the shallowest part being where the Comoro islands seem to form stepping stones to Africa. To the east, a depth of some 2400 fathoms separates Madagascar from Mauritius and Reunion. To the northeast of Mauritius are a series of extensive shallows, some less than 100 fathoms below the surface. Northeast is the Seychelles group, also standing on an extensive thousand-fathom bank. Eastward across the Indian ocean are the Chagos and Maldive atolls marking the position of other extensive banks. These shoals and islands probably mark the land bridge which Gadow[2] says connected Madagascar and India in the early Oligocene. It had become broken up into a series of large islands by the late Oligocene and had disappeared in the Miocene. Gadow thinks that Madagascar may have been connected with Africa in the early Oligocene but was separated off very shortly afterward. From the secondary beds on the west of Madagascar, it would seem that the Mozambique channel had existed since before the Triassic. P. de la Bathie[3] has pointed out that there is nothing to show that Madagascar did not extend much farther south until comparatively recent times.

AN OUTLINE OF THE MADAGASCAR CLIMATE[4]

The southern end of Madagascar extends beyond the Tropic of Capricorn, but the average annual temperature of the whole coast is between 22° and 27° so that it may be considered wholly tropical, 20° often being taken as the limit of the Tropical Zone. Portions of the interior have an annual temperature of less than 20°, due to the effect

[1] 1880, 'Island Life,' London, pp. 384–386.
[2] 1913, 'The Wanderings of Animals,' New York.
[3] 1921, Annales du Musée Colonial de Marseille.
[4] Compiled from Poisson, R. P. C. Météorologie de Madagascar in 'Hist. Physique, Naturelle et Politique de Madagascar,' published by A. and G. Grandidier, Paris, 1930. The date on the rainfall map given here does not correspond exactly with this date but the general distribution is the same.

of altitude. The temperature decreases .46° with every 100 m. of altitude and from this one would expect the isotherm of 20° on the east at about 800 m. and somewhat higher on the west, but Poisson gives 22° for the contour of 800 m. and 19° for the contour of 1200 m. so that the isotherm of 20° is probably near the contour of 1050 m. At certain stations, at altitudes above 1500 m., 0° is sometimes recorded, and at Antsirabe (altitude 1512 m.) −8.6° has been recorded. At higher points the temperature probably goes still lower, at least occasionally, although Poisson says that on Mt. Ankaratra, considered the coldest part of Madagascar, until now (1930), it was unusual for 0° to be recorded. Occasional frosts can probably be expected above 1500 m.

The amount of annual rainfall varies greatly over the island and is closely correlated with the direction of the prevailing winds. In winter, the southeast trades are the prevailing winds, but in the summer the northwest trade winds of the northern Indian Ocean reach the northwest coast. Summer is the rainy season because then the northeast and northwest winds blow into doldrums. The east coast is continually under the influence of the east trade winds and has no dry season. The rainfall reaches 5127 mm. at Île Ste. Marie and steadily decreases southward until it is only 1777 mm. at Ft. Dauphin; northward it decreases more rapidly to 980 mm. at Diego Suarez; and passing on to the central plateau, the rainfall decreases to 1360 mm. at Tananarive. The western side of the island lies in the lee of the mountain mass and receives little rain in the winter. In the summer the northwest coast also is a windward slope and has a marked wet season, which extends southward with lessening intensity. The annual rainfall for Nossi Be is 2580 mm.; for Majunga, 1467 mm.; and for Morondava, 770 mm. In the extreme south of the island there is less difference between the dry and the wet seasons, and since it lies partly in the lee of the eastern mountains and south beyond the influence of the northwest winds, that portion of the island receives very little rain. Tulear receives 493 mm. of rainfall annually, and the rainfall is probably much less farther south about Lac Tsimanampetsotsa. Approaching Fort Dauphin the rainfall increases to 532 mm. at Ambovombe.

Two seasons are usually evident, separated by differences of humidity and temperature. The hot, wet summer season is from November to April, and the relatively cool, dry winter season from May to October.

The east coast has considerable seasonal variation in both temperature and rainfall. At Tamatave the average summer temperature is

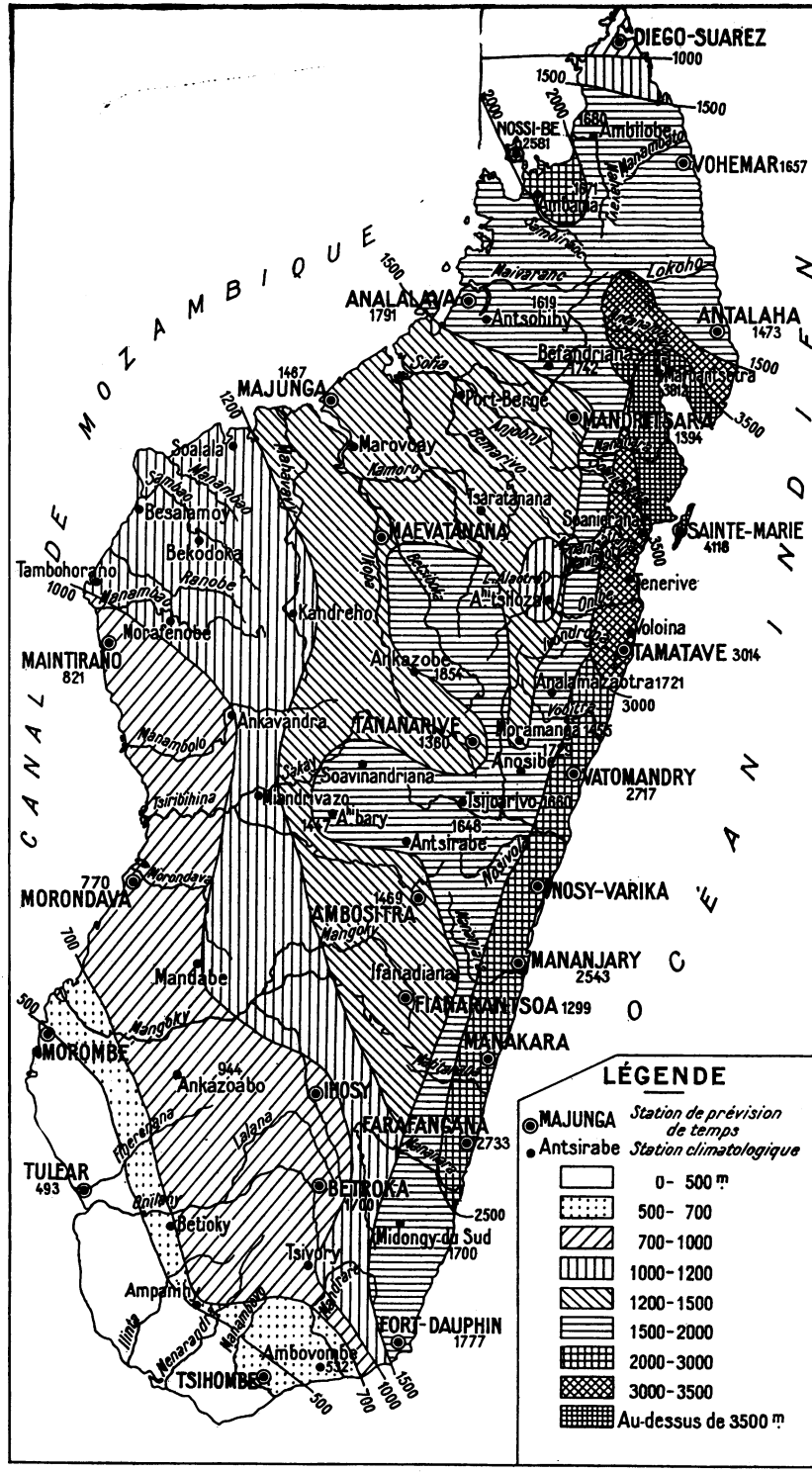

Fig. 23. Map showing the total annual rainfall of Madagascar in millimeters. Prepared by the Madagascar Meteorological Service under the direction of R. P. Poisson.

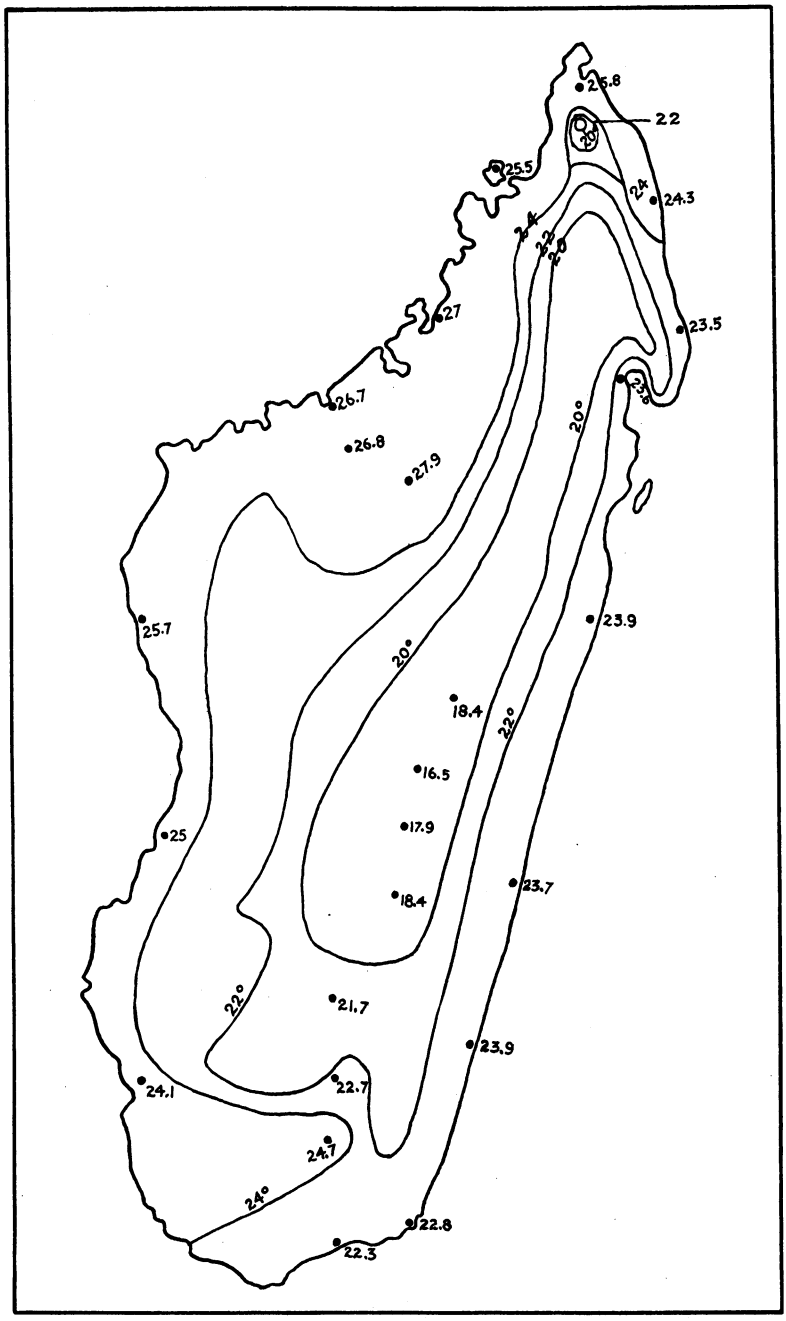

Fig. 24. Map showing the average annual temperatures in Madagascar (compiled from data given by Poisson, 1930, Hist. Phys. Nat. et Politique de Madagascar).

25.8°, and some 1795 mm. of rain falls in sudden showers or as heavy rains. In winter, the average temperature is 21.9°, with 1219 mm. of fine rainfall. This area is characterized by no real dry season. As one goes on to the central plateau, there is little rain during the winter and it is cool; at Tananarive in winter 114 mm. of rain falls and the average temperature is 16.3°, whereas during the summer 1246 mm. of rain falls and the average temperature is 20.5°. On the northwest coast, at Nossi Be, where the rainfall is heavy, it falls mostly in one season so that there is a well-marked dry season. The summer and winter temperatures are 26.5° and 24.6°, respectively, and the summer and winter rainfalls are 2159 mm. and 422 mm., respectively.

On the western side of the island, the seasons show little difference in temperature. At Majunga, the summer temperature is 27.9°, and the winter temperature 25.4°. The difference in rainfall is very pronounced, however, 1403 mm. falling in summer and but 64 mm. in winter. The amount of rainfall decreases steadily as one goes south from the Sambirano and the rain falls chiefly in one season.

The southwest has considerable variation in seasonal temperature and rainfall. At Tulear in summer, the average temperature is 26.3° and 379 mm. of rain falls, while in the winter the average temperature is 21.9° and 114 mm. of rain falls. At Tsimanampetsotsa, the rainy season may fail to materialize, and no rain fall during the hot season, as happened in 1929 and 1930. At Ampotaka, one or two heavy showers and a few light showers may fall during the hot season.

The accompanying maps show details of rainfall and temperature over the island (Figs. 23 and 24).

THE DISTRIBUTION OF THE FORESTS IN MADAGASCAR

The extent of the forested areas, as well as the type of the forest, is of such importance in the limitation or extension of the range of birds that a brief summary of the extent of these areas and the recent changes in the forest will be given here. (The country is described more in detail in the itinerary and a fuller discussion of the types of country is given in the discussion of faunal areas.) Perrier de la Bathie[1] has given a very complete account of the distribution of the flora of the island, and I have drawn on that source for data concerning the areas that we did not visit. P. de la Bathie[2] has shown that probably the greater part of Madagascar was wooded within the time of its occupation by

[1] 1921, Annales du Musée Colonial de Marseille, pp. 1–268.
[2] Idem, pp. 260–266.

man. At the present time, the forested areas have been greatly reduced through the agency of man until the areas of virgin forest occupy only one-eighth of the total area of the island. Vestiges of the forest that once covered the central highlands still exist as scattered "islands" of trees. On the wooded slopes the fires are yearly decreasing the extent of the forest.

P. de la Bathie[1] says that of the 58,200,000 hectares of the island's surface, only 7,000,000 are covered with endemic vegetation today. This does not imply that the rest of the island is treeless, for in the east, wide areas of secondary brush have grown up as the forest has been destroyed. In the west, annual brush fires have changed the wooded plains to open savannas or to palm-dotted plains. On the plateau and in parts of the east, the forest destruction has been complete over extensive areas of land, although here and there may be seen scattered areas of brush or trees along some valley. Humbert[2] says that the usual estimate of seven to ten million hectares of forested land in Madagascar is exaggerated, this estimate including secondary brush, the brush of the southwest, and the mangrove areas. He claims that not more than two to three million hectares are forested and that the areas of secondary brush exceed those of forest in size.

The present forest forms a belt of humid forest along the eastern slopes that is nearly continuous with the humid forest of the Sambirano by way of the south of Tsaratanana. An isolated area of humid forest exists on the summit of Mt. d'Ambre. In the north, between Maroantsetra and Mt. Tsaratanana, a large area of virgin forest remains, extending from sea level to about 1900 m. This area has been little affected by fire. Farther south the forest becomes reduced in extent and in the southeast becomes broken up into isolated areas, extending nearly to Fort Dauphin (Fig. 25).

The coastal country in the extreme north is more or less covered with dry deciduous forest. South of the Sambirano, it extends in a wide, very broken belt down the west side of the island, gradually becoming lower and drier as arid conditions are encountered. The subdesert brush extends across the south of the island nearly to Fort Dauphin, where it meets the humid forest of the east. In both of these areas are limited extents of humid gallery forest along the streams.

The central plateau is practically bare of trees and large areas of grassland are found on both the eastern and the western slopes. Other

[1] *Op. cit.*, p. 7.
[2] 1927, Mémoires de l'Académie Malgache, V, p. 10.

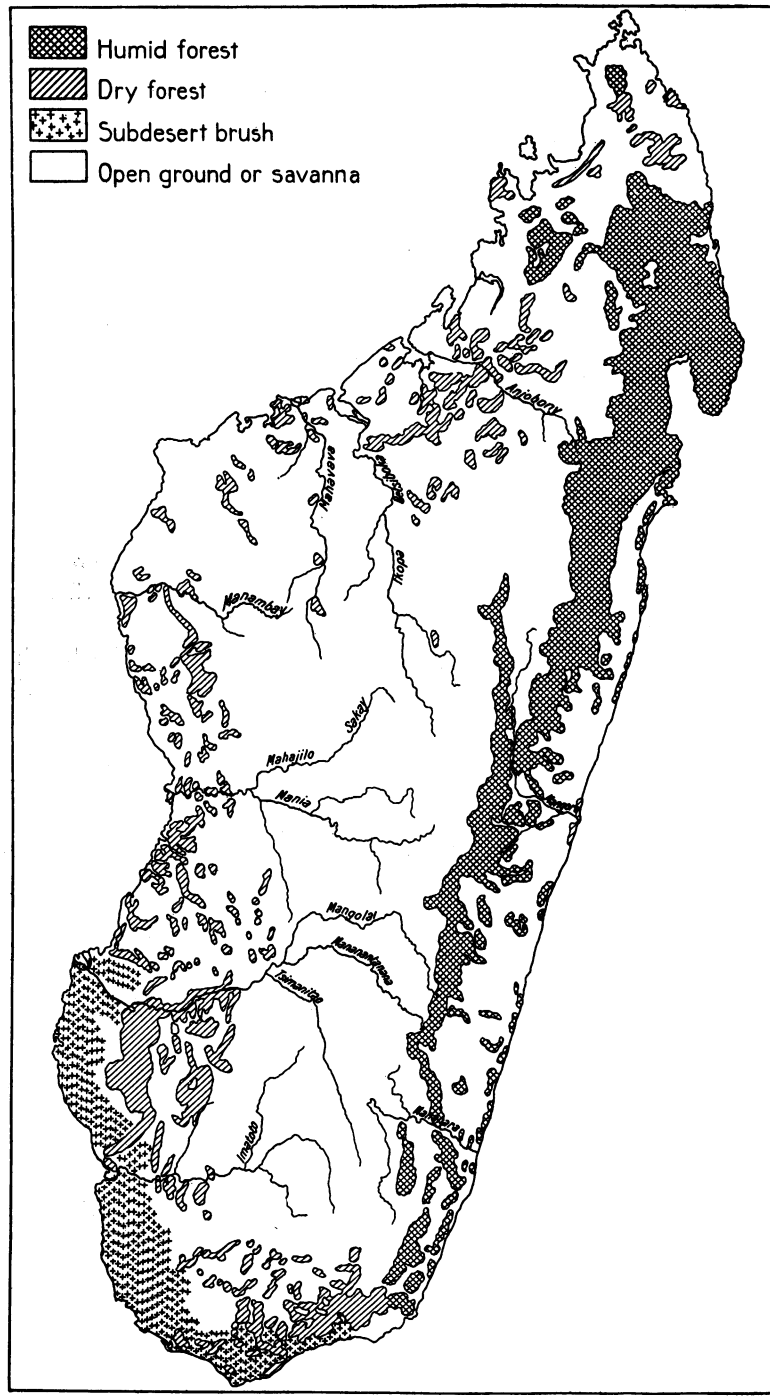

Fig. 25. Map showing forest distribution in Madagascar.

portions of the plateau, while still somewhat wooded, show the effect of the brush fires of the natives, and their wasteful method of cutting and burning virgin forest. In the east, extensive areas of secondary brush surround the forested areas; and in the west, open savanna country occurs, where the scattered trees are those that have escaped or withstood the fire. The subdesert in the southwest has largely escaped this destruction because of the scarcity of combustible material.

The rainfall is the most important of the climatic conditions determining the various types of forest. Sixty inches (about 1500 mm.) of rainfall usually is considered necessary for the growth of a humid tropical forest, but a prolonged dry season may also be a controlling factor. Referring to the rainfall map of Madagascar, we find that the areas marked as receiving 1500 mm. or more rainfall a year include almost all of the areas that have a humid type of forest. A few areas seem to be exceptions to this, notably the summit of Mt. d'Ambre, but more data may show that the annual rainfall there is greater than is shown on the present map. The valley of the Sambirano and Nossi Be also suffer a dry season, but evidently the 2000 mm. of rain received there yearly is sufficient to offset that and support a humid forest. The amount of rainfall decreases as one goes farther inland from the eastern coast and the area marked as receiving 1500 mm. a year of rainfall does not include all the area occupied by the humid forest or formerly occupied by it.

The higher altitudes on the eastern slopes and the central highlands have a dry season and some of the regions receive less than 1500 mm. of rainfall, but there the damper atmosphere, carried from the lower slopes where there is no dry season by the prevailing east winds, probably has an effect on the existence of a humid type of forest, and the forest itself may have an effect in condensing the moisture from the passing mists as well as in retaining the moisture. However, when once the forest is destroyed, as has happened over the greater part of the plateau, the humus is washed away, the moisture disappears soon after the rains, and there is nothing to condense the passing mists; consequently the humid forest is unable to reëstablish itself. The soil soon becomes so impoverished that it supports nothing but a scanty growth of grass. (Also see P. de la Bathie,[1] and Humbert.[2])

The coastal region in the north, from Antalaha and Voehmar to Ambilobe, receives 1500 mm. of rain yearly, but during the dry season

[1] 1921, *op. cit.*, pp. 3–44, 261, 262.
[2] 1927, Mémoires de l'Académie Malgache, V, pp. 8–9.

the rainfall is scanty and thus a balance is held in determining the dry, deciduous type of forest that occurs there.

In the west, south of Analalava, the intense dry season precludes the occurrence of a humid forest. Though nearly 1500 mm. of rainfall are received yearly at Majunga, it falls chiefly during one season. In these dry areas, however, where the forest is of a dry, deciduous type, along the streams are found gallery forests which have a humid character. This is due to the ground water, supplied by the rivers that have their headwaters in the central highlands, and the gallery forests are thus somewhat independent of the amount of rainfall received in the west.

As one passes from the highlands down the western slopes the temperature increases, and the consequent lessening of the relative humidity of the winds that continue over the central highlands may be a factor in the intensity of the dry season.

South of the Mangoky and around the south of the island to Ambovombe the rainfall is below 600 mm. Four hundred and ninety-three mm. of annual rainfall is given for Tulear and there is probably less in some of the country farther to the south. The forest is reduced to low trees and brush with occasional areas of a western type of vegetation. The size of the leaves is reduced and the seasonal fall of leaves is not so pronounced as in the occidental type. P. de la Bathie[1] suggests that this area may have extended farther south and that some of its flora originated in the south and spread northward.

The extent and type of the marshes vary considerably over the island. The marsh vegetation is less dependent on the rainfall than on the presence of permanent, shallow, standing water and on the type of the soil. In the east the configuration of the land, with a few exceptions, limits the extent of the marshy areas, whereas the flat country of the west offers more favorable conditions for their occurrence.

In the arid part of the subdesert, occasional pools occur, but many of them are seasonal, drying up completely, or their limits may fluctuate greatly and little marsh vegetation exist. Another factor affecting the distribution of birds, which will be considered later, is the amount of forest surrounding these marshes.

The mangrove areas depend not so much on relative humidity as on suitable tidal areas and consequently are much more common in the west than elsewhere on the island.

The general shape of Madagascar has probably been much the same, though its size may have been different within recent geological times,

[1] 1921, *op. cit.*, pp. 251, 252, 258.

judging from the ancient formations. The same winds and consequent rainfall probably gave the same relative rainfall in the various parts of the island so that the types of forest in the different parts of the island have had a long continued existence. The extent of these areas, however, may have been different. P. de la Bathie[1] has suggested that the subdesert extended farther south within comparatively recent times and G. Grandidier,[2] speaking of certain mammals of Madagascar now found only as fossil forms, says that their disappearance was recent, probably within the time of man's occupancy of the island. Many of these animals were lemurs, arboreal creatures, so that the discovery of their bones in the central plateau, now treeless, conclusively proves that a forest existed there in comparatively recent times.

G. Grandidier[3] also points out that the highland country has gradually become drier, basing this belief on the geological evidence of much more extensive marshes, and the fossil evidence of a former more humid type of vegetation on the central highlands.

Jully (G. Grandidier[4]) found fossil trees and other vegetation of a comparatively recent geological time at Antsirabe, indicating the former existence of a flora on the central plateau more tropical in character than the present one.

From this evidence, it would seem that the central plateau was not only wooded in comparatively recent geologic times, but that this forest was of a much more humid tropical type than the present forest of the upper edge of the eastern forest belt and the present scattered areas on the plateau. Also in comparatively recent geologic times, the rain forest on Mt. d'Ambre was probably connected with that of the east. The humid forest probably spread much farther west and south than its present limit indicates. The subdesert was possibly somewhat restricted in its northward distribution. P. de la Bathie[5] says that within recent times the island was probably of greater extent to the south and that this land was probably covered with subdesert vegetation. The deciduous forests of the west were thus rather restricted in their extent.

The humid period may have been contemporaneous with the pluvial period that occurred in Africa during the Pleistocene (Lonnberg[6]). As the climate became drier, the rain forest retreated somewhat into the east, and north into the Sambirano, and the extent of the dry forest of

[1] 1921, *op. cit.*, p. 258.
[2] 1905, Nouvelles Archives du Muséum, (4) VII, pp. 52, 53.
[3] 1905, *op. cit.*, p. 53.
[4] 1905, *op. cit.*, p. 34.
[5] 1921, *op. cit.*, p. 258.
[6] 1929, Ark. f. Zool., Stockholm, pp. 1–33.

the west increased. The rain forest on Mt. d'Ambre became isolated. The subdesert flora spread northward. With the advent of man and the destruction of the forest on the plateau and serious inroads on that of the east, the rain forest became still more restricted and the climate became drier. The central plateau became treeless and areas of open ground and brush appeared in the east. With the present destruction of the forest by human agency in the northwest, the humid forest of the Sambirano is gradually becoming even less extensive and is being encroached upon by the deciduous forest and brush of the west.

So we find that there are three main types of forest: the humid forest, once more extensive and now retreating; a western deciduous woodland that was formerly confined to a narrow area in the west, and is now gradually encroaching on the open ground left through the destruction of the forest on the central plateau and in the east; and the subdesert brush, which probably extended farther south. Restricted in its southward extent by the encroaching sea, it has spread northward into the southwest, and has intruded on the deciduous woodland which in turn has retreated, leaving islands of woodland in favorable places.

FAUNAL AREAS AND GENERAL FACTORS OF DISTRIBUTION

In studying the distribution of bird life over the island of Madagascar, I found that the avifaunal associations restricted to the different types of vegetation occurring in the various parts of the island were very striking. The humid forests of the east, the deciduous woodlands of the plains and hills of the west, and the arid brush and forests of the south and southwest, each had associations of birds peculiar to them.

Grandidier[1] had also observed this and had divided the island into biotic areas, an eastern, a western, and a central province, listing the birds he considered typical of each. But the difference between the central and eastern provinces are those due to habitat, the difference between the extensive grass areas of the central highlands and the areas of woodland on the slopes, rather than more fundamental differences. Perrier de la Bathie,[2] in an excellent work on the flora, studied the distribution of the plants of the island and, taking into account the changes brought about by man, reached a better understanding of the biotic divisions. He recognized an east and a west area, with various subdivisions. Humbert in 1927[3] summarized the work of Perrier de la Bathie and published plates showing the vegetation of each type of

[1] 1879, Hist. Nat. Madag., Oiseaux, pp. 745–747.
[2] 1921, Annales du Musée Colonial de Marseille, pp. 1–268.
[3] 1927, Mémoires de l'Académie Malgache, Fascicule V, pp. 15–22.

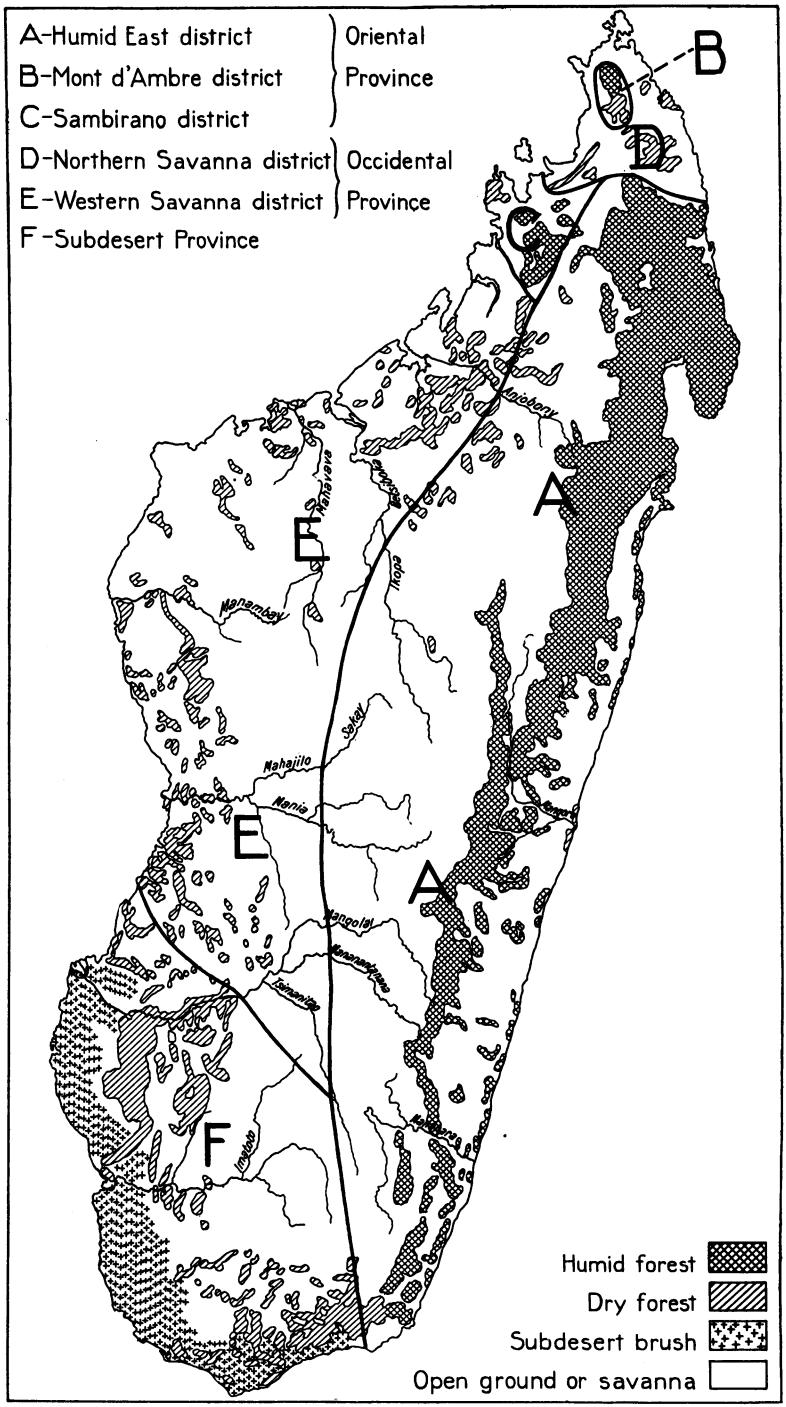

Fig. 26. Map showing biotic divisions in Madagascar.

country. Our study of the bird life of the island largely bears out Humbert's divisions based on plant distribution, though it gives different extents and values to some of them.

The divisions which Humbert recognizes are as follows:

ORIENTAL REGION.—The eastern part of the island between Vohemar and Fort Dauphin and the central part of the country above about 800 meters, and the valley of the Sambirano.

1.—Domain of the plains and low mountains of the east (the eastern side of the island from Vohemar to Fort Dauphin, below 800 meters).

2.—Domain of the high plateau and the high mountains of the central part of Madagascar (the central part of the island above 800 meters).

3.—Domain of the Sambirano (the area including the peninsula of Ampasimena south to Port Radama and inland to an altitude of 800 meters).

OCCIDENTAL REGION.—The north of the island, north of Ampasimena and Vohemar, below 800 meters, and the western part of the island, extending from sea level at Port Radama inland to about 800 meters, where the boundary of the region follows the west slope of the island. At 18 degrees latitude, the boundary line runs across the slope of the central mountains near the mountain Andringitra, then passes a little to the east of the watershed between the high Onilahy and Ionaivo rivers and from there runs obliquely southeast to the coast between Fort Dauphin and Cape Andavaka.

1.—Domain of plains and plateau of the west and north including all of this region except the next subdivision.

2.—Domain of the subdesert (a belt of country along the coast from Morondava nearly to Fort Dauphin). This area is about 800 kilometers long and from 25 to 75 kilometers wide.

In studying the distribution of the birds the divisions of P. de la Bathie and Humbert seem applicable in general but I have made some modifications.

The biotic divisions that I recognize on the basis of avian distribution cannot, of course, be sharply defined. Within each area, a series of conditions exist and an association of birds is found that sets it off from every other province. Some forms, however, range more widely, encroaching on the next province, while others do not range over the whole province. Thus it is only a summary of the various ranges of birds that determines the limits of the biotic divisions, and these boundaries never can be definite. True, in certain habitats, the limits are sometimes definite, as where the forest gives way abruptly to grasslands and forest species stop and open-ground birds are found; but usually the forest changes first to brushlands, and scattered clumps of trees are found in the open ground and some of the forest birds range out into these. Similarly, birds of the open ground venture into the forest along the trails and clearings. But these are habitat differences and most of

the characteristic birds of each zone are forest species whose ranges meet and overlap as the different types of forest meet.

From a study of the avifauna the following provinces with their various districts may be recognized (Fig. 26):

ORIENTAL PROVINCE
- Humid East District
- Sambirano District
- Mt. d'Ambre District

OCCIDENTAL PROVINCE
- Northern Savanna District
- Western Savanna District

SUBDESERT PROVINCE

The Oriental Province corresponds to that of Humbert but the distribution of bird life does not warrant the setting up of a central district.

The Humid East district includes the greater part of the domain of the plains and the low mountains of the east, though in the north its limit is more nearly at Antalaha than at Vohemar, and in addition, it includes the central domain of P. de la Bathie and Humbert except for the forest of the western slopes above 800 meters which probably should be considered with the Sambirano district.

The Sambirano district corresponds closely to that of Humbert but probably should include in addition the forest of the western slopes above 800 meters which P. de la Bathie and Humbert include in the central region.

The Mt. d'Ambre district has few characteristic forms, but for the sake of convenience, can be recognized as consisting simply of the summit of Mt. d'Ambre above 800 meters.

The Occidental Province in general corresponds with that of P. de la Bathie and Humbert in the north, but I have given the Subdesert region in the south equal rank with the Oriental and the Occidental and have considered it of greater extent than did either Bathie or Humbert.

The Occidental and the Subdesert meet and intergrade between Morondava and Tulear. The limits inland were not determined but they probably extend directly to 800 meters where both meet the Oriental. Ihosy is chiefly subdesert in character.

The Northern Savanna district comprises the Occidental north of the Humid East and the Sambirano districts.

The Western Savanna district comprises the Occidental Province, south of the Sambirano district.

The Subdesert Province comprises the southern part of Madagascar

between the Oriental and the Occidental provinces inland to 800 meters. Humbert's Subdesert domain comprises simply that region which I consider as the arid part of the Subdesert.

The peculiar fauna of Madagascar has been produced through isolation by wide seas over a long period. Within the island, however, there are not sufficient physical barriers to account for the differences in avian associations that occur in different parts of the island. These differences depend, rather, on the varying types of vegetation which in turn depend on the amount of rainfall, and on the adaptation of the birds to these various environments over a long period.

The distribution and general character of the forest has been discussed and it will be found that the most important areas of distribution can be correlated with these areas.

In Madagascar there are no life zones determined by temperature such as occur in North America, and no altitude life zones dependent on temperature such as those found by Dr. Chapman in South America[1] and by Dr. Chapin in Africa.[2] Since at sea level the whole island lies within the isotherms of twenty-two and twenty-five degrees (twenty degrees usually being taken as the limit of the tropical zone), the slight variation in temperature dependent on latitude is not enough to make itself felt.

In the mountain mass that extends the length of the island, the highest peak reaches an altitude of nearly 3000 meters, while the average height of the central highlands is about 1700 meters.

The temperature decreases as one ascends the mountains but the only truly mountain bird species found there are *Dromaeocercus seebohmi* and *Sarothrura watersi*, birds of the little marshes and brushlands whose lower limit of distribution was about 1700 m., at about the line where occasional frosts were first experienced. This corresponds with what Dr. Chapin found in Africa,[3] namely, that below 1700 m., there is little change in distribution and that a further effect of temperature on distribution is noticeable at the line of occasional frosts.

The distribution of altitudinal subspecies, however, does not correspond so well with this. There are only three altitudinal subspecies recognizable in Madagascar, and while in the east two are found only above 1800 meters and one appears to range down to about 1500 meters, in the western part of the plateau one (*Saxicola t. ankaratrae*) ranges down to 700 meters.

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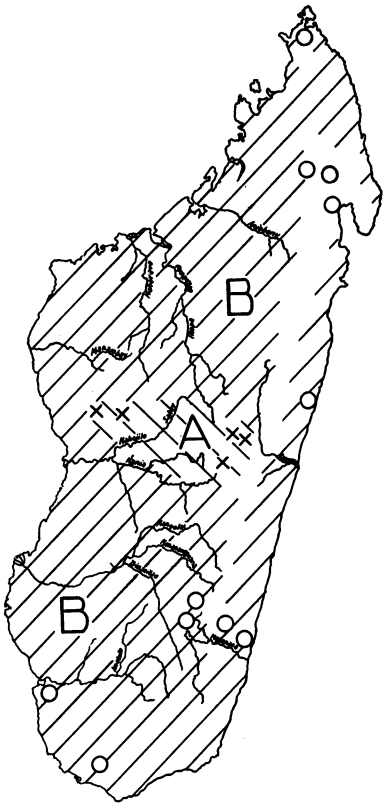
[1] 1917, 'The Distribution of Bird-life in Colombia,' Bull. Amer. Mus. Nat. Hist., XXXVI, p. 84–93.
[2] 1932, 'The Birds of of the Belgian Congo,' Bull. Amer. Mus. Nat. Hist., LXV, pp. 92–98.
[3] 1923, American Naturalist, pp. 106–125.

These few mountain birds, while significant as showing the inception of altitudinal forms, are too few to characterize a montane avifauna. It is worthy of note that these higher altitude subspecies have their



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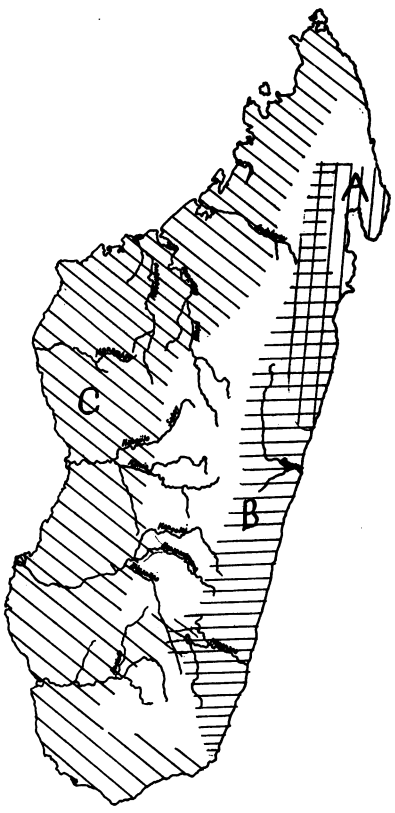

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Fig. 27. The probable range of the races of *Saxicola torquata;* (A) *ankaratrae* (locality records marked ×), (B) *sibilla* (locality records marked ○).

Fig. 28. Range of *Copsychus albospecularis. C. a. albospecularis* (A) is restricted to the northern part of the Humid East district, intergrading with *C. a. inexpectatus* (B) which occurs farther south; *C. a. pica* (C) is a widespread bird of the Occidental and Subdesert provinces and ranges into the Sambirano and Mt. d'Ambre districts.

range around the greatest mountain mass in Madagascar, Mt. Ankaratra, and that specimens from other parts of the island from altitudes that are as high as some of those inhabited by the mountain races about

Mt. Ankaratra, are referable to the lowland races (as for example *S. t. sibilla* at one day west of Andapa). (Fig. 27.)[1]

The greater part of the central highlands of Madagascar is bare of trees, probably a secondary condition, and the bird fauna of that area was poor in species and similar to that found in the open ground at lower altitudes. However, *Saxicola torquata* was more common on the highlands than at the lower altitudes though it did range down to sea level.

The forest on the eastern slopes does not as a rule reach the average height of the plateau. Although some forest species are not found below 500 meters and others not below 1000 meters such as *Pseudocossyphus sharpei, Neomixis viridis, Neomixis striatigula sclateri,* and *Oriolia bernieri;* and other species, such as *Canirallus kioloides* and *Coua serriana,* were not found above 1000 meters; one finds no definite change in the bird life as one ascends the mountains.

A number of brushland birds, such as *Numida m. mitrata* and *Agapornis cana,* and certain marsh birds, such as *Egretta a. melanorhynchus, Egretta dimorpha,* and *Nettapus auritus,* were not found above 1000 meters, but these data rest only on the result of our own collecting, which was not extensive enough in suitable habitats at the higher altitudes, particularly in marshy areas, to give results of much value in determining the upward range of many of these species.

While the temperature may control the mountain distribution of *Dromaeocercus seebohmi* and *Sarothrura watersi,* and also be a factor in the control of the distribution of the birds that range upward to 1000 meters and those that occur only above 1000 meters, it has but little influence in the distribution of the greater part of the bird life of the island.

The paucity of peculiar species at the higher altitudes is easily understood since the extent of land above 1700 m. is limited and apparently the lack of a considerable mass of land above 1700 meters has given no opportunity for the evolution of a montane fauna. These higher mountains have had no connection with colder lands from which a mountain fauna could be drawn.

The greater part of the central highlands was covered with a tropical forest in recent geological times and probably had a corresponding avifauna, and as this forest retreated into the east the avifauna accom-

[1] 1933, Salomonsen, Bull. Brit. Orn. Club, LIV, pp. 9–12, first pointed out that in Madagascar some species varied with altitude, and later (1934, Nov. Zool., XXXIX, pp. 207–215) named the altitudinal races.

panied it. The destruction of the remaining forest on the plateau made it impossible for a forest fauna to maintain itself, and the open-ground forms that remained were those few, such as *Saxicola torquata* and *Mirafra hova*, that already existed there in some of the small natural clearings.

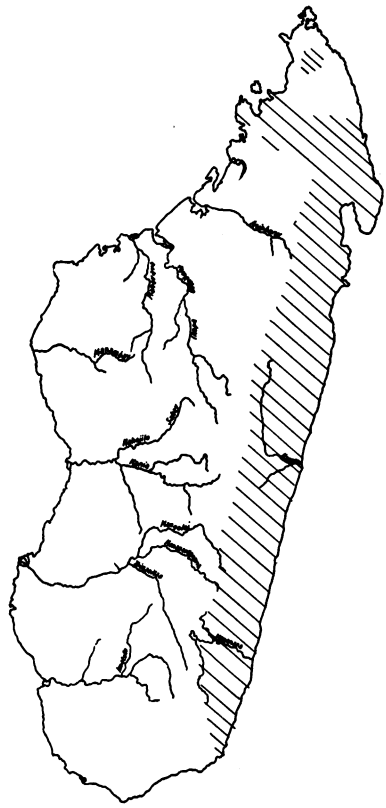
The belt of forest around the island is nearly continuous and the different types of forest meet and intergrade. Such isolation as occurs in the area of rain forest on Mt. d'Ambre is ecological, since the forest there is separated from that on Mt. Tsaratanana by open-ground and forest of the western type.

The bare central plateau now separates the eastern forest from that of the west for the greater part of its length, though in recent times, within the occupancy of man, the plateau was more or less covered with humid forest which brought the forests of the east and the west close together. The effects of this can be seen in the existing races of *Copsychus albospecularis*, wherein the birds from the upper edge of the eastern forest, at Ivohibe, showed a tendency toward the western form, *Copsychus a. pica*, while those from a lower altitude, at Vondrozo, are typical *Copsychus a. inexpectatus*, showing that the ecological barrier of the bare central plateau is comparatively recent (Fig. 28).

Even now the rain forest of the east is continuous with the rain forest of the Sambirano district or is connected with it by scattered areas of forest. In the Sambirano, the rain forest meets the drier forest of the west, and the rain forest is being gradually encroached upon by the drier forest, due to the deforestation of the land. In the southwest the subdesert forms gradually appear and many of the forms encountered in the west are intermediate between the subspecies found in the Oriental and those in the Subdesert. We did not visit the eastern edge of the Subdesert but this province probably meets the Oriental somewhere between Ambovombe and Fort Dauphin. The transition there between the avifauna of the Subdesert and the Oriental is probably abrupt, as the two types of the forest are at opposite extremes.

Some species, such as *Streptopelia p. picturata* and *Ixocincla m. madagascariensis*, that occurred wherever there were wooded areas, are limited only by the extent of these wooded areas. Some species equally widespread become modified into two or more races. Other species, such as *Nelicurvius nelicourvi*, *Atelornis pittoides*, and *Oxylabes madagascariensis*, which were found only in the humid tropical forest (Fig. 29), *Coua coquereli* and *Coua gigas*, found only in the drier forests of the west (Fig. 30), and *Thamnornis chloropetoides*, found only in the arid

brush of the southwest (Fig. 31), were all limited to these distinct types of forest. This preference for a certain type of forest was also shown by such birds as *Upupa e. marginata, Falculea palliata, Coua cristata,*



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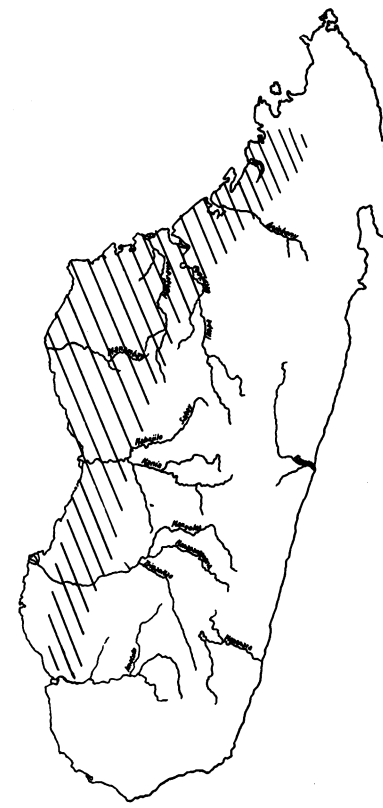

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Fig. 29. Range of *Nelicurvius nelicourvi*, a bird of the humid forests of the Oriental Province.

Fig. 30. Range of *Coua coquereli*, a bird of the dry woodlands of the Western Savanna, ranging southward into the edge of the Subdesert.

and *Oena c. aliena*, which ranged throughout the Occidental and the Subdesert in the drier forest, but appeared only in the secondary brush of the Oriental (Fig. 32); and by *Alectroenas madagascariensis, Hartlaubius auratus*, and *Cyanolanius madagascarinus*, which frequented the heavy forests of the east and the more densely wooded areas of the

west but were absent from the lower, drier forests of the Subdesert (Fig. 33).

It is interesting to consider the distribution of some of the more

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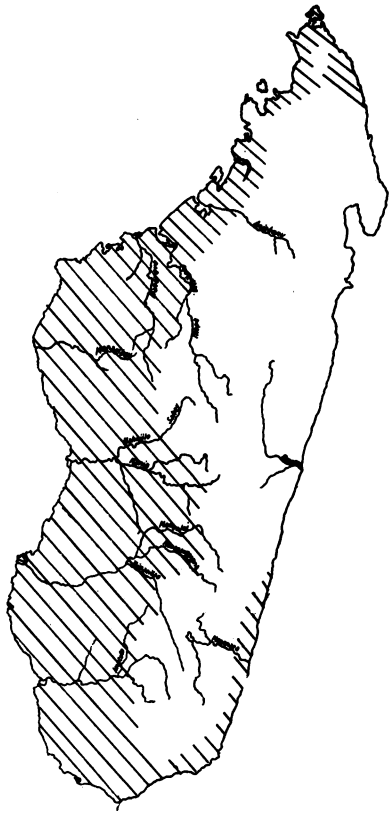

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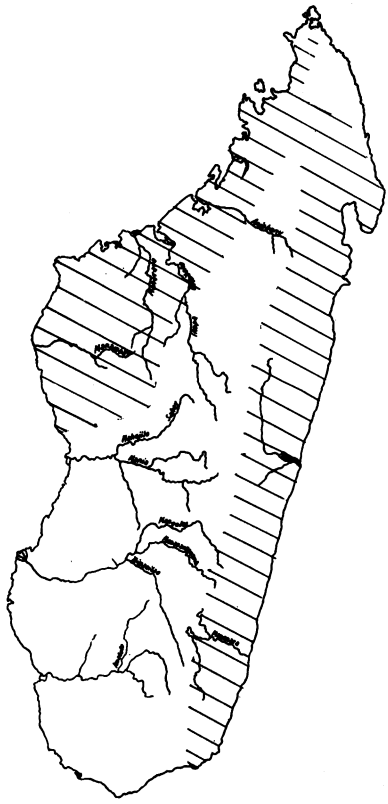
Fig. 31. Range of *Thamnornis chloropetoides*, a rather widespread bird in the brush of the Subdesert Province.

Fig. 32. Range of *Oena capensis aliena*, a bird of the open woodlands and brush and the edge of the grassland in the Occidental and Subdesert provinces, which extends its range into the brushlands of the coastal area of the Oriental Province.

closely related species and to see how they replace each other in the different biotic areas of the island. *Coua caerulea*, an arboreal bird of the humid forest, is replaced by *Coua cristata* in the drier forest, and *Coua cristata* in turn is replaced by *Coua verreauxi* in an area in the

Subdesert (Fig. 34). The terrestrial couas, *Coua reynaudii* and *Coua serriana* of the Oriental Province are replaced by *Coua gigas*, *Coua coquereli*, and *Coua ruficeps* in the Occidental, and though *Coua ruficeps*



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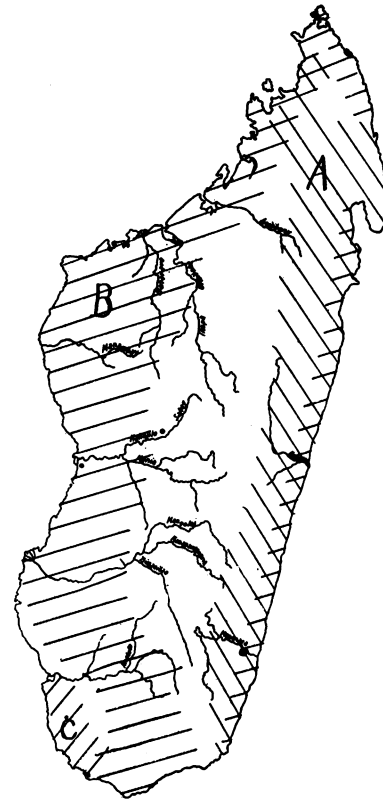

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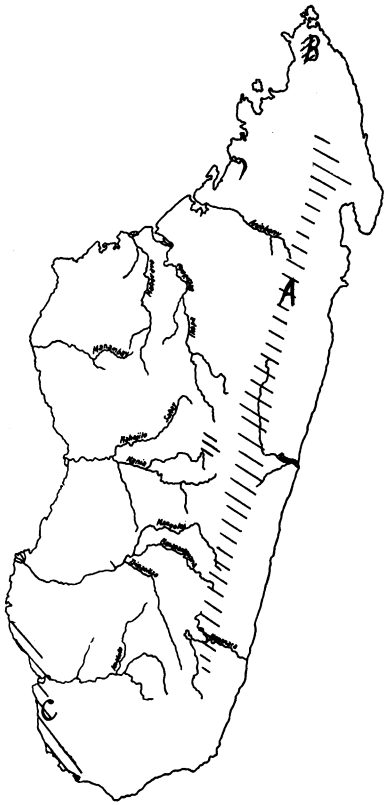
Fig. 33. Range of *Alectroenas madagascariensis*, a common bird of the humid forest of the Oriental Province and less common in the dry forests of the Occidental Province.

Fig. 34. Range of the three species of arboreal couas showing how they replace each other. *C. caerulea* (A) is a bird of the humid forest of the Humid East and Sambirano districts, extending its range into the Northern Savanna district; *C. cristata* (B), disregarding subspecies, is a bird of the drier woodlands of the Occidental Province, but ranges into the humid forest of the Sambirano district and into the secondary brush and the edge of the humid forest along the coast of the Humid East district; *C. verreauxi* (C) is restricted to part of the Subdesert Province from the greater part of which *C. cristata* is absent.

ranges into the Subdesert it is modified into another race, and another terrestrial coua, *Coua cursor* replaces *Coua gigas* and *Coua coquereli*.

In the *Philepittidae Philepitta castanea* is a bird of the forests of the



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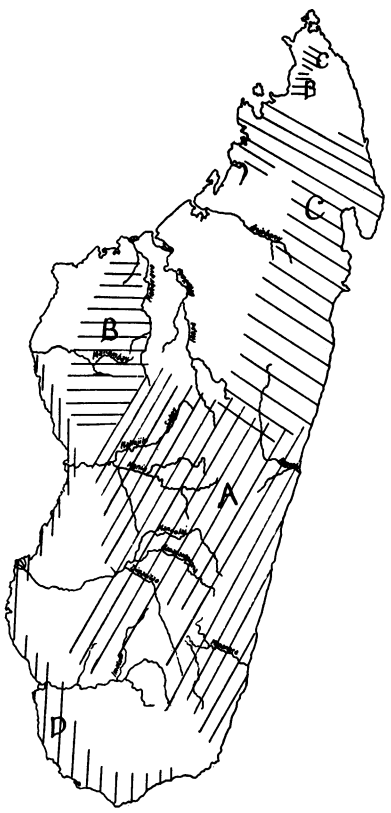

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Fig. 35. Range of the genus *Pseudocossyphus*. *P. s. sharpei* (A) is a bird of the humid forest of the Humid East district at the higher altitudes; *P. s. erythronotus* (B) is restricted to the humid forest on Mt. d'Ambre; *P. imerinus* (C) is restricted to the sandy areas along the coast of the Subdesert.

Fig. 36. Range of *Nesillas typica*. *Nesillas t. typica* (A) is a bird of the brush-land and forest of the southern part of the Humid East district and extends its range into the Western Savanna district, intergrading at Tsiandro with *N. t. obscura* (B) which is also found in the Northern Savanna district, its range being cut in two by *N. t. ellisii* (C), a bird of the northern part of the Humid East district, the Sambirano and Mt. d'Ambre districts; *N. t. lantzii* (D) is a bird of the arid Subdesert Province.

Oriental while *Philepitta schlegeli*, of similar habits, occupies the Occidental and ranges into the Sambirano district.

Another interesting case is that of the genus *Pseudocossyphus* which has one species in the Oriental and another in the Subdesert, but none in the Occidental (Fig. 35).

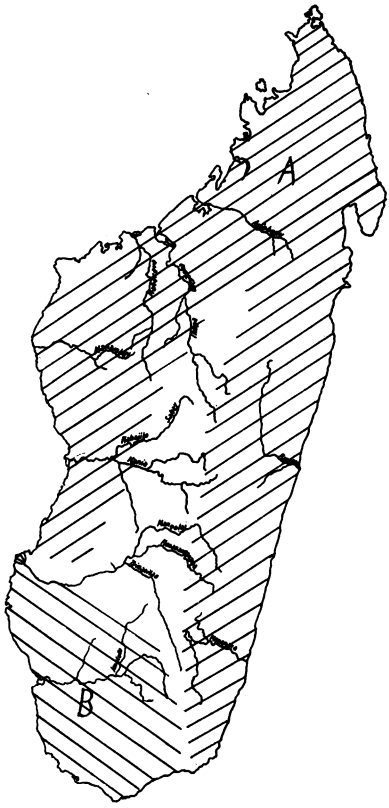
There are also cases of closely related species, one of which may be widespread over the island while the other is of restricted range within the range of the first. This is illustrated by *Newtonia brunneicauda* and *Foudia madagascariensis*, both widespread species, while *Newtonia archboldi* is restricted to the Subdesert, *Newtonia amphichroa* to the Humid East and Mt. d'Ambre, and *Newtonia fanovana* is known only from the central part of the Humid East. *Foudia omissa* is restricted to the Oriental.

Among the subspecies also there tends to be some correlation with the biotic areas, though the races of *Neomixis tenella* do not show this as clearly as do the races of *Nesillas typica* (Fig. 36). But in most of the subspecies the correlation with the biotic areas is rather evident. In general a darker race inhabits the Oriental and often the Occidental, while another, lighter-colored race occurs in the Subdesert, as with *Agapornis cana* and *Cinnyris sovimanga* (Fig. 37). In other species one race occupies the Oriental and the other the Occidental and Subdesert, as with *Artamella viridis*, *Coracopsis vasa*, and *Coracopsis nigra*. The areas of intergradation between the races of each species do not always coincide, as a consideration of *Coracopsis vasa* and *Coracopsis nigra* will show. *C. v. drouhardi* occurs in the Subdesert, the Western and Northern Savannas, and in the Sambirano; *C. v. vasa* is restricted to the Humid East, while *C. n. nigra* extends over the Oriental and the Northern Savanna and the northern part of the Western Savanna and *C. n. libs* occurs only in the southern part of the Western Savanna and the Subdesert (Figs. 38 and 39).

Certain species represented by a race in the Humid East and one in the Subdesert intergrade over a wide area in the Occidental, which province is intermediate in climatic conditions. This is the case with *Coracina cinerea* and *Leptopterus chabert* (Fig. 40). Some forms show an intergradation in the southwest as well, where the transition between the Subdesert and the Oriental is abrupt. This is the case with *Vanga curvirostris* (Fig. 41).

Other species, such as *Schetba rufa* and *Bernieria madagascariensis* (Fig. 42), are represented by a race in the Oriental and another in the Occidental but are absent from the Subdesert. A few species, such as

Coua ruficeps, which are found only in the Occidental and Subdesert are represented by different races in each province (Fig. 43). *Foudia sakalava*, represented by one race in the Northern Savanna, and another



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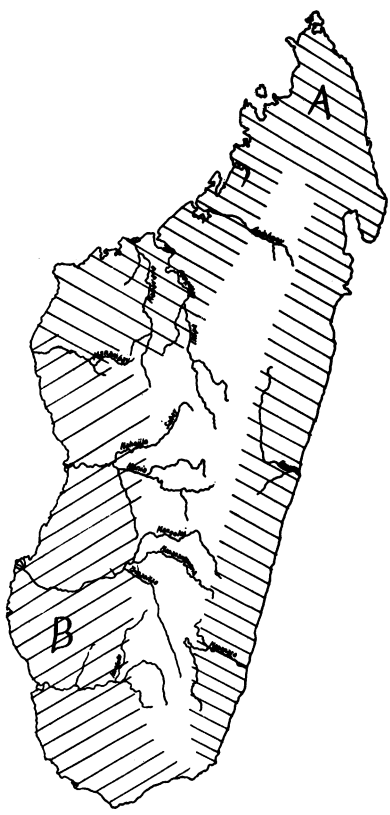

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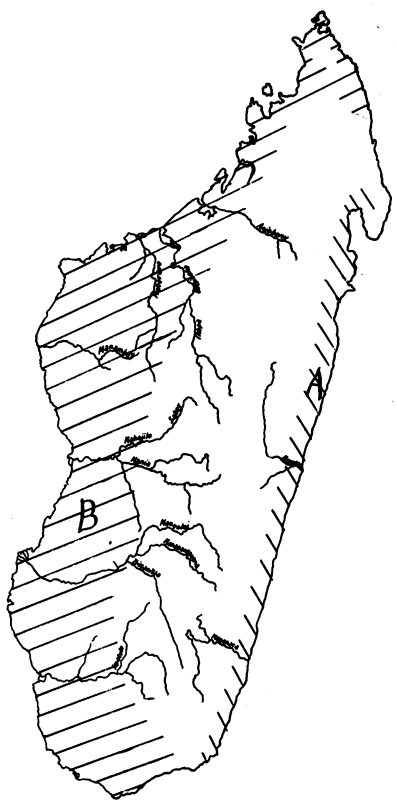
Fig. 37. Range of *Cinnyris sovimanga*. *C. s. sovimanga* (A) is a bird of the humid forest and brush of the Oriental Province and the dry forest and brush of the Occidental Province; *C. s. apolis* (B) is a bird of the brush and wooded area of the Subdesert.

Fig. 38. Range of *Coracopsis nigra*. *C. n. nigra* (A) is a bird of the humid forests of the Oriental Province and the dry forests of the Occidental, replaced by *C. n. libs* (B) in the southern part of the Western Savanna and in the wooded areas of the Subdesert.

in the Subdesert, has an intermediate form in the Western Savanna (Fig. 44); while *Coua cristata*, a bird of the drier forests of the west,

is represented by three races (Fig. 45). *C. c. cristata* is most common in the Northern Savanna but also is found in the secondary brush of the Humid East and the Sambirano at low altitudes, into which it has



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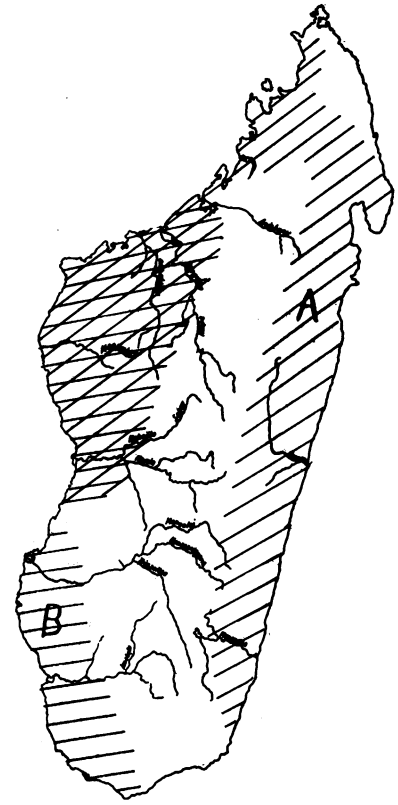

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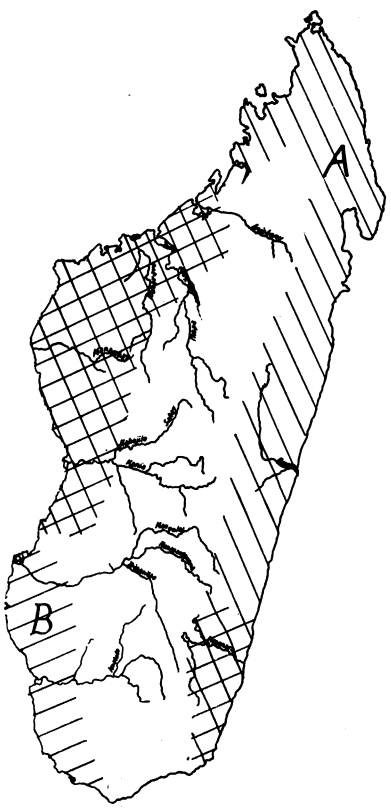
Fig. 39. Range of *Coracopsis vasa*. *C. v. vasa* (A) is chiefly a bird of the more open wooded areas and the edge of the humid forest at low altitudes in the Humid East district; *C. v. drouhardi* (B) is a bird of the dry open woodlands of the Occidental and Subdesert provinces and of the humid forest of the Sambirano district.

Fig. 40. Range of *Coracina cinerea*. *C. c. cinerea* (A) is a bird of the humid forest of the Oriental Province; *C. c. pallida* (B) is a bird of the more heavily wooded areas in the Subdesert. The form which occurs in the Western Savanna is intermediate in its characters.

probably spread secondarily around the edges of the island, the formation of this brushland providing a habitat similar to some of the low open woodland of the western part of the island. In the Western

Savanna, the species is represented by *C. c. dumonti*, and in the southwest by *C. c. pyropyga*, this latter race apparently being absent from most of the range of *C. verreauxi*, though both occur in similar habitats



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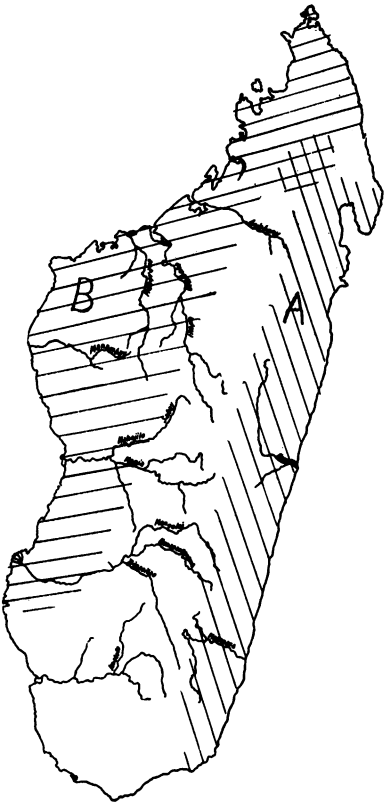

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Fig. 41. Range of *Vanga curvirostris*. *V. c. curvirostris* (A) is a bird of the humid forests of the Oriental Province, intergrading strongly with *V. c. cetra* (B), a bird of the dry wooded areas of the Subdesert, in the Western Savanna and also in the southern part of the Humid East district.

Fig. 42. Range of *Bernieria madagascariensis*. *B. m. madagascariensis* (A) is a bird of the humid forest of the Humid East; *B. m. inceleber* (B) is a bird of the dry woodlands of the Occidental Province, also ranging into the humid forests of the Sambirano and Mt. d'Ambre, intergrading with *B. m. madagascariensis* in the northeast.

in different parts of the Subdesert, and on the edges of the range of *C. verreauxi* they occur together. It may be noted that in this case as

in many others, the closest relationship of the birds occurring in the east and west is through the north. The distribution of *Neomixis striatigula* is especially interesting, one race being rare and restricted

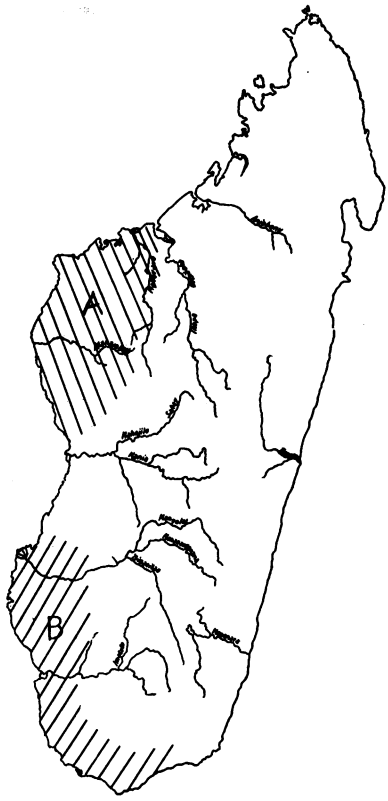

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Fig. 43. Range of *Coua ruficeps*. *C. r. ruficeps* (A) is a bird of the woodlands in the Western Savanna district; *C. r. olivaceiceps* (B) occurs in the wooded and brush areas of the Subdesert Province.

Fig. 44. Range of *Foudia sakalava* as found by the Mission. *F. s. sakalava* (A) was found only in the Northern Savanna district; *F. s. minor* (B) was found only in the Subdesert Province. The form found about Lac Kinkony was intermediate.

to the Humid East, and the other common in the Subdesert. None occurs in the Occidental. This case is similar to the distribution of the species of *Pseudocossyphus* (Fig. 35).

The ecological isolation of Mt. d'Ambre is plainly correlated with

the evolution of the two races of birds, *Pseudocossyphus sharpei erythronotus* and *Bernieria zosterops fulvescens*, that are represented elsewhere by other races only in the forests of the Humid East (Fig. 35).

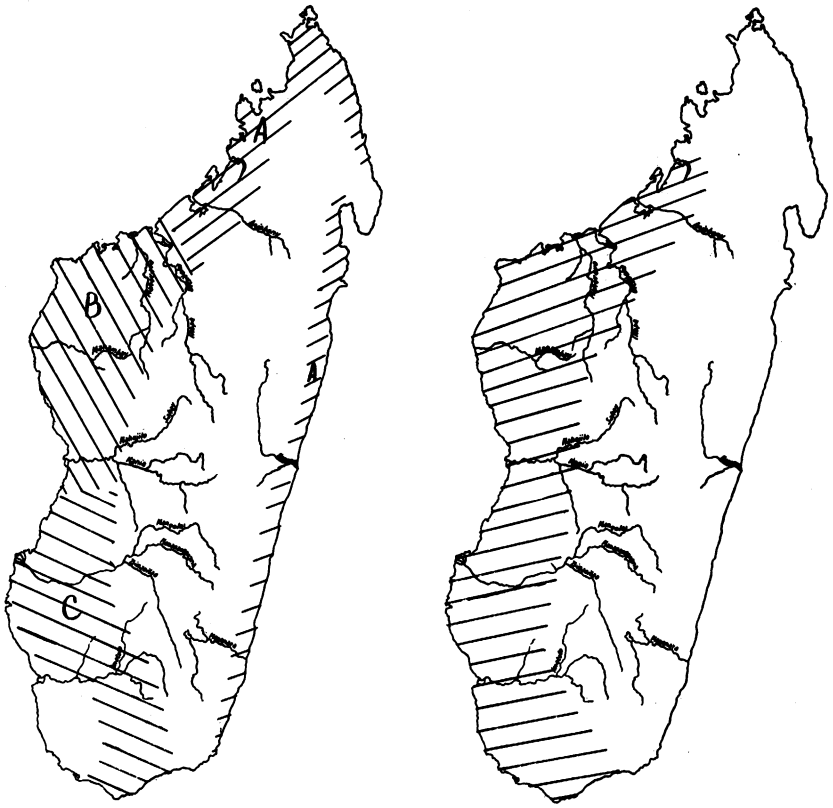

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Fig. 45. Range of *Coua cristata*. *C. c. cristata* (A) is most common in the Northern Savanna district but extends its range into the Sambirano district and along the coast in the Humid East district; *C. c. dumonti* (B) occupies the Western Savanna and *C. c. pyropyga* occupies the Subdesert Province.

Fig. 46. Range of *Eremialector personatus*, a bird widespread in the open brush and savanna of the Western Savanna district and the Subdesert Province. It was not found in the Northern Savanna district.

The Sambirano district seems to form an ecological barrier between the Northern and Western Savannas, some species of the Western Savanna or Western Savanna and Subdesert do not range into the

Northern Savanna, like *Coua coquereli* and *Eremialector personatus* (Fig. 46).

Nesillas t. obscura, found in the Northern and Western Savannas, has

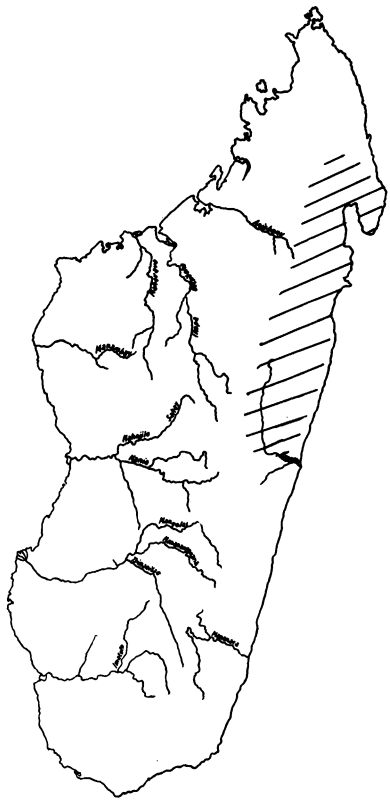

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Fig. 47. Range of *Brachypteracias leptosomus,* a bird of the northern and central parts of the Humid East district.

Fig. 48. Range of *Hartertula flavoviridis,* a bird found only in the central and southern parts of the Humid East district.

its range divided by the Sambirano, where *N. t. ellisii* was common (Fig. 36). The humid character of the Sambirano is old, and probably formerly was more pronounced, so it seems that *N. t. obscura* may have arisen in two different places entirely separated.

Since the greater part of Madagascar is not wooded, it is easily seen that no forest species can range over the whole of the island nor over

the greater part of it. The nearest approach to a widespread distribution over the island is the distribution of some of the open-ground birds that were found over all of the open ground and brushlands and ranged into the little clearings in the forest. *Turnix nigricollis* and *Mirafra hova* are examples of this.

Many of the forest species that range over the three provinces, such as *Leptosomus d. discolor*, while common in the denser forests of the Oriental, occurred only in the more heavily wooded areas of the Occidental and the Subdesert. This was particularly noticeable with the species that ranged only through the Oriental and Occidental forests. These were common in the Oriental and gradually became less common farther south in the Occidental, one species after another disappearing as the forested areas became restricted and the xerophytic brush appeared. Examples of this type of distribution were *Alectroenas madagascariensis*, *Hartlaubius auratus*, *Cinnyris notatus*, and *Cyanolanius madagascarinus* (Fig. 33). This type of distribution is also true for some other species, such as *Bernieria madagascariensis*, that become modified into races in the Occidental, or to those species, such as *Vanga curvirostris* and *Coracina cinerea*, that range through the three biotic provinces but become modified into races in the Subdesert, where they are not common.

The extent of the beaches and muddy bays along the coast is an important factor in determining the abundance of the various shore birds and water birds that winter in Madagascar. The greater number of these frequent the western coasts and those of the Subdesert, the narrow beaches and rough seas of the Humid East offering them little attraction.

Some birds, such as *Actophilornis albinucha*, *Egretta a. melanorhynchos*, *Plegadis f. falcinellus*, and *Anastomus l. madagascariensis*, which favored the larger, more extensive marshes without close surrounding forest, were more common in the larger marshes of the west. The clearing of the land in the east and the cultivation of swamp rice, resulting in the formation of shallow swamps, has probably been a factor in the intrusion or increase of these forms in the east. Probably this has caused also an increase in the numbers of other marsh birds that frequented the smaller marshes in the forest as well as in the number of birds of the more open swamps, such as *Scopus u. tenuirostris* and *Bubulcus i. ibis*. The southwest largely lacks marsh vegetation except inland beyond the arid regions. A few birds such as *Ardeola idae* were found along the rivers, while some species such as *Phoenicopterus r.*

antiquorum and *Threskiornis a. bernieri*, preferring wide, open pools without surrounding vegetation, were common throughout the west and southwest but did not range into the east.

Possibly some birds, such as *Thamnornis chloropetoides*, that are widespread throughout many of the habitats in the southwest, have become adapted to the bright sunlight and the arid conditions in the southwest and are directly influenced by them.

There are, however, many cases of restricted distribution within the provinces that because of lack of available data cannot be correlated with any of these factors. Possibly a study of the inner relationships of these species, with respect to each other, will help to explain their distribution.

Certain species such as *Mesoenas unicolor*, *Dromaeocercus brunneus*, *Brachypteracias leptosomus* and *Hartertula flavoviridis*, were restricted to one or another part of the Humid East (Figs. 47 and 48), though P. de la Bathie[1] has said that this forest was homogeneous throughout its length. *Coua verreauxi* had a restricted range in the Subdesert and *Coua cristata*, a closely related species, was absent from the greater part of it, although they were found together on the southern edge of the former's range (Fig. 34).

Many species, characteristic of one type of forest, ranged commonly into the edge of another. *Philepitta schlegeli* and *Coua coquereli*, both birds of the drier forests, ranged commonly into the edge of the humid forest of the Sambirano where *C. coquereli* occupied the same haunts as did *C. reynaudii*, a bird of the humid forest, but *C. reynaudii* did not range out into the drier forests of the Northern Savanna.

Most of the conclusions on the changes that have taken place in the distribution of bird life must be based on the indirect evidence of changes in the flora, which have already been discussed. The former extension of the humid forest over the central plateau was accompanied by an extension of the fauna adapted to the forest which is richest in peculiar forms. This avifauna, then, was continuous in space with the western fauna, which probably developed in a rather restricted area and under strong influence from the east, as is also indicated by the paucity of the endemic fauna in the west.

The number and distinctness of the birds of the southwest indicates a long period of adaptation to arid conditions. With the former extension of the island of Madagascar to the south, this avifauna probably developed in a larger area than it occupies at present.

[1] 1921, *op. cit.*, p. 75.

In recent geological times, when the humid forest on the plateau was more tropical than are its present remnants, the fauna of the humid forest probably extended much farther west than it does today, reaching to the coast in the northwest and extending down the west coast, still more restricting the area in which the western fauna could develop. At that time the Mt. d'Ambre avifauna was connected with that of the rest of the island. The gradual drying out of the country and the retreat of the humid forest caused the avifauna to retreat into the east and into the Sambirano while certain forms such as *Alectroenas madagascariensis Cinnyris notatus*, etc., that were adaptable remained behind in the more favorable locations. Other forms such as *Bernieria madagascariensis* and *Lophotibis cristata* remained behind and became modified into races.

The fauna of the Occidental retreated somewhat before the advance of the Subdesert, because of the gradual lessening of the humidity, and at the same time occupied some of the country left by the retreating avifauna of the Humid East. With the destruction of the forest over much of the plateau, the Occidental and Oriental forests became more isolated, and with the destruction of the rain forest in the east and the subsequent formation of brush areas resembling the brush areas of the west, certain western species, such as *Oena c. aliena*, and *Coua cristata*, moved into the east around the ends of the mountains, *Coua cristata* more commonly by way of the north where the transition from arid to humid conditions is gradual, rather than in the southwest where the transition is abrupt, and *Oena c. aliena* by way of the south. Certain species such as *O. c. aliena* spread into the brush along the rivers onto the central plateau. The clearing of the forests around the marshes in the east made these areas more favorable for certain herons and ducks, and the formations of rice fields, changing narrow streams to broad shallow marshes, probably resulted in the increase of many marsh birds, as we have mentioned before. The peculiar Madagascar avifauna evidently has become modified by two main types of environment, the humid forest of the east and the arid wooded and brush areas of the Subdesert, and by an environment of less importance, intermediate between them, the periodically dry woodlands of the west.

DISTRIBUTION OF BIRDS THROUGH THE THREE BIOTIC PROVINCES

The limits of the three biotic provinces are determined through a consideration of the average distribution of birds that have a limited adaptability and consequently a restricted range. Many forms, how-

ever, are adaptable to varying conditions and range widely without becoming modified enough to be considered as subspecifically distinct.

In order to avoid repetition later it seems advisable to list here the birds that range unchanged over three provinces. The particular relationship of the species to its habitat will be taken up under the discussion of each province.

The following birds were found in the three biotic provinces[1]:

Phalacrocorax africanus pictilis
Ardea purpurea madagascariensis
Bubulcus ibis ibis
Ardeola idae
Ardeola ralloides
Butorides striatus rutenbergi
Scopus umbretta
Anas punctata
Dendrocygna viduata
Sarkidiornis melanotos
Anastomus lamelligerus madagascariensis
Charadrius marginatus tenellus
Charadrius pecuarius pecuarius
Charadrius tricollaris bifrontatus
Fulica cristata
Turnix nigricollis
Margaroperdix madagascariensis
Numida mitrata
Streptopelia picturata picturata
Falco newtoni
Aviceda madagascariensis
Milvus migrans parasitus
Buteo brachypterus
Accipiter madagascariensis
Astur francesii
Gymnogenys radiatus
Otus rutilus
Tyto alba hypermetra
Cuculus poliocephalus rochii
Centropus toulou toulou
Caprimulgus madagascariensis madagascariensis
Apus apus balstoni
Apus melba willsi
Cypsiurus parvus gracilis
Zoonavena grandidieri
Eurystomus glaucurus
Leptosomus discolor discolor
Merops superciliosus
Phedina borbonica madagascariensis
Cisticola cherina
Ixocincla madagascariensis madagascariensis
Dicrurus forficatus forficatus
Mirafra hova
Foudia madagascariensis
Spermestes nana
Corvus albus

DISTRIBUTION OF BIRDS FOUND ONLY IN THE ORIENTAL AND OCCIDENTAL PROVINCES

Although the Oriental and Occidental provinces differ widely in the types of forest, brushlands, marshes, and shore areas occurring in each, many adaptable forms exist that range widely throughout both provinces. The forest and brushland forms common to these two provinces, such as *Alectroenas madagascariensis*, are common in the more densely wooded areas of the west and become rare in the southwest as the forest decreases until they finally become very rare or disappear altogether.

[1] Some species with a distribution still doubtful have been omitted from this and the following lists.

The reason for this appears particularly evident if we consider the original avifauna of the Oriental as gradually retreating into the Sambirano.

The marshes of the Occidental are particularly favorable for the occurrence of the larger marsh and wading birds that do not like the immediate vicinity of cover, though some of these range also into the more open, larger marshes of the east.

Some species, which as a whole range over the three provinces, become differentiated into races in the Subdesert. One race of a widespread species was restricted to the Oriental and the Occidental, though in the southern part of the Occidental forms might be found that were intermediate between those of the widespread race and those of the Subdesert. (Some species of wide distribution, such as *Neomixis tenella* and *Nesillas typica*, became differentiated into races in each province.)

The following birds were found in the Oriental and Occidental, becoming rare or entirely absent in the Subdesert Province, or replaced by other races:

Podiceps pelzelnii
Larus cirrocephalus
Anhinga rufa vulsini
Melanophoyx ardesiaca
Nycticorax nycticorax nycticorax
Ixobrychus minutus podiceps
Plegadis f. falcinellus
Nettapus auritus
Dendrocygna fulva
Anas punctata
Thalassornis leuconotus insularis
Rostratula benghalensis
Glareola ocularis
Actophilornis albinucha
Dryolimnas cuvieri cuvieri
Porzana pusilla obscura
Gallinula chloropus pyrrhorrhoa
Porphyrula alleni
Porphyrio madagascariensis
Alectroenas madagascariensis
Falco peregrinus radama
Machaerhamphus alcinus anderssoni
Astur hensti
Circus aeruginosus macroscelis
Asio madagascariensis
Asio capensis hova
Agapornis cana cana
Apus melba willsi
Ispidina madagascariensis
Calamocichla newtoni
Coracina cinerea cinerea
Leptopterus chabert chabert
Cyanolanius madagascarinus madagascarinus
Vanga curvirostris curvirostris
Cinnyris notatus notatus
Cinnyris sovimanga sovimanga
Motacilla flaviventris
Hartlaubius auratus

Probably many migrant birds of the seashore, common in the Occidental, also range into the Oriental, at least occasionally.

DISTRIBUTION OF BIRDS IN THE ORIENTAL AND THE SUBDESERT PROVINCES

The Oriental and Subdesert provinces stand as opposites in regard to climate and vegetation and, as would be expected, no species occurs

unmodified in the two that does not occur also in the Occidental, one species, *Neomixis striatigula* has a race in the Oriental and one in the Subdesert, but is unrepresented in the Occidental.

DISTRIBUTION OF THE BIRDS FOUND ONLY IN THE OCCIDENTAL AND SUBDESERT PROVINCES

The Subdesert and the Occidental differ from the Oriental in that they have less rainfall and a periodic dry season resulting in drier, deciduous, more open woodland and brushland. Some of the open ground in these provinces is covered with much scantier grass than is found in the oriental. The marshes are larger and have less surrounding forest. The shores have wide beaches that offer good feeding places for shore birds and resting places for terns.

The Subdesert is much more arid than is the Occidental, the forest is lower, and more restricted, and much of the sandy land has a very scanty covering of grass. In the savanna country of the Subdesert, however, conditions are similar to those in the savanna country of the Occidental. The marshes tend to become fewer in the Subdesert and the marshy vegetation is reduced in extent. The beaches of the Subdesert show much the same characteristics as those in the Occidental although there are fewer muddy bays and consequently fewer mangroves.

Some few birds, such as *Oena capensis aliena* and *Upupa epops marginata*, are common to these two provinces and only occasionally range into the Oriental, and then only when the cleared country there offers conditions similar to those found in the Occidental and the Subdesert. Other wide-ranging species are represented by one race in the Oriental and another in the Occidental and Subdesert, and others are represented by races in the Subdesert and Occidental alone.

The following forms were found only in the Occidental and Subdesert:

Sterna bergii bergii
Sterna albifrons saundersi
Ardea cinerea johannae
Threskiornis aethiopicus bernieri
Phoeniconaias minor
Dromas ardeola
Eremialector personatus
Oena capensis aliena
Vinago australis xenia
Ninox superciliaris
Coracopsis vasa drouhardi

Upupa epops marginata
Copsychus albospecularis pica
Artamella viridis annae
Falculea palliata

Some of these, such as *Ninox superciliaris* and *Eremialector personatus*, do not range into the Northern Savanna.

The following Palaearctic migrants were found only in the Occidental and Subdesert provinces:

Numenius arquata
Numenius phaeopus
Xenus cinereus
Tringa nebularia
Erolia testaceus
Crocethia alba
Squatarola squatarola squatarola
Charadrius hiaticula tundrae
Falco concolor (a migrant from Africa)

ORIENTAL PROVINCE

The Oriental Province occupies the eastern slopes of the island of Madagascar south of Mt. Tsaratanana, the central plateau, the drainage system of the Sambirano river, and the summit of Mt. d'Ambre. Some of the wooded areas at high altitudes on the western slopes also may be referred to this province.

In the west we may accept P. de la Bathie's boundary of 800 meters altitude on the western slopes, though in the south this line descends to the coast between Fort Dauphin and Ambovombe, passing considerably to the east, and in the northwest to the coast near Port Radama. North of the Sambirano, the limit of the Oriental Province is nearly at the divide between that river and the Ifasy River. The boundary continues around Tsaratanana, where we may accept Humbert's limit of 800 meters, and descends to the coast near Antalaha. Mt. d'Ambre above 800 meters is also included in this province.

The Oriental Province lies on the oldest formations in the island of Madagascar; ancient granites and schists that have disintegrated into a deep red soil, and some volcanic areas. The land surface presents steep slopes and sharp valleys. Along the coast there is a flat, narrow coastal plain. The central highlands consist of a multitude of hills. This formation results in the occurrence of small ponds, lakes, and marshes (with a few larger lakes such as Lac Alaotra). The streams are small and rapid as a rule, when compared with those on the western

side of the island but where they enter the narrow coastal plain they become sluggish and marshy and form a series of lagoons running parallel to the east coast, between Tamatave and Farafangana.

The average yearly temperature varies little with the latitude, most localities on the coast having an average yearly temperature of twenty-two to twenty-six degrees. As one goes farther inland, ascending the mountains, the temperature decreases (0.46° for each 100 m., Poisson, 1930).

At Tananarive the average yearly temperature is 18.4 degrees and at Antsirabe 16.5 degrees, where an extreme of −8.6 degrees has been recorded. On the mountains at higher altitudes the temperature probably falls lower. Frost is said to occur on Mt. Anakaratra (alt. above 1500 m.) in July, and we observed frost at one day west of Andapa, alt. 1800 m., in August. The Sambirano has a slightly higher temperature. No data are available for Mt. d'Ambre but the temperature there is probably similar to that in the Humid East at the same altitude.

The humidity of this province, caused by the prevailing trade winds blowing on the eastern slopes, and the annual northwest winds in the Sambirano, is the feature that gives the province its distinctive flora and fauna. It receives more rainfall than any other part of the island. The rainfall varies from 3138 mm. at Maroantsetra and 5127 mm. at Sainte Marie to 1777 mm. at Fort Dauphin, on the western edge of the plateau and on the edge of the Sambirano. The greater part of the eastern slopes has no dry season except at the higher altitudes and over the central plateau, where the dry season is from May to October. Here the damper atmosphere, carried over by the prevailing winds probably has an effect in allowing a humid type of forest to exist, and the forest itself may have an effect in condensing moisture from the passing mists as well as in retaining moisture (see section on the forests).

In the Sambirano the dry season (May to October) is well marked but the district receives more than 2000 mm. of rainfall yearly. This amount diminishes on each side to about 1500 mm. which limits its extent. Here also the effects of the denudation are observable, and the deciduous brush is replacing the forest. Though the coastlands about Mt. d'Ambre are subject to dry seasons, such seasons are probably not very marked on the summit, judging from the amount of humid forest with mosses and epiphytes that exists there.

The vegetation of the province is characterized by the humid tropical forest which the natives have sadly reduced with fire and axe. In the north, between Maroantsetra and Mt. Tsaratanana, the forest is still

practically continuous from sea level to an altitude of 2000 meters, but farther south the forest on the eastern slopes is much reduced, surrounded by secondary brush, and straggling out in scattered tracts nearly to Fort Dauphin. The forest in the Sambirano is nearly or quite continuous with that in the east by way of the south of Mt. Tsaratanana and the forest P. de la Bathie speaks of as occurring on the western edge of the plateau is probably a continuation of this and is separated from the eastern forest by the treeless highlands. The forest on Mt. d'Ambre is an isolated, compact area of humid forest, with a narrow edge of brush and open ground that belongs to this province.

In the Oriental, the secondary brush is in various stages of reforestation, and much of the forest has completely disappeared, leaving open grasslands or grasslands with scattered heathlike shrubs. This type of country, which includes the greater part of the central highlands today and also extends over wide areas on the eastern slopes, especially in the south, is very poor in species of plants, and contains little bird life, but is important in its effect on distribution because it acts as a barrier in isolating forest areas and makes as effective a barrier as would areas of water.

The following forms were found only in the Oriental Province:

Podiceps rufolavatus
Lophotibis cristata cristata
Anas melleri
Nyroca innotata
Capella macrodactyla
Canirallus kioloides kioloides
Canirallus kioloides berliozi
Rallus madagascariensis
Sarothrura insularis
Sarothrura watersi
Mesoenas unicolor
Eutriorchis astur
**Heliodilus soumagnei*
Coracopsis vasa vasa
**Pachycoccyx audeberti*
Coua caerulea
Coua reynaudii
Coua serriana
**Cochlothraustes delalandei*
Caprimulgus enarratus
Brachypteracias leptosomus
Brachypteracias squamigera
Atelornis pittoides
Atelornis crossleyi
Nesillas typica ellisii
Randia pseudo-zosterops
Hartertula flavoviridis
Neomixis striatigula sclateri
Neomixis viridis viridis
Neomixis viridis delacouri
Neomixis tenella orientalis
Dromaeocercus seebohmi
Dromaeocercus brunneus
Mystacornis crossleyi
Oxylabes madagascariensis
Oxylabes cinereiceps
Oxylabes xanthoprys
Bernieria tenebrosa
Bernieria zosterops fulvescens
Bernieria zosterops andapae
Bernieria zosterops maroantsetrae
Bernieria zosterops zosterops
**Bernieria zosterops ankafanae*
Bernieria madagascariensis madagascariensis
Tylas eduardi eduardi
Artamella viridis viridis
Schetba rufa rufa

Philepitta castanea
Riparia paludicola cowani
Newtonia amphichroa
**Newtonia fanovanae*
Tchitrea mutata mutata
Pseudobias wardi
Newtonia brunneicauda monticola
Pseudocossyphus sharpei sharpei
Pseudocossyphus sharpei erythronotus
Copsychus albospecularis albospecularis
Copsychus albospecularis inexpectatus
Nesillas typica typica
Oriolia bernieri
Xenopirostris polleni
Euryceros prevostii
Hypositta corallirostris
Neodrepanis coruscans
**Neodrepanis hypoxantha*
Zosterops maderaspatanus maderaspatanus
Zosterops maderaspatanus analoga
Nelicurvius nelicourvi
Foudia omissa

* Not collected by the Mission.

From this we see that there are sixty-nine forms restricted to the Oriental Province, representing forty-five species with their races, seventeen genera, and two families. This avifauna, by far the richest in number of species, probably represents the ancestral stock from which most of the avifaunae of the Occidental and Subdesert provinces developed under different conditions. Many of these forms do not have close relatives in other parts of the island, but most of the peculiar birds, especially land birds, in the other parts of the island have some relation with these of the Oriental. Therefore, in considering the avifauna of the Occidental and Subdesert it will be compared with that of the Oriental.

Since the extension of the humid forest was at one time greater, its reduction has resulted in the restriction of the ranges of forms especially adapted to this habitat, though some other arboreal birds are able to exist in the drier forest of the Occidental as well, while others, still more adaptable, range throughout the island. With the destruction of the forest of the Oriental, secondary brush has been formed and there has been an intrusion there of some of the birds of the drier forest of the Occidental, such as *Oena capensis aliena, Upupa epops marginata,* and *Coua c. cristata; Coua c. cristata* along the coasts around the ends of the highlands, *Oena capensis aliena* both in this way and also onto the central plateau from the west. This intrusion is especially noticeable in the Sambirano, where one finds *Coua coquereli, Falculea palliata,* and *Artamella viridis annae* ranging into the edge of the humid forest.

Our work at the higher altitudes was not extensive enough to furnish data for very conclusive results on altitudinal distribution, since we did little collecting from 1500 to 2000 m. yet the following discussion may have some value, as the Oriental Province is the only one that rises

above 800 meters, and the effects of altitude on distribution were not noticeable much below that.

The effect of altitude on the vegetation has led P. de la Bathie to recognize a central region intergrading with the lower eastern forest at about 800 m. In our study of the birds, it was found that most species were not governed by altitude to any great extent. Few altitudinal subspecies have evolved in Madagascar, and these are slightly differentiated. *Saxicola torquata* has a race *ankaratrae* which inhabits the central part of the Humid East above 1500 meters around Mt. Ankaratra, and extends westward to 700 meters in the central part of the Western Savanna; *Newtonia brunneicauda* has a race *monticola* apparently restricted to Mt. Ankaratra above 1800 meters; and *Zosterops maderaspatanus* has a race *analoga* known from Mt. Ankaratra above 1800 meters and the central part of the Western Savanna, at 1000 meters. *Pseudocossyphus sharpei*, also has a tendency to be larger at the higher altitudes but this difference is too slight to use in separating a subspecies.

Two species alone, *Dromaeocercus seebohmi* and *Sarothrura watersi*, were found to be definitely restricted to altitudes above 1600 m. These were birds of the little marshes and the neighboring grasslands, the former found on Mt. Ankaratra and one day west of Andapa, on the slopes of Tsaratanana, and the latter found only west of Andapa and on the slopes of Tsaratanana (also recorded from the Betoilio country to the south). Two species, *Podiceps rufolavatus* and *Nyroca innotata*, were collected only at one station (about 750 m., Lac Alaotra). Some forest species, such as *Pseudocossyphus sharpei*, *Randia pseudo-zosterops*, *Neomixis striatigula sclateri*, and *Neomixis viridis*, were not found below 800 m. *Canirallus kioloides* and *Coua serriana* were not found above 1000 m., and *Neomixis tenella tenella* was not found above 1150 m.

One of the most striking differences in passing from the coast to the higher altitudes was the difference in the avifaunal association of the forest on the coastal plain in the east and that on the mountain slopes. *Cinnyris notatus notatus* was not very common on the mountain slopes but was abundant on the coastal plain. *Coracopsis vasa vasa* was common on the coastal plain but was absent from the forest on the mountain slopes except two days northeast of Maroantsetra, where it had followed the edge of the forest along the clearings and the trail up to about 1000 m. Many of the forest birds that were of regular occurrence on the mountain slopes and ranged nearly down to sea level were absent or rare on the coastal plain, such as *Euryceros prevostii*, *Philepitta*

castanea, *Bernieria zosterops zosterops*, *Hypositta corallirostris*, and *Schetba rufa rufa*. Of the open-ground and brushland birds, *Numida mitrata mitrata* and *Agapornis cana cana* were not found much above 1000 m.

The following species of widespread distribution were not found above 1000 m.

Anhinga rufa vulsini
Egretta alba melanorhynchos
Egretta dimorpha
Butorides striatus rutenbergi
Ixobrychus minutus podiceps
Anastomus lamelligerus madagascariensis
Sarkidiornis melanotos
Nettapus auritus
Thalassornis leuconotus insularis
Charadrius pecuarius pecuarius

From this it can be seen that while some species are restricted to certain altitudes, the majority of the birds occur at all altitudes up to 1800 m. at least. Between the coastal plain and the mountain slopes where altitudinal differences are slight, the difference is more pronounced than that occurring anywhere on the slopes, so that from our present knowledge it would seem that the effects of altitude in controlling distribution, up to 1800 m., is a minor factor affecting but a few forms and is nowhere very apparent. When the forests with mosses and lichens above 1700 m. on Mt. Tsaratanana, and one day west of Andapa, have been studied, it probably will be found that many of the typical forest birds of the lower mountain slopes are absent. However, so little of the forest does extend above 1800 m., except in the north on Mt. Tsaratanana, and so great a part of the central highlands is treeless, that this mountain forest is a rather restricted habitat. P. de la Bathie,[1] 1927, records that on the upper slopes of Mt. Tsaratanana, much of the forest has been burned, for it becomes extremely inflammable when dried out. Thus two factors, the nonexistence of extensive areas of forest above 1800 m. and the destruction of the existing areas at this altitude, have not allowed the evolution of a distinct mountain-forest fauna.

The following districts of the Oriental Province may be recognized, based on the restriction of certain birds to only a part of the province: Humid East, Sambirano, and Mt. d'Ambre districts. Minor restricted areas of distribution within the Humid East can also be recognized.

Before discussing these areas of distribution within the province, it may be advisable to consider the ecological distribution of the forms occurring there. The preference which various birds show for particular

[1] 1927, Mémoires de l'Académie Malgache, Fasc. III.

types of habitat enables one to speak of "littoral," "marsh," "forest," "secondary brush," and "grassland" avifaunal associations. These are applicable to widespread species as well as to those of more restricted range. Particular local conditions that were not apparent in this study restricted some species to only a part of one of these habitats.

LITTORAL ASSOCIATION.—The narrow, steeply shelving beaches and the rough seas of the eastern coast offer little attraction to numbers of shore birds, though most of the forms that visit Madagascar perhaps occur there at times.

The broadly shelving coast of the Sambirano, with extensive sand beaches and muddy flats, is similar to the coasts of the Occidental and has little in common with that of the Humid East. The discussion of the birds that occur there will be taken up when the particular district is considered.

The only common resident bird characteristic of the beaches of the Humid East was *Charadrius marginatus tenellus; C. thoracicus* has also been recorded there (Richmond[1]). Migrants, such as *Arenaria i. interpres* and *Charadrius leschenaulti*, occurred there; and *Sterna b. par*, *Fregata* (species?), and *Oceanites oceanites* were seen on the coast.

MARSHES.—The marshes and streams of this province are usually small and many of the smaller ones have low dense vegetation of grasses and sedges. Some of the larger marshes, particularly near the coast, resemble those of the west and have a succession of plant life from open water through submerged and floating vegetation, reeds and grass, to firm land. The streams usually have but little marsh along their margins except near the coast. Probably the original forest enclosed the marshes and the western species, such as *Himantopus h. himantopus*, *Actophilornis albinucha*, and some of the herons and ducks that prefer more open country have probably come into the Oriental Province secondarily as the forest has retreated. These birds have not yet become common. The modification of the marshes and some times the surrounding country into swamp rice fields had probably resulted in the increase of certain species, particularly *Bubulcus ibis* and *Scopus umbretta*, which favor that type of habitat, and of the birds such as *Foudia madagascariensis* and *Motacilla flaviventris* that find more food there.

The following species peculiar to Madagascar were found only in the marshes of the Oriental:

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[1] 1896, Proc. Biol. Survey, Washington, pp. 53–54.

Podiceps rufolavatus	*Rallus madagascariensis*
Nyroca innotata	*Sarothrura watersi*
Anas melleri	*Riparia paludicola cowani*
Capella macrodactyla	*Dromaeocercus seebohmi*

Riparia paludicola cowani was also found over the surrounding grassy country.

The terns, *Chlidonias leucopareia sclateri* and *Chlidonias leucoptera* were found only on Lac Alaotra in this province.

Rallus madagascariensis was confined largely to the denser vegetation of these swamps, *Capella macrodactyla* frequented it, *Sarothrura watersi* ranged out into the neighboring grasslands, and *Dromaeocercus seebohmi* was found out in the grasslands and brushy hillsides as commonly as in the swamps.

The marshes with more open, taller grasses and reeds, sometimes quite restricted in area on the edge of some stream and sometimes quite extensive and bordering on the edge of some pond or lake, or occupying the whole of some valley and closely resembling certain habitats in the Occidental Province, were chiefly characterized by widespread forms.

Calamocichla newtoni was practically confined to this habitat, perching on the reeds or searching for food among them; *Dryolimnas c. cuvieri* was commonest in it, though this bird also ranged out into the damp luxuriant grass on its borders, into the more shallow swamp areas, and occasionally into the forest where there was much herbaceous ground-cover. *Porzana pusilla obscura* was largely restricted to this habitat, but also fed out in the more open marsh and over the floating vegetation on its edge. *Porphyrio madagascariensis* also was confined largely to this type of vegetation occurring on the edge of the open water, but also fed on the floating vegetation on its edge, as did *Porphyrula alleni*, which ranged farther from its shelter over the lily pads, and *Gallinula chloropus pyrrhorrhoa*, which swam among the floating vegetation. All of these birds sought shelter in the reeds when danger threatened them. *Ixobrychus minutus podiceps* occurred there and *Butorides striatus rutenbergi*, *Ardeola idae*, and *Ardeola ralloides* sought it as a shelter, though they preferred the more open muddy pools and river bars to feed upon. *Centropus t. toulou* was often seen in this tall grass and *Foudia madagascariensis* frequented it; *Corythornis vintsioides* was often seen perched on the reeds along the margins of the pools and streams.

The shallow, muddy pools with short or open vegetation, such as rice fields before the rice is well grown, and swampy ground with short

grass, which closely resemble some habitats in the west, were frequented by certain widespread forms; *Egretta dimorpha, Melanophoyx ardesiaca, Scopus umbretta,* and *Plegadis falcinellus falcinellus* fed here. *Bubulcus ibis ibis* was often found feeding here, though it also fed out over the grasslands. *Ardea purpurea madagascariensis* was common in this habitat but also fed out over the dry grass country. *Anastomus l. madagascariensis* was occasionally found in such places but also ranged out over the damp grasslands. *Charadrius p. pecuarius* and *Charadrius tricollaris bifrontatus* fed in the shallower places, the former also occurring on the coast. *Butorides striatus rutenbergi* fed in this habitat but sought shelter in the denser reeds. When the rice was ripening *Foudia madagascariensis* flocked into it in large numbers to feed on the grain.

The open, damp ground about the edge of the swamps and pools was a favorite haunt of *Motacilla flaviventris,* and *Corythornis vintsioides* was often seen sitting on low reeds or hummocks.

The pools of open water or those with some aquatic vegetation, sometimes more or less hemmed in with reeds or with forest, were frequented by *Anas melleri, Anas erythrorhyncha, Dendrocygna viduata,* and *Podiceps petzelnii,* which were also found along some of the small streams. *Anas erythrorhyncha* also fed in the flooded rice fields. *Dendrocygna viduata* was usually found sitting on some firm shore, *Nettapus auritus* frequented the little pools in the open ground where there was much submerged aquatic vegetation. *Porphyrula alleni* ran about over the floating vegetation. *Gallinula chloropus pyrrhorrhoa* swam about in the water, both birds flying to shelter in the reeds at the approach of danger. *Corythornis vintsioides* was often seen perched on bushes on the edge of pools and streams, darting down to the open water for its prey. *Anhinga rufa vulsini* and *Phalacrocorax africanus pictilis* perched in the trees along the larger streams, and *Scopus umbretta* often nested in the trees leaning over the streams or pools. *Glareola ocularis* was seen sitting on the rocks in some of the larger streams. Some species like *Circus a. macroscelis* and *Riparia p. cowani* ranged over all the marshes for their prey, and the swifts, *Cypsiurus parvus gracilis* and *Zoonavena grandidieri,* sometimes congregated over them to feed.

FORESTS.—The greater part of the peculiar avifauna of Madagascar, and the most interesting, was found in the humid tropical forest of this province, the extent of which has already been given. Longitudinally, there was little difference in the appearance of the forest at any one altitude, and P. de la Bathie[1] says that there is little difference in the

[1] *Op. cit.,* p. 75.

flora. But as we went from the sea coast to the mountain tops, there were definite changes in the appearance of the forest, and P. de la Bathie has set off a central region with a lower limit at about 800 meters on the basis of this difference. There was, however, no very evident change in the avifauna to support this division.

On the coast, the tall trees were interspersed with many palms, and the tree tops met overhead and kept out the sunlight. Epiphytes and lianas were less common here than at the higher altitudes, and the undergrowth in the forest was rather open. This was particularly true of the coastal plain, where palms, particularly traveler's trees, abounded and the ground-cover, though dense enough to hide terrestrial birds, offered no real obstacle to walking about. As we descended the mountain slopes we found that the ground-cover became more dense. At 20 km. west of Vondrozo, altitude 500 meters, lianas became common and palms less so, though they were still common along some of the streams that formed little marshes in the forest. At two days northeast of Maroantsetra, altitude 1000 meters, the ground-cover was still open except on the tops of ridges that rose considerably higher than 1000 meters, where the trailing bamboos became tangled and dense.

At Ivohibe, altitude 1000 to 1300 meters, and above Andapa (same altitude) the forest contained tall trees and palms were few; epiphytes and lianas were common, and the tangled ground-cover so dense that it was out of the question to force our way through. Above Andapa, as we approached 1800 meters, we found the forest to be lower, the trees heavily draped with lichens and the ground thickly carpeted with moss, though in some of the valleys there was still the forest of taller trees and tangled ground-cover characteristic of the slightly lower altitudes. The altitudinal distribution has already been discussed (pages 244–246).

The following forest forms were found only in the woodlands of the Oriental Province:

Lophotibis cristata cristata
Canirallus kioloides (both races)
Mesoenas unicolor
Eutriorchis astur
**Heliodilus soumagnei*
Coracopsis vasa vasa
**Pachycoccyx audeberti*
Coua caerulea
Coua reynaudii
Coua serriana
Randia pseudo-zosterops
Hartertula flavoviridis
Neomixis striatigula sclateri
Neomixis viridis (both races)
Neomixis tenella orientalis
Dromaeocercus brunneus
Mystacornis crossleyi
Oxylabes madagascariensis
Oxylabes cinereiceps
Oxylabes xanthophrys

**Cochlothraustes delalandei*
Caprimulgus enarratus
Brachypteracias leptosomus
Brachypteracias squamigera
Atelornis pittoides
Atelornis crossleyi
Philepitta castanea
Newtonia brunneicauda monticola
Newtonia amphichroa
**Newtonia fanovana*
Pseudobias wardi
Tchitrea mutata mutata
Pseudocossyphus sharpei sharpei
Copsychus albospecularis albospecularis
Copsychus albospecularis inexpectatus
Nesillas typica typica
Nesillas typica ellisii
Bernieria tenebrosa
Bernieria zosterops (all five races)
Bernieria madagascariensis madagascariensis
Tylas eduardi eduardi
Artamella viridis viridis
Schetba rufa rufa
Oriolia bernieri
Xenopirostris polleni
Euryceros prevostii
Hypositta corallirostris
Neodrepanis coruscans
**Neodrepanis hypoxantha*
Zosterops madaraspatanus analoga
Nelicurvius nelicourvi
Foudia omissa

* Not collected by our expedition.

These forest birds and also those with a wider distribution showed preference for certain parts of the trees in the forest so that various associations such as those of the tree tops, the middle spaces, the ground-cover or underbrush, and the forest floor, could be recognized in almost any type of forest.

Some birds were found almost entirely in the tree tops where they searched for their food among the larger branches, on the twigs, or among the leaves, rarely descending into the smaller trees or bushes, which constituted the middle spaces. The following are the most important:

Alectroenas madagascariensis
Falco zoniventris
Buteo brachypterus
Coracopsis vasa vasa
Coracopsis nigra nigra
Cuculus poliocephalus rochii
Eurystomus glaucurus
Leptosomus discolor discolor
Merops superciliosus
Randia pseudo-zosterops
Neomixis striatigula sclateri
Neomixis viridis (both races)
Neomixis tenella tenella
Neomixis tenella orientalis
Ixocincla madagascariensis madagascariensis
Tylas eduardi eduardi
Coracina cinerea cinerea
Dicrurus forficatus forficatus
Leptopterus chabert chabert
Cyanolanius madagascarinus madagascarinus
Artamella viridis viridis
Oriolia bernieri
Calicalicus madagascariensis
Euryceros prevostii
Cinnyris notatus notatus
Cinnyris sovimanga sovimanga
Zosterops maderaspatanus maderaspatanus
Hartlaubius auratus

Certain birds favored the tall slender saplings and the smaller trees that formed a stratum below the tree tops or the trailing lianas and tree trunks. The birds that frequented these middle spaces ranged occasionally and sometimes even commonly into the tree tops and into the ground-cover or even onto the ground.

The following birds were the more important of these:

Streptopelia picturata picturata
Coua caerulea
Newtonia brunneicauda
Newtonia amphichroa
Pseudobias wardi
Tchitrea mutata mutata
Bernieria madagascariensis madagascariensis
Schetba rufa rufa
Vanga curvirostris curvirostris
Hypositta corallirostris
Neodrepanis coruscans
Nelicurvius nelicourvi

The shrubbery of herbaceous plants forming a stratum close to the ground was the favorite haunt of a numerous group of birds that I have called the "ground-cover association." The following birds were characteristic of this:

Centropus toulou toulou
Ispidina madagascariensis
Philepitta castanea
Newtonia amphichroa
Pseudocossyphus sharpei
Copsychus albospecularis albospecularis
Copsychus albospecularis inexpectatus
Nesillas typica typica
Nesillas typica ellisii
Hartertula flavoviridis
Dromaeocercus brunneus
Oxylabes madagascariensis
Oxylabes cinereiceps

Psuedocossyphus sharpei feeds on the ground but perches in the ground-cover and in the middle spaces. *Ispidina madagascariensis* darts down from its perch on some low branch to pick up its prey on the ground. *Philepitta castanea* occasionally mounts to the tree tops.

We were in the forest of the Humid East chiefly in the seasons when most of the birds were not breeding. At that time the birds tended to move about in large flocks of various species, perhaps comparable with the winter flocks of some woodland species of more northerly climates, such as the winter associations of kinglets, chickadees, creepers, and woodpeckers.

As we hunted through the forest, hours would pass sometimes without the sight of more than a very occasional paradise flycatcher or blue coua. Then, suddenly, the trees about us would be alive with birds, as we encountered one of these flocks. The flock was often traveling rapidly and its different members gleaned their food from the tree tops to the ground-cover. For a time the birds would be all about us, then, as the flock passed on, the forest would be as quiet and desolate as before.

These flocks contained a variety of species and the individuals were sometimes very numerous. Their ranks contained birds which frequented all the forest associations except that of the forest floor. Certain species were characteristic of these flocks and some groups of these were usually found together. Thus, *Neomixis tenella, Neomixis viridis, Newtonia brunneicauda, Cinnyris s. sovimanga, Zosterops m. maderaspatana, Cyanolanius m. madagascarinus,* and *Calicalicus madagascariensis* were usually found together in the twigs and among the leaves of the tree tops, sometimes accompanied by the rare *Neomixis striatigula sclateri* and *Randia pseudo-zosterops.* The birds *Artamella v. viridis, Tylas eduardi, Euryceros prevostii,* and *Oriolia bernieri* formed another group that fed together in the branches of the tree tops. *Coracina c. cinerea* consorted with one or the other of these groups but often kept to the larger branches. *Hypositta corallirostris* frequented the upper part of the tree trunks and larger limbs. *Bernieria m. madagascariensis, Tchitrea m. mutata, Nelicurvius nelicourvi, Schetba r. rufa, Vanga c. curvirostris,* and *Coua caerulea* occupied the middle spaces, often ranging up into the tree tops and down into the ground-cover, and *Bernieria zosterops, Oxylabes madagascariensis, Hartertula flavoviridis, Copsychus a. albospecularis,* and *C. a. inexpectatus* occupied the ground-cover. Sometimes most of the above-mentioned birds were found moving about together in loose feeding flocks, at other times the larger species such as *Artamella v. viridis,* and *Euryceros prevostii* were in the forepart of the flock and as they passed on the smaller species would appear. *Tchitrea m. mutata* frequently was found in the wake of such a flock and *Vanga c. curvirostris* seemed to prefer the outskirts of the flock. Sometimes the associations would consist entirely of smaller species, or of the larger ones.

Oriolia bernieri, when found, was usually associated with *Euryceros prevostii;* and *E. prevostii,* when found, was usually in the company of *Artamella v. viridis. Tylas eduardi* also favored the company of these latter birds. *Artamella v. viridis* was very common, however (we collected twenty-five specimens from one flock), and it does not follow by any means that it was always accompanied by either *Euryceros prevostii* or *Tylas eduardi,* both uncommon or rare birds, though to be sure, we scanned each flock eagerly for such rarities.

Calicalicus madagascariensis was very often found in these flocks and as it was a bird that called persistently, its notes were often a guide, aiding us in locating one of the flocks.

Almost all of the more common insectivorous birds of the forest

except those of the forest floor were found, at least occasionally, in these flocks, and from ten to fifteen species and even more were found frequently in one of them, the most common species being those that have been listed.

Occasionally breeding birds were found in these flocks, especially in the northern part of the Humid East, in August when the breeding season was starting. It was always possible that these breeding birds were not traveling in a flock but happened to be in the path of one of them, and so became associated with it for a short time. This habit of flocking may be simply the result of a gregarious tendency but possibly there are advantages which the members of the flocks derive from such an association.

Considering the different food and feeding habits of the various species it seems possible that one bird may startle from its hiding place some animal that it does not desire for its own food, and this animal, once startled into flight, becomes conspicuous and may be seen by a bird of another species that does desire it for food. This mutual starting into activity of the world of organisms on which birds prey may be a factor from which the members of the flock derive a mutual advantage.[1]

GROUND-COVER.—Some species were almost entirely terrestrial while others fed on the forest floor and perched in the trees. These formed the association of the forest floor of which the following birds were the most characteristic:

Lophotibis cristata cristata
Canirallus kioloides
Dryolimnas cuvieri cuvieri
Mesoenas unicolor[2]
Streptopelia picturata picturata
Coua reynaudii
Coua serriana
Caprimulgus madagascariensis
Caprimulgus enarratus
Brachypteracias leptosomus
Brachypteracias squamigera
Atelornis pittoides
Atelornis crossleyi
Ispidina madagascariensis
Pseudocossyphus sharpei sharpei
Pseudocossyphus sharpei erythronotus
Copsychus albospecularis albospecularis
Copsychus albospecularis inexpectatus
Mystacornis crossleyi

Dryolimnas cuvieri cuvieri ranged onto the forest floor only where there was luxuriant herbaceous vegetation. *Ispidina madagascariensis* picked up its prey on the ground but perched in the bushes; *Pseudocossyphus sharpei* and *Streptopelia p. picturata* fed on the ground but perched in the bushes or saplings, often mounting to the tree tops; and *Caprimulgus enarratus* slept on the ground but probably fed on the

[1] In this connection see Chapin, 1932, Bull. Amer. Mus. Nat. Hist., LXV, pp. 220–224, and Stresemann, 1917, Verhandl. Orn. Ges. Bayern, pp. 127–151.
[2] According to various accounts.

wing. *Caprimulgus m. madagascariensis* was found sleeping only on the edge of the forest though it fed over the forest at night.

BRUSHLANDS.—When the forest has been destroyed by burning, as has happened over a large part of the Oriental Province, a secondary brush springs up which attempts to reëstablish forest conditions. P. de la Bathie[1] says that this brush is relatively poor in species of plants when compared with the original forest. Where this brush is allowed to grow it produces a stand of trees that provides food and shelter for many birds, but often it has been burned again and again so that the shrubs and bushes have largely disappeared, and all degrees of intergradation between grasslands and heavy brush which approach forest conditions appear. Sometimes, particularly at higher altitudes, it gives way to an association of heathlike plants, bracken and grass.

To list all of the birds that occur, at least occasionally, in these areas would be to list most of the forest forms as well as those of the open ground. However, some are characteristic, or at least more common in it and range less commonly into the open ground or into the forest.

The brushlands merge on one side with the open grasslands where open-ground birds are common and on the other side with the forest where forest birds are common. Species that occur commonly in mixed brush and grassland, and which apparently reach their maximum abundance there, are *Margaroperdix madagascariensis*, *Numida m. mitrata*, *Turnix nigricollis*, and *Sarothrura insularis*. These are terrestrial birds and range out onto the grasslands. *Spermestes nana* and *Foudia madagascariensis* were common in these areas, often being found about cultivated lands and on the edges of swamps; and *Foudia omissa*, a bird of the forests, also ranged into these brushlands.

Saxicola torquata and *Cisticola cherina* were common in the more open brush, especially in the association of heathlike plants, grass and brush, though *Cisticola cherina* was also common in the damper grasslands. *Falco newtoni* and *Milvus migrans parasitus* were common here but also ranged out into the open ground, particularly about dwellings. *Merops superciliosus* perched on the topmost twig of some bush in this area and made sallies forth into the air above it for passing insects while swifts and swallows swept through the air, as they did in most of the other habitats. *Caprimulgus m. madagascariensis* slept on the ground here and replaced the swallows during the night. *Nesillas typica typica* was very characteristic of the brush but also occurred commonly in the

[1] *Op. cit.*, p. 30.

ground-cover of the forest. As the brush approached forest conditions, it was invaded by many of the tree-top and middle-space birds, such as *Ixocincla m. madagascariensis, Neomixis tenella, Tchitrea m. mutata, Newtonia brunneicauda, Calicalicus madagascariensis, Nelicurvius nelicourvi, Artamella v. viridis, Cyanolanius m. madagascarinus, Vanga c. curvirostris* and many others. Most of the birds of the ground-cover and forest floor, however, did not range commonly into the brush until conditions were very similar to those of the forest, although a few, such as *Coua reynaudii, Philepitta castanea,* and *Copsychus albospecularis,* did so. It was in this habitat that certain western species, such as *Oena capensis aliena* and *Upupa epops marginata* that favor scattered brush areas, and *Coua c. cristata* of the denser brush, were found.

GRASSLANDS.—The grasslands cover the greater part of the central highlands and occupy more or less extensive areas of the eastern slopes, particularly in the southeast. A narrow margin of grassland, occurring about the humid forest on Mt. d'Ambre, might be referred also to this province. In the Sambirano, a few areas of grassland occur at lower altitudes, although the greater part of that district is grown up with brush and resembles the Occidental. The grass forms but a scanty covering for the soil at the higher altitudes in the oriental. In the valleys where the soil is damper and on the narrow coastal plain in the east, the grass grows taller and more abundantly. On the central highlands, some of the grassland is thickly grown with bracken and heath-like plants which are often more abundant than the grass itself, and give a brush association. As one approaches the forest, various bushes appear as scattered individuals, then as smaller clumps and finally form a secondary brush association.

The characteristic birds of the grasslands were few in number and widespread in distribution within the island. The only truly characteristic bird that fed and nested in the extensive dry grassy areas was *Mirafra hova,* though *Turnix nigricollis* was also common but preferred the vicinity of the brushlands.

Margaroperdix madagascariensis and *Numida m. mitrata* ranged out on the grasslands only on the edge of the brush; *Saxicola torquata* preferred the vicinity of the brushlands; and *Bubulcus i. ibis* and *Ardea purpurea madagascariensis* ranged into the grassland to feed, though *Ardea purpurea madagascariensis* especially was more characteristic of the marshes. *Motacilla flaviventris* also favored the vicinity of the marshes and *Cisticola cherina* was more common in the damper valleys with more luxuriant grasses. *Foudia madagascariensis* and

Spermestes nana both were more common near brushland or swamps. *Milvus nigrans parasitus* and *Falco newtoni* were commonly seen feeding over the open ground and sometimes perching on a low hummock, but they preferred to roost in trees or on native houses. *Agapornis cana cana* fed on the ground in the grasslands but preferred the vicinity of the brush. *Merops superciliosus* sometimes sailed from its perch out over the open ground in search of its insect prey, while the swifts and swallows sometimes swept over it, though, since insects were apparently more common around trees or bushes or near swamps, they preferred to feed there. *Caprimulgus m. madagascariensis* slept on the ground in the brush in the day time and flew about over the open ground in the vicinity of the brush at night.

Since the birds characteristic of the Oriental are not all widespread throughout it, the following districts based in difference in avifaunal association can be recognized: the Humid East district, the Sambirano district, and the Mt. d'Ambre district.

The Humid East is the largest and most important, being richest in species. It also includes the most humid part of Madagascar.

The Sambirano is simply an arm of the Humid East, lacking many of the characteristic birds of the Oriental and having also an intrusion of some western forms, becoming thus a zone of transition.

Mt. d'Ambre is an isolated area of rain forest that has long been separated from the rest of the Oriental. It is rather poor in Oriental species.

Humid East District

The Humid East, occupying the eastern slopes of the island and the central plateau, and comprising the greater part of the Oriental Province with the exception of the Sambirano and Mt. d'Ambre, is the largest of the districts and the richest in endemic forms. It is entirely separated from Mt. d'Ambre by the deciduous forests and grasslands of the Occidental. The forest of the Humid East meets, or nearly meets, that of the Sambirano around the south of Mt. Tsaratanana, where it intergrades with it at about 800 meters elevation, according to P. de la Bathie,[1] who studied it from a botanical standpoint.

This district has practically no dry season over a great part of its extent, except at the higher altitudes. The Humid East is characterized by a humid tropical forest on the eastern slopes, now much reduced in

[1] *Op. cit.*, p. 115.

area and for the greater part bounded by treeless areas, which occupy the greater part of the central highlands, though occasional areas of forest still exist there. Some areas of open ground occur on the slopes.

The forest contains the greater number of peculiar species. A few of the marsh birds are also distinctive, but those of the open ground are all more widespread.

The following birds are found only in the Humid East:

Podiceps rufolavatus
Anas melleri
Nyroca innotata
Capella macrodactyla
Canirallus k. kioloides
Rallus madagascariensis
Sarothrura watersi
Mesoenas unicolor
Eutriorchis astur
**Heliodilus soumagnei*
**Pachycoccyx audeberti*
Coracopsis vasa vasa
**Cochlothraustes delalandei*
Coua serriana
Brachypteracias leptosomus
Brachypteracias squamigera
Atelornis crossleyi
Philepitta castanea
Riparia paludicola cowani
Tylas eduardi eduardi
Artamella viridis viridis
Schetba rufa rufa
Oriolia bernieri
Xenopirostris polleni
Newtonia monticola
**Newtonia fanovana*
Pseudobias wardi
Tchitrea mutata mutata
Pseudocossyphus s. sharpei
Copsychus a. albospecularis
Copsychus a. inexpectatus
Nesillas typica typica
Randia pseudo-zosterops
Hartertula flavoviridis
Neomixis striatigula sclateri
Neomixis viridis viridis
Neomixis viridis delacouri
Neomixis tenella orientalis
Dromaeocercus brunneus
Dromaeocercus seebohmi
Mystacornis crossleyi
Oxylabes cinereiceps
Oxylabes xanthophrys
Bernieria tenebrosa
Bernieria zosterops andapae
Bernieria zosterops maroantsetrae
**Bernieria zosterops ankafanae*
Bernieria zosterops zosterops
Bernieria madagascariensis madagascariensis
Euryceros prevostii
Hypositta corallirostris
Neodrepanis coruscans
**Neodrepanis hypoxantha*

* Not collected by our party.

The little marshes of the Humid East contained two species peculiar to the district, *Capella macrodactyla* and *Rallus madagascariensis;* and the water bird *Anas melleri* was also peculiar. Lac Alaotra was the only locality where two water birds peculiar to Madagascar, *Podiceps rufolavatus* and *Nyroca innotata*, were secured. We also secured two terns, *Chlidonias leucoptera* and *C. leucopareia sclateri* which we found only on Lac Alaotra, but which have a wider distribution outside of Madagascar.

P. de la Bathie[1] (1921) says that this Humid East forest is very similar throughout its length and we found that its general appearance is the same despite the lessened rainfall in the south. The following birds of the Humid East were found throughout the length of the forest:

Canirallus k. kioloides
Rallus madagascariensis
Coracopsis vasa vasa
Anas melleri
Caprimulgus enarratus
Philepitta castanea
Riparia paludicola cowani
Pseudobias wardi
Randia pseudo-zosterops
Mystacornis crossleyi
Bernieria madagascariensis madagascariensis
Tylas eduardi eduardi
Tchitrea mutata mutata
Artamella viridis viridis
Oriolia bernieri
Hypositta corallirostris
Neodrepanus coruscans

However, despite this similarity throughout the length of the forest, there are definite changes in the distribution of certain birds, and areas exist where some forms are present or most abundant and other areas occur where they are absent or much less common. Much more data must be gathered before the limits of these areas can be determined with any degree of certainty, and with the data at hand I can but suggest their limits. These are, briefly, the southern Humid East forest about Ivohibe, Vondrozo, and Farafanga (Manombo, southeast); the central Humid East forest about the Sianaka forest[2] (Didy, Fito), and Fanovana; and the northern Humid East forest from Maroantsetra and Antalaha to one day west of Andapa.

Five forms not found in the northern Humid East, represented there by different races, were *Hartertula flavoviridis*, which was fairly common in the central and southern Humid East forest and absent from the northern Humid East forest, *Nesillas typica typica*, *Neomixis viridis viridis*, *Neomixis tenella orientalis*, and *Bernieria z. zosterops*, found only in the southern part of the Humid East. The last four intergrade at Fanovana with other races which replace them in the northern part of the Humid East forest.

The following birds are known only from the central Humid East forest:

Mesoenas unicolor
**Heliodilus soumagnei*
**Cochlothraustes delalandei*
**Newtonia fanovana*
Dromaeocercus brunneus
Oxylabes cinereiceps
Oxylabes xanthophrys
Bernieria tenebrosa
Xenopirostris polleni
**Neodrepanus hypoxantha*

* Not secured by our party.

[1] *Op. cit.*, page 75.

[2] We did not visit the forest of Sianaka, unfortunately, but we bought a large series of skins from M. Herschell-Chauvin that had been collected in that area, which gave us an idea of the avifauna, and we spent nearly two weeks collecting at Fanovana, only a short distance south of the forest of Sianaka.

Oxylabes cinereiceps, *Oxylabes xanthophrys*, and *Dromaeocercus brunneus* were apparently common, judging from the number of skins in the possession of M. Chauvin, though we failed to find them north or south of the central Humid East. *Mesoenas unicolor* and *Bernieria tenebrosa* were rare even in the forest of Sianaka, and though the former has been taken by native collectors at Fito, it was not known by the natives at Fanovana. *Heliodilus soumagnei* and *Xenopirostris polleni* were very rare. We secured but one of the latter and none of the former.

Atelornis crossleyi was apparently very common, judging from specimens in M. Chauvin's collection, though we secured but a single specimen elsewhere, while *Atelornis pittoides* was rare in this area but was found throughout the length of the Humid East and was fairly common at one camp in the northeast.

The following forms were found only in the central and the northern parts of the humid forest:

Eutriorchis astur
Coua serriana
Brachypteracias leptosomus
Brachypteracias squamigera
Atelornis crossleyi
Copsychus albospecularis albospecularis
Neomixis viridis delacouri
Neomixis striatigula sclateri

Copsychus a. albospecularis was restricted to the area about the Bay of Antongil, intergrading with *Copsychus a. inexpectatus* as far south as Fanovana; *Neomixis striatigula sclateri* was rare and may be taken farther south, but the others, with the exception of *Eutriorchis astur*, which was rare, were fairly common birds in the northern part of the Humid East forest, and were more or less so in the central east, but were absent from the southeast. *Berneria zosterops andapae* is restricted to a small area in the extreme north of the Humid East, and *B. z. maroantsetrae* is confined to a small area just south of it.

The only two species that can be called mountain birds were *Dromaeocercus seebohmi* and *Sarothrura watersi*, both of very limited distribution. This distribution has been discussed in the section treating of altitude, as have the few altitudinal subspecies.

It is difficult to correlate these differences in avifaunal distribution with any series of factors, except that of the steadily diminishing rainfall as one goes south from the Bay of Antongil, for as we have mentioned, P. de la Bathie says that the forest is homogeneous throughout its length in spite of this difference in rainfall.

One other factor that may have some effect is the destruction of the forest in the south, but it is improbable that this is very important, as large areas of forest still exist in the south, and again, there are birds whose range is only the central part of the Humid East forest, not in the northeast, and there are three forms that occur only in the southern and central parts of the Humid East.

Sambirano District

The Sambirano occupies the basin of the Sambirano River and the peninsula of Ampasimena. Our collecting was done in a limited area in this district at low altitudes and further collecting is necessary to establish the inland limits of its avifauna. P. de la Bathie,[1] from a study of the plant life here, is of the opinion that this district intergrades at about 800 meters with the "central region," which I have included with the Humid East in this paper. Probably the forests on the western edge of the plateau, which P. de la Bathie mentions as having a humid character, belong to this district. Their avifauna is probably similar to that of the Sambirano, and is a mixture of the two faunas, east and west, with a scarcity in the number of forms of both.

The climate of the Sambirano is slightly warmer than that of the Humid East. The rainfall during the period from November to April, under the influence of the northwest winds, is about equal to the total rainfall of the southern part of the Humid East. During the rest of the year the rainfall is very slight, since the district is sheltered from the prevailing trade winds.

The limited areas of virgin forest in this district are much like those in the Humid East; sometimes with a dense tangled ground-cover of herbaceous growth, in other places with a rather open forest floor.

This district is simply an arm of the Humid East, more or less continuous with it by way of the south of Mt. Tsaratanana, though separated from it for the greater part of its length by areas of open ground. Its limits north and south on the coast are determined by the gradually decreasing rainfall as one moves away from the Sambirano River. This factor of diminishing rainfall, in connection with the seasonal distribution of the rains, limits the growth of humid tropical forest. At the higher altitudes its limits are doubtful.

A great deal of the forest of this area has been burned and largely replaced by secondary brush, some of it humid in character, some of it

[1] 1921, *op. cit.*, p. 115.

of the dry deciduous type found in the west. At the lower altitudes there is little grassland, the country being largely grown up with brush similar to that found in the west. Marshes are few and small along the Sambirano River but on the coast shallow, marshy, or grassy pools occur.

The shore line, with its flat beaches and wide muddy bays and flats, is especially attractive to many shore birds, but this district is of such limited extent on the coast that the actual coast line may be considered a part of the Occidental.

The avifauna of the Sambirano probably extended much farther south formerly, when the central plateau was wooded and the forest of the east and west in close proximity. With the gradual retreat of the rain forest this has been left as an outlying area of the humid forest, some of the birds of the humid forest still range part way down the west into the dry forests, while others range commonly into the Sambirano district; some of the forms occur there only occasionally and others not at all. With the retreat of the rain forest and its avifauna there has been an intrusion into the district of the western flora and fauna, resulting in the present mixture of eastern and western forms. We found only one bird, *Canirallus k. berliozi*, peculiar to this district, the distinguishing character of the district being a lack of Humid East species and but few Occidental forms.

The following birds characteristic of the Oriental Province occurred in the Sambirano district:

Lophotibis cristata cristata
Sarothrura insularis
Coracopsis nigra nigra
Coua caerulea
Coua reynaudii
Caprimulgus enarratus
Atelornis pittoides
Nesillas typica ellisii
Oxylabes madagascariensis
Nelicurvius nelicourvi

Caprimulgus enarratus was not unoommon while *Coua reynaudii*, and *Coua caerulea* were common, though none of these forms occurred on Mt. d'Ambre. *Nelicurvius nelicourvi* was fairly common, *Atelornis pittoides* and *Oxylabes madagascariensis* were rare and *Sarothrura insularis* was not uncommon.

The following birds characteristic of the Occidental occurred in the Sambirano district:

Coracopsis vasa drouhardi
Coua cristata cristata
Coua coquereli
Upupa epops marginata
Bernieria madagascariensis inceleber
Falculea palliata

Coracopsis vasa drouhardi and *Bernieria madagascariensis inceleber* were western races of species common in the Oriental. *Coua c. cristata* was a bird of the deciduous forests of the Northern Savanna and only ranged into the secondary brush and into the edge of the forest. *Falculea palliata, Upupa epops marginata* and *Oena capensis aliena* were also widespread western birds, ranging only into the secondary brush. *Actophilornis albinucha* and *Himantopus h. himantopus* occurred in a few of the marshes near the coast, and probably represent intrusions from the Occidental.

The wide beaches were much the same as those of the neighboring Occidental, and the ecology of them will be taken up under a discussion of that province. *Haliaeetus vociferoides* was very common on the beaches among the mangroves and many of the Palaearctic visitors that occurred along the west coast were also common here. Two terns, *Sterna hirundo* and *Sterna anaethetus antarctica* were secured only on the coast here.

Mt. d'Ambre District

The Mt. d'Ambre district includes the area of rain forest and a small amount of open ground occupying the summit of Mt. d'Ambre above 800 meters. (800 to 1361 m. altitude.) We have no data on the climate, but during our stay there in the month of October the weather was cool and rains frequent. The existing humid vegetation indicated a damp climate with a very limited dry season.

The mountain is an ancient basaltic cone with numbers of peaks and extinct craters. The craters contain little lakes, some with subterranean outlets. We visited one of them that was about a kilometer across and had been filled in with silt so that more than half of it was marshy. Another was perhaps a half kilometer across with very steep shores and little marshy area. Its level evidently fluctuated considerably, for we saw debris lodged three and a half meters or more above the level of the lake.

The forest on the summit of Mt. d'Ambre is a beautiful humid growth, with lianas, moss, and other epiphytes, though it is not as dense

nor as tall as the forest of the Humid East found at a similar altitude. Tree ferns were common and a great deal of herbaceous ground-cover occurred, though in some places the ground-cover was quite open. Some of the forest has been cut over and has grown up to a very dense humid secondary brush. The limiting factor for this district is the humidity, and on the west side where the forest was continuous with that at lower altitude, the change was abrupt from the humid forest of the summit to the deciduous woods of the lower altitude. In the deciduous forest, we found *Upupa e. marginata* and *Coua c. cristata* although they were not found on the summit where lived such typical humid forest birds as *Atelornis pittoides, Nelicurvius nelicourvi,* and *Newtonia amphichroa.* The open ground that can be referred to this district is but a narrow fringe along the edge.

This bit of rain forest was probably at one time continuous with the rest of the humid forest of the east and with the gradual lessening of the humidity has been separated from it for a long time, so that two very distinct races of Oriental species have evolved, *Pseudocossyphus sharpei erthronotus* and *Bernieria zosterops fulvescens.* Like the Sambirano, this district is characterized by lacking many of the forms distinctive of the Humid East.

Its avifauna was not rich and was composed largely of forms of the Humid East with the intrusion of some western forms though this mixture of eastern and western forms was not nearly as marked as in the Sambirano district.

The following birds characteristic of the Oriental Province occurred in the Mt. d'Ambre district:

Lophotibis cristata cristata
Sarothrura insularis
Atelornis pittoides
Newtonia amphichroa
Nesillas typica elisii
Oxylabes madagascariensis
Nelicurvius nelicourvi
Foudia omissa

The following birds characteristic of the Occidental and Subdesert occurred:

Tchitrea mutata singetra
Copsychus albospecularis pica
Bernieria madagascariensis inceleber
Zosterops maderaspatanus ampotakae

Many of the birds common in the Humid East were absent from the Mt. d'Ambre district. Two birds of the Oriental, *Foudia omissa* and *Newtonia amphichroa*, that occurred in this district were not found in the Sambirano, nor was *Bernieria zosterops* represented there. *Oxylabes madagascariensis* and *Atelornis pittoides* were common in the Mt. d'Ambre district but were very rare in the Sambirano, only one specimen of each being taken there. On the other hand, some species, such as *Coua reynaudii*, *Canirallus kioloides*, and *Caprimulgus enarratus*, were not uncommon or fairly common in the Sambirano but were not found in the Mt. d'Ambre district. A rather surprising case was that of *Coua caerulea*, a bird that was common in the Humid East and the Sambirano and ranged up into the Northern Savanna as far as Tsarakibany (fifteen miles southwest), almost within sight of the humid forest on Mt. d'Ambre, but was not taken on Mt. d'Ambre during the month we collected there.

The birds characteristic of an area at the same altitude in the Humid East that also occurred on Mt. d'Ambre were those that frequented the middle spaces, the ground-cover, and the forest floor. None of the typical Oriental birds of the tree tops association was found.

Sarothrura insularis, a typical bird of the brush, and *Saxicola torquata sibila*, typical of the brush and grasslands, occurred commonly. The absence of the water birds in this district was to be expected because of the scarcity of suitable habitat for them. *Artamella viridis annae* probably occurs in this district, at least occasionally.

OCCIDENTAL PROVINCE

The Occidental Province includes the western slopes of Madagascar from the Sambirano south to an intergradation with the Subdesert, between Morondava and Tulear, and extending inland from that, probably to an altitude of about 800 meters.[1] It also includes the northern part of the island at lower altitudes from the northerly limits of the Sambirano around the north of Mt. Tsaratanana, where again we may accept P. de la Bathie's limit of 800 meters, and gradually descends to the coast near Antalaha. The summit of Mt. d'Ambre above 800 meters must be excluded from the Occidental, for its vegetation and avifauna both show it to be a part of the Oriental Province.

These western slopes are for the most part gradual, giving broad, rolling plains and low hills, though the hills sometimes rise abruptly from the surrounding country. Large, shallow streams occur and areas

[1] P. de la Bathie, 1921, *op. cit.*, p. 182.

of extensive marsh and lake are common. The land under the sea slopes away gradually, giving broad beaches. Large bays are fairly common.

Passing inland from the coast, one first crosses narrow littoral dunes, then various sedimentary formations which increase in age as one goes farther inland—calcareous plateaus of varying age from the Eocene to the Jurassic, various recent clays and sandstones. Basalts of various ages, especially of the Cretaceous, are common; some of them are very recent, others deeply decomposed into clay. One reaches finally the ancient soils of the plateau formed from the gneiss and the ancient basalt.

Thus a variety of soils exists, some of which have very distinct types of vegetation, but when one comes to consider the distribution of the birds in relation to these types of vegetation, the relationship is not so clear.

The temperature of the province, with a yearly average of about 22° to 28°, is rather uniform throughout its length, decreasing somewhat as one approaches the highlands; but this is probably not the most important factor in the distribution of birds. The amount of rainfall is the chief factor, because it determines the limits of the dry forest. This province is largely sheltered from the prevailing trade winds by the central highlands. The northwest winds which bring the rainy season are felt most pronouncedly in the Sambirano, where the rainfall is over 2000 mm. These winds also bring the seasonal rains to this province, but do so with steadily lessening intensity as one goes south. Thus, to the north of Majunga the annual rainfall is some 1500 mm., which amount is diminished about one half at Morondava and to about one third at Tulear. Not only is the rainfall scanty but it is very seasonal and occurs only from November to April. Under the influence of the northwest winds, severe, sudden, short downpours often occur.

In summer at Majunga the average temperature is 27.9° and the rainfall 1403 mm.; in winter the average temperature is 25.4° and the rainfall 64 mm.

The wooded areas of this province extend along the western plains and on the hills as isolated areas of woodland. The savannas and palm-plains largely take the place of the open ground. As one passes southward from Majunga the amount of annual rainfall falls below the 1500 mm. that is usually accepted as necessary for the development of a humid tropical forest. The rainfall continues to decrease as one goes still farther south, the trees becoming more deciduous, the forests more open and of lower trees. In this province one finds areas of low brush

as well as some wooded and brush areas on the calcareous hills that resemble those of the Subdesert.

The most evident types of vegetation are:

Savannas

Palm-plains

Wooded plains with a modified type of humid forest extending as gallery forest along the streams

Grotesque vegetation of the calcareous hills

Xerophytic brush of the sandy coastal areas

The wooded plains are the most typical areas of the Occidental Province and in them one finds many of the species that are characteristic of this province. The savannas and palm-plains represent the open ground and in them one finds little but widespread forms; however, certain areas of brush and woodland do contain typical western subspecies of widespread forms so that this type of country must be included in the Occidental Province, even though it closely resembles in appearance the savanna country farther south which is included in the Subdesert, and is, in fact, little differentiated from it. The vegetation of the calcareous hills also closely resembles that of the calcareous plateaus in the Subdesert, but here it contains Occidental forms and the typical species of the Subdesert are absent. The calcareous hills are isolated "islands" of this type of vegetation, so there has been no opportunity for an intrusion of the more southern species, or competition with the surrounding Occidental forms has eliminated them.

The sandy areas along the coast which are covered with the xerophytic brush characteristic of the Subdesert are more or less continuous with it up to Cape St. André, consequently it is not surprising to find occasional Subdesert forms extending some distance northward, although this type of country is largely occupied by typical Occidental forms. A striking case of this was the very common occurrence of *Coua r. ruficeps* in this type of country at Soalala, while in very similar country near Iotry, *C. r. olivaceiceps* was very common.

Fire has probably been an important factor in the destruction of wooded areas that were once of much greater extent, and the burning of the grassland and into the edge of the brushlands can still be seen.

The following birds are characteristic of the Occidental:

Ardea humbloti	*Coua coquereli*[2,3]
Lophotibis cristata urschi	*Coua gigas*[2]
Anas bernieri	*Philepitta schlegeli*[3]
Actophilornis albinucha[1]	*Nesillas typica obscura*

[1] Ranging into the Humid East and Sambirano.
[2] Ranging into the edge of the Subdesert.
[3] Ranging into the Sambirano.

Amaurornis olivieri
Mesoenas variegata
Vinago australis xenia[1]
Haliaeetus vociferoides[1]
Coua cristata dumonti
Coua ruficeps ruficeps
Neomixis tenella decaryi
Bernieria madagascariensis inceleber[2]
Tylas eduardi albigularis[3]
Schetba rufa occidentalis
Xenopirostris damii[3]
Foudia sakalava sakalava

In addition *Coua cristata cristata* and *Neomixis tenella tenella* were most common in the Northern Savanna but they both ranged into the neighboring parts of the Oriental.

The following birds that have a wide range outside of Madagascar were found only in the Occidental:

Hydroprogne caspia
Sterna dougalli
Sterna anaethetus antarctica
Coturnix d. delegorguei

Thus there are twenty forms restricted to the Occidental, including ten subspecies and ten species. No Mascarene genus is restricted to this province.

The relationship of the woodland forms is clearly with those of the rest of Madagascar. The following forms have their closest relatives in the Oriental:

Lophotibis cristata urschi
Mesoenas variegata
Vinago australis xenia
Philepitta schlegeli
Nesillas typica obscura
Bernieria madagascariensis inceleber
Tylas eduardi albigularis
Schetba rufa occidentalis

The following have their closest relatives in the Subdesert or are common to the Subdesert and Occidental:

Coua cristata dumonti
Coua ruficeps ruficeps
Coua gigas
Foudia sakalava sakalava

Neomixis tenella decaryi has close relatives in all of the biotic provinces. The peculiar water and marsh birds, on the other hand, have no very close relatives in Madagascar.

The avifauna of the Occidental is not nearly as distinct in woodland forms as in either of the other provinces, and probably evolved in a rather restricted area during the time when the climate was more humid and the humid forest extended much farther into the west than it does today.

[1] See footnote 2, p. 265.
[2] See footnote 3, p. 265.
[3] Not collected by our party.

With the retreat of the rain forest, due to the drying out of the climate, the western forest spread to much of its present extent, but when man with fire destroyed more of this forest, particularly in the Sambirano (the destruction is still going on there), the deciduous brush came to occupy much of this land, and similarly around the end of the island the western fauna is following the secondary brush along the coastal plain into the east. Along the western streams that arise in the central highlands, the secondary brush carries a few western and Subdesert forms onto the highlands

Some marsh birds characteristic of the west were found occasionally at least in the broader marshes of the east, such as at Lac Alaotra, or in the secondarily formed swamp rice fields in cleared land. Their numbers have probably been increased by the formation of these fields.

In respect to the subspecific differentiation of many widespread species which are represented by distinct races in the Oriental and Subdesert, the Occidental is intermediate, the specimens from the southern part tending toward the Subdesert forms and those from the northern part toward the Oriental forms, as with *Coracina cinerea*, *Vanga curvirostris*, and *Leptopterus chabert*.

The preference of various birds for certain types of habitat enables one to speak of various avifaunal associations in this province as well as in the Oriental; but the more open type of forest, the many clearings and openings in it, the amount of low brush in some habitats that approaches forest conditions, the open wooded plains that merge into savannas, and the scarcity of any extensive area that is not at least dotted with scattered shrubs or palms makes the various wooded areas and open ground associations very confusing. A littoral, a marsh, a woodland, and a savanna or grassland association may be recognized.

Littoral Association.—The broad shelving beaches and the muddy flats that are left exposed in the bays at low tide provide favorite resting and feeding places for many of the shore and water birds that visit Madagascar. Some of the birds that usually frequent the marshes and the margins of the river also find suitable feeding grounds on the edge of the salt water. Beside the resident birds, many of the Palaearctic migrants come to these coasts, or wandering birds from their breeding grounds in neighboring islands find these coasts more to their liking than those of the other biotic provinces. The coast of the Sambirano is very similar to the rest of the west coast and it may be advisable to consider it with the coast of the Occidental. Though many of the sea birds were recorded from a few stations only, we did little col-

lecting on the coast for these forms, and it is probable that their distribution is more widespread than our records show. However, in case this should not be so, it may be well to state their distribution as we found it.

The following birds were the more characteristic of the littoral association:

Hydroprogne caspia
Sterna bengalensis par
Sterna dougalli arideensis
Sterna bergii bergii
Sterna albifrons saundersi
Sterna anaethetus antarctica
Fregata ariel iredalei
Ardea purpurea madagascariensis
Ardea cinerea johannae
Ardea humbloti
Butorides striatus rutenbergi
Threskiornis aethiopicus bernieri
Ibis ibis
Anastomus lamelligerus madagascariensis
Numenius arquata
Numenius phaeopus phaeopus
Xenus cinereus
Tringa nebularia
Erolia testacea
Crocethia alba
Arenaria interpres interpres
Squatarola squatarola squatarola
Charadrius hiaticula tundrae
Charadrius marginatus tenellus
Charadrius pecuarius pecuarius
Charadrius leschenaulti
Dromas ardeola
Glareola ocularis
Milvus migrans parasitus
Haliaeetus vociferoides
Corythornis vintsioides
Corvus albus

Fregata a. iredalei and *Sterna a. antarctica*, from our observations, might better perhaps be referred to a marine association.

Not all of the other birds gathered on the beaches for the same purpose. The terns all fished out over the open water and came to the sand bars to rest, though the commoner species, *Sterna bergii bergii* and more particularly *Sterna bengalensis par*, were almost always to be found in suitable resting places when the tide uncovered the sand bars. At high tide they fished out over the sea and often sought some of the sand bars not covered by the tide or perched in the mangroves lining the shore. Some of the birds, such as *Xenus cinereus* and *Tringa nebularia*, fed almost exclusively on the muddy bays. Some birds, such as *Squatarola squatarola squatarola*, *Erolia testacea*, *Numenius arquata*, and *Numenius p. phaeopus*, though most common in the muddy bays, also frequented the sandy beaches; while others, such as *Charadrius marginatus tenellus*, *Arenaria i. interpres*, and *Crocethia alba*, seemed to favor the sandy beaches. *Glareola ocularis* was noted only occasionally on the coast, flying over the muddy flats; *Dromas ardeola* favored the sandy beaches though it was found also on the muddy areas. *Ardea cinerea johannae* was commonest along the mud flats, perhaps because fish were more common there, but was found also along the beaches. *Ardea humbloti* and *Ardea purpurea madagascariensis* were

found only in the muddy bays, stalking along the shore or fishing in the water. *Butorides striatus rutenbergi* was found only on the mud flats in the proximity of the mangroves in which it sought cover. *Egretta dimorpha* was commonest in the muddy bays, again perhaps a matter of food, but was common also about inland waters. *Haliaeetus vociferoides* was occasionally seen on the mud flats or on the sand bars, but usually preferred to perch in the mangroves and swoop down into the water for its prey. It was most common in the muddy bays, but was found also along the sandy or more particularly the rocky beaches, and was found also on some of the larger rivers and lakes. *Milvus migrans parasitus* was occasionally noted along the beach picking up fish from the fish traps. *Corvus albus* was sometimes quite common along the sandy coast, picking up whatever the sea had washed up there. *Corythornis vintsioides* was not common in this habitat but was occasionally seen perched on some rock or mangrove, watching for its prey in the edge of the sea.

The mangrove swamps perhaps could be considered as wooded areas but their relation to the littoral area is such that they may well be considered here. The species of plants that are characteristic of them are very restricted and few in number, but these few species are very common individually. This habitat occupies the edge of many of the muddy bays and the mouths of the rivers that are within the influence of the tide. The land on which the mangroves grow is usually flooded at high tide and exposed at low tide.

The birds that frequented the mangroves were few in number, and none of them, with the possible exception of *Haliaeetus vociferoides*, were commonest in or characteristic of them. The occurrence of *Haliaeetus vociferoides* is not because of the mangroves themselves but is the result of the shallow muddy bays that make possible the growth of the mangroves and give good feeding grounds for the birds. The mangroves themselves are merely convenient perches, though possibly they also furnish nesting sites.

The forms commonly found in the mangroves were:

MARSH OR LITTORAL FORMS

Sterna bengalensis par
Sterna bergii bergii
Ardea cinerea johannae
Ardea humbloti
Egretta dimorpha
Butorides striatus rutenbergi
Numenius arquata
Numenius phaeopus phaeopus
Xenus cinereus
Arenaria interpres interpres
Squatarola squatarola squatarola
Haliaeetus vociferoides
Corythornis vintsioides

WOODLAND FORMS

Coracina cinerea cinerea
Artamella viridis annae
Vanga curvirostris curvirostris
Falculea palliata
Cinnyris sovimanga sovimanga

Ardea humbloti, Ardea cinerea, Egretta dimorpha, Squatarola squatarola squatarola, Arenaria interpres interpres, Numenius p. phaeopus, Numenius arquata, and both of the terns perched in the mangroves to wait for the tide to fall. *Calamocichla newtoni,* a marsh bird, was rarely seen in this habitat. *Numenius p. phaeopus, Numenius arquatus* and *Xenus cinereus* fed commonly on the mud among the mangroves as well as on the open flats. *Butorides striatus rutenbergi* retreated into the trees for shelter and fed among them as well as on the open flats, though it was much more common in the inland marshes. *Corythornis vintsioides* perched in them to watch for its prey in the water beneath. The woodland birds listed ranged into them commonly to feed while *Cinnyris sovimanga sovimanga* was seen collecting nesting material there.

MARSH ASSOCIATION.—The extensive marshes reach their maximum in this province. In bays and arms of lakes, and on bays along the rivers, there is a gradual change from open water, and masses of floating vegetation, interspersed with areas of open water, through tall reeds and grasses standing in the open water, to the damp grassy country that is often open savanna or palm-plain. The downpours which characterize the rainy season in this province greatly change the level of the water in these areas, so that what was a comparatively solid marsh and reed area in the dry season may be an area with floating vegetation in the wet season. Or the tall grasses and reeds growing in the shallow edge of the pools in the dry season may be a line of vegetation with only the tops showing some distance from the shore, with open water behind it, in the wet season. Similarly, in the wet season, small streams in broad grassy valleys become extensive flooded grassy marshes, and palm or savanna valleys may be five or six feet under water, with grass tops projecting here and there along the trail that the natives followed dryshod in the dry season. Some of the marshy pools become completely dry in the dry season.

There is probably a seasonal change in the distribution of the water birds, though this may be only local and may be only the congregating of water birds at certain points. However, to gain even a slight under-

standing of this, a longer stay is required than the few months in the wet season that we spent there, and more data is needed than that obtained through our observations eked out with the scanty information that could be gleaned from the colonists and natives.

The usual stages in the development of a marsh have been indicated as consisting of the gradual encroachment of the vegetation on the open water, but at Lac Iotry, where the states seemed to be exhibited most clearly, the succession was in reverse order, for the lake, with a subterranean outlet, has been continually rising, and for years has been flooding the surrounding grassy plain. This area has become a reedy marsh, changing to an area of floating vegetation and then to open water as the depth increases. A few bushes, killed by the water, stand in the marsh. The old trail that used to lead from Befandriana to Morombe now lies at the bottom of the lake, about a quarter of a mile from its head.

Some of the shores of the lakes and ponds slope into the water with little or no marshy areas, and are covered with very short grass, resulting in a damp grassy bank, while along the rivers there are many flat sand bars or sand spits. The swamp rice fields, which are the most common type in this province, have changed grassy fields to swampy land, and before the rice is high they present very shallow muddy areas with scanty vegetation, favored by many birds. Along the rivers there is often a border of tall reeds or grass with little other marsh.

Most of the marshes exhibit some of these phases and each habitat may be characterized by certain birds more or less peculiar to it. However, these birds usually ranged into several types of habitat and some of them out into the littoral areas as well, especially where there were muddy bays with conditions similar to those of the marsh. Also, some birds of the littoral association ranged into the marshes. It may be worth while to consider the various minor associations within the marsh.

Open Water Association.—Few birds were characteristic of the open water of the lakes, though *Larus cirrocephalus* and numerous other marsh birds were often seen flying about over it. *Anhinga rufa vulsini* and *Phalacrocorax africanus pictilis* were often seen fishing in the open water in the rivers, but in the lakes they preferred the vicinity of the floating vegetation. *Haliaeetus vociferoides* was occasionally seen flying over the open water or striking at a fish there, but was rare in the marshes, when it was present at all, and the bird usually spent its time perched in the trees along the edge of the water.

Floating Vegetation.—The open water is being gradually en-

croached upon by areas of aquatic vegetation that are submerged or barely reach the surface. Open water usually appears in places through the vegetation, and on its inner edge it is being encroached upon by the reeds. This type of habitat is found in some of the quiet bays along the rivers, and some of the little ponds about Namoroka were almost filled with this type of vegetation, though the most extensive areas of it were in the lakes Kinkony and Iotry. On Lac Kinkony there were many fish in this type of habitat that attracted natives as well as various species of herons. Here *Nettapus auritus*, *Thalassornis leuconotus insularis*, and *Podiceps pelzelnii* were found, the first especially in little pools among the reeds, while *Thalassornis leuconotus insularis* favored the wider extents of this habitat. As the aquatic vegetation became dense enough for the nimble-footed *Actophilornis albinucha* to run over it, they frequented it as also did *Porphyrula alleni*, and when it became dense enough to form real mats of vegetation on which the larger birds could stand, *Ardea cinerea johannae*, *Ardea purpurea madagascariensis*, *Ardea humbloti*, and *Egretta alba melanorhynchos* also frequented it and were sometimes seen standing belly-deep in the water. These herons were found also along the grassy shores of the ponds and the sand bars of the rivers.

Actophilornis albinucha was largely restricted to this type of habitat, *Porphyrula alleni* ranged over it, and *Gallinula chloropus pyrrhorrhoa* liked to swim in it or, more rarely, to walk about over it. The last two liked the vicinity of the reeds, to which they flew for shelter when danger threatened. *Porphyrio madagascariensis* was still more restricted to the vicinity of the reed beds where it spent much of its time, though it was often seen on the edge of this habitat. *Porzana pusilla obscura* and *Amaurornis olivieri* skipped about over the lily pads in the floating vegetation on the edge of the reeds where they also retreated for shelter, and *Ixobrychus minutus podiceps* was occasionally flushed there. The ducks, *Anas punctata* and *Anas erythrorhyncha* favored the shallow open pools in the reeds and grasslands, as did the few *Fulica cristata* that I saw in the Occidental, though those in the Subdesert were on the edge of Lac Tsimanampetsotsa in the short open stands of reeds, and swam out into the open water at the approach of an intruder.

Reeds and Tall Grass Associations.—This habitat gradually encroaches on the open floating vegetation and on its inner edge intergrades with the grasslands. Along the rivers there is often no other marsh except this fringe of reeds and grass, while some of the marshes are composed of little but this sort of vegetation. The denizens of the

reeds were so shy and retiring that it was difficult to find out much about them in the short time we spent studying them. *Calamocichla newtoni* was the commonest and most often seen, perched on the reeds or hopping about among them, and though it was almost confined to this type of habitat, was found almost everywhere that this habitat occurred. When this habitat was on the edge of floating vegetation into which other birds could range, *Ixobrychus minutus podiceps*, *Porzana pusilla obscura*, *Amaurornis olivieri*, and *Porphyrio madagascariensis* were found in it, perhaps only for shelter but probably for feeding also. *Porphyrio madagascariensis* roosted in the reeds there, and *Porphyrula alleni* and *Gallinula chloropus pyrrhorrhoa* sought shelter there. A few *Butorides striatus rutenbergi* were found in the marshes of the west and these were seen in the reeds though they also liked to feed in the shallow muddy places and on the river bars. When this habitat was adjacent to open water along a river or lake shore, few inhabitants were found except *Calamocichla newtoni*, but when shallow feeding ground was adjacent, both species of *Ardeola* (*idae* and *ralloides*) occurred there, seeking it for shelter. *Cisticola cherina* was found out in the marsh sometimes, as well as in all the dry grassy habitats, and *Foudia madagascariensis* was often found in the smaller marshes, sometimes congregating there to sleep in the reeds, though it also slept in the trees on the edge of the marshes. *Motacilla flaviventris* was seen sometimes walking about on the lily pads.

Many birds liked to walk about on the muddy bottom of shallow pools. *Himantopus h. himantopus*, *Plegadis f. falcinellus*, and *Scopus umbretta* liked to feed in such places. *Charadrius p. pecuarius* and *Charadrius t. bifrontatus* were found here, although they favored the river bars. *Egretta dimorpha* was found both here and along the coast, and *Ardeola idae* and *Ardeola ralloides* occurred when the habitat was more grassy.

The firm grassy shores of ponds and lakes or the sandy shores of the rivers were favorite resting places for *Dendrocygna viduata* and *Sarkidiornis melanotos*. *Threskiornis aethiopicus bernieri* favored the sand bars especially, and *Charadrius p. pecuarius*, *Tringa hypoleucos*, and *Charadrius t. bifrontatus* also frequented them, as did some of the shore birds of the littoral association. *Eremialector personatus* and *Oena capensis aliena* came to them to drink; *Numenius arquata* and *Numenius phaeopus*, *Charadrius hiaticula tundrae*, *Tringa hypoleucos*, *Egretta dimorpha*, and *Butorides striatus rutenbergi* fed in the broad shallow pools or on the lake margins, though the last two were not found at Lac Iotry.

Phoeniconaias minor favored such places, especially those at some distance away from any vegetation that might conceal an enemy.

The damp grassy valleys harboured *Dryolimnas cuvieri cuvieri* and *Cisticola cherina*, though when they were flooded the avifauna changed.

Some of the little ponds were thickly grown up with trees which sometimes stood in quite deep water. These occasionally sheltered *Dryolimnas cuvieri cuvieri, Gallinula chloropus pyrrhorrhoa*, and *Podiceps pelzelnii* was found in the open water in the center. Several of these ponds were of especial interest because of the marsh birds that nested there, such as *Bubulcus ibis ibis, Egretta dimorpha, Anastomus lamelligerus madagascariensis, Threskiornis aethiopicus bernieri, Phalacrocorax a. pictilis*, and *Gallinula chloropus pyrrhorrhoa*. The trees and bushes rising on the margins of marshes or bodies of water or occurring in them provided perches for *Anhinga rufa vulsini, Phalacrocorax africanus pictilis, Anastomus lamelligerus madagascariensis, Haliaeetus vociferoides*, and most of the larger herons.

Woodland Association.—The wooded areas of the west show great diversity in the types of vegetation that occur there: the dry forest of the calcareous plateau that is much the same as that of the Subdesert, though in the west it holds Occidental species of birds; the low dry forest on the drier hills and on some of the drier plains; and the more luxuriant forest of the damper plains and hills, which sometimes extends as a narrow border along the rivers through the savannas or open ground, giving "gallery forest." The wooded areas in some places change abruptly to savanna, an area of scattered trees on a grassy plain, seemingly a result of repeated burnings, with here and there isolated areas of woods or brush, apparently saved from burning by some natural agency such as the rocky soil. At Soalala the wooded plains had been burned recently so that much of the country was covered with brush with some charred stubs of trees still evident. In some places the wooded plains change gradually to more open wooded country, with large trees surrounded by brush, and in some places this seemed a natural condition. The palm-plains and the savannas do not properly belong to the wooded areas. The scattered, isolated trees attract few birds, though some birds do range into them occasionally from the areas of denser brush that frequently occur near-by.

In general the forest becomes less luxuriant, drier, more deciduous and composed of lower trees as one goes south and the rainfall decreases, though the forest is much the same along the streams even into the Sub-

desert. Compared with the Oriental forest, that of the Occidental is drier, deciduous, and more open so that open-ground birds were often found in the clearings or glades in the forest, and there was no definite line between the open ground that is largely occupied by scattered areas of trees and brush, and the forest that is much broken up by glades and clearings. However, distinct areas of open ground or of forest are sometimes encountered. In general, one can distinguish a tree association of birds, though many of these forms often feed on the edge of open ground or in the scattered brush.

The following are forms rather characteristic of the wooded areas:

Lophotibis cristata urschi
Alectroenas madagascariensis
Vinago australis
Streptopelia p. picturata
Oena capensis aliena
Falco concolor
Buteo brachypterus
Accipiter madagascariensis
Astur hensti
Astur francesii
Gymnogenys radiatus
Otus rutilis
Ninox superciliaris
Coracopsis nigra libs
Coracopsis vasa drouhardi
Agapornis c. cana
Cuculus poliocephalus rochii
Coua cristata dumonti
Coua r. ruficeps
Coua coquereli
Coua gigas
Caprimulgus m. madagascariensis
Leptosomus d. discolor
Ispidina madagascariensis
Philepitta schlegeli
Newtonia brunneicauda
Tchitrea mutata
Copsychus albospecularis pica
Nesillas typica obscura
Neomixis t. tenella
Neomixis t. decaryi
Bernieria madagascariensis inceleber
Ixocincla m. madagascariensis
Coracina c. cinerea
Dicrurus f. forficatus
Leptopterus c. chabert
Cyanolanius m. madagascarinus
Artamella viridis annae
Schetba rufa occidentalis
Calicalicus madagascariensis
Falculea palliata
Cinnyris n. notatus
Cinnyris s. sovimanga
Zosterops maderaspatanus
Foudia madagascariensis
Foudia sakalava
Hartlaubius auratus
Corvus albus

These forms were not equally widespread through all the types of forest, and where they did occur were not characteristic of all the forest habitats. The avifaunal associations in the different types of forest were not noted carefully enough for lists to be made, and many of the same birds were found in different types of forest, though on the calcareous plateau and in other low dry forests there seemed to be fewer species than were found in the more humid, luxuriant forests. Moreover, some birds that seemed to be restricted to one type of habitat in one locality were found in another habitat in another locality.

There is not the distinct differentiation into strata within the western forest that is so noticeable in the humid forest as one stands on the forest floor and gazes into the tree tops arched overhead. The trees are lower and the middle spaces are less noticeable, especially where the trees have become low enough to intergrade with the bushes so that the tree tops and the ground-cover overlap. In general, however, a forest floor, ground-cover, and arboreal association of birds can be recognized.

FOREST FLOOR ASSOCIATION.—Some forms spent nearly all of their time on the ground in the forest, but this association did not include the species which preferred the glades and the open ground on the edge of the forest, or those that preferred the brushlands, but only those that were largely confined to the forests, though they sometimes ranged out into the brush or open ground. Most of these birds were peculiar to the Occidental or to the Occidental and Subdesert. *Mesoenas variegata* was found only on the ground in the forest; *Coua ruficeps*, *Coua coquereli*, and *Coua gigas* frequented the ground, occasionally mounting to a low bush to rest or call; *Lophotibis cristata urschi* fed on the ground but perched high up in the trees; *Caprimulgus m. madagascariensis* slept on the ground but fed over the forest and open ground. *Streptopelia p. picturata* fed on the ground but was seen very commonly in the trees. *Foudia sakalava* fed both on the ground and through the trees and was perhaps a bird of the more open woods; *Copsychus albospecularis pica* was a bird of the ground-cover and was occasionally seen on the forest floor. *Platalea alba* was noted feeding on the ground in the forest along the Mahavavy River where recent floods had left the ground wet and covered with silt.

Ispidina madagascariensis picked up its prey from the ground but perched on the trees and bushes.

GROUND-COVER ASSOCIATION.—Where the forest is dense there is a well-defined ground-cover but where the trees are lower the tree tops approach the ground-cover and in the brushlands these two strata overlap, so that some of the birds of both of these habitats were found feeding in the same places. The ground-cover association included the birds that were common in the ground-cover of the forest and in the low brush. The number of such species was very few when compared with those of the Oriental. *Nesillas typica obscura* and *Copsychus albospecularis pica* were largely restricted to this habitat and were wide-ranging through its various types. *Bernieria madagascariensis inceleber*, though often found in the ground-cover, was more restricted

to the true forest, where it ranged through the trees as well. *Ispidina madagascariensis* perched in the ground-cover in the forest or low in the trees to watch for its prey on the ground. *Foudia sakalava* was sometimes found in the low brush or the ground-cover in the more open forest, though it also fed in the ground and in the trees.

ARBOREAL ASSOCIATION.—Since the middle spaces disappear as the trees become lower and approach the ground-cover, though a middle-space association may be recognized in the heavier forests where the tree tops are also easily defined, it seems best to recognize simply an arboreal association in this western forest. Some of these species come down into the brush and some of them range out into the savanna occasionally, but the following are the more characteristic arboreal forms:

Alectroenas madagascariensis
Vinago australis
Streptopelia picturata picturata
Falco concolor
Aviceda madagascariensis
Buteo brachypterus
Accipiter madagascariensis
Astur hensti
Astur francesii
Asio madagascariensis
Otus rutilus
Ninox superciliaris
Coracopsis vasa drouhardi
Coracopsis nigra
Agapornis cana cana
Cuculus poliocephalus rochii
Coua cristata cristata
Coua cristata dumonti
Eurystomus glaucurus
Leptosomus discolor discolor
Merops superciliosus
Philepitta schlegeli
Newtonia brunneicauda
Tchitrea mutata singetra
Neomixis tenella tenella
Neomixis tenella decaryi
Bernieria madagascariensis inceleber
Ixocincla madagascariensis madagascariensis
Coracina cinerea cinerea
Dicrurus forficatus forficatus
Leptopterus chabert chabert
Cyanolanius madagascarinus madagascarinus
Artamella viridis annae
Schetba rufa occidentalis
Calicalicus madagascariensis
Vanga curvirostris curvirostris
Falculea palliata
Zosterops maderaspatanus ampotakae
Cinnyris notatus notatus
Cinnyris sovimanga sovimanga
Foudia sakalava sakalava
Hartlaubius auratus

Cinnyris s. sovimanga, Zosterops maderaspatanus, Neomixis t. tenella and *Neomixis t. decaryi, Artamella v. annae,* and *Ixocincla m. madagascariensis* usually fed through the tree tops and ranged out into all of the lower brush; *Falculea palliata* was similar in a choice of habitat but fed more often through the larger branches of the trees. *Hartlaubius auratus* and *Leptopterus c. chabert* were usually seen in the tops of the larger trees or bushes and *Dicrurus f. forficatus* was seen perched in

some conspicuous place, either in the wooded areas or in the brush. *Tchitrea mutata* and *Newtonia brunneicauda* fed through the tree tops and the middle spaces as well as in the brush, while *Vanga c. curvirostris* preferred the trees rather than the lower brush. *Leptosomus d. discolor* was usually seen in the tops of the taller trees, and *Coracina c. cinerea* and *Cyanolanius m. madagascarinus* were usually found in the larger trees, and were consequently rarer in the south. *Bernieria madagascariensis inceleber* favored the middle spaces in the wooded areas though it was found also in the tree tops, as was *Philepitta schlegeli*, which also frequented the ground-cover. These two forms ranged also into the humid forest of the Sambirano, and *Bernieria madagascariensis inceleber* ranged into that on Mt. d'Ambre. *Otus rutilus*, *Ninox superciliaris*, *Astur francesii*, and *Accipiter madagascariensis* were usually found in the more heavily wooded areas. *Alectroenas madagascariensis* and *Vinago australis* frequented the tree tops, and *Buteo brachypterus*, *Aviceda madagascariensis* and *Gymnogenys radiatus* were usually seen there too, often on the edge of the forest, *Buteo brachypterus* and *Gymnogenys radiatus* often circling overhead. *Astur hensti* was found in the more heavily wooded areas and in the gallery forest along the streams through the dry forest; *Coracopsis vasa drouhardi* was a conspicuous bird of the tree tops, where it fed, though it also fed on the ground in the clearings. *Coracopsis nigra* was less conspicuous, preferring denser areas, and it also fed in some of the low fruit-bearing bushes. *Streptopelia p. picturata* was often seen in the trees, though it fed on the ground; *Cuculus poliocephalus rochii* was usually seen in the tree tops in the heavier forest and brush. *Eurystomus glaucurus*, *Falco concolor*, and *Merops superciliosus* perched on the tops of trees often on the edge of the forest and out in the savannas, watching for prey or flying about overhead in search of it. *Coua cristata* ranged through all of the trees and larger brush. *Agapornis c. cana*, *Oena capensis aliena*, and *Upupa epops marginata* fed on the ground in the edge of the brush but perched in the brush and the trees on the edge of the forest; *Schetba rufa occidentalis* tended to prefer the middle spaces in the dry wooded areas.

Brushland Association.—The brushlands sometimes occupied considerable areas and were often the results of burnings. They were usually more or less broken up with areas of open ground. Numbers of birds, somewhat common in the open woodlands, fed in the open ground and perched in the trees of the wooded areas, while some birds more characteristic of the brushlands ranged both into the forest and into the open ground.

Birds characteristic of the brushlands:

Turnix nigricollis
Margaroperdix madagascariensis
Numida mitrata mitrata
Eremialector personatus
Oena capensis aliena
Agapornis cana cana
Caprimulgus madagascariensis madagascariensis
Upupa epops marginata
Foudia madagascariensis
Foudia sakalava sakalava
Spermestes nana

Agapornis c. cana, *Oena capensis aliena*, and *Upupa epops marginata* fed commonly in the glades and clearings in the forest and brushland and ranged out into the open ground, but perched and nested in the trees. *Turnix nigricollis*, *Margaroperdix madagascariensis*, and *Numida m. mitrata* were largely terrestrial birds of the brushlands, though they ranged out into the open ground and *Numida m. mitrata* also perched in the trees. *Caprimulgus m. madagascariensis* slept on the edges of the glades; *Eremialector personatus* frequented the more open areas in the brushlands as well as the open ground; and *Foudia madagascariensis*, *Foudia sakalava sakalava*, and *Spermestes nana* fed on the ground and on the grass, in the brush as well as in the other open habitats, and perched in the bushes.

Savannas and Palm-plain Association.—The savannas and palm-plains are grassy areas with isolated, scattered trees, largely occupying land that would otherwise be open ground. Their influence on the avifauna is much the same as that of the open ground, which they largely replace. The few scattered trees of the savanna or palm-plain do not prevent the presence of open ground birds, and also do not have much influence on the presence of forest forms, except as they occur in scattered clumps, when they may be regarded as islands of the forest.

The following were characteristic birds of the savannas:

Turnix nigricollis
Coturnix delegorguei delegorguei
Eremialector personatus
Falco concolor
Cypsiurus parvus gracilis
Eurystomus glaucurus
Merops superciliosus
Cisticola cherina
Mirafra hova
Foudia madagascariensis
Spermestes nana

As in the open ground in the east, the western grasslands have few common birds, *Mirafra hova* being the only one commonly met with in the extensive areas of savanna. In the north *Motacilla flaviventris* was

sometimes fairly common in the palm-plains, apparently nesting in the palms. *Cisticola cherina* and *Turnix nigricollis* were fairly common, though the former preferred the denser grass of the valleys, *Turnix nigricollis* preferring that in the vicinity of the brush. *Coturnix d. delegorguei* was also common in the grassland in the northwest, particularly in the dry weed-grown rice fields. *Spermestes nana* and *Foudia madagascariensis* were occasionally met with in this habitat; *Eremialector personatus* was sometimes fairly common; *Merops superciliosus*, *Falco concolor*, and *Eurystomus glaucurus* were found perched in the scattered trees, watching for their prey, and *Coracopsis vasa drouhardi* sometimes was seen flying over the savanna.

Conditions of the palm-plains were similar except that there the palms attracted the swifts (*cypsiurus*) which were sometimes common there. Of course, other birds occurred in the savannas and as one approached the little swamps and areas of brush or gallery forest along the streams, many of the birds that were characteristic of the swamp, brushland, or the forest appeared.

Although the birds of the Occidental frequented certain habitats, it does not follow that they occurred wherever the habitats occurred. Some of them were restricted to one locality, some to another, while some ranged much more widely into one or both of the other provinces as already has been indicated.

The Occidental Province may be subdivided into the Western Savanna and the Northern Savanna districts.

These two faunal areas are much alike in their general appearance and in considering their avifauna it is found that their chief difference lies in the fact that many of the forms that are common in and characteristic of the Western Savanna do not reach the Northern Savanna. These two divisions are separated by the forest of the Sambirano district which, before man's destruction of the forest, probably acted more effectively as a barrier than now, when so much of the forest has been destroyed that some of the secondary brush is almost continuous across the district, thus connecting the Western and Northern Savannas.

Northern Savanna District

This district includes that part of the Occidental Province that lies north of the Sambirano and the Humid East districts of the Oriental Province. Its physical and climatic features are not especially peculiar and have been sufficiently treated in the general consideration of the Occidental. Its avifauna presents only one race confined to the district,

Foudia s. sakalava, which strongly intergrades with the form found farther south. Several races, however, have their center of distribution in the Northern Savanna, such as *Coua c. cristata* and *Neomixis t. tenella*, which are commonest here but spread into the Oriental. *Sterna d. arideensis*, which is not confined to Madagascar, was found only on the coast of this district.

Some of the widespread forms over the island are represented by western races, such as *Coracopsis vasa drouhardi*, *Zosterops m. ampotakae*, *Tchitrea m. singetra*, and *Bernieria madagascariensis inceleber*, while others are represented by eastern races such as *Coracopsis nigra nigra* and *Vinago a. xenia*. Several forms that are peculiar to the Western Savanna or the Western Savanna and the Subdesert do not occur in the Northern Savanna, such as *Coua ruficeps*, *Coua coquereli*, *Ninox superciliaris*, and *Eremialector personatus*.

Western Savanna District

This district occupies that part of the Occidental Province that lies south of the Sambirano district, and intergrades with the Subdesert in the southwest of Madagascar. Its physical features and climatic conditions have already been discussed in the general consideration of these features for the Occidental.

Several forms were found only in this district:

Ardea humbloti
Anas bernieri
Amaurornis olivieri
Vinago australis xenia
Coua cristata dumonti
Coua ruficeps ruficeps
Coua coquereli
Philepitta schlegeli (also in Sambirano)
Neomixis tenella decaryi
Schetba rufa occidentalis
**Tylas eduardi albigularis*

* Not collected by our party.

Several forms ranging through the Subdesert and this district of the Occidental were not found in the Northern Savanna, such as *Eremialector personatus* and *Ninox superciliaris*. *Foudia sakalava minor* ranged through the Subdesert and Western Savanna and was represented by another race in the Northern Savanna. Two marsh-loving species, *Amaurornis olivieri* and *Anas bernieri*, were found only in the central part of the Western Savanna.

SUBDESERT PROVINCE

The Subdesert occupies the southwest and the extreme south of Madagascar. Though its characteristics are very well marked in the extreme southwest of the island, it gradually intergrades with the

Occidental between Tulear and Morondava as one goes north. As one goes inland onto the grassy savanna which takes the place of the open ground in this province, one finds few birds except the widespread forms. Where brush and wooded areas occur, forms characteristic of the Subdesert avifauna (such as *Cinnyris sovimanga apolis*, *Neomixis s. striatigula*, and *Coua cristata pyropyga* at Ihosy) are present, hence these areas must be considered as belonging to the Subdesert Province and we may use Humbert's line,[1] which he used to separate the Occidental from the Oriental Province as the westerly limit of the Subdesert. Humbert[2] considers the greater part of what is here considered the Subdesert as a part of the Occidental, and limits the Subdesert to the vicinity of the southwest coast of the island, which I consider as the arid Subdesert. The boundary between the Oriental and the Subdesert descends to the vicinity of Fort Dauphin,[3] where the transition to Oriental conditions is probably abrupt, since the amount of rainfall in that part of Madagascar varies greatly within a very short distance.

The land surface in this province slopes gradually, with rolling plains, low hills that rise sharply, and flat sandy areas. In the south the ancient formations slope gradually to the sea, separated from it only by very recent formations along the coast, but in the southwest, a series of low hills of recent age rise parallel to the coast between the inland savannas and the sandy coastal country. In some places these hills come out to the coast. These recent formations are of less extent in the Subdesert Province than they are in the Occidental.

The streams of the Subdesert are broad and shallow, often with many sand bars and with more or less tall rank grass on the banks. Those that have their headwaters far inland often rise in flood in the wet season, not because of rains that have fallen in the Subdesert, for sometimes when the flooding occurs no rain has fallen there, but because of the more frequent rains in the highlands.

Little marsh area is found in the Subdesert. Lac Iotry and other near-by ponds with well-developed marsh conditions should be considered part of the Occidental existing this far south, for the more typical desert pools have little or no marsh. Damp grassy places do occur occasionally, and the pools may have a margin of herbaceous growth, but are often shrunken by drought so that there is a margin of soil between the vegetation and the water, and some of the pools dry up completely. The water in them is usually very alkaline. As

[1] 1927, Mém. Acad. Malgache, V, pp. 15–17.
[2] Idem, p. 17.
[3] Idem, p. 17.

one goes inland onto the savannas, a few marshy pools are found, and these probably cause an increase in the number of widespread marsh birds; some of the characteristic marsh birds of the Occidental having been found there.

The land under the sea slopes away gradually, giving broad beaches and shallow muddy estuaries that are emptied at low tide, though these latter are less common than in the Occidental, and consequently there are fewer mangrove swamps. The water near the shore is shallow and there is a long coral reef, sometimes more than a mile or two from the shore, along the southwest coast.

The aridity of the Subdesert is it distinguishing feature. Though this is not the hottest part of Madagascar, there are usually few clouds in the sky, the trees cast little shade, and the sun seems to beat down more intensively than in the hotter regions about Nossi Be. The province lies in the lee of the central highlands, sheltered from the prevailing eastern trade winds, and lies south beyond the influence of the northwest winds, so that the rainfall is scanty. The average rainfall at Tulear is 493 mm., and is probably much less in the sand and calcareous region farther south about Lac Tsmanampetsotsa. The natives told me, when I was there in February, 1930, that the rains had failed that year. The average temperature at Tulear is 24.1°. Farther south it is probably cooler, for at Ampotaka and Ampanihy in March, 1930, the evenings were delightfully cool.

Two seasons may be distinguished: one, from November to April, when the weather is hottest and most of the rain falls, coming in irregular showers that are sometimes of considerable intensity; the other, from May to October, cooler and with less rain, though the southeast trade winds coming around the southern end of the highlands may bring some moisture.

VEGETATION.—Correlated with the aridity of this province, which gradually increases as one passes from the Occidental southward, the wooded areas are characterized by smaller trees (those of the same species may be smaller here than in the Occidental—P. de la Bathie, 1921[1]), by a reduction in foliage, by the fact that the seasonal fall of leaves is not so universal as in the Occidental, by xerophytic brush, and by the occurrence of many shrubs armed with spines (in some plants, such as the Euphorbias, the leaves may be entirely reduced and the twigs bear chlorophyll). These conditions are not exclusively restricted to the Subdesert, since some of them are found wherever arid conditions

[1] *Op. cit.*, pp. 241–245.

exist in the Occidental. Also, in the Subdesert where there is sufficient ground moisture from the streams, the wooded plains and the forest bordering the rivers are much the same as those of the Occidental, and represent arms or islands of Occidental flora. These areas of flora similar to the Occidental, however, have, a Subdesert fauna. If these areas are part of the Occidental flora that have been left behind as it retreated northward the Occidental avifauna that may have been left in them has been "flooded out" by Subdesert forms.

The wooded areas of the Subdesert tend to open, with scattered areas of open ground, and the wooded plains change gradually to savannas containing scattered areas of brush, and these open wooded areas and the savannas cover the greater part of what may be considered open ground, where the birds of the grassland occur. Some of the heavily wooded areas on the more fertile and moister ground have been burned; but the lack of grass to carry the fire and the slow-burning character of the desert brush have protected, and no doubt will continue to protect the greater part of the characteristic Subdesert vegetation.

The vegetation of the province falls into several rather clearly defined types: the desert brush of *Didierea*, the desert brush of *Euphorbia*, the low grotesque forest of the calcareous plateaus, the wooded plains with modification into the lower brush forest on the low hills and into gallery forest along the streams, the scattered areas of brush in the savannas, and the savannas themselves.

The first three types are very arid and are most characteristic of the Subdesert. They occupy the areas along the coast, those in the southwest inland to the edge of the calcareous hills, and in the south, inland perhaps 100 km. from Cape Ste. Marie (Mr. Burgess, a missionary at Fort Dauphin, confirmed this limit). This arid section of the Subdesert corresponds to Humbert's Subdesert domain. These are the areas in which the species characteristic of the Subdesert occurred, though they were not necessarily present over the whole extent of the areas. The wooded plains and the savannas come between these areas and the Oriental Province, though along the rivers they extend as gallery forest nearly to the sea, resembling similar areas in the Occidental. Their avifauna was composed largely of widespread species, though when these forms have been differentiated in the southwest into Subdesert races, such races occur in these areas, so they must be considered a part of the Subdesert Province, although they do not contain forms as characteristic as those of more arid regions.

The following forms were restricted to the Subdesert:

Monias benschi
Agapornis cana ablectanea
Coua verreauxi
Coua ruficeps olivaceiceps
Coua cursor
Uratelornis chimaera
Newtonia archboldi
Pseudocossyphus imerinus
Nesillas typica lantzii
Thamnornis chloropetoides
Neomixis striatigula striatigula
Neomixis tenella debilis
Coracina cinerea pallida
Leptopterus chabert schistocercus
Vanga curvirostris cetera
Xenopirostris xenopirostris
Cinnyris sovimanga apolis
Foudia sakalava minor

The list includes eighteen forms, representing ten races, eight species, and three genera peculiar to the Subdesert. Besides these birds that are characteristic of the Subdesert and which are all more or less restricted to the vicinity of wooded or brush areas, a gull, *Larus dominicanus*, which reaches Madagascar and has a widespread range outside of the island, was found only along the coast of this province, where it frequented the sandy beaches. It was found inland also at Lac Tsimanampetsotsa.

The relationships of the endemic fauna of this province are clearly with the rest of the avifauna of Madagascar. Some forms, such as *Neomixis s. striatigula*, *Pseudocossyphus imerinus*, and *Uratelornis chimaera*, have their closest race, species, and genus, respectively, in the Oriental. Others, such as *Coua r. olivaceiceps*, *Coua cristata pyropyga*, *Coua cursor*, and *Coua verreauxi*, have their closest relatives in the Occidental, the first two being represented by other races, and the second two by species largely confined to the Occidental. *Coua verreauxi* is very close to *Coua cristata*, which is also represented in the Subdesert. Seven of the other forms are races of species that are widespread in the island. *Vanga c. cetera* and *Leptopterus c. schistocercus* intergrade strongly with the Oriental forms in the Occidental, and also show some intergradation in the southern part of the Humid East. *Coracina c. pallida* intergrades through the west only, while the other four forms show little intergradation. The Subdesert avifauna was probably derived from that of the Oriental through adaptation to arid conditions over a long period of time.

As in the other provinces, preferences of various birds for certain habitats enables one to speak of a littoral, a marsh, a woodland, a savanna, and an open ground avifaunal association.

Littoral Association.—This association has already been discussed under the same heading for the Occidental Province, and conditions are very similar here, though in the Subdesert the shallow muddy

bays are fewer, and consequently there are less extensive mangrove areas than in the Occidental.

The following sea and shore birds that were found in the Occidental were not found in the Subdesert:

Hydroprogne caspia
Sterna hirundo
Sterna anaethetus antarctica
Fregata ariel iredalei

The widespread birds that occurred on the coast have been listed, and those not confined to the Occidental were found in the Subdesert. There were no birds peculiar to this province restricted to this habitat. We found the plover, *Charadrius thoracicus*, only in a muddy bay on the coast, but it has been recorded from the Humid East[1] and is probably more widespread than our records show.

MARSH ASSOCIATION.—The extensive marshes around Lac Iotry seem best referred to the Occidental, since the two provinces overlap here. The marshes and pools belonging to this province are, rather, the shallow brackish pools, usually with little or no marsh areas on their edges, and many of them are seasonal. If a margin of grassy marsh occurs along the edge of the pool it may be separated from the water by an area of beach, or the pool may be entirely dried up during the dry season. Damp grassy areas that attract some birds do occur here and there around springs. Along the rivers there are often grasses and reeds, but little marsh is found. The broad sand bars and beaches of the rivers afford resting places for some birds. However, as one goes inland, one finds marshy pools that resemble those of the Occidental. None of the marsh birds were distinct.

Ardea cinerea johannae, Ardea purpurea madagascariensis, Egretta dimorpha, Threskiornis aethiopicus bernieri, Dendrocygna viduata, Sarkidiornis melanotos, and *Charadrius p. pecuarius* were the characteristic birds along the sand beaches and sand bars of the rivers, though *Egretta dimorpha* was found also on the coast. *Charadrius pecuarius* was found in the little damp grassy places and in the muddy bays along the coast. *Ardeola idae* was found often along the rivers and about the little marshy pools farther inland; *Bubulcus i. ibis* was found about almost any of the areas of water inland, though it was more common feeding over grassy or cultivated open ground even when such an area was very dry, as in the case of the corn fields of the more arid Subdesert regions. *Butorides striatus rutenbergi* was seen only occasionally along the river banks where, like *Ardeola idae*, it took shelter along the grassy margin.

Phoeniconaias minor favored the wide shallow pools where there was

[1] Richmond, 1896, Proc. Biol. Soc. Wash., X, p. 53.

little surrounding vegetation. *Anas erythrorhyncha* and *Fulica cristata* were the only common water birds on Lac Tsimanampetsotsa, where they fed along the narrow muddy shore and escaped into the lake at the approach of danger. A small flock of *Dendrocygna viduata* was seen flying over the lake; *Larus dominicanus* was also fairly common here, though it was equally so on the coast. Many shore birds, such as *Squatarola s. squatarola*, *Numenius arquata*, and *N. phaeopus*, as well as many of the smaller ones and also some of the herons, probably occurred along the shores of Tsimanampetsotsa. Many of the littoral birds of the coast also occurred some distance up the mouths of the rivers and it was in such places that we found *Ibis ibis* and *Anastomus l. madagascariensis*. *Scopus umbretta* was not common in this area but was found along some of the streams and about some of the little muddy pools. It was probably much commoner farther inland, not being found in the very dry sandy areas near the coast. Most of the marsh birds were absent from the pools in the very sandy country, though there may be a seasonal difference in their local distribution. During the season that we were in this type of country, the rains were said to have failed, and perhaps water birds were less plentiful than in other years.

WOODLANDS.—The most characteristic wooded areas of this province are those near the coast. As one goes farther inland, savannas and gallery forests appear that are much like those of the Occidental. Though few birds peculiar to either province occurred in these woodlands, the subspecies that did occur were those of the Subdesert. The vegetation falls into several types.

The Subdesert Didierea brush, a forest or brush of strange spiny plants from six to ten meters high, was largely found in the extreme south of the island. It occurred at Ampotaka, and Mr. Burgess, a missionary from Fort Dauphin, told me that it covered the greater part of the extreme south of Madagascar, reaching nearly to Fort Dauphin.

The Subdesert Euphorbia brush, consisting of bushes from three to seven meters high, with reduced leaves and a greenish-gray color, was typical of the arid sandy areas along the coast. We found this type of brush to be the richest in peculiar Subdesert species of birds.

The low dry forest of the calcareous plateaus, consisting of trees from five to eight meters high, was composed of strange gnarled bushes, large-trunked trees and strange vines, nearly all spiny. These plants grew in the crevices and cracks in the rock wherever there was sufficient soil. Much of the limestone is on the surface and has weathered, needle-

like points sticking up and great flakes of stone lying about, which ring like metal when they are struck.

Some of the dry though fertile land supports a real deciduous forest of good-sized trees, interspersed with much brush, which, on the more sterile soil and on the sand, intergrades with the Euphorbia brush or with the vegetation of the calcareous plateau.

In the damper situations and along the river valleys the trees are tall and evergreen, due to the ground moisture, and resemble similar areas in the Occidental. In places where suitable land is greatly restricted, this vegetation is reduced to a narrow fringe along the streams.

As we have said, the various types of woodlands and desert brush of this province have suffered little from the depredations of man, though the Didierea brush has been cut and burned in small areas and certain species of gum-bearing trees on the calcareous plateaus have been greatly reduced in numbers by excessive tapping. However, areas of wooded plain country found along the rivers and the gallery forests have been destroyed in some places to provide land for agriculture, as at Ampotaka, and have been replaced by low secondary brush.

The Didierea brush is restricted largely to this province but the other types of country are found often in the Occidental, the Euphorbia brush extending along the narrow sandy coast to north of Majunga, though often interrupted by savannas that come out to the coast, and the strange, dry forest of the calcareous plateau is found on outcropping limestone areas as far north as Namoroka and Rodo (north of Vohemar).

Though there is a pronounced overlapping and intermingling of the faunas of the two provinces from Morondava to Tulear, the areas of western character that occur in the Subdesert were occupied by typically Subdesert forms, and the areas of Subdesert character in the Occidental held typically Occidental forms. However, this condition of overlapping floras made the occurrence of typically desert subspecies, such as *Nesillas t. lantzii* as far north as Maintirano, less unusual than it might at first appear.

It is difficult to define a woodland and an open-ground association that will hold for any extensive areas in this province because of the open character of the wooded land and the occurrence of clumps of trees or brush on the savannas, so that the birds of the open ground and brushlands were found almost everywhere over these areas. It is also difficult to distinguish a brushland and a forest association, for many of the trees are low, approaching brush conditions, and most of the woodland birds occurred in the brush, while forms that were commonest

in the brush of the other provinces were found to be common in the open forest of the Subdesert. In studying the habits of the birds that are peculiar to this province, one finds that they are all birds of the woodland or desert brush.

A vertical distinction of habitats of the forest and brush forms of this province is likewise difficult as it was in the Occidental, since in so much of the forest of the Subdesert, the association of the tree tops mingles with that of the ground-cover and we found birds of both groups feeding together in the bushes. In some places the distinction was noticeable, however, and it may be advisable to indicate such a distinction because it may show why some of the forms which frequent the taller trees, such as *Leptosomus d. discolor*, were not found commonly in the Subdesert, and it may point out the adaptability of others to varying conditions. Also it may possibly suggest why these birds have been able to become common in all three biotic provinces of Madagascar. A forest-floor, ground-cover, and arboreal avifaunal association may be recognized in the Subdesert.

The following birds were the more characteristic of the forest floor:

**Monias benschi*
Streptopelia picturata picturata
**Coua ruficeps olivaceiceps*
**Coua cursor*
Caprimulgus madagascariensis madagascariensis
**Uratelornis chimaera*
**Pseudocossyphus imerinus*
Copsychus albospecularis pica
Foudia sakalava minor

The first four of the list were largely terrestrial birds, the Couas occasionally mounted into a bush or tree to rest or call, and *Monias benschi* only went up into a bush to nest.

Streptopelia p. picturata and *Foudia sakalava minor* often fed on the ground but also ranged through the trees; *Pseudocossyphus imerinus* fed chiefly on the ground but perched in the tops of trees to rest when it was alarmed. *Caprimulgus m. madagascariensis* slept on the ground but fed in the air. *Copsychus a. pica* was a bird of the undergrowth, often seen on the ground. *Monias benschi* and *Uratelornis chimaera* seemed restricted to the southwest, north of Tsimanampetsotsa; and *Pseudocossyphus* to the Euphorbia brush on the edge of the sea. *Coua cursor* became more common in the south while *Coua r. olivaceiceps* became scarcer.

* Endemic to this province.

GROUND-COVER ASSOCIATION.—In the forest this association is definitely one of the ground-cover, but none of the forms occurring there were restricted to it. They ranged out into the lower Subdesert brush that characterizes so much of the province.

**Nesillas t. lantzii*, **Thamnornis chloropetoides*, and *Copsychus a. pica* were the most characteristic of this habitat, gleaning through the twigs for small insect prey. **Newtonia archboldi* ranged here and also up into the lower trees. These birds were rather widespread in the arid part of the province. *Centropus t. toulou* was common, and where the trees were low or replaced by shrubs, such arboreal forms as *Tchitrea mutata*, **Neomixis tenella debilis*, **N. s. striatigula*, *Newtonia brunneicauda*, and **Cinnyris sovimanga apolis* often ventured lower into the forest and into the ground-cover.

ARBOREAL ASSOCIATION.—The forms of this association were typical of the trees, some being confined to the tops of the tall ones where they fed, and some only perching in the trees and feeding on the ground or taking their prey on the wing, while others ranged wherever there were trees or bushes. These are all grouped together and their particular relation to habitat is considered in the following discussion.

The following are the more common arboreal birds:

Streptopelia picturata picturata
Falco concolor
Falco zoniventris
Aviceda madagascariensis
Buteo brachypterus
Accipiter madagascariensis
Astur francesii
Gymnogenys radiatus
Otus rutilus
Ninox superciliaris
Coracopsis vasa drouhardi
Coracopsis nigra libs
Cuculus poliocephalus rochii
Coua cristata pyropyga
Coua verreauxi
Eurystomus glaucurus
Leptosomus discolor discolor
Merops surperciliosus
Newtonia brunneicauda
Tchitrea mutata
Pseudocossyphus imerinus
Neomixis striatigula striatigula
Neomixis tenella debilis
Ixocincla m. madagascariensis
Coracina cinerea pallida
Dicrurus forficatus forficatus
Leptopterus chabert schistocercus
Vanga curvirostris cetera
Xenopirostris xenopirostris
Falculea palliata
Cinnyris sovimanga apolis
Zosterops maderaspatanus
Foudia sakalava minor

The widespread forms, *Ixocincla m. madagascariensis*, *Dicrurus f. forficatus*, and *Newtonia brunneicauda*, which ranged through the trees and into the brushlands in the Oriental humid forest, were found here in almost any area of arid woodland or brush as well as in the wooded

* Peculiar to this province.

areas and gallery forest of the savannas, and were consequently common. *Streptopelia p. picturata* ranged in the trees of the denser wooded areas and brush, though it fed on the ground. *Leptosomus d. discolor* liked to feed in the taller brush and trees, as did *Coracopsis vasa drouhardi*, a conspicuous species of the more open woodland, and *Coracopsis nigra libs*, a less conspicuous and less noisy bird that was found more commonly in the densely wooded areas. *Astur francesii* preferred the taller, denser forests and was not common in the areas of lower forests. *Otus rutilus* and *Ninox superciliaris* also preferred forest areas to the areas of desert brush, as did *Gymnogenys radiatus* and *Buteo brachypterus*, though these latter also ranged out into the savanna where the trees offered perches and they could feed in the open ground. *Accipiter madagascariensis* was perhaps more common in the wooded areas of this province than elsewhere, though it also occurred in the Occidental and was rare in the Oriental. *Aviceda madagascariensis* preferred the vicinity of larger forest; *Falco zoniventris*, which was fairly common in the rain forest, perched on some tall stub, was occasionally found sitting on some perch above the desert brush or in the wooded plain. *Cuculus p. rochii* preferred the taller forest, but often ranged into the forest areas in the savanna. These widespread birds that preferred the denser, taller forests were naturally less common in the Subdesert.

Eurystomus glaucurus and *Merops superciliosus* frequented the edges of the forest and open savanna country where there was more room to pursue their insect prey on the wing.

The arboreal birds common only to the Occidental and the Subdesert are few. *Falculea palliata* favored all the forest and larger brush areas and ranged into the scattered areas of woodland in the savannas and open wooded plains where it was more common. *Artamella v. annae* frequented both the wooded areas and the desert brush, though it was not common.

Of the arboreal birds restricted to this province, some races of widespread forms, such as *Neomixis tenella debilis* and *Leptopterus chabert schistocercus*, are found in practically any area of woodland or brush, while *Vanga curvirostris cetera* and *Coracina cinerea pallida* were restricted to more heavily wooded areas. *Coua cristata pyropyga* frequented almost all of the woodland and desert brush regions but was strangely absent from the range of *Coua verreauxi*, a bird of similar habits, about Lac Tsimanampetsotsa. *Neomixis striatigula striatigula*, a race of a tree-top bird of the Oriental, was in this province a bird of the tree tops in the wooded areas but was also very common in the low brush.

Pseudocossyphus imerinus, a species with a related species in the east, which inhabits the damp forest in that province, was a bird which feeds on the ground, but perches on the tops of low trees. It was confined to the sand Euphorbia brush on the coast. *Xenopirostris xenopirostris* was fairly common but was found only in the Subdesert brush.

The banding together into loose feeding flocks of birds was not nearly so evident in this province as in the Oriental. Some species, however, such as *Falculea palliata* and *Foudia sakalava minor* were found in quite large flocks. In March and February most of the birds had finished breeding in this province and little family parties, apparently of that season's brood, were common. Some species, such as *Thamnornis chloropetoides*, *Newtonia archboldi*, *Newtonia brunneicauda*, *Neomixis tenella debilis*, *Neomixis striatigula striatigula*, and occasionally *Nesillas typica lantzii*, *Foudia sakalava minor*, and *Tchitrea mutata*, were found in mixed scattered flocks feeding through the brush.

SECONDARY BRUSHLANDS.—The secondary brushlands are of much less extent in the arid part of the province than in the more moist portions. The birds that ranged into the secondary brush in the other provinces here found a parallel in birds, sometimes of the same species, that ranged through the wooded areas and into the low desert brush, though the desert brush is an endemic type of vegetation. The open wooded areas with natural clearings or glades caused by sterility of soil, favored the occurrence of such species as *Upupa epops marginata*, *Oenas capensis aliena*, *Numidia meleagris mitrata*, and *Gymnogenys radiatus* which frequented the edge of the forests and brush rather than the more densely wooded areas. **Agapornis cana ablectanea*, somewhat affected by the extent of the open country bordering on the forest, was limited in distribution in the arid part of the Subdesert because of the scarcity of food offered by the scanty grass, but was more common in the damper savanna country that contained more wooded areas. Crows and kites, birds of the open woodlands and savannas, were much more common in the Occidental than in the Subdesert, though the former was common along the coast where the latter was only fairly common.

OPEN-GROUND ASSOCIATION.—In the Subdesert the birds of the open ground occupied the open areas in the woodland and desert brushlands and in the savannas. They were widespread forms that have already been listed, and their ecological relationships were much the same as in the other provinces. They were few in number in the Subdesert. *Mirafra hova* was common wherever grass areas occurred;

* Restricted to this province.

Cisticola cherina was also common, even in the scanty grass areas in the arid portions of the province. *Saxicola torquata sibilla* was found occasionally, even in the clearings in the Euphorbia brush, and *Eremialector personatus* frequented the more open areas in both the arid and savanna types of country.

The species restricted to the Subdesert were largely restricted to the arid part of the province (as *Monias benschi, Uratelornis chimaera, Coua verreauxi, Coua cursor, Newtonia archboldi, Pseudocossyphus imerinus, Xenopirostris xenopirostris*) and some of them seem to be restricted to only a part of it. Some of the Subdesert subspecies of more widely spread species, however, were found not only in the arid part of the Subdesert but also in the areas of brush and woods in the savanna part of the Subdesert. Indeed it is because of this occurrence of Subdesert subspecies rather than Occidental subspecies that this savanna area is included in the Subdesert.

DISTRIBUTION OF THE PECULIAR MASCARENE GENERA IN MADAGASCAR, ACCORDING TO THE BIOTIC PROVINCES

Restricted to the:

ORIENTAL	OCCIDENTAL	SUBDESERT
Eutriorchis	None	*Monias*
Heliodilus		*Uratelornis*
Cochlothraustes		*Thamnornis*
Brachypteracias		
Atelornis		
Pseudobias		
Randia		
Hartertula		
Dromaeocercus		
Mystacornis		
Oxylabes		
Oriolia		
Euryceros		
Hypositta		
Neodrepanus		
Nelicurvius		

ORIENTAL AND OCCIDENTAL		OCCIDENTAL AND SUBDESERT	ORIENTAL AND SUBDESERT
Lophotibis	*Bernieria*	*Falculea*	*Pseudocossyphus*
Dryolimnas	*Cyanolanius*		
Mesoenas	*Schetba*		
Alectroenas	*Hartlaubius*		
Philepitta	*Tylas*		

COMMON TO THE THREE PROVINCES

Margoraperdix
Coracopsis
Coua
Zoonavena
Leptosomus
Newtonia
Calomicichla
Nesillas
Neomixis
Ixocincla
Leptopterus
Artamella
Calicalicus
Vanga
Xenopirostris
Foudia

THE AFFINITIES OF THE MADAGASCAR AVIFAUNA

The avifauna of Madagascar is old. The birds that occur on the island have been isolated for so long that many of them have evolved into forms representing families and genera that are peculiar to the Mascarene islands.

The peculiar and interesting fauna of Madagascar has attracted the attention of naturalists for a long time and has been the object of much investigation and speculation.

The Mascarene islands including Madagascar, the Comoros, Mauritius, Reunion, the Seychelles, and neighboring islands, have been considered as forming a subregion of the Ethiopian region (Beddard,[1] Heilprin,[2] Newton,[3] Wallace,[4] and others), but some authorities (Allen,[5] Lydekker,[6] Reichenow,[7] Chapin[8]) have considered this area as a region and there seems ample justification for this. Using birds as a criterion, it seems that the Mascarene islands should be considered a separate region: the Malagasy region.

The following families are peculiar to the Malagasy region:

Aepyornithidae (extinct)	*Brachypteraciidae*	*Vangidae*
Mesoenatidae	*Leptosomatidae*	*Eurycerotidae*
Raphidae (extinct, not on Madagascar)	*Philepittidae*	*Hypositidae*

[1] 1895, 'A Textbook of Zoögeography,' Cambridge.
[2] 1887, 'The Geographical and Geological Distribution of Animals,' New York.
[3] 1893–1896, 'A Dictionary of Birds,' London.
[4] 1876, 'Geographical Distribution of Animals,' London, and 1880, 'Island Life,' London.
[5] 1878, U. S. Geol. Survey Bull., pp. 313–377.
[6] 1896, 'A Geographical History of Mammals,' Cambridge.
[7] 1900–1901, Die Vögel Afrikas, Neudamm, I.
[8] 1932, 'The Birds of the Belgian Congo,' Bull. Amer. Mus. Nat. Hist., LXV.

The following families peculiar to the Ethiopian region do not occur on Madagascar:

Balaenicipidae
Sagittariidae
Musophagidae
Phoeniculidae
Coliidae
Picathartidae
Buphagidae
Promeropidae

No families are restricted to the Indian region, but the Pittidae reach their highest development there and are represented by a few species in Africa. None of them occurs in Madagascar. The families Timaliidae, Pycnonotidae, Dicruridae, and Nectariniidae are rather characteristic of the Indian region but also are represented in Madagascar as well as in Africa. The genera *Acridotheres, Gracula, Chloropsis*, and *Pericrocotus;* the trogons of the genus *Harpactes;* the bee-eaters of the genus *Nyctiornis;* the parrots of the genera *Palaeornis* and *Loriculus;* and many highly specialized gallinaceous birds characterize the Indian region (Sclater[1]). None of these occur in Madagascar.

In addition, the distinctiveness of the fauna of Madagascar is emphasized by the number of genera that are peculiar to these islands. Many of these peculiar genera are so distinct from the related genera in Africa and Asia that it is difficult to determine to which they are most closely related.

List of the genera found in Madagascar which are peculiar to Madagascar or to the Mascarene islands:

Lophotibis
Dryolimnas
Mesoenas
Monias
Margaroperdix
Alectroenas
Eutriorchis
Heliodilus
Coracopsis
Coua
Zoonavena
Leptosomus
Brachypteracias
Atelornis
Uratelornis
Philepitta
Newtonia
Pseudobias
Pseudocossyphus
Hartertula
Neomixis
Dromaeocercus
Mystacornis
Oxylabes
Bernieria
Ixocincla
Tylas
Leptopterus
Cyanolanius
Artamella
Schetba
Oriolia
Calicalicus
Vanga
Xenopirostris
Euryceros
Falculea
Hypositta

[1] 1891, Ibis, pp. 529 and 530.

Calamocichla	*Neodrepanus*
Nesillas	*Nelicurvius*
Thamnornis	*Foudia*
Randia	*Hartlaubius*[1]

From this it can be seen that the avifauna of the Mascarene islands is very distinct from that of the Ethiopian region, indeed, it is more different from the Ethiopian region than the Ethiopian region is from the Indian region. The actual number of birds on Madagascar is small, compared with continental areas, and consequently there has been a tendency to unite the Mascarene islands with the nearest large continental region, despite the distinctive fauna. From a consideration of the birds alone the Mascarene islands should be classed as a region.

When the peculiar avifauna of Madagascar became known, the question naturally arose. "Whence did it come?" Some authorities (Sclater, Newton, Wallace, Lydekker, and Allen, among them) held that the fauna was undoubtedly of African origin and that the presence of an Asiatic element was either the result of accidentals that had become established ("recent colonists" as Wallace calls them), or was a relic of the original Afro-Indian fauna that had survived in Madagascar only because the island had become separated before the arrival of the more advanced forms. G. Grandidier[2] considers part of the fauna to have been obtained from an earlier European fauna by way of Africa. Other students, among them Isidore Geoffroy St.-Hilaire (see Hartlaub, 1877, 'Die Vögel Madagascars, etc.,' VIII, p. 8, Halle) and Hartlaub,[3] saw in the Asiatic relationships the basis for a former, closer connection with Asia. Von Pelzeln[4] held that Madagascar and the Malay Archipelago were once connected and that possibly a little later there was a direct land connection between Africa and India. He also held that these two land bridges may have been connected. Trouessart[5] inclined toward the view that Madagascar was once connected with an Antarctic continent.

In considering the avifauna we find the greater part of it so distinct that at the present time it is impossible to say whether it is more closely related to that of the Ethiopian or of the Oriental region. Some of the birds, however, show some relationship to one or the other.

Two families that are usually cited to characterize the Ethiopian

[1] To these may perhaps be added the monotypic genus *Mentocrex* of Peters for the Madagascar *Canirallus* and the monotypic genus *Lemurolimnas* of Salomonsen for *Sarothrura watersi*.
[2] Grandidier, G., 1905, 'Rech. sur les Lémuriens Disparus et en Particulier sur ceux qui vivaient à Madagascar,' Nouvelles Archives du Muséum, (4) VII, Chapter VIII.
[3] Hartlaub, 1877, Ibis., pp. 334–336.
[4] von Pelzeln, A., 1875, Verh. Zool.-Bot. Ges. Wien, pp. 33–62.
[5] Trouessart, E. L., 1907, Rev. Sci., Paris, pp. 129–138.

avifauna, the Scopidae and Numididae, are represented in Madagascar, but in *Numida* the Madagascar representative is identical with one of the African races, while in *Scopus* the Madagascar bird is but a slightly differentiated race.

The following genera occurring in Madagascar are found in Africa but not in India:

1.—Represented by peculiar species in Madagascar:

Actophilornis
Canirallus
Sarothrura
Vinago
Gymnogenys
Agapornis
Pachycoccyx
Corythornis
Ispidina
Phedina
Spermestes

2.—Represented by peculiar races in Madagascar:

Thalassornis leuconotus
Oena capensis

3.—Represented by the same races in Madagascar and Africa:

Melanophoyx ardesiaca
Porphyrula alleni

The following species represent genera that are found both in Africa and in India, though the species themselves do not occur in India.

1.—Represented by different races in Madagascar:

Phalocrocorax africanus
Threskiornis aethiopicus
Anastomus lamelligerus
Charadrius tricollaris
Asio capensis
Cypsiurus parvus
Riparia paludicola

2.—Not represented by different races in Madagascar:

Larus cirrocephalus (also American)
Chlidonias leucopareia
Ardeola ralloides
Egretta dimorpha
Platalea alba
Ibis ibis
Nettapus auritus
Dendrocygna viduata (also American)
Anas erythrorhyncha
Anas punctata
Charadrius marginatus
Charadrius pecuarius
Glareola ocularis
Porphyrio madagascariensis
Fulica cristata
Coturnix delegorguei
Corvus albus

The following races of more widespread species are found only in Africa and Madagascar:

Egretta alba melanorhynchos
Porzana pusilla obscura
Coturnix coturnix africana
Milvus migrans parasitus
Machaerhamphus alcinus anderssoni
Sterna bergii bergii

Pseudocossyphus is probably closest to *Monticola* which occurs in both the Ethiopian and the Oriental regions. The Madagascar bird is probably closest to some of the African forms.

Hartlaubius is possibly closest to some of the African tree starlings.

The following genera are represented in the Indian region and in Madagascar but do not occur in Africa:

Amaurornis
Ninox
Collocalia
Copsychus

The Asiatic species, *Cuculus poliocephalus*, is represented in Madagascar by a breeding race that migrates to Africa.

Beside these Asiatic affinities the family Hypositidae is related to Sittidae, which occur in Asia, Europe, and North America but not in Africa. The genus *Ixocincla* is very closely related to the Asiatic genus *Microscelis; Dicrurus f. forficatus* is closer to some of the Indian drongos than to the African ones; *Ardeola idae* is probably closer to the Asiatic members of the genus than to the African forms, and *Upupa epops marginata* is rather close to the Indian form. *Astur hensti* is a large goshawk with its closest relatives in the Indian and Palaearctic regions.

In these listed affinities the African relationships are greatly in excess of the Indian ones, but the latter cannot be dismissed as having no consequence. If one considers the direction of the prevailing winds that blow on Madagascar, one finds that for half the year the northeast trade winds blow, favoring arrivals from India. During this same period the northwest winds blow from Africa to Madagascar, and during the rest of the year the prevailing winds are the southeast trades. On this basis, conditions are just as favorable for wanderers arriving from Asia as for those coming from Africa.

However, when one considers the distances, the matter seems quite different. Since the distance from Africa to Madagascar is about two hundred and fifty miles and many migrants make this flight twice a year, it does not seem strange that occasional strays may have come across and established themselves in Madagascar. This is further indicated by the fact that many of the birds showing the most marked affinities between the forms of Africa and Madagascar are birds of strong flight, many of them marsh or open-ground birds.

On the other hand India is about 2000 miles away, with only a few small islands between. The hypothesis that small birds would be blown so far and establish themselves is not very plausible, especially

in the case of little birds like nuthatches and thrushes, as are some of the birds in Madagascar that show affinity with Asia.

The varying degree of specialization of the birds with African affinities, even to the occurrence of the same race in both Africa and Madagascar, points to the gradual addition of African forms to the Madagascar fauna, and the same condition, though to a lesser degree, is indicated in the Asiatic forms.

In conclusion it seems that the greater part of the peculiar avifauna of Madagascar does not show relationships that can be considered closer to the African or Asiatic avifauna. This is particularly true of the forest birds. The African affinities, which, from a varying degree of distinctiveness, or lack of it, which they have attained, would indicate a gradual intrusion of African forms that have flown to Madagascar. This could possibly have occurred without a closer land connection than exists today.

There are also a number of forms with Asiatic affinities, though fewer, that show varying degrees of distinctiveness and indicate an Asiatic element in the Madagascar fauna, acquired at various times. Considering the distance that these birds had to come it seems probable that there has been a closer connection at some time, possibly islands that have since sunk beneath the sea.

Finally there is the greater part of the peculiar Madagascar avifauna, which appear to have no very close relatives outside of Madagascar and which arrived possibly over the land bridge by which the flightless birds and the mammals probably came, and have since evolved in Madagascar. At the present time the most that can be said is that this avifauna has been isolated long enough to develop forms distinct enough from those of Africa and India to entitle the Mascarene islands to the rank of a region; the Malagasy region.

MIGRATION IN MADAGASCAR

The problem of migration in Madagascar cannot well be solved or even indicated through the results of only two years' work carried on at various points over an island 1000 miles long and averaging 250 miles wide. However, some of the facts and inferences that are apparent may be of interest.

Migration, as it affects Madagascar, presents three phases:

1.—The Palaearctic species spending the northern winter in Madagascar
2.—The species which breed in Madagascar but spend the austral winter elsewhere
3.—The species which migrate within the island.

List of Palaearctic birds collected in Madagascar by the present Mission:

Species	Earliest Date	Latest Date
Sterna hirundo	Dec. 27	Jan. 12
Chlidonias leucoptera		May
Charadrius hiaticula tundrae	Dec. 5	March 2
Charadrius leschenaulti	Sept. 22	May 4
Squatarola s. squatarola	Sept. 28	April 1
Erolia testacea	Oct. 15	March 2
Crocethia alba	Sept. 29	March 3
Tringa nebularia	Nov. 29	March 1
Actitis hypoleucos	Aug. 18	March 15
Xenus cinereus	Nov. 5	April 5
Arenaria i. interpres	Sept. 25	May 4
Numenius arquata	Nov. 5	April 3
Numenius phaeopus phaeopus	Sept. 26	April 3
Falco eleonorae	Nov. 29	
Riparia r. riparia	Dec. 11	

The list includes two terns, eleven shore birds, one falcon, and one passerine bird. Several individuals of another species of passerine bird, *Hirundo rustica*, were seen on January 20, 1930, at Tulear, but were not collected. Most of these records were made during the austral summer when one would expect the birds to be there, but M. Decary secured a specimen of *Numenius phaeopus*, June 6, 1930, at Tambohorano.

The other Palaearctic migrants known to visit Madagascar are:

Stercorarius parasiticus
Tringa ochropus
Limosa lapponica
Erolia minuta
Charadrius mongolus

Madagascar Migrants to Africa

The following species nest in Madagascar and spend the austral winter in Africa[1]:

Species	Earliest Date	Latest Date
Ardea idae	(no date)	
Falco concolor	Nov. 13	April 6
Eurystomus glaucurus	Sept. 27	April 1
Merops superciliosus	(no date)	
Cuculus poliocephalus rochii	Aug. 6	March 2

Some *M. superciliosus* stayed in Madagascar throughout the year and we have records for them for every month of the year, but they

[1] Lavauden, 1929, Journal für Ornith., Festschrift, p. 232, suggests, probably incorrectly, that *Sarkidiornis melanotos* and *Anas punctata* also migrate to Africa.

seemed to become common in August and September, though this may have been because we were in the dense forest or on the high plateau just previous to that time, where *Merops* naturally was less plentiful.

Apparently *Eurystomus* was absent entirely from Madagascar during the winter, while *Cuculus* was nearly so, a single specimen having been taken May 23, possibly representing a non-migrating individual.[1]

MIGRATION WITHIN THE ISLAND OF MADAGASCAR.—We secured no direct evidence of any migration of the resident species of Madagascar from one part of the island to another, though it has been suggested that certain species migrate from the west to the east during the dry season.[2]

As we did not remain long enough in any one locality to follow the changes with the seasons we have no direct evidence, but by indirect reasoning it seems probable that the majority of species are sedentary.

Many of the species are represented by distinct races in the different biotic provinces of the island. If the Occidental subspecies migrated into the Oriental, it would have been during the dry season when we were collecting in the Oriental, and yet we did not find them.

Similarly, this would apply to Subdesert forms that would have migrated, perhaps into the Occidental instead of over the plateau or around the end of the plateau into the Oriental. But M. Delacour and Mr. Lowe did not find them in the Occidental in July, the middle of the dry season, nor did we collect them in the southern part of the Humid East in the dry season.

The question arises whether or not the western species might not extend farther into the Subdesert, or the Oriental forms farther into the Occidental during the wet season, but we collected in the Subdesert and in the Occidental during the rainy season and did not find them there.

From the results of the collecting in the Oriental in the dry season, when there should have been migrants there from the drier parts of the island if such migration occurs (and many of these birds could have been recognized by their plumage); from the collecting in the Occidental in the dry season when species migrating within the island should not have been there; from the results of our collecting in other parts of the Occidental during the wet season when migrants should have been there; and from collecting in the Subdesert in the wet season, we may assume that a well-defined migration between the different parts of the

[1] For a discussion of Madagascar migrants in Africa see Chapin, 1932, Bull. Amer. Mus. Nat. Hist.' LXV, p. 350.

[2] Lavauden, L., 1929, Jour. für Ornith., Festschrift Hartert, pp. 230–235.

island does not exist for the majority of resident birds within the island.

There may be exceptions to this but we secured no evidence to show them at the present time. Delacour (1932, L'Oiseau et R. F. O., II, pp. 34, 55) suggests that *Phedina* and *Alectroenas* may migrate within the island, but he found both of these forms at Ankavandra in the dry season.

The wanderings of kites, crows, and buzzards in search of food, or as they follow the swarms of locusts, can scarcely be considered migration, any more than can the daily wanderings of terns over a wide bay, as they follow the appearance of schools of fish.

There may be also local changes in the abundance of various species within limited areas: the flooding of some of the Occidental plains and valleys may cause a spreading out of the marsh birds that are congregated about streams and marshes which do not dry up during the dry season, and may cause sand grouse to seek higher ground, and drive *Turnix* out of the valleys; but these phenomena, though seasonal, can scarcely be called migration.

It is probable that there is some migration of the flamingoes but its extent is unknown. Some other species, especially the sea birds, may be found to be wanderers to Madagascar.

BREEDING SEASON OF MADAGASCAR BIRDS

The aim of our work in Madagascar was the collection of a series of bird skins. We were continually moving, seldom spending more than a month in any one place or more than a few months in any part of the island. With the restriction of a species to one or another part of the island, it was impossible to follow the activities of any but the most widespread species throughout the year. The different climatic conditions over this island, chiefly the duration of the rainy season, probably imposes different limits on the extent of the breeding season of the same widespread species in different parts of Madagascar. Our data can show only the amount of breeding activity in certain parts of the island for limited periods and so enable us to form an idea of the general breeding season over the whole island.

Besides the nests found, birds which were found upon dissection to have their gonads enlarged were considered as indicators of the time of breeding. When fledgling birds were found the probable month of egg-laying was estimated to give the approximate time of breeding (this accounts for the breeding records we have for a locality during the months when we were not there).

We found that most of the woodland species were beginning to breed in August and September in the Humid East, before the heavy rains. During October and December most of the birds were breeding in the north and northwest and southwest. In January, February, and March, birds were still breeding in the region about Soalala in the west when the rains were still frequent; but in the southwest where little rain fell during this period, the breeding season was over for most species.

We were not in the field much during April, the end of the rainy season, but a few birds appeared to be still breeding in the area about Majunga (west) during this month, and many of the water birds at Andreba (east) had apparently bred during April also. During May, in the dry season, few birds were breeding on the central plateau at Monjakatompo, none of the forest birds were breeding at Fanovana (east), and very few in the northeast. During June, i.e. the dry season, in the southeast, the northeast and the west, few forest birds were breeding.

From this evidence we can assume that the breeding season for forest birds in general started a month or two before the rainy season, i.e. in the latter part of August and September in the Humid East, continued until March or April, the end of the rainy season in the western savanna, and lasted not much beyond December in the arid part of the Subdesert, where little rain fell at any season of the year.

The birds of the open ground, brushlands, and marshes seem much less restricted to any one season and some of them, such as *Foudia madagascariensis*, *Mirafra hova*, *Cisticola cherina*, and *Eremialector personatus*, seem to breed throughout the year, but it is improbable that they do so in all localities. Local conditions probably affect this. Thus *Foudia madagascariensis* was not breeding over the greater part of the arid country about Ampotaka in March but I found one nest in the rank vegetation along the river. In the southeast in June and July, *Streptopelia p. picturata* collected in the forest showed no signs of breeding, but some of them collected in the brushland were breeding at this time.

Also, while some individuals may be breeding, others in the same habitat may not be doing so. At Tananarive in May, I found a nest of *Mirafra hova* with eggs in it and saw numbers of these birds giving their flight song, and at the same time collected many other specimens of the same species that showed no indication of breeding.

Some marsh species were found breeding in April and May at Lac Alaotra (east) and in December at Lac Iotry (southwest), but we lack

data for determining whether they breed during the whole year in some localities or whether they have different breeding seasons in different parts of the island. The latter seems improbable.

The following is a summary of the breeding activities of the various biotic districts:

SOUTHERN PART OF THE HUMID EAST.—Observations made from June to October. In June very few birds were breeding. In July, a few open-ground birds and in August some woodland birds began to breed. In September and October many of the birds were breeding.

CENTRAL PART OF THE HUMID EAST.—Observations made from April to June. In April none of the birds of the forest were breeding at Fanovana; in May and June, at Andreba, many of the water birds were breeding or had bred but a short time before.

NORTHERN PART OF THE HUMID EAST.—Observations made from May to September. In May, June, and July few of the birds were found breeding; in the latter part of August and the first part of September, many forest birds were beginning to breed.

MT. D'AMBRE.—Observations made from October to November. Most of the forest birds were breeding during this period.

SAMBIRANO.—Observations made from November to January. Many of the birds, both woodland and open-ground forms, were breeding or had just bred.

NORTHERN SAVANNA.—Observations made from September and November. Many birds were breeding.

WESTERN SAVANNA.—Observations made June to August, and February to April. In June, July, and August, from Tsiroanamandidy to Tsiandro, a few water birds were breeding. In February, March, and April, from Namoroka to Majunga, a few birds were breeding, many birds had young out of the nest, and apparently March and April marked the end of the breeding season for most of the birds.

SUBDESERT.—Observations made October to March. In October, November, and December many birds were breeding; in January a few birds were nesting (we did little field work during January); in February and March the breeding season was recently passed and many flocks of fledgling young were flying about.

The breeding season is correlated more or less with the rainy season, though on the east coast it starts before the rains. The breeding season in the Western Savanna is more prolonged than in the Subdesert where the rainfall is scanty. The woodland and forest birds are more restricted to a definite breeding season than are the water birds and the birds of the open ground, which may be found breeding throughout the year.

The dry season, that is from May to October, is the austral winter and during this season all breeding activities are at their lowest ebb. In the Occidental and Subdesert many of the plants cease their activities. Insects which probably would furnish food for the young of many species, even of seed-eating birds, are scarce. With the coming of the

rains which, in the Occidental and Subdesert especially, herald the approach of another season of growth, plants send forth their leaves, insect life probably becomes more abundant, and perhaps because of this increased food supply for the young, many birds breed. In the Subdesert, where the rainy season is shortest, the breeding season is shortest. In the Occidental, with its longer rainy season and the probable occurrence of more abundant insect life over a longer period, the breeding season extends over a longer period. The birds of the Humid East that enjoy a damp climate the year around also breed during the summer (November to April). Some species seem to be restricted much less than others to a definite breeding season, though local conditions may in part account for this. The probable periodic activity of insect life is perhaps the obvious explanation for the restriction of the breeding season of many of these species. Further investigation will be required to test the truth of this theory. Other factors, among them the time of ripening of fruits and seeds, may affect other species; and only a knowledge of the life history and ecology of each species will enable one to understand its time of breeding.

SUMMARY

This paper contains the data on the distribution and habits of the Madagascar birds that were collected by the Mission Zoologique Franco-Anglo-Américaine in Madagascar from May, 1929 to May, 1932. M. J. Delacour has already published a list of the birds collected and the present paper is intended to be supplementary to that work. During the two years that were spent in Madagascar, members of the Mission visited many of the areas in the island that are important from the standpoint of distribution of birds, and this paper is based largely on the results of their collecting.

Madagascar is an elongated mountain mass with a steep eastern slope and a gradual western slope. The eastern slopes, exposed to the continual trade winds, receive the greatest amount of rain; the northern part of the west coast is periodically under the influence of the northwest winds, and has a wet and dry season. Farther south in the west the amount of rainfall decreases steadily until in the southwest, sheltered as is the country there from the eastern trade winds and lying south beyond the influence of the northwest winds, the amount of rainfall is scanty. This rainfall has a definite influence in the production of types of forest.

A humid belt of forest lies along the eastern slopes, on Mt. d'Ambre,

and in the northwest; areas of deciduous woodlands occur in the west; and arid subdesert brush appears in the southwest. Much open ground exists, including the greater part of the central highlands.

A study of the avifauna shows that the areas of distribution of most of the species of birds can be correlated with these types of forest. Temperature is an unimportant factor in the distribution of most birds.

The greater part of the endemic birds are forest birds. The island was at one time, probably within the occupancy of the island by man, much more wooded than it is today, and the present open ground and brushlands are a secondary condition, and few birds are found peculiar to them. These birds, moreover, are widespread within the island. The marshes hold a few peculiar species, especially in the west, where the configuration of the land gives broad valleys and wide streams and ponds.

The following main biotic divisions may be recognized: the Oriental Province, including the Humid East, Sambirano, and Mt. d'Ambre districts; the Occidental Province, including the Northern Savanna and Western Savanna districts; and the Subdesert Province.

The avifaunal differences in the different biotic areas are due to an adaptation to environment over a long period. Altitude and temperature are unimportant factors in the distribution of the greater number of forms. There are no physical barriers to account for these differences in avifauna as the zones meet and intergrade around the island and the forest is more or less continuous.

The open-ground forms are largely widespread in Madagascar as are many of the marsh birds, though some of them are restricted to one province or another. The forest holds the greatest number of peculiar birds, some of which are adaptable, and range throughout the island wherever there are trees, others range just as widely but become modified into races under the different conditions existing in different parts of the island. Some species are adaptable to the conditions in two of the three provinces and some species are restricted to one province. No woodland birds spread over the whole island, since much of Madagascar is bare of trees.

During that period when Madagascar was more completely wooded than it is today, the climate was more humid, and the humid forest spread farther north and south than its present extent would indicate. The dry deciduous forest of the Occidental Province was more restricted, as was the northern extent of the Subdesert, though at that time the island possibly extended farther south and that area was occupied by the Subdesert.

With the drying out of the climate the humid forest retreated into the east, and north into the Sambirano; the dry western forest extended its limits; the southern part of the island was submerged and the Subdesert became restricted in its southern extent but possibly spread northward. With the arrival of man, most of the forest of the central highlands was destroyed and the humid forest still further restricted, and the drier forest encroached on the area formerly occupied by humid forest in the northwest. The avifauna of each type of forest followed these changes, and with the destruction of the humid forest in the east came an intrusion of a few western forms following the brushland.

Thus we find a retreating Oriental fauna of which there are some representatives in the Occidental, though fewer and fewer occur as one goes south from the Sambirano toward the Subdesert; an Occidental fauna which is spreading into the secondary brush of the Oriental; and a stationary Subdesert fauna.

The closest connections between the forms of the Subdesert and those of the Oriental are through the Occidental, which is intermediate between them in climate and in type of vegetation. This is shown by the birds that became modified into subspecies in the Oriental and the Subdesert and are intermediate in character in the Occidental.

The habitat discussion is taken up under each province. In general the birds of the ground-cover and the forest floor tend to have a larger percentage of peculiar forms than those of the middle spaces and the tree tops. The birds of the open ground and the brushlands tend to be widespread. The endemic avifauna of the wooded areas of the Subdesert and the Occidental is almost all closely related to that of the Oriental, while that of the marsh in the Occidental has its closest relatives outside of Madagascar.

The avifauna of Madagascar is distinctive enough to justify maintaining the Malagasy region with nine families peculiar to it. Its affinities with both Africa and Asia are shown, with varying degrees of specialization, as though they had arrived in Madagascar at various times. The African element, consisting largely of open-ground and marsh birds, could have arrived without a closer land connection. The Asiatic affinities seem to indicate a closer land connection, probably by a series of islands.

A land bridge undoubtedly existed by which some of the older endemic birds arrived, but these have evolved in Madagascar until now they do not indicate their origin.

A number of Palaearctic birds migrate to Madagascar, and four

species that breed in Madagascar migrate to Africa. No evidence of migrations within the island by local birds was recorded.

The breeding season corresponds with the austral summer which is the rainy season. Local factors influence the length of the breeding season in various parts of the island. A few birds breed throughout the year.

PART II

A LIST OF THE BIRDS OF MADAGASCAR WITH NOTES ON THEIR DISTRIBUTION AND HABITS

Classification and Nomenclature

M. J. Delacour has published a list of the birds collected by this expedition[1] in which localities for many of the specimens and taxonomic notes are given, and as this paper is intended as a supplement to that one, giving the field notes made during the course of the two years of field work, I have for the most part adhered to the system of classification and nomenclature adopted by Delacour rather than that used by Sclater in the 'Systema Avium Aethiopicarum' (1924, 1930).

Number of Species Included

The following list includes, besides the species collected or seen by the Mission Zoologique Franco-Anglo-Américaine, the other species which have been definitely recorded for Madagascar, so as to make the list more generally useful. For convenience in reference, the species not recorded by our party are marked with an asterisk (*) and some reference is given. Some of the early records of specimens, taken in the days when localities were not considered as important as they are now, and not recorded since then from Madagascar but found commonly elsewhere, have been put in a hypothetical list at the end. Many sea birds nest on the Mascarene Islands and though most of them probably wander perhaps to the Madagascar coast, as probably do other southern sea birds, they too must be considered in the hypothetical list until definitely recorded.

The present expedition collected 243 species and subspecies and there are about 34 other forms definitely recorded, so that the total number of birds known from Madagascar is about 277 species and subspecies. The following is a list showing the genera, species, and subspecies in each family represented.

	Genera	Species	Forms (i.e., species and subspecies)
Podicipidae	1	3	3
Hydrobatidae	2	2	2
Puffinidae	3	3	3
Laridae	9	17	17
Phaëthontidae	1	3	3

[1] 1932, L'Oiseau et R. F. O., pp. 1–96.

	Genera	Species	Forms (i.e., species and subspecies)
Sulidae	1	2	2
Phalacrocoracidae	1	1	1
Anhingidae	1	1	1
Fregatidae	1	2	2
Ardeidae	8	13	13
Plataleidae	4	4	5
Scopidae	1	1	1
Ciconiidae	2	2	2
Phoenicopteridae	2	2	2
Anatidae	6	10	10
Scolopacidae	8	11	11
Rostratulidae	1	1	1
Charadriidae	3	9	9
Recurvirostridae	2	2	2
Dromadidae	1	1	1
Glareolidae	1	1	1
Jacanidae	1	1	1
Rallidae	10	11	12
Mesoenatidae	2	3	3
Turnicidae	1	1	1
Phasianidae	2	3	3
Numididae	1	1	1
Pteroclidae	1	1	1
Columbidae	4	4	5
Falconidae	11	16	16
Strigidae	3	4	4
Tytonidae	2	2	2
Psittacidae	2	3	6
Cuculidae	5	13	16
Caprimulgidae	1	2	2
Micropodidae	4	5	5
Coraciidae	1	1	1
Leptosomatidae	1	1	1
Brachypteraciidae	3	5	5
Meropidae	1	1	1
Alcedinidae	2	2	2
Upupidae	1	1	1
Philepittidae	1	2	2
Hirundinidae	2	3	3
Muscicapidae	3	6	8
Turdidae	3	4	8
Sylviidae	8	11	20
Timaliidae	3	7	12
Pycnonotidae	2	2	3
Campephagidae	1	1	2
Dicruridae	1	1	1

	Genera	Species	Forms (i.e., species and subspecies)
Vangidae	9	11	15[1]
Eurycerotidae	1	1	1
Hypositidae	1	1	1
Nectariniidae	2	4	5
Zosteropidae	1	2	4
Motacillidae	1	1	1
Alaudidae	1	1	1
Ploceidae	3	5	6
Sturnidae	1 + 1	1 + 1	1 + 1 (introduced)
Corvidae	1	1	1
Totals	164	238	277

New Forms Described

In studying the specimens collected by this expedition, M. J. Delacour and M. J. Berlioz found that the material contained one genus, two species, and ten subspecies that had not been described. The following are the forms that were described from the material collected.

Described by J. Delacour and J. Berlioz in L'Oiseau et la Revue Française d'Ornithologie, 1931, pp. 1–5:

Randia pseudo-zosterops
Foudia sakalava minor
Newtonia archboldi

Described by J. Delacour in the same journal, 1931, pp. 473–486:

Coua cristata dumonti
Nesillas typica obscura
Neomixis striatigula sclateri
Neomixis tenella decaryi
Neomixis tenella debilis
Neomixis tenella orientalis
Bernieria zosterops fulvescens
Coracina cinerea pallida
Schetba rufa occidentalis

Described by J. Delacour in the same journal, 1932, p. 6:

Podiceps rufolavatus

Since the report on the birds collected by this expedition was published two new species have been described:

Newtonia fanovanae Gyldenstolpe
Neodrepanis hypoxantha Salomonsen

[1] *Falculea* is placed in the Vangidae.

Salomonsen has also reëxamined the Madagascar collections in Paris and London and, using subtle differences which were not considered great enough to be of subspecific value in the original working out of the collection, has described a number of forms, of which I have recognized the following:

Canirallus kioloides berliozi
Vinago australis xenia
Newtonia brunneicauda monticola
Tchitrea mutata singetra
Saxicola torquata ankaratrae
**Neomixis striatigula pallidior*
Neomixis viridis delacouri
Bernieria zosterops andapae
Bernieria zosterops maroantsetrae
**Bernieria zosterops ankafanae*
Zosterops maderaspatanus ampotakae
Zosterops maderaspatanus analoga

I have also described the Madagascar *Scopus umbretta* as a new subspecies *tenuirostris* and have recognized the race *Tylas eduardi albigularis*.

New Records for Madagascar

In addition to the new forms, the following forms of which we obtained specimens were recorded for the first time from Madagascar[1]:

Chlidonias leucoptera
Sterna hirundo
Fregata ariel iredalei
Phoenicopterus ruber antiquorum
Charadrius hiaticula tundrae
Riparia r. riparia

Also one species, *Hirundo rustica*, hitherto unrecorded from Madagascar, was seen but not collected.

Sequence of Localities

M. Delacour has listed some of the localities at which we obtained the species, and in the present paper the distribution of the species is usually given by reference to the biotic divisions that have been discussed in the first part of the present paper. Where localities are cited, they usually begin with the southern part of the Humid East district and continue around the northern and western parts of the island to the Subdesert.

* I have seen no material of these two forms.
[1] Delacour, 1932, L'Oiseau et R. F. O., pp. 1–83.

References

The greater part of the data on distribution is that collected by the present expedition. Where other data is used, reference to this is made. The data on habits and habitats were all gathered by members of the expedition, and when data from native sources is included, it is so marked. A few preliminary notes on the birds were included in the itineraries published by Delacour (1930)[1] and Rand (1932),[2] and in the list of species published by Delacour (1932).[3]

Vernacular Names

Vernacular names in English are not in use for most of the species treated; however, since such names may be of some value, I have included most of those used by Sclater,[4] and for some forms I have manufactured English names.

Many of the birds are known to the Malagasy by name, especially the larger and more conspicuous birds. Similar species are of course often confused so that some of the names may not be confined to one species. As with other peoples, the natives of Madagascar often try to name birds that they do not know, consequently the stranger may be misled, but I have checked most of these names time and again and have eliminated the doubtful ones. Native names vary in different parts of the island. Sometimes these names are changed only in a few letters as in "Dadara" and "Tatara" for *Caprimulgus madagascariensis;* in others, they are quite different as the use of "Tatara" or "Dadara" and "Quapak" for the same bird. Sometimes the same widespread tribe has different names for the birds in different parts of its territory.

Many native names are descriptive of the bird, its habits or its haunts, or are onomatopoeic. I have attempted to give the meaning for many names, but for some, such as "Vintsy" or "Drongo," there is no evident meaning. Many dialects are spoken in various parts of the island, often with only slight letter changes in some of the words, in other cases with such great changes that the natives from different parts of the island sometimes find difficulty in conversing. The Hova language has been written and is being taught in the native schools and work has been done with some of the other dialects.

At first I had a Hova boy, who could write, put down the names of the birds for me, but he often wrote the Hova variation and I changed

[1] 1930, L'Oiseau et R. F. O., pp. 65–77, 160–179.
[2] 1932, L'Oiseau et R. F. O., pp. 227–282.
[3] 1932, L'Oiseau et R. F. O., p. 196.
[4] 1924, 1930, 'Systema Avium Aethiopicarum,' London.

them to forms I thought closer to the sound. Later, as I became somewhat acquainted with the language, I wrote the names myself. As these names will only be used in Madagascar where native aid will be available in pronouncing them, I have tried to spell them as they would be written in Malagasy. However, the accents have been marked and the rules for pronouncing Malagasy can be found in a Malagasy dictionary or vocabulary. Not all the variations of a word have been listed, only the more evident ones being given.

Color Terms

Ridgway's 'Color Standards and Nomenclature,' 1912, has been used where practical. In describing the eggs it did not always seem advisable to use these terms and where I have used Ridgway's terminology the terms are enclosed in quotation marks. I used Ridgway's 'A Nomenclature of Colors, etc.,' 1886, for the shapes of the eggs and have inclosed his descriptive terms in quotation marks.

ANNOTATED LIST

Podiceps rufolavatus Delacour[1]

Madagascar Red-necked Grebe

This species was found only in the Humid East at Lac Alaotra (altitude 750 meters) where it was apparently common.

This grebe breeds at least in April, May, and June, as the following data indicate.

May 30, 1929	Females, laying	Lac Alaotra
May 31, 1929	Several well-grown young	Lac Alaotra
June 7, 1929	Several well-grown young	Lac Alaotra
June 9, 1929	Females, laying	Lac Alaotra

*Podiceps ruficollis capensis** Salvadori

African Little Grebe

With the discovery of *Podiceps rufolavatus* in Madagascar doubt arose as to the occurrence of this species, but Delacour[2] has recorded several Madagascar specimens in the British Museum and the Paris Museum. There are also one immature specimen in the American Museum, and several adult specimens in the Rothschild collection.

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* Throughout this list the * indicates species that we did not collect.
[1] For a discussion of relationships see 1933, L'Oiseau et R. F. O., III, pp. 4–7.
[2] 1932, Ibis, pp. 685–686.

Podiceps pelzelnii Hartlaub

Madagascar Little Grebe

DISTRIBUTION.—From sea level to 1800 m.; we found this species common in all the ponds and rivers of the Oriental and in the ponds and lakes of the Occidental, but not in the Subdesert.

HABITS.—At Ivohibe the little grebes fed in the slow stretches and pools of the river, often swimming from pool to pool through the swift water. This was in the breeding season (August and September) and they were usually in pairs and calling. At Namoroka in March where the plains are dotted with little ponds with much floating vegetation or reeds, these birds were very common and nesting. At Lac Iotry in December there was no indication of nesting, and grebes were very common in loose flocks among the floating vegetation. More than a hundred would be in sight at one time. When alarmed by too close an approach, they went skittering off over the water, half running, half flying, some even flying one or two hundred yards after a running start. The adult has a rattling call; and the young, a plaintive "peet."

Of eight stomachs examined, all contained aquatic insects; four also contained feathers.

The breeding season probably includes at least the months of August, September, October, January, February, and March, as the following data indicate.

August 29, 1929	Nest containing eggs	Ivohibe
September 2, 1929	Males, testes enlarged	Ivohibe
November 22, 1929	Three small young	Befandriana
March 4, 1931	Two small young and one female laying	Namoroka
March 23, 1931	Nest with eggs	Lac Kinkony
June 1–4, 1929	Several young, nearly full grown	Andreba (Lac Alaotra)

At Namoroka where each pond contained a few grebes, several old nests, probably of this species, were seen in the little ponds containing much vegetation. The nest at Lac Kinkony was in an arm of the lake containing much floating vegetation. It was attached to some aquatic vegetation about sixty yards from shore. The nest was a floating mass of water-soaked vegetable material, about 500 mm. across and about 150 mm. deep. The top was barely 75 mm. above the surface of the water. A shallow depression on the top of this mass contained the eggs. Du Mont, who found this nest, saw the bird leave the nest while he was fifty yards away. It covered the eggs with bits of material from the sides of the nest before it left.

Another nest, Ivohibe, August 29, 1929, was in a quiet weedy bay

of the river. The nest itself was a floating mass of rotting, water-soaked vegetation, attached to the edge of a mass of floating vegetation so that the nest was in nearly clear water. The nest measured about 350 mm. across by 160 mm. deep, with a shallow depression on the top, 90 mm. across, for the eggs.

The two nests contained three eggs each. The eggs varied in shape from "ovate" to "elongate ovate" and one was nearly "fusiform" with the greatest thickness in the middle of the egg. The shells of one set that were heavily stained, apparently from contact with the water-soaked nest, were smooth, and slightly shiny, possibly due to the heavy staining; the color originally was probably bluish white, but they were heavily stained with dirty yellowish brown and brownish. This stain does not wash off. The shells of the other sets of eggs, which were only lightly stained, were dull, with a few small scratches on the surface. The original color showed through in a few places as very pale bluish-white but the greater part of the surface was lightly stained with brownish. The measurements of the two sets of eggs are as follows: one set from Lac Kinkony, 39.3 × 24.4 mm., 37.3 × 24.2 mm., and 36.2 × 25.3 mm.; one set from Ivohibe, 36.2 × 24.2 mm., 35.6 × 24.9 mm., and 35.9 × 25.0 mm.

NATIVE NAME.—This grebe was called "Kiboráno" by the Bara and Atamoor in the southeast.

Oceanites oceanicus oceanicus (Kuhl)

Wilson's Storm-petrel

On the morning of April 29, 1930, while entering the mouth of the Bay of Antongil by steamer, several solitary individuals of this species were seen by Archbold, Du Mont, and myself.

***Fregetta tropica melanogaster** (Gould)

Indian Ocean Black-bellied Petrel

This petrel of the southern Indian Ocean was seen repeatedly by Newton[1] on a trip from Mauritius to Madagascar and one was captured near Tamatave.

***Pachyptila vittata salvini** (Mathews)

Crozet Broad-billed Whale Bird

Four specimens from Madagascar, collected by Lantz, were reported by Hartlaub.[2] This is well within the range of this bird, which inhabits the southern Indian Ocean north to Mozambique and the Seychelles.

[1] 1863, Ibis, p. 175.
[2] 1877, 'Die Vögel Madagascars,' p. 376.

***Macronectes giganteus giganteus** (Gmelin)

Giant Petrel

One specimen is preserved in the local Museum at Tananarive.[1]

***Puffinus pacificus hamiltoni** Mathews

Seychelles Wedge-tailed Shearwater

This shearwater inhabits several of the Mascarene Islands and could well be expected on the Madagascar coast. Hartlaub[2] says its range includes Madagascar and Stejneger[3] records one specimen.

Larus dominicanus Lichtenstein

Southern Black-backed Gull

DISTRIBUTION.—This gull was fairly common along the coast of the Subdesert from the vicinity of Lac Tsimanampetsotsa south to Androka. It was present in fair numbers on Lac Tsimanampetsotsa.

HABITS.—The black-backed gull was usually seen in pairs, sitting on the sandy beach. Occasionally it was seen in small parties. The birds seen on Lac Tsimanampetsotsa were sitting out in the lake. As my porters appeared, a few birds rose and circled about overhead, apparently out of curiosity, giving me an opportunity to collect my first specimen.

Extreme dates: earliest, February 12, 1930; latest, March 4, 1930. An immature-plumaged bird was seen at Androka, March 4, 1930.

Larus cirrocephalus Vieillot

Gray-headed Gull

DISTRIBUTION.—This gull was found only at two localities, Lac Alaotra (750 meters), May and June, 1929, and Lac Iotry (nearly sea level), November and December, 1929. At Lac Iotry it was fairly common, usually seen moving about over the lake in parties of three to six or so.

***Catharacta antarctica intercedens** Mathews

Kerguelen Skua

Hartlaub[4] speaks of a specimen in Paris, which was collected by Bernier and according to Schlegel and Pollen[5] this bird was not uncommon on the Madagascar coast.

[1] See also Lavauden, 1929, Journal für Ornithologie, p. 234.
[2] 1877, 'Die Vögel Madagascars,' pp. 369, 370.
[3] 1881, Nyt. Mag. Natur., Christiania, p. 11.
[4] 1877, 'Die Vögel Madagascars,' p. 380.
[5] 1868, 'Recherches sur la Faune de Madagascar, etc.,' p. 145.

***Stercorarius parasiticus** (Linnaeus)
Richardson's Skua

Grandidier[1] records this species for Madagascar while Sclater[2] gives it as moving south in winter to the west coast of Africa; evidently only of casual occurrence.

Hydroprogne caspia (Pallas)
Caspian Tern

DISTRIBUTION.—Found on the coast of the Northern and Western Savanna; at Vohemar several Caspian terns were seen about open pools in a rather extensive marsh on September 26, 1930. West of Mt. d'Ambre, six or eight were seen along the sand bars on the coast on November 5, 1930. In the Bay of Baly (Soalala) about ten birds were seen on February 1, 1931.

Chlidonias leucopareia sclateri Mathews and Iredale
South African Whiskered Tern

Found only on Lac Alaotra, where M. Delacour records it as fairly common.

Chlidonias leucoptera (Temminck)
White-winged Black Tern

Messrs. Delacour and Lowe collected three of these migrants on Lac Alaotra in May, 1929. (First record for Madagascar.)

Sterna bengalensis par (Mathews and Iredale)
Arabian Lesser Crested Tern

DISTRIBUTION.—This tern was found along the coasts of the Occidental and the Subdesert. A flock of terns seen on the breakwater at Tamatave was probably of this species. This crested tern was by far the commonest tern in Madagascar. Near Itampolo (southwest) a flock of at least a thousand was seen sitting on the beach. About Nossi Be they were very common over the whole bay between the island and the mainland. At high tide they used to sit on some exposed bit of beach or on the mangrove trees lining the bay. At Anorontsanga, January 7 to 12, 1931, where the falling tide exposed extensive flats, from four to five thousand and perhaps more of these terns were often seen. Little flocks of *Sterna hirundo* and *Sterna b. bergii* were often

[1] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 644.
[2] 1924, 'Systema Avium Aethiopicarum,' p. 147.

mixed with them. Of fifteen hundred birds that I identified, I estimated that the following proportions of the different species were present: One thousand *Sterna bengalensis par*, four hundred *Sterna hirundo*, and one hundred *Sterna b. bergii*.

While at Andampy, one day east of Maromandia, on the night of January 24, 1931, we experienced a severe wind storm from the northwest that blew houses flat in the village, blew many trees down and broke off the tops of others. One trail that I was accustomed to follow along a ridge through the forest was almost completely filled with fallen trees and branches. The next morning terns were noted passing, coming from the southeast, over the forested mountains, and continuing in the direction of Nossi Be. This flight lasted until noon, the birds passing in small flocks. Du Mont estimated the number that he saw at two hundred and fifty, while I saw about forty. These birds had evidently been blown in by the gale the night before and were returning to the locality from which they started, assuming that they were blown directly down wind, rather than the shorter direct route to the sea which was to the west.

NATIVE NAME.—"Samby," a general name for terns. As this species is the most common, the name is usually applied to it.

Sterna hirundo Linnaeus

Common Tern

DISTRIBUTION.—On the coast of the Occidental this tern was found at Ampasimena (opposite Nossi Be) and at Anorontsanga. These birds were seen in company with *Sterna bengalensis par*, usually sitting on sandy beaches. The greatest number seen in one day at Anorontsanga was four hundred, and probably many times that number were present, for the four hundred counted were members of a flock of fifteen hundred identified terns. In all there must have been six to seven thousand terns on the beach, so that if the percentage remained the same, there would have been present at least sixteen hundred of this species. A migrant; extreme dates: earliest, December 27, 1930; latest, January 12, 1931. (First record for Madagascar.)

Sterna dougallii arideensis Mathews

Seychelles Roseate Tern

DISTRIBUTION.—The roseate tern was found only on the coast of the Northern Savanna, one day north of Vohemar, where on September 24 and 25, 1930, a flock of perhaps two hundred birds was seen resting on the mud flats left by the tide.

Sterna bergii bergii Lichtenstein
Mascarene Swift Tern

DISTRIBUTION.—This tern was fairly common along the coasts of the Occidental and the Subdesert. The bird was rarely seen in large numbers. Sometimes flocks of twenty or thirty were seen, but usually it was in smaller numbers in company with the much commoner *Sterna bengalensis par.* At Anorontsanga, where the tide left extensive mud flats exposed, and *Sterna bengalensis par* was very common and *Sterna hirundo* was fairly common, we would see perhaps a hundred Mascarene swift terns in a morning.

Though this tern sometimes was seen sitting on the open beach, it favored the margins of the little inlets and bays for resting places, where it sat on the sand by the water; or a mangrove-bordered bay, where it perched on some tree until the tide had fallen enough to expose the sand bars.

Sterna albifrons saundersi Hume
Indian Little Tern

DISTRIBUTION.—We found the Indian little tern on the coast of the Occidental and the Subdesert. At Ambiky a few were seen flying about over the bay. Twice Du Mont saw a flock of thirty or so on a sand bar exposed by the tide. Du Mont observed individuals on April 4, 1930, at Tulear.

***Sterna fuscata** Linnaeus
Sooty Tern

There is but a single specimen recorded for Madagascar, one taken in the east near Rogez by Lavauden,[1] though Grandidier[2] says that it frequents the Madagascar coast.

Sterna anaethetus antarctica Lesson
Mascarene Bridled Tern

DISTRIBUTION.—Found on the coast of the Occidental; a flock of some twenty or thirty Mascarene bridled terns was seen halfway between Nossi Be and Ampasimena, December 26, 1930. They were flying about feeding or perched on floating pieces of driftwood. Two were secured from this flock.

As I left Madagascar on May 15, 1931, halfway between Madagascar and the Comoro islands, I saw about ten dark-backed terns, possibly of this species, singly or in two's or three's flying in a southeast direction.

[1] 1932, Bull. Mus. Paris, p. 630.
[2] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 660.

On May 16, 1931, off Grand Comoro, a flock of thirty or forty terns probably of this species was seen, accompanied by sixteen frigate birds.

***Gygis alba monte** Mathews

Indian Ocean White Tern

The Indian Ocean white tern inhabits the Western Indian Ocean, breeding at the Seychelles and possibly other Mascarene islands[1] so it is not surprising to find it recorded from Madagascar by Hartlaub[2] and Grandidier[3] gives it as not rare about Madagascar.

***Anous stolidus rousseaui** Hartlaub

Mascarene Noddy

The Mascarene noddy was described from Madagascar,[4] and Grandidier[5] lists it as common in the vicinity.

***Megalopterus tenuirostris tenuirostris** (Temminck)

Seychelles White-capped Noddy

This white-capped noddy is not rare in Madagascar seas according to Grandidier,[6] and Sclater[7] gives its range as the Western Indian Ocean and coasts of Madagascar.

Phaëthon lepturus lepturus Lacépède and Daudin

Indian Ocean White-tailed Tropic Bird

This tropic bird breeds on the Seychelles and Mauritius, occasionally reaching the Natal coast,[8] so it would be expected off the Madagascar coast. Delacour[9] records one coming aboard the steamer a short distance from Majunga.

***Phaëthon rubricauda rubricauda** Boddaert

Red-tailed Tropic Bird

Not rare about Madagascar according to Grandidier,[10] who killed one near Fort Dauphin. Roche and Newton[11] saw one near Tamatave.

***Phaëthon aethereus** Linnaeus

Red-billed Tropic Bird

The red-billed tropic bird has been recorded near the Bay of

[1] Sclater, 1924, 'Systema Avium Aethiopicarum,' p. 154.
[2] 1877, 'Die Vögel Madagascars,' p. 389.
[3] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 661.
[4] Hartlaub, 1861, Orn. Beitr. Faun. Madag., p. 86.
[5] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 664.
[6] 1879, Idem, p. 665.
[7] 1924, 'Systema Avium Aethiopicarum,' p. 155.
[8] Sclater, 1924, 'Systema Avium Aethiopicarum,' p. 18.
[9] 1930, L'Oiseau et R. F. O., p. 179.
[10] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 699.
[11] 1863, Ibis, p. 175.

Pasandava by Grandidier[1] and seen by E. Newton[2] on the east coast.

***Sula sula sula** (Linnaeus)

Red-footed Booby

Delacour[3] gives this as having been recorded with certainty from Madagascar, while Grandidier[4] records it as fairly common about Madagascar. Dr. Murphy tells me that in his opinion *Sula nicolli* Grant and Mackworth-Praed[5] is only a phase of plumage of *Sula sula.*

***Sula leucogaster** (Boddaert)

Brown Booby

The brown booby is listed by Delacour[3] as having been positively recorded from Madagascar.

Phalacrocorax africanus pictilis Bangs

Madagascar Long-tailed Cormorant

DISTRIBUTION.—From sea level to 1500 m.; in all the biotic areas except Mt. d'Ambre.

In the Humid East the cormorant was often seen along the small rivers and ponds; at Lac Alaotra Delacour records these birds as very wild; one was seen on a large marsh near Tananarive. A few were seen along the streams in the Northern Savanna. In the Sambirano a few were seen daily on the Ramena River or perched on the trees along its banks, and on two occasions one was seen flying over the bay at Ambiky (opposite Nossi Be), possibly carried into the bay at low tide by the river. About a little marsh barely a hundred yards across near Anorontsanga these birds were common and had evidently bred there, as ten to twenty immature birds were seen flying about the marsh and perching in the trees each time the marsh was visited.

In the Western Savanna, on Lac Kinkony, they were less common than the anhingas. Ten or more cormorants were seen each morning, where we saw twenty-five anhingas. This bird, like the anhingas, preferred the bay filled with floating vegetation at the head of the arm of the lake at Antseza rather than the open lake. They were also common, though less so than anhingas, on Lac Amparikely and in the flooded palm-plains near-by at Ambararatabe. Delacour found cormorants more common on the Manambolo River near Bekopaka than on Lac

[1] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 696.
[2] 1863, Ibis, p. 175.
[3] 1932, L'Oiseau et R. F. O., p. 86.
[4] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 696.
[5] 1933, Bull. Brit. Ornith. Club, LIII, p. 118.

Alaotra. One was seen on a little stream at Tabiky, and at Lac Iotry they were common, perching on the dead limbs standing in the marsh at the head of the lake, though here anhingas were rare. In the Subdesert a few were seen while I was descending the Onilahy River from Tongohory to the sea.

Of six stomachs examined: five contained fish from 3 to 5 inches long; one, a crayfish; one, a frog and a long, slender lizard. The breeding season probably extends at least from August to November, as the following data indicate.

August 7, 1930	Female, ready to lay	Antalaha, two days northwest Tabiky
November 1, 1929	Three young birds one-third grown, brought in by a native	
November 6, 1930	Female, ovary enlarged	Fifteen miles southwest of Tsarakibany
December 13, 1929	Male, testes enlarged	Lac Iotry
January 11, 1931	Full-grown young flying about	Anorontsanga

The iris of the adult non-breeding bird is light reddish-brown, that of the breeding bird is vivid red.

NATIVE NAMES.—This bird was known by a variety of names, as "Rangamanara" in the southeast by the Atamoor and Bara; "Kótonboay" (crocodile boy) in the northeast by the Betsimisaraka and Tsimihety; "Fangalamotambóay" (the one who cleans the crocodile's eyes) by the Sakalava in the west and "Vodumbóay" (the crocodile's wife) by the Antakara and Betsimisaraka.

Anhinga rufa vulsini Bangs

Madagascar Snake-bird

DISTRIBUTION.—From sea level to 1200 m.; we found this species in the Humid East and the Sambirano districts of the Oriental, and in the Occidental.

In the Humid East a few anhingas were seen perched on dead stubs drying their wings along the brush-lined river near Ivohibe. Delacour found it at Lac Alaotra, where it was shy. In the Northern Savanna one was seen perched above a quiet pool on the edge of a river about 35 km. northwest of Vohemar. In the Sambirano a few were seen along the Ramena River. These birds were commonest in the Western Savanna. At Lac Kinkony they were common, twenty-five being seen in a morning, and sometimes four or five were perched on one tree. They were not at all wary, one could paddle to within easy range of them while they were feeding or where they were perched in trees or on the fronds of the palms that now stood in the water. Often when I rounded a

point in the pirogue, I would see a bird sitting on a mound of vegetation in the water or on the lake shore within a few yards of me. Rather than fly, they usually plunged into the water and disappeared. When perched in trees, where it was easy to secure a start, they usually flew away. Anhingas preferred the bay filled with floating vegetation to feed in, possibly because of the abundance there of fish on which they fed. This bird also was common on the marshy Lac Amparikely and in the flooded palm-valley at Ambararatabe.

At Soalala one was seen in the bay at low tide, though possibly it was in the fresh water carried down by the river. Delacour records the anhinga as more common on the Manambolo near Bekopaka than at Lac Alaotra.

At Lac Iotry occasional anhingas, along with cormorants, were seen perched on the bushes standing in the water. They were always very wary here. These birds probably breed in March at least, for at Lac Kinkony on March 23, 1931, one female was collected with the ovary enlarged.

The specimens which I examined had fish, sometimes of a surprising size, in their stomachs, while Delacour, near Bekopaka, found the stomachs of anhingas filled with seeds of water lilies.

NATIVE NAME.—The natives did not distinguish between this bird and the cormorant, applying the same names to both.

Fregata ariel iredalei Mathews

Mascarene Lesser Frigate Bird

DISTRIBUTION.—The only two frigate birds collected (near Nossi Be, December 8, 1930) were of this species. Frigate birds (sp.?) were often seen in the vicinity of Nossi Be and as far south as Analalava, December, 1930 and January, 1931. Three were seen from the mail steamer off Antalaha, April 25, 1929; a flock of sixteen were seen May 15, 1931, when approaching the Comoro Islands, after leaving Madagascar.

HABITS.—About Nossi Be, the frigate birds were usually seen sailing high in the air. On one occasion two were with a flock of terns (*Sterna bengalensis par*) and at another time, four were seen with a flock of terns (*Sterna b. bergii*). Their method of feeding was to wait until some of the numerous terns located a school of fish, and when a tern captured a fish the frigate bird attempted to frighten it into dropping its prey. Two frigate birds sometimes united in chasing one tern. Of the stomachs of the two that were collected, one was empty and the other contained three fish five inches long.

NATIVE NAME.—This bird was well known to the Sakalava in the northwest who called it "Monañdry."

***Fregata minor aldabrensis** Mathews
Aldabra Frigate Bird

This bird inhabits the Western Indian Ocean and is given by Grandidier[1] as not rare in Madagascar seas.

Ardea purpurea madagascariensis van Oort
Madagascar Purple Heron

DISTRIBUTION.—From sea level to 1800 m.; we found the Madagascar purple heron fairly common in all the biotic districts except Mt. d'Ambre.

HABITS.—The purple heron fed along the sandy and muddy edges of the rivers and ponds, in the marshes, on the shores of swamps, and in the swamp rice fields. It was often seen standing on the floating vegetation in the larger marshes, where the water reached nearly to its belly. It was occasionally found in the dry grassy country some distance from water. In the Humid East the purple heron followed the little marshes and the swamp rice fields into the clearings in the forest. Few birds of this species were found on the coast, and when found they were usually in the muddy bays and about the mouths of rivers.

As one would expect, their food was rather varied. Of five stomachs examined, one contained a water beetle two inches long and a locust; one contained a rodent (*Mus musculus*); one, a rodent (*Mus musculus*), a frog, and an aquatic insect; one, three lizards; and another, a fish, a frog, and a lizard.

The breeding season probably includes the months of June, July, October, and December at least, as the following data indicate.

June 8, 9, 1929	Two females, laying	Andreba (Lac Alaotra)
July 27, 1929	Nest in construction	Ivohibe
October 1, 1929	Female, ovary enlarged	Manombo (southeast)
December 14, 1929	Female, breeding	Iotry

Near Ivohibe in a patch of trees in open country near a swamp I shot a male with testes greatly enlarged, July 27, 1929. The bird was standing on a partly completed nest about twenty feet up in a tree. The nest was a bulky structure of sticks. Another bird, presumably the female, was seen July 31, 1929, at the nest to which many sticks had been added.

NATIVE NAME.—This heron was called "Rangóra" in the southwest by the Bara and the Atamoor, and "Langáraka" in the west by the Sakalava, though these were rather general names used for large dark herons.

[1] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 706.

Ardea cinerea johannae Gmelin

Comoro Gray Heron

DISTRIBUTION.—Found only in the Occidental and Subdesert, on the lakes, along the large rivers and along the coast. In the Occidental one was seen on the coast in a muddy mangrove-lined bay to the west of Mt. d'Ambre. In the similar mangrove-bordered bays opposite Nossi Be and south to Anorontsanga, they were common, five to ten being seen in a day. A few were seen along the sandy beaches but they were less common there. A few were seen along the Betsiboka river. At Lac Kinkony several were seen daily, standing along the lake shores or on the masses of floating vegetation. A few were seen in the Bay of Baly (Soalala). Delacour found it on the Manambolo River near Bekopaka. At Lac Iotry a few were seen standing along the shallow lake shore, and from Manombo (southwest) south to Androka occasional birds were noted on the sandy beach, on the shallow coral reef, and in the few muddy bays. An occasional bird was noted on the sand bars on the low reaches of the Onilahy river.

HABITS.—At Ambiky, opposite Nossi Be, this bird perched in the mangrove trees at high tide, sometimes three in one tree, but when they were fishing they were solitary. The fish weirs, set so that the falling tide left the fish stranded behind them, were favorite fishing places. The gray herons' long legs allowed them to fish in these weirs before the tide had fallen sufficiently for the natives to arrive and collect the fish. When fishing in the open water they stalk slowly along, the neck extended and the head up, watching sharply for their prey. None was seen feeding away from the water.

Four stomachs examined contained nothing but fish, from eight to twelve inches long.

NATIVE NAME.—This gray heron was known as "Vána," a name also used for other large dark herons.

***Ardea goliath** Cretzschmar

Goliath Heron

This African species is recorded as not common in Madagascar by Grandidier.[1]

Ardea humbloti Milne-Edwards and Grandidier

Madagascar Heron

DISTRIBUTION.—Found only in the Occidental Province; on Lac Iotry and Lac Kinkony and on the coast opposite Nossi Be.

[1] 1879, 'Hist. Nat. Madag., Oiseaux,' p. 542.

HABITS.—In the muddy mangrove-lined bay at Ambiky, opposite Nossi Be, three or four Madagascar herons were seen daily, stalking about on the mud flats or in the shallow water or feeding in the fish weirs. At Lac Kinkony only a few were seen about the marshy arms of the lake at Antseza, standing in the shallow water on the lake shore or on masses of floating vegetation. At Lac Iotry, four of these birds were seen about the marshy part of the lake during our stay there. None of these herons was seen feeding away from water and the stomachs examined all contained rather large fish.

The breeding season probably includes at least the month of December, as the following data indicate.

December 8, 1929	Two females, ovaries enlarged	Lac Iotry
December 4, 1930	One female, ovary enlarged	Ambiky

NATIVE NAME.—The natives did not distinguish between this heron and *Ardea c. johannae.*

Egretta alba melanorhynchos (Wagler)
African Great White Egret

DISTRIBUTION.—From sea level to 800 m.; found in the Humid East, the Western Savanna, and the Subdesert. In the Humid East one of these birds was seen in a small marsh near Vondrozo, and Delacour found it rare at Lac Alaotra. In the Western Savanna it was not common: a very few were seen about the marshy portions of Lac Kinkony; two were seen in the flooded palm-plains at Ambararatabe; at Soalala one was found about a marsh just back of a mangrove swamp on the coast; at Lac Iotry this bird was fairly common along the marshy lake shores and on the floating masses of vegetation. In the Subdesert one was collected at the mouth of the Onilahy river (Bay of St. Augustin).

HABITS.—Three stomachs examined contained fish from five to ten inches long. The breeding season includes the month of December at least, as the following datum indicates.

December, 1929	Several birds, with gonads enlarged	Lac Iotry

Egretta dimorpha[1] Hartert
Mascarene Reef Heron

DISTFIBUTION.—From sea level to about 1000 m.; found in all the biotic districts except Mt. d'Ambre. In the Humid East it was common in the swamps and flooded rice fields from near the coast inland to

[1] Grant and Mackworth-Praed consider this a subspecies of *Egretta garzetta*, see 1933, Bull. Brit. Ornith. Club, LIII, pp. 189–194, 245–246; but see also Steinbacher, 1936, Orn. Monatsber., pp. 19–22.

Ivohibe, following the rice fields in to the clearings in the forest as well as in the more open ground. Two were seen between Ambalavao and Ihosy. Delacour found it at Lac Alaotra. None was seen on the coast of this district. In the Occidental this bird was common along the coast, especially in the muddy, mangrove-lined bays. In the bay at Ambiky, opposite Nossi Be, twenty or more were seen in a morning. They were also found along the sandy margins of the rivers and in some of the marshes, but few were seen in the extensive marshes at Lac Kinkony and none at Lac Iotry. In the Subdesert, the reef heron occurred commonly along the sandy coast and along the margins and sand bars of the Onilahy and Menarandra rivers. One was seen on a little pond at Ampotaka.

Though the dark and the light phases of this bird often occurred side by side, one or the other often predominated or appeared exclusively. Thus in the southeast, where it was common, not a white bird was seen. In the northern part of the island, the two phases were present, although at Ambiky, where twenty or more were noted in a morning, not a white bird was seen; at Ampasimena, but a short distance south, a few in the white phase were found. At Namoroka and at Ambararatabe, few dark-colored birds were seen, as was the case farther south.

HABITS.—This bird usually fed in the shallow water of the marshes or the edges of the rivers, or in the edge of the sea, walking about quickly or running to catch some prey it had sighted. If often fed in the little pools left by the tide, running from one to the other. At Ambiky and Ampasimena sometimes as many as eight of these birds would be perched in the mangroves waiting for the tide to fall.

One that I watched feeding in the shallow water of the Bay of Baly (Soalala), February 25, 1931, stalked about rather rapidly, neck fully extended, until it sighted some small fish. Then it would crouch down, body level with the water, neck drawn in, and slowly stalk its prey. Within range of the prey it had sighted, its head would snap forward, and if successful in capturing the fish, the bird came flying in to the beach, perhaps ten meters away, where it swallowed the fish. Once it dropped a fish onto the sand, but siezed it before it could slip away into the water. Occasionally, if it had caught a small fish, it swallowed it where it stood without coming to land.

Of fifteen stomachs examined, eight contained fish; four, cray fish; and one, aquatic insects. Two birds had earthworms in their gullets, probably for feeding young birds.

The breeding season apparently extends from July to January as the following data indicate.

July 26, 1929	Male, testes enlarged	Vondrozo
August 15, 1929	Male, testes enlarged	Ivohibe
September 14, 1929	Male and female in breeding condition	Ivohibe, one day north
September 22, 1929	Male, testes enlarged	Farafangana
September 19, 1930	Female, ovary enlarged	Vohemar
December 3, 1930	Female, laying	Ambiky
January 11, 1931	Nest with young	Anorontsanga
March 4, 1931	Nest with young	Namoroka

At Anorontsanga there was apparently a nesting colony in a little swamp barely one hundred yards across, about a mile from the coast. The swamp was in a little valley. It consisted of a tangle of bushes, three to six meters high, growing in standing water with here and there open pools. The water was deep and the presence of crocodiles, one of which seized a cormorant which I had shot, made it advisable to climb from tree to tree in exploring the swamp, thus limiting our activities. *Bubulcus i. ibis* had nested in abundance here, and there were many young about in the trees. *Threskiornis a. bernieri* and *Anastomus l. madagascariensis* were also nesting in the swamp and *Phalacrocorax a. pictilis* had nested here, for many well-grown young were flying about. On January 11, 1931, some eight or ten reef herons, all in the dark phase, were making regular trips to and from the swamp, apparently feeding young, but only one nest was found.

The nest was a scanty platform of sticks, about 500 mm. across, placed on the flat crotch of a tree, well sheltered among the twigs and leaves, about two meters above the water. One half-grown young was standing on the nest and another, considerably larger, was perched on the branches near-by. Both were in the dark gray plumage. I had visited this swamp the day before and had seen a dark bird feed the young at this spot. As all the other birds seen were in dark plumage (though on the coast they were half white and half dark), it is probable that both parents were dark in this case.

The day before, when I had watched the swamp for some time and shot a number of birds, the reef herons had circled about, lighting, and then continued their flights for food. This day, at the first shot when I secured a *Melanophoyx ardesiaca*, the reef herons at once left the swamp and were very slow to resume feeding.

At Namoroka, March 4, 1931, the natives showed me a nest of this species. It was in savanna country, in a tree in a small pond which was thickly grown with trees and bushes except in the center. These

ponds in the dry season would undoubtedly be much smaller and bushes and trees would then be growing on the banks of a small pond. The nest was about two meters above the water. It was a flat structure of sticks. Three well-grown young, all in white plumage, were standing on branches near-by. One old bird, then another, both in white phase, came to the nest. From my poor vantage point I could not see whether or not both birds fed, but certainly one of them did. They left together. Several times at ten to fifteen minute intervals a single white bird returned to the nest and fed the young. I collected one adult bird and waited for its mate. A bird in the gray phase came and sat near-by but paid no attention to the young begging for food. Shortly after, the male came in to feed the young, and I collected it. The day before the natives had brought me two young birds in white plumage that had been taken from a nest near here.

The young were being fed largely on earthworms, with a few other fossorial "grubs." In both lots of young, the nestling down, an abundance of which was still clinging to the feathers, was whitish.

In these two cases both parents were of the same color phase: in the first case, gray; in the second, white; and the young resembled their parents. In the large series collected and in the much larger number seen, the intergrades were very few, and a special effort was made to secure these specimens. In each case but a few feathers were the color of the other phase. In general habits however the two phases are the same and birds of both color phases were often found together.

NATIVE NAME.—The reef heron was usually confused with other species of heron. The Antakara at Vohemar called the gray phase "Vana," a name used for the gray heron; the Sakalava at Namoroka called the bird in the white phase "Kilandrybé" (meaning the large cattle heron), a name also used for *Egretta alba melanorhynchos.*

Melanophoyx ardesiaca (Wagler)

Black Heron

DISTRIBUTION.—From sea level to 750 m. This was one of the few birds whose range did not correlate with the faunal areas which I have outlined. We found this species in the northern part of the Humid East, the Northern Savanna and the northern part of the Western Savanna. In the northern part of the Humid East it was fairly common at Lac Alaotra. At Maroantsetra five were seen about the flooded rice fields. In the Northern Savanna severa lwere seen about an extensive marsh and a flock of five on a sand and bar in a river near Vohemar, later flying up

to perch on a dead tree; several were seen about the flooded valleys in the palm-plains near Ambilobe and in the marshes south of Anaborana. Two were seen about a little marshy pond and swamp near Anorontsanga and the species was fairly common in some of the flooded valleys and rice fields near Lac Kinkony where flocks of ten to fifteen were sometimes seen; a specimen was secured at Namoroka.

Near Marovoay, April 4, 1931, I had an opportunity to watch one of these birds feeding in the shallow water of a flooded rice field. It was shortly before dark and the bird was feeding actively. It would take a few rapid steps, apparently to overtake prey it had sighted, then spread it wings, bringing them forward until they met, and with the tips of the quills in the water. The head was in the canopy formed by the wings and I could see the movements of the body as the bird apparently caught the fish bewildered by the darkness. Several times the bird raised its head from between its wings, ruffling its crest in so doing, to look about for possible danger, then ducked its head back into the shelter of its wings. Apparently it overtakes its prey and by making a canopy of its wings confuses them so that they are more easily caught. That its method was successful I found on collecting the bird and examining its stomach and gullet, which contained twelve fish from 15 to 30 mm. long.

NATIVE NAME.—"Lómba cómba" (one who eats under cover), among the Sakalava, Antakara, and Betsimisaraka.

Bubulcus ibis ibis (Linnaeus)

Buff-backed Heron

DISTRIBUTION.—From sea level to 1800 m., in all the biotic provinces. This species was widespread over the open ground of the whole island, particularly in the vicinity of water, following the little clearings into the forest of the Oriental and also roaming over dry plains in the Occidental and Subdesert.

HABITS.—In the Humid East this bird frequented the swamp rice fields and here was less often seen in the grassy country. The work of natives in clearing land and planting rice fields has probably resulted in this bird becoming much more common than it was formerly. Particularly on the western plains, these birds followed the cattle, but were often seen in flocks by themselves moving across the plains or through the dry corn fields of the Subdesert. The flocks were continually milling, the rearmost birds flying to the front so that the flock was always moving.

The flights of these birds to their roosting places, where they spend the night perched in the reeds in some marsh or in trees by the marsh, is a sight that never fails to stir the beholder. At Befandriana, perhaps 1500 congregated in one marsh, perching on reeds, coming in at dusk in flocks of from ten to thirty. One of the most beautiful flights was that up the Vohemar River near Maroantsetra, just before dark. Flock after flock passed up stream, the beautiful white birds low over the dark water, the wooded banks indistinct in the gathering darkness, and here and there raphia or coconut palms silhouetted against the sky. Near Iotry on the high plateau, some five hundred birds were seen just at dawn, perched on the reeds in a little swamp on the wide plain. While motoring at twenty-five miles an hour on the plateau we easily passed an alarmed bird, which was flying parallel to the road.

Flocks of these birds were seen feeding on swarms of locusts at Ivohibe. Of three stomachs examined from elsewhere, one contained several frogs, 12 mm. long, several spiders, 50 mm. long, and some grasshoppers; the second contained eight spiders and a caterpillar; and the third contained three frogs, 38 mm. long, and some spiders and grasshoppers.

The breeding season includes at least the month of November, as the following data indicate.

November 28, 1929	Male and female, gonads enlarged	Iotry
December 12, 1929	Female in breeding condition	Iotry
January 11, 1931	Many young half grown	Anorontsanga

At Anorontsanga, January 11, 1931, a number of these birds had nested in the trees in the little swamp mentioned under *Egretta dimorpha*. Numerous old nests, probably of this species, were about 380 mm. across, placed in convenient crotches, from two to five meters above the water. They were rather flat platforms of sticks. Perhaps fifty young in various stages of development were seen climbing about in branches and numerous adults were making regular trips to and from the swamp.

NATIVE NAME.—The buff-backed heron was called "Vorokotsy" by the Bara and Atamoor, and "Kilandry" by the Antakara and Sakalava.

Ardeola idae (Hartlaub)

Madagascar Squacco Heron

DISTRIBUTION.—Breeds in Madagascar, migrating to Africa. Chapin[1] gives it as occurring in Africa from May to October. At first

[1] 1932, Bull. Amer. Mus., LXV, p. 350.

I did not distinguish between this species and *A. ralloides*, so that notes on the abundance of this species in the east must be taken from the number of skins which we collected. Delacour[1] says that it was common in the west and on the plateau, and less so in the east. In the Subdesert one was found about a little muddy pond at Ampotaka where it flew up and perched in the trees when alarmed. This bird was common along the Onilahy River from Tongohory to its mouth, where it was usually seen perched on the tall grasses along the banks or on some stick. In the Occidental none was seen at Lac Iotry though *A. ralloides* was very common. At Tabiky where no *A. ralloides* was found, this bird was fairly common about the little grassy marshes and occasionally birds were found walking along the little wooded streams through the limestone, flying up to perch in the trees when alarmed. Near Ambilobe, however, both birds were found about the same little ponds in the flooded palm-plains. No concentration of these birds was seen such as was observed with *A. ralloides*.

One stomach examined contained nine frogs from 25 to 38 mm. long and a mass of bones from other partly digested frogs.

NATIVE NAMES.—Both this bird and *A. ralloides* were called "Kéhofótsy" (the white green heron), and "Voromalándry" (the white bird).

Ardeola ralloides (Scopoli)

Squacco Heron

DISTRIBUTION.—From sea level to 1800 m.; in the Oriental and Occidental. This species was not very common in the Humid East where it frequented the marshes and paddy fields, though it was fairly common about Tananarive. In the Occidental this bird was sometimes very common. In an extensive marsh near Vohemar and in that about Lac Iotry, from sixty to a hundred birds were seen in a morning, from six to eight birds being in an area a few yards square.

HABITS.—The squacco heron fed on the marshy shores or on the floating vegetation. When a bird wished to escape observation it crouched down, feathers closely drawn in, and its rusty yellow plumage rendered it quite inconspicuous; it flushed only on a close approach.

Of three stomachs examined, one contained four small fish; one, aquatic insects and a little vegetable matter; and another, nine fish from 50 to 75 mm. long and a mass of bones representing as many more.

The breeding season apparently includes the months of September, October, and December as the following data indicate.

[1] 1932, L'Oiseau et R. F. O., pp. 12, 13.

September, 1930	Birds in breeding condition	Vohemar
November, 1929	Birds in breeding condition	Lac Iotry
December, 1929	Birds in breeding condition	Lac Iotry

NATIVE NAME.—This bird was not distinguished from *A. idae*, the same names being applied to both.

Nycticorax nycticorax nycticorax (Linnaeus)

Night Heron

DISTRIBUTION.—From sea level to 1500 m.; we found this species commonly at only a few points, in the Oriental and the Occidental. The night heron was very common and was breeding in a marsh near Tananarive, perhaps two hundred birds being seen there on one visit to the marsh. Delacour found it at Lac Alaotra; a single specimen was seen on the Vohemar River near Maroantsetra. In the Northern Savanna a few were found about the grassy pools in the palm-plains near Ambilobe. In the Western Savanna it was common at Lac Iotry, where it usually was seen perched on the dead bushes in the marsh.

HABITS.—The breeding season apparently includes at least the months of December and May, as the following data indicate.

December, 1929	Several birds with gonads enlarged	Lac Iotry
May 3, 1929	Nest with eggs	Tananarive

The nest at Tananarive, May 3, 1929, was in a rather extensive marsh. Only one nest was found, though no extensive search was made for others. The nest was a rather scanty affair, placed on a mass of reeds about one and a half feet above the water, and contained two eggs. They were ovate in shape; the shell, was slightly chalky, the paler egg more so than the other. The color was light bluish green, one egg being paler than the other. The two eggs measure 49.0 × 36.0 mm. and 50.0 × 35.2 mm.

Butorides striatus rutenbergi (Hartlaub)

Madagascar Green Heron

DISTRIBUTION.—From sea level to 750 m. We found this species in all of the biotic provinces. In the Oriental it was found in the Humid East and the Sambirano, where it was common in the luxuriant vegetation along the streams and rivers, feeding out in the open marshes and swamp rice fields. It was less common in the Occidental and rather local, becoming rare farther south. In the Northern Savanna it was fairly common in the vegetation along the streams, feeding out on the bare sand bars in the rivers as it did in the Sambirano. At Ambiky, opposite Nossi Be, it was fairly common about the mangrove swamps and islets.

At Anorontsanga several were seen feeding on the mud flats left exposed by the falling tide. In the Western Savanna at Lac Kinkony, a single bird was secured in the tall grass on the lake shore. Delacour secured one along the Manambolo River near Bekopaka. None was found at Lac Iotry. In the Subdesert, one was seen in a mangrove swamp a short distance south of Tulear and another flew from one reed bed to another in the Bay of St. Augustin at the mouth of the Onilahy River.

HABITS.—The green heron fed out on the open muddy flats and sand bars, but it usually preferred the vicinity of masses of vegetation where it could fly for shelter. A common pose of the bird when in the open was with the body held nearly horizontal and the head drawn in close to the body, giving it a close resemblance to the end of a bit of drift wood.

Its usual call of alarm as it was startled into flight was a sudden "Keu," though it also had a harsh rattle.

One stomach examined contained aquatic insects.

The breeding season included the months of September and November at least, as the following data indicate.

September 22, 1929	Female, ovary enlarged	Farafangana
November 17, 1930	Male, testes enlarged	Anaborano

NATIVE NAME.—The green heron was called "Keho," from its call, by the Bara and the Atamoor; "Voropásika," meaning "bird of the sand," by the Betsimisaraka; and "Voromóty," meaning "dead bird," and Ambaramóty," meaning "dead reeds," by the Antakara and the Sakalava.

Ixobrychus minutus podiceps (Bonaparte)
Madagascar Little Bittern

DISTRIBUTION.—From sea level to 1000 m. We found this species in the Humid East, the Sambirano, and the Western Savanna. The only specimens seen were the eleven that were collected.

HABITS.—At Maroantsetra two were found in the thick growth of reeds along the sluggish river. At Andapa one was taken in the rather extensive grassy and reedy marsh. In the Sambirano three were taken at Bezona in the fringe of reeds along the river. In the Western Savanna, the specimen taken at Lac Kinkony was perched in the fringe of tall grasses along the lake shore, and at Lac Iotry the four birds found were flushed ahead of the pirogue as it was pushed through the scattered reeds and the rather dense floating vegetation in the extensive marsh at the head of the lake.

Of two stomachs examined, one contained a frog; the other, a frog three small crayfish, two spiders, and two grasshoppers.

The breeding season includes at least the months of November and December, as the following data indicate.

November 27, 1930	Female with egg in oviduct	Bezona
December 5, 1929	Two females, breeding	Iotry

Two specimens taken at Bezona, November 26, 1930, were nearly full grown but still had traces of pale buffy to whitish down clinging to the feathers of the back. The egg from the oviduct of a bird at Bezona. November 27, 1930, was whitish in color.

Platalea alba Scopoli

Spoonbill

DISTRIBUTION.—We found this species only in the Occidental Province. In the Northern Savanna the spoonbill was fairly common in the extensive marsh one day north of Vohemar, where ten were seen in a morning; two were seen flying over the palm-plain to the southwest of Mt. d'Ambre. In the Western Savanna it was fairly common at Namoroka where it was usually seen feeding in the flooded rice fields. Near Ambararatabe, on the edge of the Mahavavy River, several were found in the forest where the ground was wet and covered with sediment from the recent floods; and a few were seen sailing about high over the flooded palm-valley in company with open-billed storks. At Lac Iotry an occasional bird was seen in the extensive marsh at the head of the lake.

The contents of three stomachs are listed below: twenty small fish and six small crayfish, one large water beetle and many small crayfish, one large water beetle.

NATIVE NAME.—"Sótrotsóina" meaning "spoonbill" by the Antakara and Sakalava.

Plegadis falcinellus falcinellus (Linnaeus)

Glossy Ibis

DISTRIBUTION.—From sea level to 1500 m. We found this species in the Humid East, the Sambirano, the Northern and Western Savannas, and into the edge of the Subdesert. In the Humid East the glossy ibis was fairly common at Vondrozo (July), in the marshes and swamp rice fields and in the open ground. At Ihosy (August) it was also fairly common. At Tananarive (May) a flock of fifteen was observed over a rather extensive marsh. At Lac Alaotra (May and June) Delacour found them

abundant. In the Northern Savanna it was abundant about an extensive marsh one day north of Vohemar (September), where about six hundred were seen in a morning. This ibis was fairly common about the little grassy ponds in the palm-plain near Ambilobe (November). In the Western Savanna this bird was common in the pools in the cultivated fields near Ambiky (December), two flocks being seen over the bay there. From Namoroka to Soalala and at Narovoay (February and March) it was common in small flock sabout the flooded grassy valleys, the ponds, and flooded rice fields in the open savanna. Delacour found it along the Manambolo River near Bekopaka (July), and at Iotry (November and December) it was fairly common along the shores of the lake, usually in pairs or singly.

HABITS.—The breeding season may be prolonged over a large part of the year as the following data indicate.

May 29 to June 11, 1929	Several birds in breeding condition	Lac Alaotra
November 29, 1929	Female in breeding condition	Lac Iotry

NATIVE NAME.—The glossy ibis was called "Voromáinty" (meaning black bird) by the Atamoor; and "Renikato" by the Antakara.

Threskiornis aethiopicus bernieri (Bonaparte)

Sacred Ibis

DISTRIBUTION.—Found in the Occidental and the Subdesert, but little above sea level. In the Occidental, this ibis was common on the coast opposite Nossi Be, where it frequented the muddy bays and bars at Ambiky. From ten to fifteen of these birds were seen each morning there, usually in pairs. At Anorontsanga a few were seen perched in the trees about a little tree-grown swamp a mile or so inland, where they were breeding, and a few birds were seen on the coast feeding on the mud flats left by the falling tide. At Namoroka, the bird was fairly common about the muddy, flooded rice fields in the open savanna. On the Manambolo River near Bekopaka, Delacour found it in pairs and family parties along the muddy banks and sand bars; at Lac Iotry four were seen along the open marshy shores. In the Subdesert it was often seen feeding along the sand bars in the Menarandra River at Ampotaka.

HABITS.—In feeding, the bill was thrust into the mud up to the eyes. Eggs are probably laid in November at least as the following datum on the time of breeding indicates.

January 11, 1931	Two nests containing young about one-third grown	Anorontsanga

The two nests (January 11, 1931, Anorontsanga) were in a little swamp about a mile from the coast in a little valley. The swamp was barely a hundred yards across and was a tangle of bushes and low trees growing in standing water, with open pools here and there. (This was the same swamp in which *Egretta dimorpha* was nesting.)

The nests were two and three meters above the water in forks of trees. The nests were firm structures from 450 mm. to 500 across and 250 mm. deep, composed largely of twigs, some of which may have been taken from living trees as the leaves were still attached, though dry. The depression on the top was lined with leaves. Each nest contained two young, one somewhat larger than the other in each case. One old bird perched near-by and occasionally uttered a low gutteral note of protest.

NATIVE NAME.—This ibis was called "Voronósy" meaning "the bird of the island."

Lophotibis cristata cristata (Boddaert)

White-winged Ibis, Crested Wood Ibis

DISTRIBUTION.—From sea level to 1800 m.; in the forests of the Oriental and the Northern Savanna. This ibis was fairly common at all our camps in the heavy forest in the Oriental Province but especially so in the forest near the sea, 20 km. southwest of Maroantsetra. A single bird was seen in the Northern Savanna in the dry forest at Tsarakibany (15 miles southwest).

HABITS.—During the day this wood ibis was usually found in pairs, or more rarely singly, walking about on the forest floor. It was not restricted to damp places or the vicinity of little streams, but was found throughout the forest. The ibis was an inconspicuous bird on the ground but in flight the white wings were striking. When flushed, it often flew to a perch in a neighboring tree.

At Maroantsetra (20 km. southwest) in June, where these birds were common in the low flat forest near the sea, they began to be noisy at dusk. In the brilliant light of the moon two or three were sometimes seen to fly into one tree top, their white wings flashing conspicuously, and several birds were calling until 9:30 P.M., after which time all became quiet. At Vondrozo, one was occasionally heard calling from a wooded hillside in the early evening. At Anaborano (one day southeast) a bird was sometimes heard calling during the day. Their call was a loud, rather creaky "ack–ack– – –"

The breeding season probably includes at least the month of November, since on November 17, 1930, at Anaborano, a female with the

ovary enlarged was collected, and on January 2, 1931, a juvenile was taken at Marotony. The feet of the young birds are much paler than in the adult, the skin about the eye is grayish, and the eye is brown in the young bird, while in the adult the eye is dark red and the skin about the eye is red. Of thirteen stomachs examined, ten contained various insects, including beetles; one, a centipede; one, spiders; and three, earthworms.

NATIVE NAME.—Usually "Akoála" meaning "fowl of the forest," though the Betsimisaraka sometimes called this ibis "Akovohitra," meaning "fowl of the mountain." In the northeast I occasionally heard this bird called "Lanpirana," which was probably a Hova name.

Lophotibis cristata urschi Lavauden

Western White-winged Ibis or Crested Wood Ibis

DISTRIBUTION.—This western race of the white-winged ibis was found only in the Western Savanna, but in the northern part of its range it intergraded with the preceding, judging from one specimen taken at Soalala. Delacour found it at Bekopaka; at Tabiky it was common and often seen in the dry brush forest on the low hills, in the more densely wooded areas of the wooded plain, and along the little streams bordered by gallery forest through the limestone areas. Here it was often heard calling during the morning. A single bird was seen at Iotry, in the Subdesert brush on the sandy area, and another was brought in by the natives. The latter bird's stomach contained two 100 mm. lizards, one 250 mm. snake, and various insects.

HABITS.—The breeding season probably includes at least the month of November, since on November 2, 1929, a female ready to lay was taken at Tabiky.

NATIVE NAME.—"Akoála" meaning "fowl of the forest."

Scopus umbretta tenuirostris Rand[1]

Madagascar Hammerkop

DISTRIBUTION.—From sea level to 1800 m.; common about the shallow muddy ponds and flooded rice fields of the Humid East and the Occidental, even ranging into the little clearings in the forest; and one bird was observed about a little muddy pond in the Subdesert near Ampotaka.

In the Humid East this bird was common and conspicuous about the marshes on the central plateau, where the presence of rice fields af-

[1] 1935, Amer. Mus. Novitates, No. 827.

forded feeding places and the mimosa and blue gum trees planted along the roads furnished nesting sites. The clearing of the land on the eastern slopes, the destruction of the forest in the central plateau, and the subsequent forming of rice fields has probably resulted in an increase in this species in the Humid East, as it has with *Bubulcus i. ibis*. The planting of trees on the central plateau, thus furnishing nesting places for this species, probably also has increased their numbers in this otherwise treeless country. The bulky nests were a common sight along the roads, and were as striking as the odd appearance of the birds feeding in the paddy fields. In the southeast they were not very numerous but their conspicuousness and the fact that a pair, presumably the same birds, were found about the rice fields on the outskirts of a village day after day, made them seem rather common.

HABITS.—The bird was noisy in flight, continually called "Taket-taket - - -." It fed in shallow pools, preferably muddy ones, and in the flooded rice fields.

Of two stomachs examined, one contained several fish; the other, seven fish, 75 mm. long, and several small crayfish.

The nesting season includes at least the months of June, July, September, and November, as the following data indicate.

June 5, 1929	Nest in construction	Near Fianarantsoa
July 14, 1929	Female, laying	Vondrozo
August 25, 1929	Well-grown young taken from the nest	Ivohibe
September 17, 1929	Female, laying	Ivohibe
November 5, 1929	Nest in construction	Tabiky

The nest was the usual bulky affair, placed in a main fork of a tree; it was usually in an isolated tree or clump of trees, or in the fringe of trees along the road or in one leaning over a stream or a bit of marsh. Three old nests and one new one were seen in one tree in the open ground near a swamp near Ivohibe. One egg, removed from the oviduct of a bird, July 15, 1929, at Vondrozo, was ovate in shape, color white. It measures 45.9 × 34.9 mm.

NATIVE NAME.—Called "Tákatch" from its call.

Ibis ibis (Linnaeus)

Wood Ibis

DISTRIBUTION.—Found in the Occidental and the Subdesert. One wood ibis collected December 8, 1930, at Ambiky, was the only one seen there. One of these birds was brought in by a native at Ambararatabe, who said that it had been taken from the nest the year before and kept captive. A solitary bird was occasionally seen over the open pools in the

broad marshes at Lac Iotry. In the Subdesert an occasional solitary bird was seen along the sandy coast from Manombo to Tulear, and five of them were seen in the Bay of St. Augustin at the mouth of the Onilahy River.

Anastomus lamelligerus madagascariensis Milne-Edwards
Madagascar Open-bill

DISTRIBUTION.—From sea level to 1200 m.; we found the open-bill in the Humid East, the Occidental, and the Subdesert. In the Humid East one was seen at Ivohibe in a shallow, grassy swamp in the open ground and a few were seen flying about over the open ground at Manombo (southeast). Delacour found this bird fairly common at Lac Alaotra. In the Northern Savanna it was common about the grassy plains on the edge of an extensive marsh one day north of Vohemar and a few were seen in a grassy swamp near Anaborano. At Ambiky a dozen or so were seen in a damp grassy valley. In the Western Savanna this bird was common in damp grassy areas and at Anorontsanga they fed out on the flats left exposed by the falling tide. At Tabiky many were seen in the dry savanna country. At Lac Iotry they were common in grass country bordering the marsh. In the Subdesert a few were seen on the muddy areas at the mouth of the Onilahy River.

The open-bill was often seen in flocks of from ten to fifteen individuals, feeding on the ground or perched in some tree in the savanna. Birds were often seen soaring in circles high overhead. At Ambararatabe about twenty were seen in the air at one time soaring over the flooded cycad-plain. Several times I saw these feeding on the large land snails that were found in the damp grassy land.

The curiously shaped bill is used in extracting snails from their shells. One bird that I watched feeding at Anorontsanga, held the snail in its bill, the lower mandible within the shell, and in the body of the snail, the upper mandible on the outside of the shell, where the brush-like edge of the bill gives a good grip. By shaking its head it tore off a piece of snail as the snail shell slipped from its bill, and the process was repeated until the greater part of the snail had been extricated. The shell was not broken, though the edge of the shell was sometimes chipped and numerous empty shells about on the ground showed the same chipped edge. I did not see the bird beat the shell on the ground. Several times when flushed this bird lit in a tree, carrying a snail in its bill. Small shell fish, common on the muddy tidal flats, probably were eaten

in the same way by the birds feeding in those places, as the stomach contents indicated.

HABITS.—The breeding season probably includes the month of September and November at least, as the following data indicate.

September 1929	Two specimens, gonads enlarged	Manombo (southeast)
January 11, 1931	Two nests with young	Anorontsanga

The two nests at Anorontsanga, January 11, 1931, were in a swamp of tangled bushes and small trees growing in standing water in a little valley in the brush country (see *Egretta dimorpha* for a description of this swamp). One nest was four meters above the water on top of a bush, supported by twigs and small branches. It was a round structure about 750 mm. across and 450 mm. deep (outside). The other nest was on a raphia palm leaf that offered a horizontal surface. To fit this support, the nest was elongate and narrow, about 750 mm. long by 450 mm. wide and 250 mm. deep. Both nests were exposed to the full rays of the sun with no protecting vegetation above them. Both were composed of sticks, lined with grass, leaves, and plant stems, and were rather foul-smelling places.

One nest contained two young which were standing in the nest, bill drawn in close to the necks as in the adult. The other nest contained three young, two of which climbed from the nest at my approach.

NATIVE NAME.—"Famakacóra," meaning "snail axe."

Phoenicopterus ruber antiquorum Temminck
Greater Flamingo

DISTRIBUTION.—The only specimen secured was one at Lac Iotry. It was brought in by a native who said that he had captured it by swimming under water and seizing it by its feet.

Phoeniconaias minor (Geoffroy)
Lesser Flamingo

DISTRIBUTION.—Found in the Western Savanna and the Subdesert. At Lac Kinkony the natives knew the flamingo but said that it would not appear until the following month (April). At Lac Iotry it was very common but wary, seeking the shores remote from the villages. Often during the day or in the evening long lines of these beautiful pink birds were seen flying about high over the lake, or over the country to the west, uttering gooselike calls.

In the Subdesert it was common about the alkaline pools between Manombo and Tulear and a few were seen on Lac Tsimanampetsotsa.

NATIVE NAME.—Universally know as "Shamok" by the Masquer and Sakalava.

Sarkidiornis melanotos (Pennant)
Knob-billed Goose, Comb Duck

DISTRIBUTION.—From sea level to 1200 m.; this duck was found in the Humid East, Sambirano, Occidental, and the Subdesert. In the Humid East a few were secured at Ivohibe; at Lac Alaotra, it was not numerous. In the Northern Savanna a few were seen over an extensive marsh one day north of Vohemar. In the Sambirano, a few of these birds were seen about the flooded grassy pools in the open ground. In the Western Savanna it was tolerably common about the little pools in the savanna between Namoroka and Soalala. Only one was seen at Lac Kinkony though a few were seen in the near-by marshes, and on the sand bars in the Mahavavy River. Delacour found this species very abundant near Bekopaka. At Tabiky a few were seen in the marshy rice fields and at Lac Iotry it was not uncommon. In the Subdesert occasional flocks of three or four to twelve birds were seen resting on sand bars in the Onilahy and Menarandra Rivers.

HABITS.—These birds usually fed in small ponds or rice fields in open country and spent the greater part of their day resting on the sand bars in rivers or on the firm shore of some lake or pond. Birds shot at Lac Iotry had rice in their gullets though the nearest rice field was some four kilometers away. Near Lac Iotry a pair of these birds was often seen flying about over the wooded areas or perched in trees, uttering a harsh call resembling that of a raven. The natives said that this bird did some damage to the rice fields.

NATIVE NAME.—The native name, apparently taken from its call, is variously "Hóngóngo," "Angóngo," or "Tsinóngo."

Nettapus auritus (Boddaert)
Dwarf Goose

DISTRIBUTION.—From sea level to about 1200 m. The dwarf goose was found in the Humid East, the Sambirano, and the Northern and Western Savannas. In the Humid East a few were secured in the southeast; at Lac Alaotra it was not very abundant. In the Occidental it was a common bird of the open ponds and the floating vegetation of the lakes and marshes.

HABITS.—The dwarf goose is found usually in pairs or in small flocks. They are beautiful little birds, rather active, usually easily

approached, and they flush quickly with a short soft call, "quit–quit– –." They fly but a short distance, twisting and turning. When wounded they dive well. This bird, *Podiceps pelzelnii*, and *Thalassornis l. insularis* were the only common water birds over wide areas of floating vegetation on Lac Kinkony and Lac Iotry.

The breeding season probably includes at least the months of June and January, as the following data indicate.

January 8, 1931	Female laying	Anorontsanga
January 23, 1930	Male, testes enlarged	Majunga
June 4, 1929	Male, testes enlarged	Andreba
March 28, 1931	Male and female with three small young	Ambararatabe
March 22, 1931	Three small young	Lac Kinkony

The young were attended by both parents. They dived and swam very well under water.

NATIVE NAME.—This bird was called "Fiamboa" by the Sakalava about Lac Kinkony.

Dendrocygna viduata (Linnaeus)

White-faced Tree Duck

DISTRIBUTION.—From sea level to 1500 m.; found in the Humid East, the Occidental, and the Subdesert. This is the most common duck in Madagascar, widespread over the greater part of the island, frequenting the ponds, rivers, marshes, and lakes, especially where there are firm banks for them to sit and rest. There they spend much of their time. In the Occidental and the Subdesert, flocks of a hundred to five hundred were seen on the sand bars in the rivers and streams, often in company with a few *Sarkidiornis melanotos* and *Threskiornis a. bernieri*. At Tabiky small flocks were found resting by the remaining pools in the drying-up stream bed which ran through the brush forest and was bordered with richer gallery forest. They were very common at Lac Iotry where the less marshy shores were often lined with them. This duck was also found commonly about the little ponds on the open ground of the Humid East. At Manombo, flocks of from twenty to forty were often seen, flying low over the sea, parallel to the coast, sometimes a quarter of a mile out.

HABITS.—The breeding season probably includes at least the months of September, November, and January, as the following data indicate.

September 1, 1929	Male, testes enlarged	Ivohibe
September, 1929	Several specimens in breeding condition	Manombo (southwest)
November 22, 1929	Female, ready to lay	Befandriana

January 16, 1931	Flock of twelve downy young	Maromandia, one day east
January 20, 1931	A pair in breeding condition	Maromandia, one day east
March 27, 1931	Ten small downy young	Ambararatabe

NATIVE NAME.—This duck was usually called "Vívi" by the natives, but in the northwest it was called "Tsiríry" by the Betsimisaraka.

Dendrocygna fulva (Gmelin)

Fulvous Tree Duck

DISTRIBUTION.—Found only at one locality in the Humid East; Lac Alaotra (altitude 750 m.) and at one locality in the Western Savanna; Lac Iotry (near sea level). At Lac Alaotra Delacour records it nearly as common as *D. viduata*. At Lac Iotry it was common though less so than *D. viduata*.

HABITS.—At Lac Iotry this duck spent most of its time sitting on the edge of lake shore, in small parties or flocks, often in company with *D. viduata*.

The breeding season probably includes at least the months of November, December, and April, as the following data indicate.

November 30, 1929	Female, ready to lay	Lac Iotry
December, 1929	Many breeding specimens	Lac Iotry
May 29–June 11, 1929	Several females with young	Andreba (Lac Alaotra)

Anas melleri Sclater

Meller's Duck

DISTRIBUTION.—The Humid East; from sea level to 1800 m. Meller's duck was a tolerably common bird of the open ponds and sluggish streams of the open ground, the edge of the forest, and sometimes found on the larger and more quiet streams in the forest. It was often seen in the rice fields where the natives said that it did much damage to the crops. These ducks were usually seen in pairs or parties of three or four.

HABITS.—The breeding season probably includes at least the months of July and September, as the following data indicate.

July, 1929	Several birds in breeding condition	Vondrozo
September, 1929	Several birds in breeding condition	Ivohibe, one day north

NATIVE NAME.—Called "Haky" or "Haky-omby" in the southwest by the Bara and Atamoor.

Anas erythrorhyncha Gmelin

Red-bill

DISTRIBUTION.—From sea level to 1500 m.; occurring in all the biotic districts. In the Humid East this species was fairly common

about marshy ponds and streams, both in the open ground and in the edge of the forests. It was the only duck occurring on the little lakes on the summit of Mt. d'Ambre. In the Occidental it was fairly common about the little ponds in the savanna at Namoroka, but none was seen on the extensive marshes about Antseza on Lac Kinkony and it was only occasionally noted at Lac Iotry. In the Subdesert, flocks of ten to twenty were quite common on Lac Tsimanampetsotsa where the only other duck seen was one small flock of *D. viduata* that was flying over.

HABITS.—The red-bill does much damage to rice fields and the natives often put up "scarecrows" of tattered garments or bundles of grass to keep them away. In the well-settled districts of the Humid East this bird spends the day on quiet stretches of river or on sand bars and feeds during the night in the rice fields, though it stays in the morning until driven out by the natives.

One specimen, just moulting out of eclipse plumage and not yet able to fly, was taken September 1, 1929, near Ivohibe, while many other birds were in full wing.

Anas bernieri (Hartlaub)

Madagascar Teal

Two specimens were taken by M. Decary in the Western Savanna near Maintirano.

Anas punctata[1] Burchell

Hottentot Teal

DISTRIBUTIONS.—From sea level to about 1800 m. We found this species in the Humid East and the Western Savanna. In the Humid East, four were secured at Ivohibe, a country with rather extensive open marshes; at Lac Alaotra it was very common; one was secured a day west of Andapa, on the edge of the central highlands. In the Western Savanna an occasional bird was noted at Namoroka over the grassy pools in the savannas; at Bekopaka it was common. A few small flocks were seen flying over the reedy marsh at the head of Lac Iotry or in the little pools of open water among the reeds.

HABITS.—Delacour found this bird rather abundant and tame at Lac Alaotra where it kept together in small parties and was little inclined to fly. I found it rather wary, flushing quickly and flying to a distance.

[1] Neumann, 1932, Ornith. Monatsber., pp. 150, 151, has described the Madagascar bird as *A. p. delacouri*, but it is doubtfully distinct.

The breeding season includes at least April, May, and June, as the following data indicate.

May 30, 1929	Five young	Andreba (Lac Alaotra)
May 31, 1929	Male, breeding	Andreba (Lac Alaotra)
June 7, 1929	Male, breeding	Andreba (Lac Alaotra)

Nyroca innotata Salvadori

Madagascar Pochard

DISTRIBUTION.—Collected only in the Humid East at Lac Alaotra (alt. 750 m.) where it was common: Du Mont saw this species on a small pond near Antsirabe.

Thalassornis leuconotus insularis Richmond

Madagascar White-backed Duck

DISTRIBUTION.—From sea level to 750 m., in the Humid East and the Occidental. In the Humid East this duck was common on Lac Alaotra and a specimen was secured from a small pool on the edge of the forest near Vondrozo. In the Occidental it was tolerably common on the more open water of the extensive marsh one day north of Vohemar; common at Lac Kinkony on the marshy arm of the lake at Antseza; over the flooded palm-valley plains at Ambararatabe and the marshy Lac Amparikely; and at Lac Iotry it was common in the marshy area at the head of the lake.

HABITS.—This duck was a rather sluggish bird of the ponds and lakes where the floating vegetation was not too dense. At Iotry none was breeding, and the birds were found in loose rafts of fifty to one hundred among the less dense aquatic vegetation; hundreds were seen here in a morning. The birds in rafts in the more open water among the floating vegetation were usually wary, flying with a little run while still out of gunshot, but pairs or small flocks in openings in the reeds at the end of the lake often sat within gun range while I fired at something else. Though the birds usually flushed when alarmed, they can dive well, and crippled birds were very hard to secure.

The food of the specimen examined was chiefly small seeds of aquatic plants.

The breeding season probably includes at least the months of April and May, as the following data indicate.

May 30, 1929	Two small young	Lac Alaotra
July 29, 1929	Three half-grown young	Ankavandra

NATIVE NAME.—This duck was called "Maheryalehuin" (hard head) by the Sakalava about Lac Kinkony.

Numenius arquata (Linnaeus)
Curlew

DISTRIBUTION.—The two races of this bird which occur as migrants in Madagascar were not distinguished in the field so that the following notes may refer to one or the other race or to both.

The long-billed curlew was found along the coast of the Occidental and the Subdesert from west of Mt. d'Ambre to Androka. It was usually not very common, being much outnumbered by *Numenius phaeopus*. However, at Anorontsanga, this species was common and outnumbered *Numenius p. phaeopus* by three or four to one. It was usually very wary, but at Ambiky, where it was feeding about the mangroves, it was fairly common and easily approached. A migrant; extreme dates—earliest November 5, 1930, west of Mt. d'Ambre; latest April 3, 1930, Salara (near Tulear).

NATIVE NAME.—"Máhataváza" among the Sakalava; this name was also used for *Numenius p. phaeopus*.

Numenius phaeopus phaeopus (Linnaeus)
Whimbrel

DISTRIBUTION.[1]—This bird was common along the coastlands and the neighboring grasslands a short distance inland in the Occidental and the Subdesert. The whimbrel was sometimes very common, and at Androka, at the mouth of the Ilinta River about five hundred were seen in a few hours; it was usually found, however, in two's or three's or in small parties. A migrant; extreme dates—earliest, September 26, 1930, Vohemar; latest, April 3, 1930, Salara.

M. Decary secured a specimen June 26, 1930, at Tambohorano.

NATIVE NAME.—"Máhataváza" among the Sakalava (also used for *Numenius arquata*).

Xenus cinereus cinereus (Güldenstädt)
Terek Sandpiper

DISTRIBUTION.—We found this sandpiper on the coasts of the Occidental and the Subdesert from west of Mt. d'Ambre to Tulear. It was tolerably common in the muddy bays and about the mangroves west of Mt. d'Ambre, and was seen feeding on the mud flats and among the mangroves at low tide on the coast opposite Nossi Be. It perched in the mangroves at high tide. Du Mont saw this bird at Tulear.

[1] Lavauden, 1932, Bull. Mus. Paris, p. 631, discusses the possibility of this species breeding in Madagascar.

The terek sandpiper was usually seen singly or in small parties, though at Ambiky fifteen were seen perched in one mangrove tree.

It occurs as a migrant; extreme dates—earliest November 5, 1930, west of Mt. d'Ambre; latest, April 5, 1930, Tulear.

Actitis hypoleucos (Linnaeus)

Common Sandpiper

DISTRIBUTION.—From sea level to 2200 m.; found in the Humid East, the Sambirano, the Occidental, and the Subdesert. This sandpiper was a common bird along the little beaches of the rivers and streams, and was usually seen singly.

It occurs as a migrant; earliest, August 18, 1929, Ivohibe; latest, March 11, 1930, Ampotaka and March 15, 1930, Antalaha.

Tringa nebularia (Gunnerus)

Greenshank

DISTRIBUTION.—Found in the Occidental and Subdesert. It frequented the muddy bays on the coast and some of the more open grassy shores on Lac Iotry.

A migrant; extreme dates—earliest, November 27, 1929, Lac Iotry; latest, March 1, 1930, Androka.

***Tringa ochropus** Linnaeus

Green Sandpiper

A Palaearctic migrant to Africa, which Delacour[1] gives as of certain occurrence in Madagascar.

***Limosa lapponica lapponica** (Linnaeus)

Bar-tailed Godwit

This Palaearctic migrant ranges as far south as the Seychelles and there is one skeleton from Madagascar, sent to Paris shortly before 1879.[2]

Erolia testacea (Pallas)

Curlew Sandpiper

DISTRIBUTION.—We found this species fairly common on the coasts of the Western Savanna and Subdesert and on the shores of Lac Iotry. Along the coast the curlew sandpiper frequented both the sandy beaches and the muddy bays, at Lac Iotry it occurred along the grassy, slightly marshy shore. The birds were usually seen in flocks of five to thirty.

It occurs as a migrant; extreme dates—earliest, October 15, 1929, Tulear; latest, March 2, 1930, Androka.

[1] 1932, L'Oiseau et R. F. O., p. 86.
[2] 1879, 'Hist. Nat. Madag. Oiseaux,' p. 632 (Grandidier).

***Erolia minuta** (Leisler)

Little Stint

This species occurs commonly in winter in the Seychelles, but the only record for Madagascar is a specimen recorded by J. Verreaux[1] and described as a new species, *Limicola hartlaubii*.

Crocethia alba (Pallas)

Sanderling

DISTRIBUTION.—The sanderling was fairly common on the coasts of the Occidental and the Subdesert. It was usually seen in small flocks on the sandy coast, but one flock on a mud bank at Androka, March, 1930, contained more than one hundred individuals.

It occurs as a migrant; extreme dates—earliest, September 29, 1930, Vohemar, one day north; latest, March 3, 1929, Androka.

NATIVE NAME.—"Viky-viky," among the Sakalava, apparently a general name for small shore birds.

Capella macrodactyla (Bonaparte)

Madagascar Snipe

DISTRIBUTION.—From sea level to 1800 m. in the Humid East. This snipe is a common bird of the little grassy and sedge-grown marshes and swamps.

HABITS.—The snipe lies close, flushing with a hoarse call. Its flight is not as swift as that of some of the smaller snipe. The nuptial flight song, similar to that of *Capella delicata*, was heard at Doany, September 9, 1930.

The breeding season probably includes July and August, as the following data indicate.

August 24, 1929	Nest with one egg	Ivohibe
August, 1929	Several downy young were brought in by the natives	Ivohibe

The nest at Ivohibe, August 24, 1929, was on a dry hummock in a grassy swamp. A faint runway through the grass led from the damp swamp some three feet away to the nest, which was completely arched over with grass. The nest itself was a slight hollow with a scanty grass lining. There was but one egg. This egg was pyriform in shape; the ground-color brown with a few irregular dark spots and a large blotch completely covering the larger end.

NATIVE NAME.—This snipe was called "Hárakáraka" by the Bara and Atamoor in the southwest, and "Ráva rára" in the northeast by the

[1] 1865, App. B. of 'Voyage á Madagascar du Dr. Vincent,' pp. 4, 5.

Tsimihety, both names apparently being imitations of the flight song of this bird.

Rostratula benghalensis (Linnaeus)
Painted Snipe

DISTRIBUTION.—From sea level to 1200 m.; in the Humid East and the Occidental. In the Humid East it was fairly common at Ivohibe, about the marshes and rice fields; one specimen was secured at Andapa. In the Occidental a few were found at Anaborano about a large grassy marsh; near Namoroka a single specimen was secured, and at Lac Iotry it was common on the marshy margin of the lake.

HABITS.—The painted snipe usually lies close and when flushed does not fly far. On alighting it often stands in the open, "bobbing" the hind part of its body in an absurd fashion.

The breeding season probably includes at least the months of June and November, as the following data indicate.

November 17, 1930	Male, testes enlarged	Anaborano
August 8, 1929	A well-grown young bird brought in by natives	Ivohibe

Arenaria interpres interpres (Linnaeus)
Turnstone

DISTRIBUTION.—We found this species on the coasts of the Occidental, Oriental, and the Subdesert. The turnstone was fairly common and usually found in small flocks on the sandy beaches. At Ambiky, it was tolerably common in the muddy bays, perching on the dead mangroves at high tide.

It occurs as a migrant; extreme dates—earliest, September 25, 1930, Vohemar, one day north; latest, May 4, 1930, Maroantsetra.

Squatarola squatarola squatarola (Linnaeus)
Gray Plover

DISTRIBUTION.—This plover was a fairly common migrant on the coasts of the Occidental and the Subdesert provinces. It frequented the sand beaches and the muddy bays, perching on the mangroves at high tide. The birds usually were seen singly or in small flocks, but in the Bay of Saint Augustin, on April 1, 1930, I saw a flock of about one hundred birds. It occurs as a migrant; extreme dates—earliest, September 25, 1930, Vohemar, one day north; latest, April 1, 1930, Bay of Saint Augustin.

Charadrius hiaticula tundrae (Lowe)
Siberian Ringed Plover

DISTRIBUTION—Found along the coasts of the Occidental and the Subdesert and on the damp grassy shores of Lac Iotry. Along the coast this plover favored the somewhat muddy areas of considerable extent.

HABITS.—It occurs as a migrant; extreme dates—earliest, December 5, 1929; Lac Iotry; latest, March 2, 1930, Androka.

Charadrius marginatus tenellus Hartlaub
Madagascar White-fronted Sand Plover

DISTRIBUTION.—Found commonly on all the coasts. This sand plover was usually found along the sand beaches in pairs or in small parties, though also found in the muddy bays, but less frequently. It was the only shore bird that was found commonly along the coast of the Humid East.

HABITS.—The breeding season probably includes at least the months of May and October, as the following data indicate.

May 1, 1930	Female, ovary enlarged	Maroantsetra
October 7, 1929	Female, ready to lay; several other birds taken at the same time were not breeding	Farafangana

NATIVE NAME.—"Víky víky" or "Fandy fásky," common names for any small shore bird.

Charadrius pecuarius pecuarius Temminck
Kittlitz's Sand Plover

DISTRIBUTION.—From sea level to 950 m. We found this species commonly in the Occidental and the Subdesert, less so in the Oriental. This bird was found on the muddy flats along the sea, along the margins of the larger rivers and lakes with exposed sand or mud banks, and about muddy ponds, rice fields, and wet grassy spots inland.

HABITS.—This plover was usually seen singly or in small parties.

The breeding season probably includes at least the months of September, May, and June, as the following data indicate.

May 1, 1930	Female, ovary enlarged	Maroantsetra
June 8, 1929	Female, breeding	Andreba (Lac Alaotra)
September 20, 1930	Female, ovary enlarged	Vohemar

Charadrius thoracicus (Richmond)
Black-banded Sand Plover

DISTRIBUTION.—We secured but three specimens of this species in the Subdesert, from the muddy flats at the mouth of the Ilinta River,

March 1 and 2, 1930. Richmond (1896) described this bird from Lohololoka, on the east coast, so it is more widespread than our records show, but is evidently rare.

Charadrius tricollaris bifrontatus Cabanis
Madagascar Three-banded Plover

DISTRIBUTION.—From sea level to 1800 m.; in the Humid East, Sambirano, and the Northern and Western Savannas. This plover probably occurs also along the rivers of the Subdesert. It was a tolerably common bird, usually seen singly or in pairs, frequenting the margins of the streams and muddy ponds of the open grounds, and the wet rice fields. None was found on the coast.

HABITS.—The breeding season is probably from July to September at least, as the following data indicate.

July 27, 1929	Female, laying	Ankavandra
August 21, 1929	One small downy young	Ivohibe
September 4, 1929	Nest containing one egg nearly ready to hatch	Ivohibe
September 4, 1930	Four females, ovaries enlarged	Andapa, one day west

The nest at Ivohibe, September 4, 1929, was on a dry, gravelly hillside with a few scattered tussocks of grass about. The nest was simply a depression in the ground surrounded by a few small pebbles that evidently had been arranged around it. The bird flushed when I was about twenty yards away.

The nest contained a single egg almost ready to hatch. The egg was between ovate and ovate pyriform in shape; the shell smooth, with little or no gloss; color buffy white, so heavily marked with overlapping spots, specks, and lines of brownish black and secondary grays as to form irregular, broken masses of color, less pronounced on the smaller end. The whole egg appeared very dark. The egg measured 30.6 × 21.9 mm.

NATIVE NAME.—"Vorobato," meaning "bird of the rocks," in the southeast among the Bara.

*__Charadrius mongolus atrifrons__ Wagler
Western Mongolian Sand Dotterel

Sclater[1] says this species probably occurs in Madagascar during the winter.

[1] 1924, 'Systema Avium Aethiopicarum,' p. 121.

Charadrius leschenaulti Lesson

Great Sand Plover

DISTRIBUTION.—The coasts of the Oriental, Occidental, and Subdesert. This plover was a fairly common migrant along the sand beaches and the muddy mangrove bays.

HABITS.—The great sand plover was usually seen in flocks of five to twenty birds. At Anorontsanga, on January 12, 1931, one hundred were seen during the morning.

It occurs as a migrant; extreme dates—earliest, September 22, 1930, Vohemar; latest, May 4, 1930, Maroantsetra.

***Recuvirostra avosetta** Linnaeus

Avocet

Probably a rare bird of the Western Savanna; only found by A. Grandidier during his stay in Madagascar from 1865 to 1870.[1]

Himantopus himantopus himantopus (Linnaeus)

Black-winged Stilt

DISTRIBUTION.—From sea level to 750 m. The stilt was found in the Humid East, Occidental, Sambirano, and the Subdesert. It was common about the open shores of lakes, streams, and ponds, and in flooded rice fields of Occidental and Sambirano, but rare elsewhere. It was a noisy bird usually seen in pairs and in small flocks up to a dozen or so. At Lac Iotry a *Falco concolor* was seen to strike at and miss one of these stilts.

The breeding season includes at least March, since on March 12, 1931, a female, ready to lay, was taken at Namoroka.

NATIVE NAME.—"Tsakaránta" by the Sakalava and Antakara.

Dromas ardeola Paykull

Crab Plover

DISTRIBUTION.—The crab plover was found fairly commonly on the coasts of the Occidental and the Subdesert. It was usually found in small flocks of three or four up to twenty or thirty birds. At Anorontsanga, January 1–12, 1931, four hundred were often seen in a morning, and at Androka, about March 3, 1930, one flock of perhaps five hundred birds was seen. The crab plover frequented the edge of the water along the sand beaches, though it was sometimes found on muddy flats.

One stomach contained the remains of crabs which were very common along the beaches.

[1] 1879, 'Hist. Nat. Madag. Oiseaux,' p. 629.

NATIVE NAME.—At Ambiky this bird was known as "Tsakaránta," by the Sakalava, a name also used for the stilt which occurs inland near-by.

Glareola ocularis Verreaux

Madagascar Pratincole

DISTRIBUTION.—Found in the Humid East, the Northern Savanna, the Sambirano, and the Western Savanna. In the Humid East birds were noted by Du Mont some distance up the Vohitra River. In the Northern Savanna it was moderately common at Vohemar, one day north, where small flocks were resting in dried-up pools in a broad marsh, and a few were seen flying over mud flats on the coast. In the Sambirano at Bezona it was rather common, flocks of fifteen or so were seen perched on rocks and stubs in the river or flying about overhead. In the Western Savanna at Bekipay a flock of a dozen or more were seen flying about over a wet grassy valley.

Two stomachs examined contained insects.

NATIVE NAME.—"Voronbato" (the bird of the rocks) among the Antakara and Sakalava.

Actophilornis albinucha (I. Geoffroy Saint-Hilaire)

Madagascar Jacana

DISTRIBUTION.—From sea level to 750 m. The Madagascar jacana was found in the Humid East, the Northern Savanna, the Sambirano, and the Western Savanna. In the Humid East it was rare, being found only at Lac Alaotra by M. Delacour and Mr. Lowe. In the Northern Savanna, the bird was common about the extensive marshes one day north of Vohemar and fairly common about some of the other smaller marshes. In the Sambirano a few were seen along the Ramena River at Bezona. In the Western Savanna the jacana was common on the larger marshes, the marshy bays of the lakes, and the river margins.

HABITS.—The jacana was a noisy bird of the open floating vegetation, when disturbed it ran or flew to another part of the marsh to escape danger. Even the downy young usually did not attempt to hide in the reeds but attempted to escape by running.

The breeding season probably includes at least the months of February, March, June, and December as the following data indicate.

December 5, 1929	Female, ovary enlarged	Lac Iotry
June 29, 1929	Female, breeding	Bekopaka
June 20, 1929	Nest with four eggs	Bekopaka
During March and until April 4	Downy young were common	Lac Kinkony and Ambararatabe

The four eggs of the one nest were ovate in shape, the shell, smooth and glossy; color, "deep olive buff" to brownish "deep olive buff," well marked with irregular scrolls and lines, as though drawn with a pen, of brownish black and secondary grays. These were very handsome eggs. The measurements of the four eggs are as follows: 36.6 × 25.9 mm., 37.6 × 25.4 mm., 37.3 × 24.7 mm., and 35.7 × 24.9 mm.

Canirallus kioloides kioloides[1] (Pucheran)

East Madagascar Gray-throated Rail; Wood Rail

DISTRIBUTION.—From sea level to 1000 m.; in the Humid East. This species was a common bird of the forest floor, and was especially common on the narrow coastal plain at Maroantsetra (20 km. southwest).

HABITS.—The wood rail is a bird of the forest floor where it walks about, preferring to escape danger on foot and rarely flying, though Du Mont, at Maroantsetra, flushed one from a perch four meters up in a bush.

Its call, often heard in the depth of the forest, was a rather loud, sharp series of whistles, delivered with a rising inflection, that often seemed about to end several notes before it did. It responded rather readily to an imitation of its call and could sometimes be called up. One bird that I called up to within a few feet of me gave a few harsh clucks in answer to such an imitation.

When disturbed the wood rail kept just ahead of me, uttering an elusive, muffled "bub–bub– – – –" that was difficult to locate. Where ground-cover was dense and it was difficult to see, as near Maroantsetra, native aid in snaring the birds was invaluable. Their snares were loops of cord, spread on the ground and attached to a bent-over sapling, held in place by twigs. When the trap was tripped by the bird, the cord secured it by its feet.

The food of this rail consisted chiefly of insects. Of five stomachs examined, four contained insect matter; two, sand; one, amphibian bones; and one, seeds.

The breeding season probably includes at least the months of May, June, and October, as the following data indicate.

June 10, 1930	Downy young	Maroantsetra, 20 km. southwest
July 11, 1930	Downy young	Maroantsetra, two days northeast
October 6, 1929	Female, ovary enlarged	Manombo

On July 11, 1930, at Maroantsetra, two days northeast, I found two downy young walking about on the ground in the heavy forest. No

[1] Peters (1932, Proc. New Eng. Zool. Club, XIII, p. 65) has proposed the genus *Mentocrex* for this species, but it is perhaps best kept in *Canirallus*.

adult bird was about. I captured one young bird, but the other hid. Their call was a high thin "tee–tee– – – –." After a short wait an adult bird appeared, calling "bub–bub– – – –," nervously flirting its tail, which action in some species of rails would display the white under tail-coverts, but in this form they were dark-colored. She walked all about, sometimes coming within two meters of me. The second young had hidden, but after a time came out of hiding, started to call, and was easily found. One of the young still had the egg-tooth attached.

The following is the description of one of these young: chick in complete down, only a few quill-sheaths showing in the wings. Black predominates in the upper surface, rufous and tawny in the under surface, the chick being more black than brown. The lores, crown, back, and middle of rump are rather velvety black, a stripe along each side of back and rump light rufous brown, the down tipped black; forehead, superciliary area, auricular area, throat, sides of neck, and upper chest rufous brown, much of down tipped with black, giving a mottled appearance; lower breast black flecked with light rufous brown, belly light rufous brown or tawny, the down lightly tipped with black, which, with the dark coloring of the basal part of the down, gives a mottled appearance; wings black flecked with tawny; iris, grayish black; bill, grayish black, tip whitish; feet, black.

NATIVE NAME.—"Tsikoza ala" or "Tsikoza vohitra" (meaning the white-throated rail of the forest or the mountain), by the Atamoor and Betsimisaraka; "Drovikála" (meaning the wood rail of the forest), by the Sakalava.

Canirallus kioloides berliozi (Salomonsen)[1]

Pale Gray-throated Rail

DISTRIBUTION.—Restricted to the forest of the Sambirano where it was very common. This race is distinct from *kioloides* as Salomonsen has pointed out.

HABITS.—Similar to those of the preceding race. It breeds in November at least, as laying females were taken during that month.

Dryolimnas cuvieri cuvieri (Pucheran)

White-throated Rail

DISTRIBUTION.—From sea level to 1800 m. but rare above 1100 m.; we found this species common in the Oriental and Occidental. In the Humid East it was common along the edges of the marshes and streams

[1] 1934, Ibis, p. 386.

in the open country where tall, more luxuriant herbaceous growth abounded. In Mt. d'Ambre and the Sambirano it also was found commonly in the forest where there was luxuriant herbaceous ground-cover. In the Western Savanna the white-throated rail was common about the reedy marshes but became rare on the edge of the Subdesert at Tabiky. One was seen walking along a little stream flowing over the limestone in the forest, where there was no herbaceous cover near-by.

HABITS.—The white-throated rail was not so secretive as most rails, and was sometimes seen walking along through the more open vegetation, flirting its tail. Along the heavily grass-grown trail on Mt. d'Ambre birds occasionally flushed ahead of me and lit on a perch in a low bush.

It was sometimes a noisy bird, particularly at dusk, when it gave its loud, long-drawn whistled calls. A bird that I was beating out of a clump of vegetation gave a deep "gub–gub–gub– –." It has also a sharp squeak, "tsikeu," that I have heard the bird give when surprised at close range, and a low plaintive call audible at but a short distance.

The breeding season probably includes at least the months of October, November, January, February, and March as the following data indicate.

October 26, 1930	Female, ovary enlarged	Mt. d'Ambre
November 3, 1929	A set of three eggs, heavily incubated, brought in by a native	Tabiky
November 12, 1929	Female, ready to lay	Tabiky
November 20, 1930	Female, ovary enlarged	Anaborano
January 3, 1930	Female, ovary enlarged	Ampasimena
March 2–6, 1931	A number of small downy young brought in by natives	Namoroka
March 13, 1931	A set of four eggs, brought in by natives	Namoroka

One set contained three eggs; the other four eggs. The eggs were "ovate" in shape; the shell smooth and glossy; ground-color white, irregularly marked with small spots and specks of various shades of brown and secondary grays, particularly about the larger end.

The measurements of the two sets of eggs are as follows: (1) from Namoroka 40.8 × 32.4 mm., 41.0 × 32.0 mm., 42.2 × 31.9 mm., and 41.8 × 32.3 mm.; (2) from Tabiky 37.9 × 28.3 mm., 39.6 × 29.8 mm., and 43.6 × 30.3 mm.

NATIVE NAME.—This rail was called "Tsikóza" in the southwest by the Atamoor and the Bara and in the northeast by the Betsimisaraka. In the west it was called "Drovíky" by the Sakalava.

Rallus madagascariensis Verreaux

Madagascar Rail

DISTRIBUTION.—From sea level to 1800 m. This species was found only in the Humid East where it was common, though more so at the higher altitudes.

HABITS.—The Madagascar rail was a bird of the little, densely grass- or sedge-grown marshes in the open ground. It was very secretive, and most of the specimens were secured by the natives. Even where it was common, it was seldom flushed or seen.

One bird that flushed close to me called a sharp "tsi-kia" before it dropped into the grass a short distance away. Another call was a sharp "kik-kik."

The breeding season includes at least the months of August and September, as the following data indicate.

August 31, 1930	Female, ovary enlarged	Andapa (one day west)
September 5, 1929	Male, testes enlarged	Manombo (southeast)
October 7, 1929	A well-grown young, still retaining much black down, was brought in by a native	Manombo (southeast)

The eye is dark red in life, fading to brown on the death of the bird.

NATIVE NAME.—This rail was called "Kíký" in the southeast by the Bara and Atamoor and "Tsikéa" by the Tsimihety in the northeast; both names apparently from the bird's calls.

Porzana pusilla obscura Neumann

African Spotted Crake

DISTRIBUTION.—From sea level to 1800 m. We found this species in the Humid East and the Western Savanna. In the Humid East, Delacour and Lowe collected it at Lac Alaotra, and a few were brought in by the natives at Andapa, one day west. Du Mont saw a pair in a rice field at Tananarive. In the Western Savanna, at Befandriana, two were seen running about together over the floating vegetation in a rather extensive marsh; at Lac Iotry, several times, two of these birds were seen running about over the lily pads floating on the rather deep water at the edge of extensive beds of tall reeds.

Amaurornis olivieri (Grandidier and Berlioz)

Olivier's Rail

Distribution.—This rail is known only from the type taken at Antsalova (province of Maintirano) and from seven specimens taken by us at Ambararatabe (province of Soalala) in the Western Savanna.

HABITS.—Six of the birds were taken along the Tsiribehino, a narrow, deep stream bordered with a tall coarse grass, called "bararata," and with a narrow fringe of floating lily pads and other aquatic vegetation. These birds were found standing on or running over the floating vegetation near the shelter of the "bararata" into which they retreated for shelter. They were not particularly shy nor active. The low, flat, palm-covered valley through which this stream flowed was flooded, and one of these birds was seen walking along a floating log in a clearing where grass heads and bushes showed above the water.

On March 26, 1931, a male and female were seen with two well-grown young, one of which was collected.

Sarothrura insularis (Sharpe)

Madagascar Crake

DISTRIBUTION.—From sea level to 1800 m.; we found this species in the Oriental Province, where it was common in the Humid East; a few were heard on Mt. d'Ambre, and one was secured in the Sambirano.

HABITS.—This crake frequented the secondary brush, the grassland on the edge of the forest, and the little clearings in the forest. Though usually common, it was rarely seen, and a bird calling from a few feet away rarely could be flushed. When flushed it would fly a few feet, drop into the grass and disappear, only to call a few minutes later from the grass ahead. I fired at one running about almost underfoot, and missed it three times, yet it did not fly.

Its loud call was a "So-bir–ey biry biry bir bir – – – – –" continued for some moments, gradually becoming fainter. This call was one of the common sounds of the heath, bracken, and grass areas at Andapa, one day west, and was heard commonly within a few yards of our camp. This was extremely provoking, for a search always failed to reveal more than a glimpse of the bird, and all of our specimens were secured by natives.

The breeding season probably includes at least September and October, as the following data indicate.

October 6, 1929	Nest with four eggs, brought in by natives	Manombo (southeast)
October 11, 1929	Nest with two eggs, brought in by natives	Manombo

The two nests were oven-shaped structures, surrounded by dense grass, and were said to have been on the ground in a grassy field near the forest. The nest had rather thick walls except at the back where the

wall was rather thin. The materials on the outside of the nest were broad grass blades loosely put together. The inside was thickly lined with fine grasses. One nest measured, outside, 170 × 120 mm. wide, inside 80 × 80 mm., with an opening 70 × 50 mm.

One clutch contained four eggs, the other two eggs. The eggs were "ovate" in shape; the shell smooth and slightly glossy; the color white. One set was stained with earthy smudges which wash off; probably these stains were from the feet of the bird. The measurements of the eggs are as follows: the set of four eggs, 26.2 × 20 mm., 26.7 × 20.4 mm., 27.4 × 19.8 mm., and 26.0 × 20.0 mm.; the set of two eggs, 26.5 × 20 mm., and 26.2 × 20.7 mm.

NATIVE NAME.—This bird was well known to the natives, who usually gave it some name in imitation of its call; thus, "Biry" in the southeast by the Bara and the Atamoor, "Bébuck" in the northeast by the Betsimisaraka, "Tso-bébuck" in the northeast and the northwest by the Tsimihety and the Sakalava.

Sarothrura watersi (Bartlett)

Water's Crake[1]

DISTRIBUTION.—This species was found in the Humid East at about 1800 m. Our only specimens, from one day west of Andapa, were brought in by native hunters who told us that they were taken in the near-by little swamps and neighboring grasslands. *Sarothrura insularis* was common there but preferred the drier brush and grass areas. The natives captured this crake by beating through the grass and catching them in their hands or by knocking them down with sticks. *Sarothrura insularis* was also taken in this way, as was *Rallus madagascariensis*.

HABITS.—The breeding season includes at least the month of September, as the following data indicate.

September 2, 1930	Male, testes enlarged	Andapa, one day west
September 5, 1930	Female, ready to lay	Andapa, one day west

NATIVE NAME.—"Senpatch" by the Tsimihety; this species was often confused with *Sarothrura insularis*.

Gallinula chloropus pyrrhorrhoa Newton

Madagascar Moorhen

DISTRIBUTION.—From sea level to 1800 m.; we found this species common in the Oriental and the Occidental provinces.

HABITS.—The moorhen was a common bird of the marshy margins

[1] Salomonsen has proposed a new generic name, *Lemurolimnas*, to include only this species, but it hardly seems necessary. (1934, Ibis, p. 388.)

of ponds, lakes, and the larger marshes where it swam about on the edge of the open water or among the floating vegetation and sometimes allowed a rather close approach before flying to the sheltering reeds. This bird was not often seen walking about over the floating vegetation, though it often perched in the reeds, and, at Namoroka, one was seen walking about in a tree some twenty feet above the water of a little pool.

The breeding season probably includes at least the months of November, February, and March, as the following data indicate.

June 3, 1929	Juvenile	Andreba
March 27, 1931	Nest with five eggs	Ambararatabe
March 19, 1931	Well-grown juvenile	Ambararatabe
March 21, 1931	Downy black young	Ambararatabe
April 2, 1931	Three small young	Ambararatabe
December 6, 1929	Nest with eggs	Lac Iotry

The next at Ambararatabe, March 27, 1931, was in a bush about a meter above the water in the flooded palm-valley. The nest was basin-shaped with irregular bits of material projecting from the edges. The material was dry marsh grass (bararata), some of it very coarse, but all were flat pieces. The female skulked from the nest as I approached and was collected a few moments later.

The nest at Lac Iotry (December 6, 1929) was some three meters up in a bush in a shallow pool in open country near the edge of the lake. This nest was undisturbed for a day, for I was unable to secure the bird as it left the nest, and the eggs were eaten that night, apparently by rats (*Rattus*), as a trap set in the nest caught one of these rodents.

The clutch of eggs from Ambararatabe, March 27, 1931, contained five eggs. The eggs were ovate in shape; the shell smooth, with a slight gloss; the ground-color of four of the eggs was "cartridge buff," of one egg, "pale ochraceous buff." They were irregularly marked with small spots and fine dots of various shades of dark brownish and secondary grays, somewhat more heavily near the larger end. The measurements of this set of eggs are as follows: 43.3 × 31.8 mm., 43.8 × 32.0 mm., 44.0 × 32.2 mm., 41.9 × 32.3 mm., and 43.4 × 32.3 mm.

NATIVE NAME.—"Arétaka" by the Sakalava at Lac Kinkony.

Porphyrula alleni (Thomson)

Allen's Reed Hen

DISTRIBUTION.—From sea level to 750 m. The reed hen was found in the Humid East, the Sambirano, and the Northern and Western Savannas.

HABITS.—Allen's reed hen was only fairly common, frequenting the

larger marshes. It fed out over the lily pads and other floating vegetation like a jacana, but was always ready to fly or run to the protecting shelter of the reed beds while danger was still some distance off.

The breeding season probably includes at least January, as on March 20, 1931, at Lac Kinkony, a nearly full-grown young one was collected.

Porphyrio madagascariensis (Latham)

King Reed Hen

DISTRIBUTION.—From sea level to 1800 m. We found this species in the Humid East and the Western Savanna. In the Humid East at Manombo three were brought in by the natives; at Lac Alaotra Delacour found it common; at Maroantsetra several were seen about a marshy pool; and at Andapa, one day west, one was brought in by the natives. In the Western Savanna this bird was common on the marshy arm of Lac Kinkony and a few were seen at Ambararatabe in the flooded palm-valley. At Bekopaka, Delacour found it less common than at Lac Alaotra. At Lac Iotry it was fairly common.

HABITS.—The king reed hen was a bird of the larger marshes and the marshy portions of the lakes, where it walked about through the reeds and over the floating vegetation, usually not far from cover. When alarmed at some distance from cover it flushed, with its grotesquely huge feet striking at the air even when well started into flight, and flew to a reed bed or to a perch in a bush in the marsh. When perched in the reeds, or on a perch of several reeds bent down, it was sometimes very tame, and at Lac Iotry one that was sitting within twenty meters of me did not move away while I shot several birds near-by.

The breeding season probably includes at least the month of January and March, as the following data indicate.

March 19, 1931	Two females, ovaries enlarged	Lac Kinkony
March 22, 1931	Juvenile, well grown	Lac Kinkony

Fulica cristata Gmelin

Red-knobbed Coot

DISTRIBUTION.—From sea level to 1800 m. We found this species in the Humid East, the Western Savanna, and the Subdesert. It was found on some of the lakes and in the open water in the larger marshes, but was nowhere very common and was absent from many localities that appeared suitable for it. The coot was one of the few water birds at Lac Tsimanampetsotsa. A few birds of these species were always to be seen swimming about the vegetation along the shore or a little distance out in the lake. When alarmed they swam out into the lake.

HABITS.—The coot probably bred at least in January, as on February 15, 1930, at Lac Tsimanampetsotsa, a native brought in a set of seven eggs which contained very large embryos.

Mesoenas variegata (I. Geoffroy Saint-Hilaire)
White-breasted Mesite

DISTRIBUTION.—This bird was apparently very locally distributed in the Occidental Province. At the Falaise of Anákarana (15 mi. S. W. of Tsarakibany), a male was brought in by the natives, November 10, 1930. The following day Du Mont shot two of these birds that were running about together in rather low dry forest, somewhat clear of underbrush. Lavauden[1] has also recorded these birds from the Western Savanna, near Majunga.

HABITS.—Du Mont said that the two birds he collected walked or ran with frequent stops and changes in direction. The second bird made no attempt to fly when the first was shot. Its actions were apparently much like those of *Monias benschi*.

HABITS.—The breeding season probably included the month of November, as both birds that Du Mont shot were in breeding condition, a male and a female, the female being almost ready to lay. The nesting and habits of this bird has been recorded by Lavauden.[1]

NATIVE NAME.—The natives called this bird "Fangadehovy" at the Falaise of Anákarana, but I doubt if this name was used extensively for this bird.

Mesoenas unicolor (Des Murs)
Brown Mesite

DISTRIBUTION.—The central part of the Humid East. Our only specimens were six skins purchased from M. Herschell-Chauvin. They had been taken in the forest of Sianaka. The natives at Fanovana, but a short distance south of the forest of Sianaka, did not recognize this bird when we showed them skins of it, though they were well acquainted with most of the birds that occurred there.

It is apparently a bird of the forest floor. Lavauden[2] mentions some of the habits of this mesite.

Monias benschi Oustalet and Grandidier
Bensch's Rail; Monias

DISTRIBUTION.—A terrestrial bird of the low brush forest in the Sub-

[1] 1931, Alauda, p. 396.
[2] 1931, Alauda, pp. 397–398.

desert. It was found fairly common at Lac Iotry, where, with native aid, about forty-eight specimens were secured in a period of ten days.

The favorite habitat of *Monias benschi* was flat sandy country covered with dense brush from three to six meters high. This brush was too thick to walk through easily but had little cover close to the ground, and the firm smooth sand, though bare in places, was covered for the most part with dead leaves. A few of these birds were also found on the edge of this habitat in the open desert brush, where scattered clumps of bushes grow in the glistening sand. Its distribution seemed extremely local. I had hunted the brush in various directions from camp for days without finding it, and had about decided to abandon this area when I stumbled upon one of these birds, and in the next ten days, saw forty-three of them along the same scant mile of trail.

HABITS.[1]—*Monias benschi* was somewhat gregarious, tending to move about in small groups. Parties of five adults were seen on two occasions, four adults and one subadult on another, and groups of three adults were seen on three occasions. Males were usually in the majority in these parties, and of the specimens collected, twenty-seven were males and sixteen females. In one case two males accompanied a female that was nearly ready to lay. Apparently *Monias* is entirely terrestrial. No evidence was secured that it ever flies. Several times when I came upon a group of them, and followed shooting them one by one, they made no attempt to fly but tried to escape on foot. Two live captive birds tethered with a string also made no attempt to fly. A bird that I liberated and tossed gently into the air spread its wings and fell directly back to earth.

It was an easy matter to locate these birds in the brush. As I approached they ran nervously back and forth, calling. Usually they did not allow an approach closer than twenty to thirty meters. Then they ran off a short distance, the group keeping together, then stopped and walked back and forth, calling the while. Their pace was not very rapid and it was easy to secure them. A party of five was collected in a short time by following the survivors, which kept together. Three times when I first heard their call, I sat down quietly and the birds came up close. One female in company with four males came within a meter of me, the males staying in the background. The bird continually moved, now in one direction, now in another, nervously calling "Nak–nak–nak– –." It took short, quick steps, sometimes slightly

[1] 1931, Alauda, pp. 398–399. Lavauden describes the habits, nesting, and young of this species, differing in some respects from my findings.

sideways, bobbing its head back and forth and depressing its tail at each step, much like a pigeon. Now and then it stopped to pick up something from the ground. This female came back several times to inspect me before deciding to leave. This happened on two other occasions. Each time the female was the bolder, the males keeping in the background. On another occasion a party paid no attention to me but kept on its way.

The call of the bird, when disturbed was a slightly explosive "Nak–nak – –," or "Quck," repeated at short intervals and audible at some distance. Among themselves the birds were quiet, although several times I heard one give a low "Creeu." A young one about fifteen days old, which was brought in alive by the natives, kept calling a rather high, metallic "Peet," or "Cheet."

Several times, birds were seen to pick up something from the ground. Probably all of their food, which consists of insects and small fleshy fruit, is secured in this manner. Of the ten stomachs examined, six contained remains of caterpillars, beetles, or other insects; seven contained seeds of some fleshy fruit; two, pieces of small shells; and one, a few grains of white quartz sand. Two adult birds that were kept alive for a short time ate dismembered grasshoppers.

The nesting season probably includes at least the months of October and December, as the following data indicate.

December 18, 1929	Female, ready to lay	Lac Iotry
December 19, 1929	One young (15 to 20 days old)	Lac Iotry
December 25, 1929	Young, nearly full grown	Lac Iotry
March or April	Young, nearly full grown (specimen in Paris Museum)	10 km. northeast of Tulear

Information on the nesting habits of this bird was particularly desirable as it was hoped that this phase of its life might throw some light on the affinities of its aberrant family. Fortune favored me, and on December 21, 1929, a native came into camp with the information that he had found a nest. But, alas, he had snared the bird at its nest, and brought it to me as proof of his discovery. Though this bird was liberated it did not return to its nest, which remained deserted.

The nesting site was in open, flat, sandy country with scattered clumps of large trees and bushes, about a half mile from the trail through the brush where I had found them so common. The nest was in a bush a meter and a half above the ground, resting on several limbs that made a suitable platform for it. A sloping trunk and projecting limbs made a natural stairway so that the birds could reach the nest without flying.

The nest itself was a rather flat scanty platform of sixteen slender twigs from 150 to 225 mm. long; on this was a very thin layer of threadlike palm fibers, and, above that, heads of fine grasses, forming a pad some 225 mm. across and thin enough to see through. The snare in which the adult had been taken was still attached to a twig by the side of the nest and feathers of the bird were scattered about.

There was but a single egg in the nest. From various independent native accounts, secured both before and after the finding of this nest, the nest was a typical one. An old nest of similar structure was seen in a similar location a few days later. One egg appeared to be the usual number. When the natives brought in a small young one on December 20, they said that there was never more than one egg or young, and I found, on collecting four of a party of five, that only one of the number was a juvenile.[1]

The egg, which was fresh, was blunt ellipsoid, having the same shape at both ends; the surface was slightly shiny; the ground color whitish, rather irregularly marked, less heavily marked on one end, with medium-sized to small spots of dark brownish black and light brown. Many of the markings were more or less obscured with whitish, giving secondary grays. The egg measured 36.5 × 27.5 mm.

The sexes were easily distinguished by the color of their plumage and from native evidence it seemed that the male did the incubating and cared for the young. The natives insisted that the male was the mother. The chick which was brought in December 19, 1929, was said to have been following the bird that they brought in with it, which was a male. The bird snared at the nest was a male. This is of especial interest when taken in connection with the preponderance of males and the fact that two males were accompanying a female that was nearly ready to lay. Is the species possibly polyandrous?

The young bird, which was brought in December 19, 1929, was perhaps fifteen to twenty days old. It was strong and active, running about, and was said to have been taken following the parent bird. The young bird was apparently completely covered with down when hatched, and followed the adult at an early age. In this specimen most of the contour feathers had appeared except those on the head and neck, where feathers were present only on the crown and auriculars. The remiges and rectrices were showing appreciably. The head and neck were densely clothed with down, which was also present on the ends of all the feathers, on the legs and sides of the body and on the under surface of the

[1] Lavauden, L., 1932, Bull. Mus. Paris, p. 633, says that two eggs is the usual number.

wing. The feet were quite large and strong, the tarsus measured thirty mm. The bill was slightly curved and measured eighteen mm. The remiges had attained a length of fifty mm. and the retrices, forty mm. The body length was two hundred and fifty mm.

The down on the upper parts was rufous brown; the down on the ventral surface of the neck, on the sides of the head below the eyes, and on the upper breast, was whitish, tipped with light rufous brown. That on the chin and upper part of the throat was also tipped with fuscous color. The down on the lower breast and belly was white. That on the legs, under wings, and sides of the body was light rufous brown. Color of soft parts: iris, gray; lores, grayish pink about the eye; bill, black; feet, brownish pink; scutes, brown; and nails, blackish. The whitish feathers coming in on the breast showed this bird to be a male.

A specimen in the Muséum Nationale d'Histoire Naturelle, labeled "C. G. 1929, No. 76. Vallée de Fiheranana, 10 km. N. E. de Tulear, environs de Mars, Avril (début de saison sèche)," was a juvenile, nearly full grown, (wing 112 mm.), with the remiges not yet completely free of sheaths. The body feathers were nearly completely grown, but on the head and neck they were restricted to the crown and auricular regions, the rest of these parts being covered with down. Only a few traces of down lingered on the tips of the feathers, more particularly on the belly. Some was present on the legs and the sides of the body. In this specimen the down on the top and sides of the head was lighter than that of the young described, that on the chin and upper throat was white strongly tipped with fuscous color, but with hardly a tinge of rufous. The down on the lower throat was whitish, slightly tipped with fuscous color; that still clinging to the feathers of the belly was white, tinged with rufous. The plumage of this bird closely resembles that of the adult male.

A specimen from Lac Iotry, December 25, 1929, was in similar plumage with down persisting on the head and neck. Evidently these parts are the last to lose it.

NATIVE NAME.—*Monias benschi* was well known to the Masquer at Lac Iotry, who called it "Nak" or "Náka," from its call.

Turnix nigricollis (Gmelin)

Madagascar Button Quail

DISTRIBUTION.—From sea level to 1900 m.; a common bird of the grass and brush areas of the whole island. This quail was one of the few common birds of the treeless central plateau. In the east it fol-

lowed the clearings into the forest. In the west the button quail was common in the grassy savannas and more open woodland, and in the Subdesert it was found wherever grass occurred. This bird was often taken in cultivated plots of land, particularly in manioc fields.

HABITS.—The button quail was usually found singly or in company with two or three other birds of its own kind. When the ground-cover was thin, they could be seen running through the grass a short distance ahead. They flushed close and their flight was usually short, though rapid. The call was a rapid, muffled, "bub–bub–bub–bub – –," that could be heard only a short distance.

The breeding season probably extends at least from September to January, as the following data indicate.

September 1, 1929	Nests with four eggs	Ivohibe, one day north
September 4, 1929	Nests with three eggs	Ivohibe
September 25, 1929	Female, ovary enlarged	Manombo (southeast)
October 6, 1929	Female, ready to lay	Manombo (southeast)
October 29, 1930	Female, ovary enlarged	Mt. d'Ambre
November 1, 1930	Male, with three half-grown young	West of Mt. d'Ambre
November 8, 1930	Female, ovary enlarged	Tsarakibany (15 miles southwest)
November 21, 1929	Male, with four downy young	Befandriana
January 3, 1931	Female, ovary enlarged	Marotony
February 17, 1930	Several downy young	Lac Tsimanampetsotsa
March 20, 1930	Several partly grown young	Ampotaka

The nest found on September 1 was in a little glade in a country of secondary bush and small grass areas. The nest was on the ground near the base of a small tree among scanty grass. It was placed in a small hollow in the soil, apparently made by the bird. The structure was completely roofed over and bent-over grasses formed a cover to a runway 50 mm. long, leading to the nest. The materials were dead grasses, other herbaceous stems, dead leaves, and two small feathers. Inside, the nest measured about 70 mm. across and 80 mm. from the roof to the floor.

The nest found on September 4 was at the base of a tussock of grass in a small area of brush and tall weeds in open grass country. The nest was a substantial, domed-over structure, with no evidence of a runway leading to it, and was composed of dead grass, other herbaceous material, and leaves.

The eggs were "short ovate" to "pyriform;" the shells smooth and glossy; the color brownish white, rather heavily marked with small spots and specks of olive-brown, and blotches, spots, and specks of dark

brown as well as secondary grays. The markings were more plentiful about the larger end.

The measurements of the two sets of eggs were: set of three eggs, 28.8 × 19.5 mm., 28.2 × 19.5 mm., and 27.4 × 20.0 mm.; set of four eggs; 25.0 × 19.7 mm., 26.0 × 20.3 mm., 26.3 × 20.0 mm., and 25.9 × 19.9 mm.

On several visits to the nests the male bird was incubating. When the young hatched they kept together, and each time one of these parties was encountered, it was accompanied by a male bird.

NATIVE NAME.—The button quail was known as "Kíbo" or "Rakíbo."

Margaroperdix madagascariensis (Scopoli)

Madagascar Partridge

DISTRIBUTION.—We found this species from sea level to 1800 m.; in the Oriental, Occidental, and into the less arid part of the Subdesert. In the Humid East and Mt. d'Ambre this partridge was common and was found in the secondary brush and the neighboring grassland, and on Mt. d'Ambre also in old weedy cultivated fields. It was particularly common in the heathlike brush on the central plateau but absent from the extensive scantily grass-covered areas. In the Occidental it was not very common and was found in grassy brushlands and the denser savannas. At Tabiky, birds were observed several times in the stubble in the dried-up rice fields.

HABITS.—This partridge was usually flushed singly or in twos or threes; sometimes coveys of six to a dozen were found. When flushed, they usually flew from fifty to a hundred meters. It was sometimes very difficult to flush them a second time. The birds often rise with a cackling call. Their usual call, which was often heard and carried some distance, may be written, "cou–cou–cou––."

At Monjakatompo the natives caught many with dogs, while one day west of Andapa, many that had been taken in snares baited with rice were brought in to me.

The breeding season probably includes at least March, as on March 8, 1931, a male with testes enlarged was collected at Namoroka.

NATIVE NAME.—This partridge was called "Tráotráo" by the Atamoor and Bara in the southeast, and the Betsimisaraka in the northeast; 'Tsipóhy" was the name among the Hova and the Masquer.

Coturnix delegorguei delegorguei Delegorgue

Harlequin Quail

DISTRIBUTION.—We found this bird commonly in the Northern

Savanna. One specimen, probably of this species, was seen at Lac Iotry about December 15, 1929.

HABITS.—The birds were fairly common to the southwest of Mt. d'Ambre in open grasslands, and more so in the dry rice fields that had grown up to weeds. They were usually found in coveys of from five to ten birds. They flushed quickly, uttering a low "peet," and usually flew but a little distance.

NATIVE NAME.—This quail was well known to the Antakara who called it "Kibonómby" which means "Cow Quail."

Coturnix coturnix africana Temminck and Schlegel
Cape Quail

We secured but a single specimen from the Humid East at about 1500 m. The bird was killed in a manioc patch.

Numida meleagris mitrata Pallas
Madagascar Helmet Guinea Fowl

DISTRIBUTION.—From sea level to about 1000 m.; fairly common in the Humid East, much more so in the Occidental and the Subdesert. In the Humid East it was fairly common in the brushlands and was sometimes found in the edge of the humid forest, following the little clearings into the forest.

HABITS.—The guinea fowl was usually found in flocks or droves, often of twenty or more, in the grass of the open brush or in the edge of the forest. When alarmed the birds usually started to run, with no attempt at concealment, then as if realizing that their speed on foot was not sufficient to enable them to escape danger, they flushed heavily, and, scattering, flew to perches in near-by trees. When perched in the trees they were still wary and when approached flew again and were usually lost to view. The loud call of the guinea fowl was heard most frequently in the evening, just before dark. The guinea fowls sometimes fed in the dry rice fields of the Occidental Province.

The breeding season probably includes at least the month of November and December, as the following data indicate.

January 31, 1931	Downy young	Maromandia
February 12, 1930	Downy young	Lac Tsimanampetsotsa
February 25, 1930	One-third grown young	Lac Tsimanampetsotsa

NATIVE NAME.—"Akánga," from the bird's call, in the southeast by the Bara and Atamoor; and in the southwest by the Bara and Masquer; "Tomena," in the north and northwest by the Antakara and Sakalava.

Eremialector personatus (Gould)

Madagascar Sand Grouse

DISTRIBUTION.—We found the Madagascar sand grouse in the open brush, savannas, and plains of the greater part of the Western Savanna and the Subdesert. At Maromandia it was said to occur, and both the French Resident and the natives knew it. We found the bird from near Soalala south to Ampotaka, as far west as Ankavandra and within ninety kilometers of Ihosy, and it probably ranges across the south of the island nearly to Fort Dauphin. The bird was common in the south in the open wooded country and the plains, avoiding the more heavily wooded areas. In the north above Soalala it was only fairly common in the palm-plains and savannas, possibly because the plains were very wet from the recent rains, for we were told of a small plateau near Ambararatabe where sand grouse were said to be very common.

HABITS.—The sand grouse fed in dry areas but was seen flying about over all the country and came to the rivers, ponds, and lakes to drink and to rest on the sand bars. It was a gregarious bird, usually seen in parties of three or four to a dozen, sometimes of twenty or thirty. When approached it did not walk far, but, when one was within thirty or forty yards, all took to wing and flew to a distance, not attempting to hide, despite their protective coloration. It was often seen flying about over the country thirty to a hundred meters up, with strong direct flight, occasionally breaking into its characteristic call, which may be written, "Catch–catcha–catcha." When flushed it usually burst out into this call. It was often seen in small flocks coming to water during the morning, or resting on sand bars during the day. A large gathering of birds was observed on the sandy margin of the river at Befandriana, November 23, 1929. By 7:00 A.M. about three or four hundred birds had gathered, arriving in flocks of twenty or thirty, but by 8:30 A.M. all the birds had left. On the following day no such congregation took place, and only a few small parties came down to the river during the morning.

The following data secured on the time of breeding seems to indicate that the bird breeds throughout the year.

May 24, 1929	Juvenile bird, one-half grown	Ankavandra
June 28, 1929	Female, laying	Bekopaka
June 30, 1929	Female, finished laying	Bekopaka
July 3, 1929	Male, breeding	Beraketra
October 31, 1929	Nest containing three eggs heavily incubated	Tabiky
October 23, 1929	Young, two-thirds grown	Tulear, 80 km. east

The nest at Tabiky was found by flushing the male almost underfoot, within a few feet of the nest. The nest was in an open, slightly grassy area on a brushy, rocky hillside. It was but a slight depression in the gravelly soil with a little grass in the bottom, and contained three eggs almost ready to hatch.

The texture of the shell was smooth and glossy; the ground-color light "vinaceous buff" well marked with medium and small-sized blotches, spots, and specks of "Sayal brown," and secondary grays.

NATIVE NAME.—Variations of "Hátrakátrak" or "Cátcha cátcha," obviously from the bird's call.

Alectroenas madagascariensis (Linnaeus)
Madagascar Blue Pigeon

DISTRIBUTION.—From sea level to 1800 m. This pigeon occurred in the Oriental Province and in the Occidental as far south as Tsiandro. It was common in the Humid East at all altitudes but less so on the coastal plain. On Mt. d'Ambre and in the Sambirano (including Nossi Be) but few were seen. In the Western Savanna but two were seen at Namoroka though Delacour observed it frequently at Tsiandro. Monsieur Wants, a resident at Anaborano, told us that in that area the blue pigeon was migratory, arriving in the rainy season (November or December). Our specimens from the northwest were in December and January, but Delacour found it at Tsiandro in July.

HABITS.—The blue pigeon was a bird of the tree tops in the forest, often found in flocks of three to twelve or more. It liked to perch on some tall dead stub in the forest, or on the edge of a clearing. A gunshot often startled it into swift flight, though after a short turn over the forest it often returned to its original perch. It fed on the small fruit of forest trees and several stomachs contained nothing else.

The following data indicate that the bird breeds from July to March.

July 17, 1930	Male, testes greatly enlarged	Maroantsetra (two days northeast)
July 27, 1930	A juvenile bird	Maroantsetra (two days northeast)
September 28, 1929	Male, testes greatly enlarged	Manombo (southeast)
October 18, 1930	Female, ovary enlarged	Mt. d'Ambre
December 18, 1930	Juvenile with yellowish down clinging to feathers	Nossi Be
January 29, 1931	Juvenile with yellowish down clinging to feathers	Andampy
March 5, 1931	Female, ovary enlarged	Namoroka

The plumage of the young is more greenish blue than that of the adult. Several specimens examined, out of the nest, still had much yellowish down clinging to them.

NATIVE NAME.—In the east it was called "Finago maints" (black pigeon) by the Betsimisaraka and the Atamoor, and "Voro meahilala" (the bird that knows the road) by the Sakalava in the northwest. This latter name is also used for the domestic pigeon.

Vinago australis australis (Linnaeus)

Madagascar Green Pigeon

DISTRIBUTION.—Found from sea level to 1000 meters, in the Oriental Province, the Northern Savanna, and south into the Western Savanna as far as Namoroka. The birds from the southern part of the Humid East are paler than those from the northern part. A single specimen from Ihosy is plainly this form. The specimens from Namoroka are more similar to birds from Ivohibe and Farafangana than they are to specimens from Tsiandro. The green pigeon was most common in the more open country in the vicinity of the coast in the east, and in the denser savanna and the gallery forest of the savannas. It preferred especially the edge of the forest and areas about plantations and secondary growth, rather than the dense forest.

HABITS.—The green pigeon is an arboreal, fruit-eating pigeon, usually seen singly or in two's or three's; but sometimes numbers gathered to feed in the fruit trees and thirty or more were seen in a single tree. The French residents in the northwest say that these birds sometimes congregate in large numbers and provide excellent shooting. When flushed from such a fruit tree they did not move as a flock but flew off with a very rapid flight singly or in small parties.

This pigeon was a bird of the tree tops, though it sometimes fed on low bushes. In the west particularly, one or two were often seen perched on some conspicuous tall stub, apparently asleep in the sunshine. It has a loud, rich call of several notes.

Its food seemed to be entirely fruit, and birds were found in a favorite fruit tree day after day.

The breeding season probably includes at least the month of October as the following data indicate.

October 8, 1929	Male, testes enlarged	Manombo (southeast)
November 17, 1930	Two juveniles, half-grown	Anaborano

The partly grown young had down of a yellowish-white color rather scantily distributed on the back, and more abundant on ventral surfaces.

Vinago australis xenia (Salomonsen)[1]

Pale Madagascar Green Pigeon

DISTRIBUTION.—Found from sea level to 700 meters in the Western Savanna, except the portion from Namoroka north. A specimen from Tsiroanamandidy is somewhat darker than typical birds from Tsiandro. This species ventures into the edge of the Subdesert as far as Lac Iotry, but a specimen from Ihosy is better referred to *australis*.

HABITS.—In habits and habitat preferences this bird is much like the preceding form. The breeding season probably includes at least the months of November and December, as birds in breeding condition were taken at Tabiky and Lac Iotry in those months.

Streptopelia picturata picturata (Temminck)

Madagascar Turtledove

DISTRIBUTION.—From sea level to 2000 m., occurring in the three provinces. This pigeon was common in the forest, the secondary brush, the scattered areas of brush in the open ground, and about the plantations of the Humid East. In the Occidental, it was also common in the open forest and brushlands, but not in the open savanna. In the Subdesert, it was common only in some of the heavily wooded habitats.

HABITS.—This pigeon fed largely on the ground, walking about in the heavy forest or on the edges of the plantations, but also spent much of its time moving about through the trees. Its call was a deep "co-ooo."

The breeding season probably extends at least from July to October, as the following data indicate.

June 25, 1929	Male, testes enlarged	Vondrozo
July 26, 1929	Nest with two eggs	Vondrozo, 50 km. west
July, 1930	Several birds in breeding condition	Maroantsetra (two days northeast)
September, 1929	Several birds in breeding condition	Manombo (southeast)
September, 1929	Several young out of nest	Ivohibe
September, 1930	Male, testes enlarged	Andapa, one day west
October, 1930	Birds in breeding condition	Mt. d'Ambre
October 30, 1929	Nest containing two young, covered with much yellowish down	Tabiky
November, 1929	Young out of nest	Tabiky

The nest at Vondrozo was in a clump of brush in the open plain and was situated in a bush a meter and a half from the ground. That at Tabiky was in a clump of brush in the wooded-plain country, about two

[1] 1934, Ibis, p. 386.

and a half meters up in a bush. The nest is a rather thin flat platform of twigs, some 250 mm. across, placed on a tangle of vines and small branches. One nest contained two eggs and the other two young.

The eggs are ovate, nearly "elliptical ovate." One from the oviduct of a bird is "rounded ovate;" the shell is smooth with a slight gloss; the color white. The two eggs from one set measure 32.5 × 24.3 mm. and 34.4 × 25.2 mm. The egg from the oviduct of a bird measures 32 × 26.3 mm. The bird shot on the nest at Vondrozo, 50 km. west, on July 26, 1929, at 3:30 P.M. was a male.

NATIVE NAME.—"Demóka" or some variation of that. The name is strongly accented on the "mo" so that it suggests the bird's call.

Oena capensis aliena Bangs

Madagascar Long-tailed Dove

DISTRIBUTION.—From sea level to about 1500 m.; a common bird of the Subdesert and common in the Occidental Province; not common in the Oriental, where it spreads onto the western edge of the central highlands to Ihosy, Fianarantsoa, and Antsirabe. In the southeastern coastal plain (at Farafangana) it occurred but was not common. It probably is extending its range into this country from the south, around the end of the mountains at Fort Dauphin. This extension of range has followed the clearing of the land, the burning of the forest, and the appearance of a habitat similar to that in some of the west. In the north it was common as far south as Vohemar, and one was seen at Sambava. Its spread onto the plateau has probably been along the valleys, which are really arms of the Occidental Province, and into suitable brush areas, which at Fianarantsoa and Antsirabe are largely areas of planted blue gum and Mimosa trees.

HABITS.—This dove is a bird of the open wooded and brush country, feeding on the ground in the open brush and in the clearings in the dry forests. Near Tulear single birds were very common in the road. It usually flies singly, but sometimes several gathered at a particularly good feeding station, and when flushed as many as a dozen may line up on a branch. In the west it sometimes comes into the villages to gather the waste rice about the rice pounding-block. At Iotry it often came down to the lake to drink.

Its food consisted mostly of small seeds picked up on the ground and sometimes waste rice picked up about the villages.

The breeding season probably extends at least from September to February, as the following data indicate.

September 24, 1929	Female, ovary enlarged	Manombo (southeast)
October 13, 1929	Female, ovary enlarged	Ihosy
December 10, 1929	Female, ovary enlarged	Iotry
December 18, 1929	Juvenile birds, out of the nest	Iotry
February 24 and 27, 1931	Females, ready to lay	Soalala

NATIVE NAME.—Called "Katoot" almost universally.

Falco peregrinus radama Hartlaub

Madagascar Peregrine

DISTRIBUTION.—This magnificent falcon was found from sea level to 1000 m., on the edge of forested areas of the Humid East, and in the Occidental. Besides the four specimens secured, five others were seen. Seven of these were in the Humid East, on the edge of the forest, one was flying over the savanna at Loky (northeast), and one was taken in a flooded palm-valley at Ambararatabe.

HABITS.—This is a bold dashing falcon. Near Ivohibe, I saw one of a pair that were circling high above a little village stoop at a chicken in the center of the village. With partly closed wings it came down among the huts with tremendous speed, disregarding the natives standing about, and, missing its prey, was away again so rapidly that I forgot to shoot until it was too late. On another occasion, I witnessed a similar occurrence at the same village. Du Mont shot a specimen near Tamatave that was eating a chicken it had just killed.

NATIVE NAME.—The peregrine falcon was called "Firásha" by the Atamoor and Bara, a name also used for *Astur hensti*, and "Voromahéry," meaning "strong bird," by the Betsimisaraka.

Falco eleonorae Gené

Eleonora's Falcon

DISTRIBUTION.—The only specimen of this bird that was secured was a male, taken in the Sambirano at Bezona, November 29, 1930. It was perched on a stub in a freshly burned-over area in the forest. A bird seen circling over a similar burned area the day before was probably of this species.

Falco concolor Temminck

Sooty Falcon

DISTRIBUTION.—This bird was apparently an austral summer visitant to Madagascar, at which season it was found commonly in the Occidental and Subdesert.

The extreme dates on which we recorded it are as follows: earliest,

November 23, 1929, Befandriana, one bird, and November 13, 1930, Ambilobe, two birds; latest, April 5, 1930, Ihosy, 200 km. southwest, one bird, and April 6, 1931, Marovoay, twenty birds.

HABITS.—At Lac Iotry, from December 12 to December 17, 1929, these birds were observed in migration. Each morning from two or three to eight or ten were seen crossing the lake or marsh from the northwest to the southeast. The birds appeared singly, at irregular intervals, usually at no great height, some even low over the lake, though occasionally one would be high. Most of the birds passed on directly, though sometimes one would circle about over the lake. A few birds were collected during this flight and all had food in their stomachs.

This bird frequented the savannas, open woodland, and brush, where it was sometimes common. It was rather conspicuous, often sitting on some exposed perch and usually was not at all shy. On a sisal plantation near Tulear, January 25 to 30, 1930, the birds were very common and twenty or more would be seen in a morning, often perched in the tall flowering stalks of the sisal. At a little village near Tsimanampetsotsa, February 11, 1930, where these birds were common, sometimes as many as fifteen were seen in the air at one time, flying about, catching locusts on the wing and eating them while in the air, as would a kite (*Milvus*). On April 6, 1931, at Marovoay, where these birds were common, sometimes as many as seven were seen perched in one tree, in open marshy country where trees were scarce. In savanna country from Ampanihy to Tongohory (S. W.) these birds were often noted perched on the low ant hills.

The food of this falcon consists largely of locusts, though one specimen had the remains of a small bird in its stomach, and another that had locusts in its stomach was stooping at a stilt (*Himantopus*) at Lac Iotry.

Of twenty-three stomachs examined, one contained a small bird (*Foudia*); twenty-one contained mostly locusts; one, beetle remains, and one, other insect matter.

NATIVE NAME.—This bird was called "Híla" and "Schéndic" by the Masquer, and "Schéndic" by the Sakalava.

Falco newtoni (Gurney)

Madagascar Kestrel

DISTRIBUTION.—From sea level to 2000 m. This little kestrel was common over the whole island except in the heavy forests.

HABITS.—The kestrel was a familiar bird, preferring the vicinity of houses. At Tananarive it was often seen in the towns, perched on the

houses or trees in the park. Over the central plateau where trees were scarce it was often seen perched in the Mimosas or blue gums which line the road, or on the native houses. The walls of the mud houses of the Hova were often stained white in places from the droppings of these birds, which roosted in cornices or under the eaves. In the house we occupied at Monjakatompo a pair of these birds slept under the eaves on projecting beams and were often observed after dark with the aid of a flashlight. One day a bird got into the attic and came down into one of the rooms through an open trap door. In open country they sometimes perched on the ground or on the ant hills. The kestrel also followed the clearings and trails into the forests, where it delighted to perch on some dead stub in a commanding position. This kestrel often hovers in the air, watching for its prey. Its call was a shrill chattering cry from which its native name is derived. It liked to play in the air with large hawks, particularly *Milvus*, striking at them continually, apparently for the sport of it. Occasionally the hawk attempted to retaliate, but the little kestrel easily eluded the larger bird. A pair pursued and struck at a barn owl (*Tyto a. affinis*) that I started from the old nest of a hammerkop (*Scopus*).

The food of this species consisted largely of insects, of which grasshoppers formed the greater part. Of nineteen stomachs examined, one contained remains of a bird (*Mirafra hova*); two, rodent remains (one *Mus musculus*); one, a lizard; three, frogs; ten, locusts; and three, other insects.

The breeding season probably includes the month of September, as the following datum indicates:

September 11 and 16, 1929 Pair copulating Ivohibe

One bird of the pair was going in and out of a crevice between the thatched roof and the mud wall of a house. The wall below was stained with their excreta. It is probable that many birds nest in such locations.

NATIVE NAME.—The native name is some modification of "Kíta kíta ka" or "Hítikítéky" or "Itsi kítsi ka," an imitation of its call.

Falco zoniventris Peters
Banded Kestrel

DISTRIBUTION.—From sea level to 1000 m.; in the forests of the Humid East from the forest of Sianaka north, and in the Occidental Province and south into the edge of the Subdesert at Lac Iotry. The type comes from St. Augustin Bay in the Subdesert. About Maroantsetra and at Andapa it was fairly common, but was rare elsewhere.

HABITS.—This falcon was usually seen on the top of some dead stub above the forest, where it perched quietly for long periods. Although it was a bird of strong, rapid flight, its food was chiefly reptiles and insects.

Of seven stomachs examined; three contained chameleons; two, locusts; one, a beetle; and four, other insect matter.

Aviceda madagascariensis (Smith)

Madagascar Cuckoo Falcon

DISTRIBUTION.—From sea level to 1800 m. This hawk was a bird of the woods and brushlands of the whole island. It was not uncommon at Ivohibe, in the southeast, but was rather rare elsewhere.

HABITS.—The *Aviceda* usually frequented the brushlands and the edge of the forest where it flew from tree to bush, lighting in or on them in search of its prey, which is usually chameleons. At Monjakatompo, the bird was found in the groves of planted Mimosa trees. It usually perched in, rather than on, a tree though it was sometimes seen on a commanding perch. I saw no birds soaring, but Mr. Lowe shot two birds, which proved to be males, circling over the forest, "playing," at Tsinjoarivo. When directly overhead in flight, the larger head and slightly forked tail serve to distinguish it from *Buteo brachypterus*.

The favorite food of this hawk was chameleons, even when other food, such as other reptiles and locusts, was abundant. Of fifteen stomachs examined, eleven contained chameleons; two, unidentified reptile remains; four, locusts; one, a beetle; and two, other insects.

NATIVE NAME.—The natives do not distinguish between this bird and *Buteo brachypterus*.

Milvus migrans parasitus (Daudin)

Yellow-billed Kite

DISTRIBUTION.—From sea level to 2000 m. The kite was common over the brushland and open ground of the whole island except in the extreme southwest, where it was uncommon.

HABITS.—When swarms of locusts were passing over the village at Vondrozo these birds appeared in numbers, but they were seldom seen over the forested areas. In the southeast their daily abundance was governed by the abundance of locusts. When swarms of locusts were passing, these birds were very common; and when locusts were scarce, few of these birds were to be seen. Even when satiated, the kites were seen sailing above the swarms of locusts, apparently keeping their food supply in sight until they were hungry. They were sometimes common

about the villages, from fifty to a hundred birds sailing about, ready to swoop down and pick up any bit of offal, but they were not very bold and the half-starved dogs do a much better job of scavenging.

These birds were much disliked by the Malagasy because of their habit of eating young chickens. At Ivohibe I was called to shoot a kite that had just caught a chicken and was even then sailing low over the village devouring the downy chick held in its claw, at its leisure. About the harbor of Diego Suarez and at Majunga these birds were common, picking up floating refuse from the water, eating it as they flew about. When fed they perched on the rigging of the boats.

The kites congregated about brush fires to feed on the animal life driven from its haunts by the fire or left dead in the wake of the fire. At Tabiky, several were seen circling about over the brush, swooping down to pick large green insects from the tops of the bushes to which they were clinging, showing well their keenness of vision, for I found it difficult to distinguish the insects even at close range because of their green color which matched the leaves. The kite is usually spoken of as a scavenger but over the greater part of the island, particularly away from the towns, a large part of its food seemed to be insect matter. Two that were shot flying low over rat-infested rice fields, had remains of *Rattus* in their stomachs. On the coast to the west of Mt. d'Ambre, several kites were sailing about a fish weir, ready to snatch a stranded fish, but farther south, near Nossi Be, where fish were more common, no kites frequented the coast. This bird is a master of flying and sailing. Its call is a rather weak, broken, whistled call.

The breeding season probably includes the month of October at least. On October 31, 1929, at Tabiky, I saw a kite fly from its nest in the fork of a tree near the top, about 13 meters from the ground. This was in savanna country. From the ground the nest appeared to be of sticks and rather small for the size of the bird. I did not climb to the nest.

NATIVE NAME.—Universally known to the natives as "Papanga."

Machaerhamphus alcinus anderssoni (Gurney)

Bat-eating Hawk

DISTRIBUTION.—Two specimens in the dark-bellied phase were taken in the Western Savanna at Tabiky in wooded plain country, and two light-bellied specimens in the Humid East near Maroantsetra on the edge of the heavy forest.

HABITS.—On the afternoon of November 28, 1929, at Tabiky, a

native called me to shoot a bird that he had found. It was in a green bushy tree on the edge of the village in rather densely wooded plain country. The bird was sitting well concealed in the dense verdure some twelve meters up. As I watched, not knowing what it was, the bird flew off and with quick strong flight circled widely here and there over the trees. In a few minutes it returned and passed me at perhaps thirty-five meters, its yellow eye gleaming distinctly in the sunlight. On the morning of November 1, 1929, another flushed from a similar perch and after a wide flight passed me at close range.

Two stomachs examined contained remains of medium-sized bats.

One female had both ovaries present.

NATIVE NAME.—Known as "Schéndic" at Tabiky by the Masquer, a name also used for *Astur hensti*.

Eutriorchis astur Sharpe

Madagascar Serpent Eagle

DISTRIBUTION.—This rare hawk was found only in the northern part of the forests of the Humid East. We secured two specimens from the vicinity of Maroantsetra, one near sea level and the other at about 600 m. altitude.

HABITS.—Du Mont secured one as it flew up from a trail through the second growth along the river on the edge of the heavy forest. The other I saw fly from one tree to a perch on a large limb of another tree, on a ridge in the heavy forest.

One stomach examined contained part of a very large chameleon.

Haliaeetus vociferoïdes Des Murs

Madagascar Sea Eagle

DISTRIBUTION.—This beautiful sea eagle was fairly common along the coast of the Occidental in the northwest, south to Soalala; and Dr. White, of our Mission, told me that a native in his employ had killed one at Itamplove near Morombe in the southwest, but the specimen was not saved. A few were also seen on Lac Kinkony and in the wide flooded palm-valley at Ambararatabe and the near-by little Lac Amparikely. It was particularly common about the muddy mangrove-bordered bays along the coast where shallow water and numerous fish made feeding easy. Birds also were often seen perched on rocks along the open shore.

HABITS.—The sea eagle was a conspicuous bird that spent much time perched on the mangrove or other trees or on the mud or sand flats left exposed by the tide. On a few occasions one was seen soaring

several hundred yards up above the shore, occasionally uttering its loud musical call. When disturbed it sometimes lit on stubs a short distance inland. In the Bay of Baly (Soalala) two birds were flying short distances, lighting on the mud flats and calling. In flight they are easily recognized by the large wings, short tail, and the body somewhat tipped up.

These birds were very often in pairs, which, when collected, proved to be male and female, with no indication of breeding. In a bay opposite Nossi Be, eight were taken about the mangroves, within a radius of one-half mile during about two weeks collecting. These birds were usually not at all wary, having become accustomed to the passing of natives tending fish weirs, and it was usually possible to paddle to within easy range of them. At Ambiky, two of these birds were sitting almost directly above a native who was working on a fish weir. Their call, often heard, and uttered from the perch as well as while soaring, was a loud, rather musical yelp, repeated several times, "Quay–quay– – –."

This eagle usually watched for its prey from some vantage point, then swooped down and struck into the water for its prey, missing more often than not. At Kinkony I saw one strike and miss as it flew over the water of the open lake. The birds were in the habit of coming to the fish weirs of the natives. These weirs were long fences of cord and the midribs of raphia palm leaflets, arranged so that the falling tide leaves the fish stranded behind it. The eagles feed before the tide has fallen enough for the natives to come and collect their catch. Besides large fish, which the birds carry to the nearest land to devour, one specimen had a large eel in its gullet. None of the twenty-seven birds collected in November, December, or January showed any signs of breeding. Natives showed me a nest from which two young were said to have been taken several years before, and pointed out other nests which were said to be of this species. They were large bulky masses of sticks, conspicuously placed in the tops of mangroves on the edge of the sea and visible from a considerable distance.

NATIVE NAMES.—"An-quáy" in the west and northwest by the Sakalava and the Antakara. This name obviously is an imitation of their call.

Buteo brachypterus Hartlaub

Madagascar Buzzard

DISTRIBUTION.—From sea level to 1800 m. This hawk was common over all the wooded and brush areas of Madagascar, and was seen in

open country dotted with scattered trees, sometimes flying over the open ground.

HABITS.—The buzzard was often seen soaring over the forest in fine weather. In the southeast sometimes as many as six or seven would be in sight at the same time. When swarms of locusts were drifting over the country they formed a large part of the food of this species and the daily abundance of the hawks was determined somewhat by the presence or absence of the swarms of locusts. Its usual perch was in a conspicuous tree or on some dead stub where a good view might be commanded. The call of this hawk was a drawn-out screaming "Creeee."

Of twenty-one stomachs examined, two contained rodents; four, snakes from 200 to 375 mm. long; four, chameleons; one, a frog; eight, locusts; five, other insects; one, a centipede; and one, carrion (part of a *Tenrec ecaudatus*).

The breeding season probably extends at least from July to November, as the following data indicate.

July 14, 1929	Female, ovary slightly enlarged	Vondrozo, 20 km. west
August 11 and 23, 1929	Two males, testes enlarged	Ivohibe
September 5, 1929	Female, nearly ready to lay	Ivohibe
September 17, 1929	Nest, eggs not yet laid	Ivohibe
September 27, 28, 1929	Two females, breeding condition	Manombo (southeast)
October 12, 1930	Female, laying	Mt. d'Ambre
October 13, 1929	Nest with eggs	Ihosy
October 28, 1929	Nest with eggs	Tabiky
November 19–23, 1930	Several nests not examined but evidently in use, judging by the actions of the birds	Northern Savanna

The nest at Ivohibe, September 17, 1929, was built on a rocky ledge of a small cliff near the heavy forest. The nest at Ihosy, October 13, 1929, was ten meters up on the crotch of a palm. The other nests were from twelve to sixteen meters up in crotches of trees in the wooded plain. The nest near Befandriana was the nucleus of a colony of *Foudia sakalava*. All the nests were lined with twigs bearing wilted green leaves or with fresh leaves more recently added.

The two nests examined each contained two eggs. These were short ovate in shape; the shell dull or with a slight gloss, and slightly granular; the color whitish. The eggs measure: set from Ihosy, 54.0 × 43.4 mm. and 52.6 × 43.3 mm.; set from Tabiky, 54.9 × 45.2 mm. and 56.4 × 46.7 mm.

At Ihosy a male brought in food for a setting female, who left the

nest and met her mate on the rocky hillside. There she ate her food before returning to incubate. The birds sat rather close when I approached the nest but did not strike at me when I climbed up to it.

NATIVE NAME.—This hawk was known by a variety of names, depending on the locality. It was called "Póma" in the southeast by the Bara and the Atamoor; "Berîng" in the northeast by the Betsimisaraka; "Hîndy" in the northeast (inland) by the Tsimihety; "Tinúra" in the northwest by the Sakalava; and "Bubuck" in the west and southwest by the Sakalava and Masquer.

Accipiter madagascariensis Smith
Madagascar Sparrow Hawk

DISTRIBUTION.—From near sea level to 1000 m. We found this species rather uncommon in the wooded and brush areas of the Occidental, though it was somewhat more common in the Subdesert. In the Oriental only a single specimen was seen, though we secured a specimen from M. Herschell-Chauvin that had been taken in the forest of Sianaka.

HABITS.—The sparrow hawk was a bird that flew low through the trees, perching in inconspicuous places concealed by the foliage. Near Maromandia one was seen soaring high above the savanna. It probably kills many birds. Most of the stomachs were empty, but two contained the remains of small birds. The occasional "hawk kills" found in the forest, and others indicated by the scattered feathers of some small bird about a low perch were probably referable to this species.

The breeding season includes at least the month of November, as the following datum indicates.

November 7, 1929 Nest containing three eggs Tabiky

The nesting site was in the wooded plain country, where clumps of large trees grew close together. The nest itself was on a flat crotch about six meters up and six meters out from the trunk. It was a flat structure of coarse sticks lined with fine twigs, and here and there on the edge of the nest were flecks of down. The outside measurements were 500 mm. wide × 250 mm. deep.

The three eggs were "rounded ovate," rather blunt on the small end; texture smooth, with no gloss; ground-color white irregularly marked with color ranging from large blotches or small spots of dirty brown ("snuff brown") to dark chocolate brown ("warm sepia"), with a tendency to form a wreath about the larger end. Two of the three eggs measured 38.0 × 32.0 mm. and 37.8 × 32.8 mm.

NATIVE NAME.—This bird was not distinguished from *Astur francesii* by the natives.

Astur hensti Schlegel

Henst's Goshawk

DISTRIBUTION.—From nearly sea level to 1800 m.; in the Humid East, the Sambirano, and the Western Savanna.

HABITS.—In the Humid East, near Ivohibe, a goshawk was killed by a native as it attacked chickens in a village on the edge of the forest. At Fizona, near Maroantsetra, one was shot from a low bush on the edge of the village near the forest. At Andapa, one day west, one was seen several times, soaring over the forest and open ground, uttering its sharp broken call, "Cac–cac–cac––." In the Sambirano, at Anaborano, one day south, the bird was often seen soaring over the forest and screaming, sometimes several hundred yards up. Another was seen sitting on the top of a tall stub by a stream through the forest, and later it perched in a low tree in the forest, where the drongos were excitedly scolding it. In the Western Savanna one bird was noted over the forest on the low hills to the south of Bekotrobaka. The three specimens from near Tabiky were taken along streams in the little valleys, where the trees grew more luxuriantly than in the surrounding brush forest on the hills and in the savannas.

The stomachs of two birds taken at a nest near Tabiky, November 2, 1929, each contained portions of a mammal (*Microcebus*), probably parts of the same individual. That of a bird from near Befandriana contained the remains of a nightjar (*Caprimulgus madagascariensis*) and parts of a *Coua* (species?).

The following datum on the time of breeding was secured.

November 2, 1929 Nest with two eggs **Tabiky**

The nest was about twelve meters up in the crotch of a tree leaning over a small stream, in the type of gallery forest mentioned above. The nest was a bulky affair of sticks, some of them half an inch in diameter. The nest was lined with twigs, most of them dead, but one had a few withered leaves and had probably been placed there when fresh. Flecks of down were stuck to the projecting ends of the sticks about the edge of the nest.

The set consisted of two eggs, which were ovate in shape; the texture smooth, with a slight gloss; color, white. They measured 57.0 × 41.2 mm. and 60.0 × 42.7 mm.

Both birds were about the nest and I heard their broken scream before I was near the nest. Though they both circled about screaming as I approached, they did not come very close.

NATIVE NAME.—The goshawk was called "Schíndic" by the Mascour, a name that was also applied to *Machaerhamphus*. It was called "Fandrása" by the Bara and Atamoor, a name also used for ***Falco radama;*** and "Firásha" by the Betsimisaraka.

Astur francesii francesii[1] (Smith)

Madagascar Goshawk

DISTRIBUTION.—From sea level to 1800 m.; common in the wooded and brush areas of the Oriental and Occidental provinces, being most common in the northeast about Maroantsetra; and one was seen in the Subdesert Province.

This goshawk was usually seen sitting on some low perch in or on the edge of the forest or along the trails through the forest. Occasionally one was seen on the top of some dead tree, and telegraph poles along the trails through the forest were favorite perches, seven of these birds being seen on telegraph poles along the trail in one day's travel near Maroantsetra. It was often rather unsuspicious and allowed a close approach.

Of thirty-two stomachs examined, two contained mammal remains; one, bird remains; one, a chameleon; seven, other lizards; three, undetermined reptile or amphibian remains; seven, frog remains; four, locusts; two, cicadas; one, a wasp; one, beetle remains; seven, other insect remains.

The breeding season probably includes at least the months of September and November, as the following data indicate.

September 25, 1929	A male, testes enlarged	Manombo (southeast)
November 5, 1929	Two females, ready to lay	Tabiky

One female, ready to lay, was in juvenile brown plumage, while the other was in the adult plumage with bluish back.

The bluish back of the fresh plumage of the adult is covered with a delicate bloom which is easily rubbed off. The powder-down patches consist of a single pair, on the sides of the lower back.

Many specimens of the immature bird taken in the northeast had the ends of the tail feathers considerably battered.

It is apparently customary for the female to have both ovaries present. In eleven females, the right ovary was noted as being from one-half the size to nearly the same size as the left ovary.

[1] *Nisuoides morelii* is a synonym.

NATIVE NAME.—Called "Itsikala" (probably a contraction of "Itsiki tsika ala," "the kestrel of the forest") by the Atamoor, "Fandra kibo," "quail hawk," and "Firésha" by the Besimisaraka in the northeast and by the Antakara of the north.

Gymnogenys radiatus (Scopoli)

Madagascar Harrier Hawk

DISTRIBUTION.—From sea level to 1600 m. This species was found commonly in the wooded districts, savannas, and in neighboring open country in all the districts of Madagascar, but more commonly in the Occidental. It preferred the edge of the forest and areas of scattered trees to the dense forest.

HABITS.—In the east this bird was often seen, soaring over the heavy forest during fine weather, or perched in the top of some tree, giving its feeble scream. Birds were often seen about the banana trees (whence comes one of the native names) in the clearings, doubtless attracted by the little green lizards that feed on the insects about the banana flowers, as these lizards were found in its stomach. Specimens taken when swarms of locusts were passing were crammed with these insects. At Ambiky, on the coast opposite Nossi Be, they were frequently seen about the mangrove swamps or the little islets of mangroves.

In the west and southwest the harrier hawk was often seen soaring over the wooded areas and savannas and was more common than in the east. Several times one was seen clinging to the side of a rotten tree trunk or just below the "head" of a palm tree in search of its prey. Near Ambiky, on December 6, 1930, I watched one for some time evidently trying to secure a lizard from a hollow limb that had two openings in it some few feet apart. The bird peered in one opening, then reached in with its foot, pulling out dead leaves and other debris, peered in again, then went to the other opening and repeated the process. This was continued for sometime without success. When collected, this bird was found to have a lizard in its stomach.

At Ampotaka, March 11, 1930, three *Gymnogenys* were seen walking about on a flat sand bar in the Menarandra River. Others were occasionally seen standing on the ground or on ant hills in open savanna country, or beating low over the grassland on the edge of wooded areas.

One bird, Manombo (southeast), had gonads enlarged September 25, 1929, and nests, not examined but evidently in use, judging by the activities of the birds, were seen November 26, 1929, at Befandriana; and November 3, 1930, west of Mt. d'Ambre. So the nesting season

probably includes at least the months of September, October, and November.

The nest was a bulky structure of sticks placed in the fork of a tree from 10 to 16 meters up.

Of ten stomachs examined, one contained rodent remains (*Mus musculus*); one, fur of some small mammal; two, lizards; one, two 300 mm. snakes; one, a frog; three, locusts; two, other insects; one, a spider; one, carrion (part of a small mammal, *Tenrec ecaudatus*).

One immature female had both ovaries present, the right being one half the size of the left.

NATIVE NAME.—In the northeast this bird was called "Voronokóndra" (the bird of the banana trees) by the Betsimisaraka. Elsewhere it was known as "Fihéhaka" or "Fihíaka."

Circus aeruginosus macrosceles[1] Newton
Madagascar Harrier

DISTRIBUTION.—From sea level to 1800 m.; we found this species to be a rather uncommon bird of the open marshes and neighboring grasslands of the Humid East and of the marshes and the damper grasslands of the Occidental.

At a few places it was fairly frequent; at Lac Iotry, December, 1929, it was rather common over the large marsh at the head of the lake, and several were seen daily. Over a marsh near Vohemar, September 26, 1931, four were seen in one morning.

HABITS.—This species hunts in a typical harrier manner, beating back and forth low over the vegetation, dropping on its prey in the grass or reeds. At Lac Iotry one struck at a duck (*Anas punctata*) that I had shot; while at a little village near Ivohibe, on the edge of a marsh, a hawk of this species struck at a half-grown chicken, but missed and did not attempt to follow up and kill the chicken.

Of four stomachs examined, one contained the head and feet of a partridge (*Margaroperdix*) and remains of a rodent (*Rattus*); another, the fur of a small mammal and two frogs; a third, a portion of a young tree duck (*Dendrocygna*); and the fourth, an insectivorous mammal.

The harrier probably breeds in December at least, as on December 15, 1929, a female with ovary enlarged was collected at Lac Iotry. One female had both ovaries present.

[1] Delacour, 1932, L'Oiseau et R. F. O., p. 40, considers the type of *Circus humbloti* Milne-Edwards and Grandidier to have been an abnormal specimen of this species.

NATIVE NAME.—Called "Fotiszendela" (white rump) at Vohemar by the Antakara, and "Tsiparopíac" in the southwest by the Atamoor and the Bara.

Asio madagascariensis (Smith)
Madagascar Long-eared Owl

DISTRIBUTION.—From sea level to 1800 m.; apparently not uncommon in the forests of the Humid East and the Sambirano, where it was often heard, though only one was seen, perched on a fallen log by a stream in the forest at Vondrozo, shortly after dawn. Our specimens were taken by natives. In the Western Savanna we have but a single record. One was found at Tabiky during the morning, perched in a thick tree in the wooded plain. My attention was attracted to it by several *Calicalicus, Newtonia,* and *Cinnyris sovimanga* that were scolding it.

HABITS.—In the Humid East the natives said that it was very tame in the daytime and that specimens were taken by means of a snare on the end of a stick. One specimen from Maroantsetra was taken in a bat-net, one of a coarse mesh stretched above a clearing or trail so that the big fruit bats fly into it. When a bat, or in this case the owl, flies into it, the net is released by means of cords and pulleys and the falling net entangles the victim, bringing it to earth.

The call may be represented by the syllables "Hak-hak-hak--."

Three stomachs examined all contained remains of small mammals.

NATIVE NAME.—"Hak-kah," from its call.

Asio helvola hova Stresemann
Madagascar Marsh Owl

DISTRIBUTION.—Found from sea level to 1800 m. The marsh owl was taken in the Humid East and the Western Savanna, and south into the edge of the Subdesert.

HABITS.—In the Humid East at Tananarive three marsh owls were seen in one afternoon, beating about low over the meadow and lighting on exposed hummocks. One, when shot at and missed, began to soar high in the air, followed by two crows that kept striking at it. At Majakatompo two were seen, one flying over the grassland during the morning and the other flushed from its resting place in the grass in a wet grassy field. The natives here brought in several. At Ivohibe, where extensive grassy swamps and rice fields were common, the natives brought in several. At Andapa, one day west, where there were many small

marshes in the open ground on the edge of the central highlands, the natives brought in one. In the Western Savanna at Lac Iotry one was taken by a native, who said that it had been found in the extensive grassy meadow bordering the marsh at the head of the lake. One was also taken in the grassy savanna country some two hundred kilometers to the east of Tulear.

Of two stomachs examined, one contained mammal remains (*Rattus*?), and one a bird (*Turnix nigricollis*).

The breeding season probably includes at least the months of April, May, and July, as the following data indicate.

May 28, 1929	Two males, gonads enlarged	Tananarive
May 28, 1929	Downy young, said to have been taken from the nest, brought in by natives	Monjakatompo
August 13 and 22, 1929	Downy young, brought in by natives	Ivohibe

Otus rutilus (Pucheran)

Madagascar Scops Owl

DISTRIBUTION.—From sea level to 1800 m.; in the forests and brushlands of the Oriental, the wooded parts of the Occidental, and the areas of forest in the Subdesert.

HABITS.—The calling of the scops owl, starting at dusk, was one of the common night sounds of the forest. The call sounded like "tura–tura–tura–tura----" and was continued for some time. At Vohemar, where the bird was common in the shade trees through the town, one that was calling from a low branch was approached within a few feet. During the daytime it was found perching in thick places in the forest trees. One morning near Lac Tsimanampetsotsa one was found in a cave in the limestone.

Of twenty-three stomachs examined, all contained insect remains; one, a lizard; and one, a centipede.

The following datum on the time of breeding was secured.

November 2, 1929	Female, ready to lay	Tabiky

NATIVE NAME.—Called "Toro–toroka" by the natives wherever it occurred.

Ninox superciliaris (Vieillot)

White-browed Owl

DISTRIBUTION.—Found in the Western Savanna and the Subdesert. One specimen was brought in by a native at Ambaratabe; at Tabiky it was common in the more densely wooded plain, in the gallery forest

along the streams, and in the wooded ravines through the low hills. A few were brought in by the natives at Iotry. In the Subdesert it was not uncommon about Ampotaka, being found in the large trees about the village.

HABITS.—This owl was nocturnal, and its calling, starting at dusk, was among the characteristic night sounds at Tabiky. At Ampotaka, at dusk, two birds, a male and a female, were seen perched side by side on a dead limb over the rest house in the village. At Tabiky several times a bird was found in the daytime in the little caves along the wooded rocky ravines through the low hills. They were always rather wary and did not allow a close approach, flying out into the forest though the sun was shining brilliantly.

One of their calls was a loud "wac–wac–wac–––," and another, a single loud, explosive call.

Of eleven stomachs examined, one contained the fur of some small mammal; one, feathers of a small bird; one, a chameleon; and eight, insects.

The breeding season probably includes the months of October, November, and December as the following data indicate.

November 2, 1929	Female and two eggs containing large embryos, brought in by natives	Tabiky
November 18, 1929	Three half-grown young, grayish down clinging to the tips of the feathers, brought in by natives	Tabiky
December 14 and 15, 1929	Two nearly full-grown young	Lac Iotry
December 21, 1929	Female, ready to lay	Lac Iotry

The two eggs were said to come from one nest, and the three young from another. The nest was said to have been in a hole in a tree. The eggs were nearly "oval" in shape; the shell smooth in texture with a slight gloss; color white. The two eggs measured: 37.7 × 30.0 mm. and 38.8 × 30.7 mm.

Tyto alba hypermetra Grote[1]

African Barn Owl

DISTRIBUTION.—From sea level to 1800 m. Though all of our specimens are from the Humid East, one of these birds was seen in a tree by the hotel in Majunga (Western Savanna), and one was heard at Androka (Subdesert). The Chef de Poste at Ampotaka told me of a nest of owls, probably of this species, that had been found in the blockhouse there the year before.

[1] 1928, Ornith. Monatsber., XXXVI, p. 79.

HABITS.—Near Ivohibe, there was a tree in a clump of brush in open ground near an extensive swamp which held three old nests of *Scopus u. tenuirostris*. In one of these a barn owl was accustomed to spend the day, and on one visit two of these birds were flushed from the nest. In and below the nest were a number of pellets consisting largely of the bones and fur of small mammals. Three stomachs examined contained the remains of small mammals, including *Rattus* (sp.?).

The breeding season probably includes at least the months of April and May, as the following data indicate.

May 26, 1930	Juvenile	Maroantsetra
May 29, 1929	Female in breeding condition	Majakatompo

NATIVE NAME.—"Hora," or "Vorondola," the latter a general name for owls.

*Heliodilus soumagnei Grandidier

Soumagne's Owl, Madagascar Red Owl

Apparently a rare forest owl of the central part of the Humid East, and represented in collections by few specimens, the latest secured by L. Lavauden[1] in 1930. Lavauden states that it lives in isolated pairs, is strictly nocturnal, and feeds on batrachians.

Coracopsis vasa vasa (Shaw)

Greater Vasa Parrot

DISTRIBUTION.—Found from sea level to 1000 m. This race was found only in the Humid East where it was common in the forests of the coastal plain. It was not taken much above sea level, except at two days northeast of Maroantsetra (1000 m.), where it was common in the forest along the trail.

HABITS.—This parrot is a noisy conspicuous bird, usually seen in small parties, and often flying about over the forest. It was sometimes seen flying about over the open ground, often at a considerable height. Several times these birds were heard calling while flying about during the night, and they sometimes were seen in the moonlight. A number of birds were often seen perched on some dead tree projecting above the forest, and small numbers, with *Ixocincla* and *Hartlaubius*, gathered to feed in the fruit-bearing trees. This parrot has a variety of loud harsh calls that may be written "car-car," "ka-kee," or "caaaaak," and a softer "cree."

[1] 1932, Bull. Mus. Paris, pp. 636, 637.

The breeding season probably includes at least the month of October, as many birds with gonads enlarged were taken at Manombo (southeast) during that month.

NATIVE NAME.—The greater vasa parrot was not distinguished from *C. nigra.*

Coracopsis vasa drouhardi Lavauden[1]

Western Greater Vasa Parrot

DISTRIBUTION.—This race was found in the Sambirano, the Northern and Western Savannas, and the Subdesert. It did not range into the humid forest on Mt. d'Ambre, though it occurred in the deciduous forest on the slopes. In the Sambirano it was common in the edges of the humid forest at low altitudes. In the Occidental and Subdesert provinces it was a common, widespread form.

HABITS.—This race has much the same habits as the eastern one and was also given to flying about and calling at night. At Iotry it was often seen crossing the lake at a considerable height. Sometimes as many as ten or fifteen were seen sitting on some dead solitary stub. This parrot was a pest in the cornfields in some places, eating the grains from the ears on the stalk as the crows did. At Ampotaka it used to feed on the millet-like grain grown by the natives. The bird carried the head of grain in its bill to some perch and there, holding it in its foot, ate the grain at its leisure.

Flocks of this bird were sometimes seen feeding on the ground in the open savanna, and at Befandriana these birds were noted several times on the sandy shores of the river. At Tsimanampetsotsa from one to two hundred of these birds used to come to roost in the tall trees on the margin of the lake. As they left in the morning and flew high above the calcareous plateau, the morning sun gilded their wings before the first rays had reached the camp. In the evening the wings of the birds would catch the rays of the sun after it had disappeared from view at camp.

The breeding season probably includes at least the months of October and December, as the following data indicate.

January 3, 1931	Female, recently finished laying. Skin of head yellow; barbs are being lost from feathers	Marotony
December 3, 1929	Nest containing young, one-third grown	Iotry

The nest at Lac Iotry December 3, 1929, was in a natural cavity some three meters up in a tree, in a wooded area in the sandy country.

[1] 1929, Alauda, I, p. 231 (Tongobory).

The cavity was in a hollow trunk; the birds entered through an opening in a hollow limb that was about a meter from the trunk. The three young birds had many pin-feathers showing, but not a trace of down. The female flew about screaming while I examined the nest. When the female was collected it was found that the skin of the head was almost bare of feathers, with but a few shafts remaining from which the barbs had disappeared. Can this be a usual phenomenon with breeding birds as it was noted to a lesser extent in a few other specimens which had ovaries enlarged?

NATIVE NAME.—This bird was not distinguished from *C. nigra.*

Coracopsis nigra nigra (Linnaeus)
Lesser Vasa Parrot

DISTRIBUTION.—From sea level to 1800 m.; a common bird of the Oriental, the Northern Savanna, and the northern part of the Western Savanna, intergrading southward with *C. n. libs.* *C. nigra* is a woodland bird, favoring denser forest and brush than *C. vasa.* In the northwest *C. nigra* was frequently seen in the mangrove swamps. Both birds have about the same range, except in the Humid East where *C. vasa* was found only at the lower altitudes, avoiding the large areas of humid forest.

In speculating on the origin of these two birds, which are very much alike in color, differing chiefly in size, and of which the ranges more or less coincide, it seems probable that *C. nigra* originated in the humid forest of the east, as its habitat preference suggests, while *C. vasa* was originally a bird of the drier, more open woodland of the west and south. These birds have spread to the present limits of their ranges long enough ago to allow them to become differentiated at the extremes of their ranges into forms recognizable as geographical races.

The distribution of these geographical races also supports this view. *C. n. nigra,* the original form of the humid forest, has become modified to a paler form only in the Subdesert and the southern part of the Western Savanna where arid conditions are most intense, while *C. v. vasa,* the original form of the dry, open woodlands of the west and south, has become modified to a darker form only under the very humid conditions of the Humid East.

HABITS.—The lesser vasa parrot was commonly seen in the tree tops or flying about over the forest in parties of three or four to a dozen calling a harsh "cark cark." At Vondrozo numbers of these birds used to gather day after day to feed in certain fruit trees, the same trees that lemurs fed in during the night. The low, fruit-bearing bushes along

the trails through the forest and in the more open wooded plains also attracted these birds, where they sometimes fed within a few feet of the ground. At Ambiky I saw a lesser vasa parrot eating a mango that was hanging on the tree.

The usual call of this bird is a whistled call recalling the syllables "Dir-ti-jo" or "Dir-ti, dir-ti, dir-ti-jo ó." It also has a rather harsh croak "Cark cark--," though not so loud nor so harsh as that of *C. vasa.*

The only birds showing signs of breeding were four males taken near Martony, January 1 to 6, 1931. These birds were in breeding condition and all showed a large, rather solid, fleshy protrusion from the anus, which possibly coincides with the enlargements of the gonads.

Several females examined had the right ovary present and about one-half the size of the left. Lesser vasa parrots were often kept captive by the natives, who fed them on cooked rice and kept them in openwork baskets. They became very tame, often giving their whistled call, and could be handled freely.

NATIVE NAME.—"Vása" in the southeast among the Atamoor and Bara, "Boéza" in the northeast among the Betsimisaraka, and "Koéra" in the north and northwest among the Antakara and Sakalava.

Coracopsis nigra libs Bangs

Pale Lesser Vasa Parrot

DISTRIBUTION.—The Subdesert and the southern part of the Western Savanna; a fairly common bird of the more densely wooded areas.

HABITS.—This lesser vasa parrot has much the same habits as the preceding race. At Ampotaka this species was much more retiring and less conspicuous than *C. vasa.* Its whistled call was commonly heard, but it was several days before I was able to see one, though *C. vasa* was seen daily.

NATIVE NAME.—"Siótsa" among the Masquer.

Agapornis cana cana (Gmelin)

Gray-headed Love Bird

DISTRIBUTION.—From sea level to about 1000 m.; we found this species common in the Humid East, the Sambirano, and the Occidental. This love bird frequented the brush and open ground on the edge of the forest, following the little clearings into the forest on the mountain slopes. It was much more common on the coastal plain of the Humid East than on the mountain slopes inland.

HABITS.—This little love bird usually traveled in flocks of from five to twenty. Its flight was swift and strong, and when startled into flight it usually flew to a distance. It often perched on the tops of trees on the edge of the forest as well as in bushes, and on the infrequent telegraph wires.

This bird fed on the ground, eating the seeds of the short grasses. Along the trails they picked up rice that had been spilled, and about the villages they ate the rice that the natives had spread out to dry. They were not seen to eat standing rice, though the natives said they did so.

At Marotony in the northeast, I saw flocks of three to ten of these love birds passing in a flight along the edge of the forest just at dusk. The flight lasted for perhaps a half hour, the flocks passing at irregular intervals. In the northwest on the calcareous hills I watched a female and four males for some time. The female was in the mouth of a large natural cavity in a tree, and the four males sitting in near-by trees seemed to be courting her. One after another would fly to the mouth of the cavity where the female was sitting, and they would bow to each other several times, touching bills, when the female was apparently fed by regurgitation. Shortly another male took his place. This continued for some time.

NATIVE NAME.—The love bird was called "Kítrehoka" by the Bara and Atamoor in the southeast; "Káraoky" by the Betsimisaraka in the northeast; and "Saregy" by the Sakalava and Antakara in the north and northwest.

Agapornis cana ablectanea Bangs

Blue-washed Gray-headed Love Bird

DISTRIBUTION.—In the Subdesert Province; we found this subspecies fairly common in some of the more open desert brush, but it was rather local, being restricted to areas where there were suitable grassy places for them to feed. It was more common about the grassy areas in the savanna, especially in the vicinity of trees, than in the more arid regions.

HABITS.—The habits of this race are much like those of the preceding race (*A. c. cana*).

NATIVE NAME.—This bird was called "Farevaza" by the Mahafaly in the southwest.

Cuculus poliocephalus rochii Hartlaub

Madagascar Cuckoo

DISTRIBUTION.—From sea level to 1800 m.; found in the wooded areas of all the biotic provinces during its season in Madagascar. The

cuckoo is a bird of the woodlands and sometimes of the low bushes on the plains, and was found wherever wooded areas existed. It occasionally was taken in the Savannas, except in the Subdesert Province south of the Onilahy (February and March), though it probably does occur there also. It breeds in Madagascar and migrates to Africa.

The first time that this cuckoo was heard was September 5, 1929 (Ivohibe). Certainly none had been calling in the forests of the southeast up until that time. From then on it was heard calling commonly and later was heard in the west until the last of December. Birds were seen about Tulear in January and one was collected there January 30, 1930. One was seen near Tongohory, March 28, 1930, and another collected near Maroantsetra, May 23, 1930. This last may represent a nonmigrating individual. The following season the cuckoo was first heard on August 6, 1930 (Antalaha), on which date six were heard and one of them collected. It was heard commonly as we traveled in the north and west until April 4, 1931 (Marovoay), when collecting in the west was discontinued. None was heard at Fanovana the last two weeks of April.

HABITS.—The cuckoo was a shy, elusive bird that was more often heard than seen, and usually called for long periods from the same perch in the top of a tree where it was hidden by the foliage. It remained for some time in the same position, and ten or fifteen minutes were sometimes spent trying in vain to locate one calling from a tree top almost overhead. Sometimes, however, it selected a conspicuous perch on some dead limb. Its usual call was a loud "ko–ko kó–ko" or "ko–ko kó–kof," sometimes simply "ko–ko kof," the latter part of the call lower than the first. The call was heard indiscriminately throughout the day or night. A less frequent note was a low chattering call that I heard only during the daytime.

One stomach contained hairy caterpillars.

The following data indicate that the bird breeds in August at least.

August 17, 1930	Female, ready to lay	Andapa
January 30, 1930	Full-grown young	Tulear

It is interesting to note that in 1930 the first cuckoo was heard on August 6, while a female ready to lay was taken on August 17. An egg removed from the oviduct of a female was whitish, well marked with brown.

NATIVE NAME.—The native names are imitations of its call. It was called variously "Ko–ko," "Ko–kof," "Ko–ko–kof," and "To–ton cal–kof."

***Pachycoccyx audeberti** (Schlegel)

Madagascar Thick-billed Cuckoo

Apparently a rare bird of the forest of the northern half of the Humid East, represented in collections by five specimens: one in Leyden, one in Tananarive (Madagascar), and two in St. Denis (Reunion),[1] and one in the Rothschild collection.

Centropus toulou toulou (Müller)

Madagascar Coucal

DISTRIBUTION.—From sea level to 1800 m., the coucal was common in the wooded and brush areas in all the biotic provinces, but was absent from brush areas on the central highlands about Tananarive and Monjakatompo.

This bird was found in the ground-cover in the forest, occasionally in the trees, commonly in the brushlands and the dense reeds and grass of the smaller marshes.

HABITS.—The coucal was a solitary bird, sometimes seen in pairs, especially in the breeding season. It spent much of its time moving about in the shelter of the brush, and occasionally in the trees of the forest, when it could be closely approached before it took alarm. When perched on the top of a bush or other low conspicuous perch in the brushland, as it often was, it was always ready to dart down into the brush and creep away or to fly with heavy labored flight to another perch before disappearing into the brush. In the early morning or after a rain it was often seen sunning itself after the manner of the coucas, back to the sun, wings somewhat spread and drooping, and tail spread.

The coucal's call was a conspicuous, loud, hollow-sounding "cou–cou–cou——" or tooting. This call was heard at night on several occasions. Sometimes when one bird started to call, another joined in on a slightly different key. It also gave a rattling call and, when alarmed, a hissing "tish" that was often the first intimation one had that there was a bird within a few feet of one in the brush.

Its food consists mostly of large insects and spiders. Five stomachs examined contained beetles, grasshoppers, other large insects, and spiders.

The breeding season extends at least from October to March, as the following data indicate.

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[1] Lavauden, 1932, Bull. Mus. Paris, p. 640.

October 5–10, 1929	Several males and females, gonads enlarged	Manombo (southeast)
October 15–26, 1930	Several males and females, gonads enlarged	Mt. d'Ambre
November 24, 1929	Female, breeding	Befandriana
November 29, 1929	Female, ready to lay	Iotry
December 4–11, 1929	Several females, ready to lay	Iotry
January 2–4, 1931	Two females, laying	Marotony
February 2, 1930	Nest with two eggs	Tulear
February 27, 1931	Female, ready to lay	Soalala
March 29, 1931	Female, ovary enlarged	Ambararatabe

Moulting specimens were found in nearly every month of the year; but many birds had assumed their breeding plumage, wings and tail being retained, by October and almost all of them by November. This plumage is worn until March or even later in a few cases, when the bird undergoes a complete moult into a brown plumage.

The nest at Tulear, February 2, 1930, was discovered by seeing the male fly to it, with a long dry piece of grass in its bill. The nest was in wooded and brush country on the edge of a sisal plantation. It was about three feet up in a tangle of live brush. The nest was a bulky structure some 300 mm. across, rather flat, with a wall on one side some 150 to 175 mm. high, built there apparently to keep back the encroaching twigs. The bulk of the nest was composed of rather large herbaceous plant stems, freshly wilted, and with leaves still attached. The protecting wall was partly of herbaceous stems and partly of dead grass.[1]

The nest contained two cold white eggs which were fresh; the female was not seen. The eggs were "short ovate"; shell, smooth with a slight gloss; color, white. They measured 33.4 × 26.4 mm. and 33.4 × 26.9 mm.

All the male *Centropus* examined had the left testes rudimentary, and apparently non-functional.[2]

NATIVE NAME.—"Toulou" in the southeast among the Bara and the Atamoor; "Monjo" in the north, and northeast among the Betsimisaraka, Tsimihety, and the Antakara.

Coua caerulea (Linnaeus)

Blue Coua

DISTRIBUTION.—From sea level to 1800 m.; a common forest bird, found in the Humid East, the Sambirano, and extending northward into

[1] Schlegel and Pollen, 1868, 'Recherches sur la Faune de Madagascar, etc.,' II, p. 58, describe the nest of this bird as spherical with an opening on the side.
[2] See Rand, 1933, Auk, pp. 219–220.

the wooded areas of the Northern Savanna, nearly to but not including the mountain rain forest on Mt. d'Ambre.

The blue coua ranges through the forest from the tree tops through the middle spaces into the undergrowth, sometimes even running on the ground, and also ranges through the larger secondary brush.

HABITS.—The blue coua was sometimes solitary, often two were seen together, sometimes more. It was not at all shy of man, indeed it exhibited a certain amount of curiosity concerning him. It responded readily to squeaking, and sometimes after a shot has been fired would come gliding to the spot to investigate. The blue coua adopted a variety of poses, sitting up with its tail pointed straight down or with its tail cocked over its back, and wings slightly dragging, as it peered at some object on the ground. It slowly raised and lowered its long tail as it moved through the forest. Its movements were slow and deliberate, and it turned its head and peered now this way, now that, hopping or running through the branches, sometimes clinging to the side of a trunk of a tree, or gliding from perch to perch, sometime gaining impetus by pushing from a convenient limb without pausing. It flew heavily, preferring to glide whenever possible, often hopping to the top of one tree to glide to the next. One, crossing a clearing on a mountain slope, glided some two hundred yards without giving a wing stroke.

The variety of loud harsh calls of the blue coua were among the characteristic sounds of the forest. Now and then it gave a deep, explosive "chug" or "tish," sometimes a loud "waugh–waugh–waugh," which gradually became less emphatic. This call was louder and deeper than that of *Coua cristata*. The natives say that this call predicts rain. One that I watched calling had its head thrown back slightly, its mouth open widely and its tail vibrating at each call. It often sat on some conspicuous perch, its wings somewhat spread or standing out rather stiffly from the body, and its tail spread, to gather the warmth of the sun's rays or to dry its feathers.

The blue coua's food consists chiefly of large insects and some fruit. Of nineteen stomachs examined, one contained a 125 mm. chameleon; eighteen, insects (one, cicada; seven, locusts; one, beetles; two, large caterpillars, some of them hairy; seven, other large insects). Three contained fruit, and one, a small piece of white quartz.

The nesting season is probably the rainy season, as with other birds of Madagascar. November was the only summer month that we were in this bird's range and then the six females collected were all breeding. (15 miles southwest of Tsarakibany.)

NATIVE NAME.—"Tish" in the southwest among the Bara and Atamoor; "Maria" in the north among the Betsimisaraka, Tsimihety, and Antakara.

Coua cristata cristata (Linnaeus)

Crested Coua

DISTRIBUTION.—From sea level to 600 m. This coua was fairly common in the Sambirano, very common in the Northern Savanna, and was found sparingly down the east coast in the Humid East, on the lower edges of the humid forest. It was characteristic of the deciduous woods and brush of the Northern Savanna and its presence in the Humid East is probably an extension of its range southward, coinciding with the destruction of the humid forest to give open brushland, more suitable for it, though there may have been a few isolated areas on the coast suitable for it in the original state of the flora. Its presence in the Sambirano was probably also due to similar causes. The original heavily-forested region in the Sambirano may have been a barrier between this form and the one to the south, *Coua cristata dumonti*. The crested coua was absent from the humid forest on Mt. d'Ambre but was found in the deciduous forest up to the edge of it.

HABITS.—The crested coua was an active, conspicuous arboreal form of the Occidental Province, replacing *Coua caerulea* of the Oriental Province. This coua is strikingly beautiful in form and color. It was usually seen in small parties of three to five, except when breeding. It hopped and ran about through the branches searching for its food, adopting a great variety of poses, sometimes sitting up straight, sometimes with its body horizontal and its tail cocked up. Occasionally it descended to the ground. Its flight was heavy and it often glided from one tree to another. Like the other couas, it often sat on a conspicuous perch with its wings and tail spread and drooping to enjoy the warmth of the sun, or to dry its feathers after a rain.

It had a number of loud calls and was sometimes noisy. One call was a loud "wac–wac–wac– – –." Sometimes several birds joined in this call to make a chorus. This occurred during the day but was most conspicuous just at evening, the birds usually sitting well concealed in the big trees often some distance apart. It also had a henlike "cut–cut–cut– –" often followed by a low rolling call, or the rolling call might be given alone. It also had a loud harsh squawk, and a bird building a nest occasionally gave a little contented "creu."

Its food was mostly insects with some fruit. Of seven stomachs

examined, six contained insects (two, grasshoppers; two, beetles; two, cicadas; four, other insects) and three, fruit. One of these contained nothing but fruit.

The breeding season probably includes at least the months of September, October, and November, as the following data indicate.

September 18, 1930	Female, laying	Vohemar
September 19, 1930	Female, breeding	Vohemar
November 3–8, 1930	Several females, laying	Tsarakibany, 15 miles southwest
November 18–21, 1930	Several females, laying	Anaborano, one day south
November 19, 1930	Juvenile not long out of nest	Anaborano, one day south
November 28, 1930	Nest in construction	Bezona

The nest in construction at Bezona, November 28, 1930, was perhaps one-third finished. It was in an area of secondary brush, some 4 meters up in the top of a sapling and supported by a number of small branches. It was a bulky nest, the outside composed of slender twigs which the birds were pulling or breaking off near-by trees. Both male and female were building, the one waiting until the other left the nest before it entered and arranged the twig it carried. When the male was shot the female continued building alone.

A young bird, evidently not long out of the nest (Anaborano, November 18, 1931), had no indication of down clinging to its feathers.

NATIVE NAME.—"Tsívoka" by the Antakara and "Absanga" by the Betsimisaraka (northeast).

Coua cristata dumonti Delacour

Du Mont's Crested Coua

DISTRIBUTION.—From sea level to 700 m. This coua was fairly common in the Western Savanna. It was much like *C. c. cristata* in choice of habitat; being found in the wooded areas and out into the edge of the Savanna.

HABITS.—Its habits were much like those of *C. c. cristata.*

One stomach contained a locust; another, other large insects.

The following datum was secured on the time of breeding.

March 6, 1931	Female, egg in oviduct	Namoroka

NATIVE NAME.—"Tsívika" by the Sakalava.

Coua cristata pyropyga Grandidier

Southwestern Crested Coua

DISTRIBUTION.—From sea level to 800 m.; found commonly in the Subdesert Province, but absent from the greater part of the range of

C. verreauxi, which is the country about Lac Tsimanampetsotsa. This was an arboreal bird, of the brush and wooded areas, much like the other races in choice of habitat.

HABITS.—Much like those of *C. c. cristata*. Many of the villages have large shady trees ("Madra" trees of the Malagash), and these couas used to come into them and call, first one and then another and another took up the call until the whole village resounded with the loud "whac-whac- - -." This performance was most conspicuous at sunset but also occurred during the day. At Ampotaka, they were quite familiar and used to hop and run about on the roof of the rest house. Near that place, one gliding from a low perch took a few steps on the ground, and glided up to another perch without a pause.

Two stomachs examined contained large insects.

The breeding season probably includes the months of September and December at least, as the following data indicate.

November 3, 1929	Juvenile, but a short time out of nest	Tabiky
December 20, 1929	Nest in construction	Iotry

The nest at Iotry, about December 20, 1929, was a rather bulky structure of twigs, some 2.75 meters up in a bush in a rather dense area on the sand. A single bird was building it.

The young bird (Tabiky, November 3, 1929) still had a very short tail but there was no indication of down clinging to the tips of its feathers.

NATIVE NAME.—"Tsívoka" among the Masquer.

Coua verreauxi Grandidier

Verreaux's Coua

DISTRIBUTION.—From sea level to 100 m.; found in the Subdesert from the Onilahy to the Menarandra rivers. Over much of this area it was not uncommon and was seen almost daily, but *Coua cristata* strangely enough was absent from the greater part of this region, though found commonly to the north and the south. Near Bevoalavo both species were found, indeed a specimen of each species was taken within a half hour from the same tree on the edge of a village.

This coua frequented the Subdesert brush on the sand, the dry forest to the east of Tsimanampetsotsa, and the low forest on the calcareous plateau.

HABITS.—Verreaux's coua was a rather active arboreal species much like *Coua cristata* in habits as well as appearance. It was usually seen

in parties of two or three moving through the tree tops and the underbrush, but was somewhat more shy and retiring than *Coua cristata.*

It was somewhat noisy, but less so than *Coua cristata.* One call was a loud harsh "quark- -quark" followed by a softer "cou-cou- -"; and another a single, harsh "creu."

Coua reynaudii Pucheran

Red-fronted Coua

DISTRIBUTION.—From sea level to 1800 m.; common in the forests of the Humid East and the Sambirano. In the Humid East this bird was more common at the higher altitudes and rare in the forest of the narrow coastal plain, while *Coua serriana* and *Canirallus kioloides* were common at the lower altitudes, though all three were common in the same areas on the mountain slopes. But while *Coua serriana* was largely frugivorous, *Coua reynaudii* was largely insectivorous. In the Sambirano, *C. reynaudii* and *C. kioloides* were very common down to nearly sea level, and at Andampy the range of *C. reynaudii* and *C. coquereli* overlapped. Both were found commonly in the heavy forest, although *C. reynaudii* was restricted to the forest, while the latter ranged to the south through the brush and the deciduous wooded areas.

HABITS.—This coua was a terrestrial bird of the forest floor, favoring the localities with much tangled ground cover and ranging out into the brush on the edge of the forest and in the dense masses of herbaceous vegetation in the clearings. Its movements were slow and unhurried, walking about on the forest floor or up sloping trunks or bushes, in search of its insect food. Its habit of appearing from the thick cover, walking in the trails, and darting into cover at the approach of danger has given it the name of "Fandikalala," meaning "road crosser." It occasionally mounted to a low perch, and at Maroantsetra, two days northeast, Du Mont shot one that was some 18 meters up in a tree in the forest. At Fanovana, one was sunning itself on a low perch on the edge of the forest. It was sitting quietly, wings fully spread and standing out stiffly from the body, and the tail spread and drooping.

It has several calls; a loud "couah," a rather loud harsh cry, and a chattering call like a *Centropus.*

The food of this bird is composed mostly of large insects and some small fruit. Of the thirty-three stomachs examined, all contained insect matter (nine, caterpillars, some of them large and hairy; seven, locusts; four, beetles; one, cicada, and twenty-two, other insects);

eight of these also contained mostly fruit; one also contained a piece of white quartz and a feather.

The breeding season is probably at least from August to November, as the following data indicate.

August 30, 1930	Female, ovary enlarged	Andapa, one day west
September 25, 1929	Female, breeding	Manombo (southeast)
November 20–24, 1930	Several females, laying	Anaborano, one day south
November 24, 1930	Juvenile with short tail	Anaborano, one day south
November 25–29, 1930	Many females, laying	Bezona
January 4–23, 1931	Several females, ovaries enlarged	Maromandia, one day east

An egg, removed from the oviduct of a bird, was ovate in shape; shell, white. It measured 38 × 28 mm.

A young bird with short tail, apparently not long out of the nest, had no indication of down clinging to its feathers.

Coua serriana Pucheran

Red-breasted Coua

DISTRIBUTION.—From sea level to 1000 m.; fairly common in the forest of the northern part of the Humid East. This coua was a terrestrial bird, frequenting the forest floor and occasionally mounting to a low perch to rest or call. It favored rather more open ground-cover than *Coua reynaudii*, though both were sometimes found in the same places in the forest. This bird was not found in the secondary growth in the clearings as was *Coua reynaudii*. In the forest of the flat country on the coast, 20 km. southwest of Maroantsetra, this bird was very common, as was *Canirallus kioloides*, but *Coua reynaudii* did not occur.

HABITS.—This coua's movements as it walked about on the ground were rather slow and stately, but when alarmed it ran with considerable speed. The bird was rather shy and difficult to observe. A few were seen walking along the trails, and here the natives set snares for them.

Its call was a loud rich "Ka-coo" sometimes given from a low perch in the forest. When approached while calling, the bird stopped and stole away, to call again from another part of the forest.

In May, June, and July, about Maroantsetra, it was feeding largely on the small fruit that had fallen from the trees. This was the same food that the starlings (*Hartlaubius*), parrots (*Coracopsis*), and bulbuls (*Ixocincla*) were eating in the trees above. A few insects were also eaten (*Coua reynaudii* fed largely on insects). Of eighteen stomachs examined, all contained seeds and pulp of small fruit; two, a few small

beetles; one, a large dipterous insect; and one, a little insect matter; two contained a small quantity of quartz sand.

NATIVE NAME.—"Couah" among the Betsimisaraka. This name is also used for *Coua reynaudii*.

Coua ruficeps ruficeps Gray

Red-capped Coua

DISTRIBUTION.—This was a bird of the Western Savanna, where it was very common. This race occurred in the same habitat as the following, frequenting the ground in the brush on the sandy area near Soalala and the richly forested river-bottom lands along the Mahavavy River near Ambararatabe, where it was very common. On the wooded and brush-covered plains it was less common.

HABITS.—This red-capped coua's habits were much like these of the next race. It was a terrestrial bird, walking about on the ground with stately graceful movements, and running with speed when alarmed. One that I watched at close range walked about with unhurried movements, climbing up onto a low bush and back to earth again, occasionally picking up small prey, and now and then giving low throaty calls.

The breeding season probably includes at least February, March, and April, as the following data indicate.

February 26, 1931	Female, ovary enlarged	Soalala
April 1, 1931	Female, ovary enlarged	Ambararatabe

NATIVE NAME.—"Goorey" at Soalala and Namoroka among the Sakalava.

Coua ruficeps olivaceiceps (Sharpe)

Olive-capped Coua

DISTRIBUTION.—The Subdesert Province, frequenting the dry forest, the wooded plain, brushlands, and the Subdesert brush on the sand. At Lac Iotry it was very common, becoming less common farther south, while *C. cursor*, a bird of similar habits but more restricted to the arid portions of the Subdesert, became commoner farther south.

HABITS.—This coua was a terrestrial bird, very slender in build and graceful in movements. The long tail was often somewhat elevated as the bird walked about. Solitary in habits, it was seen in pairs only during the nesting season. In the more open brush it was often seen, apparently trusting to its speed to escape danger. A bird would sometimes pass within a few feet of me when I was sitting quietly although I was in full sight. When alarmed it runs with surprising rapidity, often

interrupting its stride with hops, and using its wings in turning sudden corners. Its flight is heavy and labored and it usually prefers to escape on foot. Once, at Iotry, I shot one of two birds perched in a bush in thick cover, and the other, within a few feet of me, dropped to the ground and made off on foot.

It occasionally mounts to a low bush to call or rest. At Iotry a female, ready to lay, and her mate were resting in a bush in rather dense cover, some two meters up. One of its calls is a rather whistled call of six or seven notes that are accented like rapid counting, the body vibrating in rhythm. This is sometimes followed by a low "cou cou – –." Another call is a low hissing "chec–chec– – – –."

Its food consists almost entirely of large insects picked up on the ground or from low bushes. One was seen eating a large grasshopper, beating it to pieces on the sand. Of four stomachs examined, all contained large grasshoppers and other insects; one contained some fruit.

The breeding season is at least from October to December, as the following data indicate.

November 2, 1929	Full-grown young	Tabiky
November 10, 1929	Female, ready to lay	Tabiky
December 12, 1929	Female, ready to lay	Iotry

One egg taken from the oviduct of a bird, December 11, 1929, is rounded ovate; its shell is rather smooth with a slight gloss; color, white; it measures 33.4 × 28 mm.

NATIVE NAME.—"Akook" among the Masquer. At Tabiky the young birds of this species were called "Aliotsy," which was also used for *C. coquereli*. At Lac Iotry this latter name was used for *C. cursor*.

Coua cursor Grandidier

Running Coua

DISTRIBUTION.—From sea level to 160 m.; in the Subdesert Province. Not uncommon at Lac Iotry but becoming more common farther south. At Ampotaka, four were sometimes seen in a morning. The running coua frequented the Subdesert brush on the sand at Iotry and Anakao, the calcareous plateau covered with low forest brush at Tsimanampetsotsa, and the Subdesert brush at Ampotaka.

HABITS.—This coua is a terrestrial form, usually walking about but when alarmed runs rapidly and may interrupt its stride with hops. It frequently perches in bushes or low trees and can fly fairly well with a heavy labored flight, as do all of the terrestrial couas, though they usually prefer to escape on foot. The only call that I have definitely

traced to this bird is a hissing "hark" or "cark." One bird that I saw at Lac Tsimanampetsotsa was carrying a large caterpillar in its mouth.

The breeding season is probably in November and December, as the following data indicate.

February, 1930	Full-grown juveniles	Tsimanampetsotsa
March, 1930	Full-grown juveniles	Ampotaka

The reddish stripe in the bare skin behind the eye may be a breeding color, since a specimen from Iotry, December 18, 1929, showed it while two from Tsimanampetsotsa, February 22, 1930, did not.

NATIVE NAME.—At Iotry this bird was known as "Aliotsy," a name which at Tabiky is applied to *Coua coquereli* and to the young of *Coua ruficeps*.

Coua coquereli Grandidier

Coquerel's Coua

DISTRIBUTION.—Ranges from nearly sea level to 700 m.; in the Western Savanna, and into the edge of the Sambirano at Maromandia, one day west. In the southern edge of the Sambirano this species was very common in the humid forest, often with rather dense ground-cover, where *Coua reynaudii* also was common. Coquerel's coua was also common in the open brush on the edge of the forest where *C. reynaudii* did not occur. At Namoroka this species was common in the brush-covered plain, the forest with rather open ground-cover, and in the low forest and brush on the calcareous hills. Only two were secured at Tabiky in the low dry forest. Farther south this coua was replaced by *Coua cursor*.

HABITS.—*C. coquereli* is a solitary terrestrial bird that walks about on the ground with slow unhurried movements, the tail often slightly raised above the wings. It is continually feeding, picking up bits of food from the ground or from twigs and leaves within reach. One of these birds would occasionally walk within a few feet of me when I was sitting quietly in the forest in plain sight. When alarmed, it runs rapidly. One of their commonests calls is a loud, clear "Ka ka ka – – –" followed by a lower, throaty coo or it may be only "Ka coo." When walking about undisturbed, it often utters little clucks and coos. One that I watched calling from a low perch threw its head back, bill pointing upward, as it called.

The food of *C. coquereli* consists chiefly of insects. Of nine stomachs examined all contained insects (four contained grasshoppers; two,

cicadas; three, caterpillars; one, a moth; three, beetles; five, other insects); one also contained a spider; two, other arthropods; and in one about twenty per cent of the stomach contents was fruit, probably picked up from the ground.

The breeding season probably includes at least January, February, and March, as the following data indicate.

January 27, 1931	Female, ready to lay	Maromandia, one day east
March 2, 1931	Several females, laying	Namoroka

NATIVE NAME.—"Mandetalk" at Andampy among the Sakalava, where it was distinguished from *Coua reynaudii;* "Aliotsy" at Tabiky among the Masquer, the name also applied to the young of *Coua ruficeps.* At Iotry, where *Coua coquereli* did not occur, *Coua cursor* was called "Aliotsy." In the region about Soalala, this species was called "Goory," as was also *Coua ruficeps,* by the Sakalava.

Coua gigas (Boddaert)
Giant Coua

DISTRIBUTION.—From nearly sea level to 700 m.; in the Western Savanna, and into the edge of the Subdesert at Iotry; fairly common at Lac Iotry but rather rare elsewhere. This was a bird of the dry forest of the calcareous areas in the Western Savannas and in the forest and brush on the sand at Lac Iotry.

HABITS.—Largely terrestrial in habits, the giant coua is an extremely stately and graceful bird, as it walks about on the ground like a pheasant, often with its tail somewhat raised. It often mounts to a low perch, 1.5 to 3 meters from the ground, to rest or call. Its flight is heavy and labored and it flies but little. The common call is a loud "wac wac-wac," often followed by an "eyou," sometimes a single loud caterwaul, "eyou" is given. The food of this species is probably largely insects; one was seen eating a grasshopper and another had its stomach filled with insects.

The breeding season probably includes at least the months of November and December as the following data indicate.

November 1, 1929	Female, nearly ready to lay	Tabiky
December 3 to 25, 1929	Several females, nearly ready to lay	Iotry

NATIVE NAME.—Called "Goory be" at Namoroka by the Sakalava. This name means "big coua."

Cochlothraustes delalandei (Temminck)

Delalande's Madagascar Coucal, Delalande's Coua

This large coua has been found in the forests of the northern half of the Humid East. Besides the two specimens in London and two in Paris, there are one in the Museum of Comparative Zoology, Cambridge,[1] one in the Philadelphia Academy of Natural Sciences, and one in The American Museum of Natural History. Lavauden,[2] is of the opinion that this bird is not extinct, but it seems strange that if this is so, such a large bird of the forest floor has not been taken by native hunters in recent years. Probably it is extinct.

Caprimulgus madagascariensis madagascariensis Sganzin

Madagascar Nightjar

DISTRIBUTION.—From sea level to 1800 m. We found this species common over the greater part of the wooded and brush areas of Madagascar.

HABITS.—The Madagascar nightjar spent the day asleep on the ground on the edge of the heavy forest of the east, in the areas of secondary brush or in isolated areas of brush in the open ground. In the west the bird was found sleeping on the ground in any of the areas of open forest. It became active at dusk, hawking for insects low over the brush or the forest, sometimes even over the ponds. It was often seen over open ground, usually on the edge of a wooded or brush area. Though the nightjar did not sleep in the heavy forest of the east, it was sometimes seen feeding about the tree tops there. We found the bird occasionally at some of our forest camps, though it apparently did not penetrate far into the forest.

Its flight was rather slow, and the bird sometimes sailed with its wings above its back. As it fed about the tree tops of the forest, its flight appeared weak and uncertain. In the early evening birds were frequently seen perched on dead limbs, and were also seen sitting in the roads or trails. They were usually not gregarious, but at Manombia, in June, a flock of perhaps two dozen appeared at dusk, fluttering about the tree tops along the road through the forest.

Their call is a "Ta tarrraa. . ." prolonged into a wooden rattle, usually given from a perch or while the bird is sitting on the ground. Another call is a loud and liquid "Wa–pit," which is sometimes given when the bird is on the wing.

[1] J. C. Greenway, Jr., *in litt.*
[2] 1932, Bull. Mus. Nat. Hist., Paris, pp. 639–640.

Much of the food of this bird consisted of large insects. Some grasshopper-like insects removed from the stomachs of birds we collected measured 54 mm. from head to tip of abdomen, and some cicadas measured 40 mm.

The breeding season included at least the months of August, September, and October, as the following data secured on the time of breeding indicate.

September 24, 1929	Nest with one egg	Manombo (southeast)
September, 1929	Several birds in breeding condition	Manombo (southeast)
September 26, 1930	Juvenile, on the wing	Vohemar (one day north)
October 10, 1929	Small downy juvenile brought in by a native	Manombo (southeast)
November 4, 1930	Juvenile, on the wing	West of Mt. d'Ambre
November 11, 1930	Juvenile, on the wing	Tsarakibany (fifteen miles southeast)
November 18, 1930	Female, laying	Anaborano
November 22, 1930	Young, not yet able to fly	Anaborano (one day south)

The nest found at Manombo (southeast), on September 24, 1929, was in a little glade on the edge of the forest. The nest was simply a small space on the forest floor somewhat clear of leaves. The female flushed from the nest and the male was sitting nearby. The nest contained one egg, while the female had an egg ready to lay, in the oviduct.

The egg was stout "elliptical ovate" in shape; the shell, smooth and glossy; the color, white, heavily marked with rather large overlapping blotches and spots of brownish black and secondary grays. The secondary grays were as plentiful as the surface markings, and, with them, covered more than half the surface of the egg. The egg measured 26.2 × 19.0 mm.

NATIVE NAME.—The Madagascar nightjar was called "Tatara" in the southeast by the Bara and Atamoor; "Dadara" in the north by the Anakara, and "Quapaka" by the Sakalava in the west. All of these names were apparently imitations of the bird's calls.

Caprimulgus enarratus Gray
Collared Nightjar

DISTRIBUTION.—From sea level to 1800 m. We found the collared nightjar in the forests of the Humid East and in the Sambirano. It was usually rather rare, but at Andapa, one day west, it was not uncommon, and at Fanovana it was fairly common. This nightjar was not uncommon also in the Sambirano at Anaborano, one day south.

HABITS.—Most of the specimens of this bird were secured and brought in by the natives. On three occasions a pair of them was found asleep on the ground in the heavy forest. One of a pair of these birds, when flushed, flew to a low limb. The collared nightjar apparently spent all of its time in the heavy forest.

Several stomachs examined contained medium-sized insects.

The breeding season probably included the month of October, as the following data indicate.

October 8, 1929	Female, ovary enlarged	Manombo (southeast)
November 24, 1930	A small downy young	Anaborano (one day south)

NATIVE NAME.—I doubt if this bird is usually distinguished from *Caprimulgus madagascariensis* by the natives, though it was sometimes called "Tatarna ala," meaning the "nightjar of the forest."

Apus apus balstoni (Bartlett)

Madagascar Black Swift

DISTRIBUTION.—From sea level to 1500 m. Birds were recorded in all of the biotic districts. In the Humid East a few were seen mixed in the flocks of *Apus melba willsi* at Ivohibe, and from Antalaha to Andapa. Mr. Lowe wrote me that he saw them daily over Tananarive the first part of August (none were seen there in May). A few were seen in the Northern Savanna to the west of Mt. d'Ambre, and on Mt. d'Ambre they were common. On the edge of the Sambirano and the Western Savanna, at Andampy and Maromandia, they were fairly common; and at Lac Iotry, on the edge of the Western Savanna and the Subdesert, a flock of several hundred were seen over the lake, and in the Subdesert another large flock was seen over the desert brush near Tsimanampetsotsa. When we were collecting on Mt. d'Ambre from a ridge where one could see the Mozambique channel, there was a steady flight of these swifts each morning during the first part of October, all of them coming from the northwest. The gonads of most of these birds collected showed some enlargement, indicating breeding.

Apus melba willsi (Hartert)

Madagascar White-bellied Swift

DISTRIBUTION.—From sea level to about 1300 m.; a wide ranging bird of the Humid East and the Occidental, and into the edge of the Subdesert. Occasionally large flocks of one hundred to two hundred were seen in the southern part of the Humid East following the mountain ridges, or over the flat country next to the coast. In the northern part

of the Humid East it was very common; at Antalaha, on the coast, they were frequent, and over the little plateau of Ankibe (Andapa) a flock of several hundred was often seen, milling about high in the air or swooping low over the vanilla and coffee plantations to feed. In the Northern Savanna it was common near Sambava; in the Western Savanna a few were seen near Maromandia, usually in company with *Apus apus balstoni*. Delacour (1930) recorded a flock of a thousand at Tsiandro.

HABITS.—The striking thing about these birds is the amazing speed at which they fly. This is especially realized when one is stationed on a ridge where birds are occasionally swooping down from a flock some two hundred yards overhead. In the southeast, where the swarms of locusts were drifting by, the swifts were feeding on these as well as on smaller insects. They often swooped within a few feet of me as I stood on some ridge and then their speed was very striking.

Several stomachs examined contained locusts, while others were filled with very small insects.

NATIVE NAME.—Called "Hela kela" by the Betsimisaraka.

Cypsiurus parvus gracilis (Sharpe)

Madagascar Palm Swift

DISTRIBUTION.—From sea level to 1100 m.; fairly common about the edge of the forest in the Oriental Province and over the secondary brush of that province, particularly near the coast where palm trees were common, but not found in the heavy forest. The palm swift was widespread in the Occidental, particularly on the palm-plains where it was sometimes very common. It was found on the edge of the Subdesert at Iotry, and in the Subdesert at Tongohory, but was absent from the greater part of it.

HABITS.—The breeding season probably extends from September to November as the following data indicate.

September 24, 1930	Nest with one egg; two large yolks in female	Vohemar, one day north
September, 1929	Several birds in breeding condition	Manombo (southeast)
October, 1929	Several birds in breeding condition	Manombo (southeast)
October, 1930	Several birds in breeding condition	Mt. d'Ambre
November 9, 1930	Nest in construction	Southwest of Mt. d'Ambre
November 17, 1930	Nest with eggs	Anaborano
November 26, 1929	Nest with three eggs	Befandriana

About December 17, 1930	Nest with three well-grown young brought in by natives	Coast opposite Mt. d'Ambre

Of five nests examined, three were in palm-plains, about 2 to 3 meters from the ground. One was in a solitary palm in a village, about 2 meters from the ground. Another, brought in by the natives, was in a coconut palm in the village. Two of the nests in palms were attached to dead palm leaves that had folded in such a way as to provide both a floor and a roof for the nest. Two of them were in green palm leaves, which also formed a roof for the nests. The nests were all very similar in construction, shallow saucers of plant down glued together and glued to the sloping surface of the leaf. As they were glued to the sloping surface of a palm leaf, the shape of the nest, when viewed from the side, was triangular. Measurements of one nest are: outside 50 × 30 mm. deep, and inside 30 × 18 mm. deep.

One nest contained three eggs; another, one egg; in the latter case the female had two large yolks developing in her body. One nest contained three young. The eggs were white; shape, elliptical ovate.

Zoonavena grandidieri (Verreaux)
Madagascar Spine-tailed Swift

DISTRIBUTION.—Found from sea level to 1000 m.; a forest bird, found in all the biotic provinces. The spine-tailed swift is common in the Humid East, more so at the lower altitudes. It is much less common in the Occidental and the Subdesert where it was only occasionally noted.

HABITS.—The spine-tailed swifts are commonly seen over the forest, sometimes low above the tree tops, or hunting over the open ground near the forest, or in clearings in the forest. Considerable numbers may assemble over the rice fields, particularly toward evening, though they are more often seen in two's or three's. In the Occidental and the Subdesert the few seen were flying about over the forest.

The breeding season probably includes the months of July, September, October, and January, as the following data indicate.

July 10, 1929	Male, breeding	Tsiandro
September 24–25, 1929	Three males, testes enlarged	Manombo (southeast)
September 19, 1930	Male, testes enlarged	Vohemar
October 14, 1930	Male, testes enlarged	Mt. d'Ambre
January 24–25, 1931	Two males, testes enlarged	Maromandia

NATIVE NAME.—"Manaviandro," which seemed to be a general name for small swifts and swallows, used by the Sakalava and Antakara.

***Collocalia francica francica** (Gmelin)
Mauritius Swiftlet

This swiftlet is common on Mauritius and Reunion, and Grandidier[1] says it is less common in Madagascar.

Eurystomus glaucurus (Müller)
Madagascar Broad-billed Roller

DISTRIBUTION.—From sea level to about 1200 m. This roller was found in all of the biotic districts. The bird breeds in Madagascar, spending the rest of the year in Africa.

The extreme dates on which this bird was noted in Madagascar were: earliest, October 12, 1929, Manombo (southeast), and September 27, 1930, near Vohemar; latest, March 22, 1930, Ampotaka, and April 1, 1931, Ambararatabe.

Little time was spent in the Humid East while this bird was in Madagascar, but a few were seen over the scattered bits of rain forest at Manombo (southeast) on October 12 and 13, and over the forest at Vondrozo while we were motoring through it on October 14, 1929. M. Chauvin had some specimens which had been taken in the forest of Sianaka. This bird was common over the rain forest on Mt. d'Ambre and in the Sambirano, where it was seen perching in the tops of trees and on dead stubs. The broad-billed roller was common over the wooded areas of the Occidental and in the more heavily wooded parts of the Subdesert. Though found over the forest, this bird preferred the edge of woodlands and the scattered areas of tall trees, so that it is probably more common in the Occidental Province than elsewhere.

HABITS.—This is a noisy conspicuous bird, sitting on some prominent perch or in the top of a tree, or flying about over the forest with strong swift flight. Both in flight and when at rest it gives its chattering call that may be written "sar a roc sar a roc– – – –." It watches for its prey from a perch and secures it on the wing by a sudden dash.

Four stomachs examined contained large insects: two, cicadas; one, a large beetle; two, other insects. The stomachs of two young from the nest each contained medium-sized beetles, and one, a large wasp-like insect. Each stomach also contained a piece of shell, evidently from the beach, though the birds had not left the nest.

[1] 1879, 'Hist. Nat. Madag.' Oiseaux, p. 200.

The breeding season includes at least the months of October and November, as the following data indicate.

October 24, 1930	Two females, ovaries enlarged	Mt. d'Ambre
December 10, 1930	Nest with well-grown young	Coast opposite Nossi Be

At Befandriana, November 23, 1929, a roller was attempting to drive pigeons away from a pigeon house in the village, and the natives said that it would nest there. The nest on the coast opposite Nossi Be (Ambiky, December 10, 1930) was some six meters up in a tree on the edge of the beach. The nest was in a natural cavity that went in from the bend of a horizontal limb. The cavity was about 200 mm. across and 760 mm. deep. The native who climbed to it said that there was no lining in this cavity. It contained two young. Before the nest was disturbed the two young birds spent their time at the entrance to the nesting cavity, while one adult sat about near-by, catching such insects as passed and carrying them to the young. When the native boy climbed to the nest, the old birds were not very pugnacious, though both appeared and kept calling more or less continuously.

NATIVE NAME.—"Tsárarahaka," "Tsáraroka," or some variation of that, obviously from the bird's call.

Leptosomus discolor discolor (Hermann)
Kirombo Courol

DISTRIBUTION.—From sea level to 2000 m.; in all the biotic provinces. *Leptosomus discolor* was common in the Oriental in the forests and secondary brush, out into the scattered areas of Mimosas and other trees on the central plateau; in the Occidental on the denser savannas and wooded plains; in the Subdesert in the heavier forest at Ampotaka.

HABITS.—The courol is a conspicuous, noisy bird of the forests and brushlands, which is often seen flying about over the forest, often circling about calling, or perched on some conspicuous stub in the top of a tree. As it gives its loud call from some such position, it leans forward and its throat swells out, its size accentuated by the long throat-feathers. In flight the wing beats are slow but the flight is bounding and graceful. It sails but rarely, sometimes with the wings held below the horizontal. Two or three birds were often seen flying about over the forest, but on one occasion, near Monjakatompo, I saw a party of seven.

The call of the courol is a loud, wild, whistled "wheu" repeated at intervals, and it sometimes breaks out into a "wha– ha – ha – ha –." The bird is easily called up by an imitation of its cry.

The courol's food is usually secured from the branches of the tops of trees and bushes. At Maroantsetra, a bird that had just captured a caterpillar in the top of a large bush flew to a dead stub, against which it beat its prey until it hung quietly in its bill. The stomach is often lined with the fur of hairy caterpillars. Of twenty-three stomachs examined, five contained chameleons (from 80 to 140 mm. long); twelve contained locusts; nine, caterpillars (largely hairy); one, various beetles; and seven, other large insects.

Birds in breeding condition were taken at Tabiky, November 1 and November 11, 1929, so that they probably breed in this month at least.

NATIVE NAME.—The bird was known as "Réoréo" in the southeast by the Atamoor and the Bara; "Kirómbo" in the north by the Betsimisaraka and Atakara, and "Vorondríu" in the west by the Sakalava and on the plateau by the Hova.

Brachypteracias leptosomus (Lesson)

Short-legged Ground Roller

DISTRIBUTION.—Found from sea level to 1800 m.; a rather uncommon bird of the heavy forest of the central and northern parts of the Humid East.

HABITS.—This roller is a bird of the forest floor, frequenting low, wet places where the trees cast a continual shade and the ground-cover of spindly saplings leaves the damp forest floor nearly bare. Upon being alarmed it does not run but flushes, and with quick, noisy flight rises a short distance to some low perch. It sits rather upright, with the bill somewhat elevated and the feathers of the throat project loosely nearly as far as the end of the bill. While sitting thus it may be closely approached, and if startled into flight, it continues some distance to another low perch, usually within six meters of the ground.

The short-legged ground roller feeds on the ground; and of eight stomachs examined one contained a snake (200 mm. long); two, chameleons (one 90 mm. long); one, beetles; two, caterpillars; four, other insect matter; and one a small snail.

NATIVE NAME.—In the northeast this bird was known as "Fangadíovy," a name also used for *Brachypteracias squamigera* and possibly for other ground rollers by the Betsimisaraka and the Tsimihety. At Fanovana it was called "Sokók" (a name that probably should refer to *Atelornis pittoides*) by the Betsimisaraka.

Brachypteracias squamigera (Lafresnaye)
Scaled Ground Roller

DISTRIBUTION.—From sea level to 1800 m. We found this bird only in the heavy forest of the central and northern parts of the Humid East from the forest of Sianaka to one day west of Andapa. It was everywhere rare.

HABITS.—This roller is a terrestrial bird of the heavy forest where the trees keep out the light from its haunts and the ground vegetation is not very dense. Upon being alarmed it usually runs a few steps and then stands quietly, with its head raised and its bill slightly elevated, as it watches the intruder. One that was surprised at close range flushed with a whir like a quail, flew a few yards, and lit on the ground. It apparently secured all its food on the ground. Of five stomachs examined, four contained large terrestrial insects, and one a spider.

NATIVE NAME.—This species was called "Fangadíovy" (as was *Brachypteracias leptosomus*) by the Betsimisaraka.

Atelornis pittoides (Lafresnaye)
Pitta-like Ground Roller

DISTRIBUTION.—From sea level to 1800 m.; in the Humid East in the heavy forest, where it was rather rare, and in the rain forest on the summit of Mt. d'Ambre, where it was very common. One specimen was secured in the Sambirano; strangely enough M. Herschell-Chauvin considers this species much rarer than *A. crossleyi*. In a year's collecting (with natives) he secured but one of this species, though he collected several dozen *A. crossleyi* in the Sianaka forest.

HABITS.—This beautiful roller is largely terrestrial, like *Brachypteracias squamigera*, and haunts the deep forest. When alarmed it runs a few steps and stands quietly watching. At Mt. d'Ambre, however, where the ground-cover was dense and where the bird was common, we found it would sometimes flush at our approach and fly to a low perch. We were usually advised of its presence by a loud, soft "kook" uttered at short intervals. The calling bird was usually on the ground, but one was some three meters up on a liana which trailed across a glade. Several birds, when alarmed, flew to low perches or from one low perch to another some distance away, making no attempt to escape on foot as a *Coua* would have done. One bird that was startled into flight flew strongly, low through the forest until lost to sight amid the trees some fifty meters away. Besides the call mentioned above, a bird at close range was heard to give a low clucking note.

The food of *A. pittoides* is chiefly insects. Of six stomachs examined, one contained ants; four, other insect remains; and one, reptile or amphibian remains.

The breeding season probably includes the months of October and November, as nearly all the specimens taken on Mt. d'Ambre during these months were in breeding condition.

NATIVE NAME.—"Tsikók" or "Sokók" (evidently from the bird's call) at Andapa one day west; but the names of all the ground rollers were used rather indiscriminately, and about Maroantsetra this bird was known as "Fangadíovy," as were the other ground rollers.

Atelornis crossleyi Sharpe

Crossley's Ground Roller

DISTRIBUTION.—Found from 800 to 1800 m.; in the central and northern parts of the forest of the Humid East. We found this roller rare, securing it at but two stations, through native hunters. We also bought a series of skins from Herschell-Chauvin; and judging from the number of skins in his collection, it was not uncommon in the Sianaka forest where he collects, though he found *A. pittoides* rare.

HABITS.—This bird probably frequents the ground in the heavy forest; one stomach examined contained insect remains.

Uratelornis chimaera Rothschild

Long-tailed Ground Roller

DISTRIBUTION.—The Subdesert, where it was fairly common in the brush of the flat, sandy country at Lac Iotry. A pair was also seen (one of them collected) near Manombo (southwest) in the brush country on the sea coast.

HABITS.—This roller is a beautiful, graceful ground bird that, when alarmed, both bounds and runs to the shelter of a near-by bush and stands quietly, often with head up and tail raised, watching the intruder. It usually walks and is largely terrestrial, but on December 31, 1929, I saw one fly from one bush to perch in another. One stomach examined contained beetles.

The breeding season probably includes at least December, as the following data indicate.

December 24, 1929	Three full-grown juveniles, lacking the long central tail feathers of adults	Lac Iotry
December 27, 1929	Female, ready to lay	Lac Iotry

The natives say that the nest is placed in a hole in the ground.

NATIVE NAME.—The Masquer at Lac Iotry called this bird "Bokatch" or "Toloranta," one name being used as often as the other.

Merops superciliosus Linnaeus

Madagascar Bee Eater

DISTRIBUTION.—Breeds in Madagascar and Pemba Island,[1] some individuals migrating to Africa where the species has been recorded from May to September.[2] In Madagascar the Mission secured specimens during every month of the year. From June to August of each year I was in heavily forested areas where these birds were naturally uncommon and consequently did not note differences in abundance indicating migration.

We found this bird from sea level to 1000 meters. It was a widespread form of the wooded and brush areas of the three provinces. The bee eater was common in the brush, the open wooded country, the savannas, and the wooded plains and was also found over the heavy forest, though it was much less common there.

HABITS.—The bee eater is a conspicuous bird, perching on some commanding perch, making sallies after passing insects and returning to its perch again, or flying about over the forest or savanna with strong swallow-like flight, sometimes sailing, sometimes catching insects. In flight it often sails about until it has located a swarm of insects, when it feeds by making swoops back and forth through the swarm, hovering on each turn before making the swift downward swoop.

In flight the bee eater is a rather noisy bird, often calling "ker keuk." In the eastern forests it was more often heard than seen as it flew over the forest. In wooded country the bird perched on the tops of the tallest trees, but in the savannas it often rested near the ground, sometimes even on the fallen branches. It was often seen in small parties, particularly after the breeding season. Du Mont saw hundreds

[1] 1930, Ibis, p. 17.
[2] 1932, Bull. Amer. Mus., LXV, p. 350.

of these birds going to roost in the isolated trees in the secondary brush country near Antalaha in April.

The food of this species consists of large insects captured on the wing. At Soalala, February 27, 1921, I saw one seize a flying grasshopper, carry it to a perch, and beat it on the branch before swallowing it. Of three stomachs examined, three contained grasshoppers; two, wasps; and one, a cicada.

The following data were secured which indicate that breeding occurs at least in September and October.

September 5, 1929	Two eggs brought in by natives	Manombo (southeast)
September, 1930	Birds in breeding condition	Vohemar
October, 1929	Birds in breeding condition	Manombo (southeast)
November 13, 1929	One nest containing three young	Tabiky

The nest at Tabiky, November 13, 1929, was a tunnel, going in from the vertical face of a shallow dry gully in savanna country. The tunnel, some 1.75 meters long, ended in a chamber about twelve inches below the surface of the ground. It was an odoriferous place, littered with remains of insects and excreta of the young. The nest contained three young, one much smaller than the other two.

The two eggs were brought in by a native at Manombo (southeast), September 5, 1929; the native said they belonged to this species and had been taken from a tunnel in the ground. One egg was ovate in shape, the other rounded ovate; the shell, smooth and glossy; color, white; they measured 25.9 × 21.4 mm. and 29.9 × 21.2 mm.

NATIVE NAME.—The native name, taken from the call of the bird, is usually some modification of "Kirio kirioka" or "Tsi kirio kirioka."

Corythornis vintsioides (Eydoux and Gervais)
Malachite Kingfisher

DISTRIBUTION.—From sea level to 1800 m.; we found this kingfisher commonly in the Oriental and Occidental. In the Humid East this little kingfisher was common along the brush or reed-fringed streams in the open country on the central plateau and on the eastern slopes; it was also often found perched on the dikes between the flooded rice fields, and in the little brushy swamps. A few of these birds were sure to be found about any little stream in the small clearings in the forest, and occasionally along the streams or in the swamps in the heavy forest. In the Occidental it was found along the brush-lined streams but not in the large reedy marshes. In the northwest it was sometimes found on

the edge of the sea, perched in the mangroves or on rocks, and feeding in the edge of the sea or in little pools left by the tide.

HABITS.—This kingfisher watches for its prey from some vantage point by the water, darting down, seizing it and returning to its perch to swallow it. It was usually seen singly but sometimes two would be perched quietly near each other. Occasionally one was seen chasing another, both birds uttering little squeaks.

Of seven stomachs examined, two contained bones of small frogs; one, eight small crayfish; four, aquatic insects; and one, a grasshopper. This last bird was sitting on a rock on the edge of the sea. The floor of an old nesting cavity that we excavated contained some fish and frog bones.

The breeding season probably includes at least the months of September, October, November, January, and March, as the following data indicate.

September 13, 1929	Female, ovary enlarged	Ivohibe
October 21, 1930	Female, ovary enlarged	Mt. d'Ambre
November 14, 1929	Female, ovary enlarged	Tabiky
January 4, 1931	Female, ovary enlarged	Marotony
April 1, 1931	Young from nest	Ambararatabe
March 2, 1931	Female, ovary enlarged	Namoroka

A number of old tunnels, probably of this species, were seen. They were placed in the vertical banks above the streams. One old nest at Bezona which I dug out had a tunnel about eighteen inches long, and ended in an enlarged chamber.

At Ambararatabe on April 1, 1931, a native brought in five young birds of this species that he said were from the same nest. One of these birds was much smaller than the others.

NATIVE NAME.—"Vintsy" or "Bintsy."

Ispidina madagascariensis (Linnaeus)

Madagascar Pigmy Kingfisher

DISTRIBUTION.—From sea level to 1800 m.; this forest kingfisher was found in the Oriental and Occidental. In the Humid East one was taken at Manombo (southeast) and M. Chauvin had specimens from the forest of Sianaka. We found it rare in the northeast except at one day west of Andapa, altitude 1800 m., where it was not uncommon. It was common on Mt. d'Ambre and fairly so in the Sambirano (Andampy). The species was uncommon in the Occidental Province. It occurred as far south as Tsiandro, where one specimen was secured.

HABITS.—This dry-land kingfisher frequented the heavy humid forest and the deciduous woods, occasionally one was seen in a small area of brush in the savanna. It was usually seen sitting quietly on a low perch in the heavy forest whence it darted to seize its prey from the ground.

Of seventeen stomachs examined, fourteen contained frogs; two, undetermined reptile or amphibian remains; one, a grasshopper; twelve, other insects; two, spiders; and one, an earwig.

The breeding season probably includes at least the months of October, November, December, and January, as the following data indicate.

October, 1930	Several specimens in breeding condition	Mt. d'Ambre
November 26, 1930	Female, laying	Bezona
January 23, 1931	Female, laying	Maromandia, one day east
January 26, 1931	One young taken from nest, brought in by natives	Maromandia, one day east
January 27, 1931	Three young, taken from nest, brought in by natives	Maromandia, one day east

At Mt. d'Ambre where these birds were common, several tunnels were seen in the vertical dry banks of road-cuttings in the forest. These were probably the nesting tunnels of this species.

The white belly in fresh specimens is strongly tinged with salmon-pink which probably fades with exposure to light.

NATIVE NAME.—"Vintsy ála" or "Vintsy mena," meaning, respectively, "forest kingfisher" and "red kingfisher."

Upupa epops marginata Cabanis and Heine
Madagascar Hoopoe

DISTRIBUTION.—Found from sea level to 1000 m.; a common bird of the Occidental and the Subdesert, and ranging sparingly into the Oriental where the destruction of the forest has given place to secondary brush more like the west. It probably spread into the east around the ends of the central plateau. In the north it was found as far south on the coast as Antalaha and in the south as far north as Ivohibe, though here it may have spread across the plateau along the river valleys, as it was also found at Ihosy.

HABITS.—The hoopoe frequents the open wooded plains, the open areas in the brushlands and the savannas. It feeds on the ground, where it walks about with quick, short steps, bobbing its head the while. Alarmed, it flies to a perch in a near-by tree, its black-and-white wings flashing conspicuously. One of its cries is a hollow, rolling call that re-

minds one of the tattoo of a woodpecker, and it also has a hissing "hash."

The breeding season probably extends from September to December, as the following data indicate.

September 25, 1930	Female, ready to lay	Vohemar, one day north
October 14, 1929	Nest, containing young	Tulear, 18 km. N.E.
November 9, 1929	Female, ready to lay	Tabiky
November 19, 1930	Two young, one-half grown	Anaborano
December 11, 1929	Nest containing one fresh egg	Iotry

The nest at Iotry, December 11, 1929, was a natural cavity about three meters above the ground in a large tree, in an open wood and brush area on the Subdesert sand. The cavity was about 600 mm. deep and contained a few leaf stems which possibly represented an attempt at a lining, and one fresh egg. The egg was slightly elongate "ovate"; the shell, smooth and glossy with a few scattered, very small pits; color, bluish white. It measured 26.9 × 18.4 mm.

The nest at Tulear, 18 km. northeast, was in a large isolated tree near a wooded area in savanna country. It was a natural cavity, about 1.5 meters above the ground, and contained young which hissed like young woodpeckers when the tree was tapped.

At Tabiky one bird, apparently a female, that was carrying food was closely followed by a male.

NATIVE NAME.—Called "Takodara" in the southeast by the Bara and Atamoor, and "Burao" in the north and the northwest by the Sakalava and the Antakara.

Philepitta castanea (Müller)

Velvet Asity

DISTRIBUTION.—From sea level to 1800 m.; in the Humid East. We found this species very common on the wooded mountain slopes of the Humid East but not in the forests of the coastal plain, though it occurred almost down to sea level on the mountain slopes.

HABITS.—This *Philepitta* was a plump sluggish bird that was usually seen sitting in some low bush in the ground-cover of the heavy forest, but was not found on the ground. Sometimes it mounted into the middle spaces in the forest and was occasionally seen in the tree tops, where an adult male was once discovered sunning itself. It also ventured into the denser secondary brush on the edge of the forest. It was not at all shy and allowed a close approach. Sometimes when I had been sitting quietly for some time in the forest one of these birds that had been sitting within a few feet of me began to move. When flushed, this bird did not

fly far and would sit quietly again, the greenish-colored female or the young male and the black-and-golden or black adult male passing equally unnoticed.

The asity is usually a solitary bird, though sometimes two or three may be found in company. Occasionally it associates with the big mixed flocks of birds of various species. It is a silent bird and though often seen no note was ever heard from it. The bird is apparently largely frugivorous. It was often seen feeding on the small berries of low bushes in the forest and the eight stomachs examined contained nothing but fruit.

The breeding season apparently begins the last of August or first of September, as the following data indicate.

August 15–31, 1930	All adult birds collected were in breeding condition	Andapa, one day west
August 29, 1930	Nest with three fresh eggs	Andapa, one day west
September 1–7	Most of the birds collected in breeding condition, including one female ready to lay	Andapa, one day west

Specimens collected in May, June, and July were not breeding.

The nest from Andapa (one day west), August 29, 1930, was about two meters up on a sapling over a rocky stream-bed in rather heavy forest. The nest was a pear-shaped, pensile structure, somewhat compressed laterally. The top of the nest was woven about the supporting branches. A sort of penthouse roof projected over the entrance. The outside of the nest was composed of mosses and long, threadlike palm fiber. Many dead leaves were stuck on the outside. Inside there was a complete, thick lining of broad, dead leaves. This was about ten mm. thick except on the bottom, which was about thirty mm. thick. There was no other lining. The whole nest was soaking wet and the green moss and leaves made it very inconspicuous. It measured outside 280 mm. deep × 225 mm. from back to front, and 150 mm. wide. The penthouse roof projected 75 mm. beyond the opening, which was about 60 mm. across. Inside it measured 160 mm. deep × 95 mm. wide.

The three eggs in the nest were "elongate ovate" in shape; the shell smooth with a slight gloss; the color pure white. The measurements were as follows: 28.3 × 18.4 mm., 28.7 × 18.6 mm., and 28.5 × 19.0 mm.

At Andapa (one day west) on September 2, 1930, a male in immature plumage that was collected had the testes considerably enlarged and was apparently breeding.

NATIVE NAME.—"Asity" by the Betsimisaraka and Atamoor.

Philepitta schlegeli Schlegel
Schlegel's Asity

DISTRIBUTION.—A forest bird of the Sambirano and the Western Savanna. This *Philepitta* was rather common in the Sambirano in the heavy forest. In the Western Savannas we secured but a single specimen at Namoroka, in the wooded plain, though M. Delacour and Mr. Lowe found it not uncommon at Tsiandro on the calcareous plateau.

HABITS.—This *Philepitta* was a quiet, rather sluggish bird of the middle spaces and ground-cover in the forest, though not seen on the ground. It was sometimes associated with flocks of other species but usually not with others of its own kind. This bird seemed somewhat more active and less restricted to the ground-cover than *Philepitta castanea*. No note was heard from this species.

This *Philepitta* was largely frugivorous. Of eight stomachs examined, all contained fruit; one, small insects; and one, a large spider.

NATIVE NAME.—"Asity" (the name also used for *Philepitta castanea* in the east) by the Sakalava at Maromandia (one day east), and "Hera hera" by the Sakalava at Namoroka.

Hirundo rustica Linnaeus

At Tulear on January 20, 1930, six or seven of these birds were seen flying about over the town, and I obtained a rather good view of several of them. This species has not been taken in Madagascar.

Riparia riparia riparia (Linnaeus)
Sand Martin

Our only record, the only record for Madagascar, was a solitary bird taken at Lac Iotry.

Riparia paludicola cowani (Sharpe)
Madagascar Sand Martin

DISTRIBUTION.—Found from 500 m. to 1800 m.; in the Humid East. This swallow was fairly common in the open ground, about the little swamps and the rice field on the plateau and coast slopes, but was not found on the coastal plain.

HABITS.—The sand martin usually moves about in small parties, or by two's and three's. At Monjakatompo, a dozen or so were often seen at one time over a small pond.

On April 25, 1931, at Fanovana, a nest containing three well-grown young was found, so eggs are probably laid in April at least. The nest was in the vertical bank of a road cut. The tunnel, some 400 mm. long, ended in an oval, flattened cavity with a nest of dried grass. The male bird was on the nest at about 10 o'clock in the morning.

Phedina borbonica madagascariensis Hartlaub

Madagascar Martin

DISTRIBUTION.—From sea level to 1800 m.; fairly common but not encountered with any degree of regularity, over the forest and the open ground of all the biotic provinces. Found feeding over the open ground, the desert brush, and the wooded plains of the Subdesert and the Occidental, and in the heavy forest of the Oriental.

HABITS.—This martin was usually found in small parties and flocks up to twenty or so. It was often seen feeding over the little marshes and rice fields particularly toward evening. When seen feeding over the heavy forest it was usually in the morning or evening, when it was on its way to and from its roosting or nesting places. At Fanovana, which is on the railway line through the forest of the Humid East, twenty or more birds used to come each evening to roost in the crevices of the roof of a railway tunnel. On Mt. d'Ambre the birds used to roost on the nesting ledges of the walls of a ravine by a stream in the forest. The cornices of the dwellings at Nossi Be were favorite roosting and sleeping places.

The breeding season probably includes at least the months of October and November, as the following data indicate.

October 19, 1930	Ten nests in construction	Mt. d'Ambre
November 6, 1929	Male, testes enlarged	Tabiky

At Mt. d'Ambre during October, perhaps ten pairs were building their nests on the narrow ledges of a rocky ravine, over a pool just below a waterfall, in the heavy forest. The nests were from three to five meters above the water, on ledges of slate only a few centimeters wide, and were usually placed behind a tuft of grass or ferns. The one nest examined was a shallow saucer of small twigs and dead herbaceous stems with a scanty lining of finer vegetable material. The birds usually lit on the ground by the stream to gather nesting material. None of the nests contained eggs on November 1, probably because the birds had been disturbed.

In the savanna to the west of Mt. d'Ambre, numbers of these martins were seen going in and out of a large sink hole which led to a subterranean

passage where the birds probably nested on the narrow rocky ledges. They were said to nest on the cornices of buildings at Nossi Be.

Delacour[1] has suggested that there is some migration within the island, depending on the season. Data bearing on this were of course difficult to secure as we were seldom in the same place at different seasons; but at Nossi Be, where they were common, we found them common in December, while in November we also found them at Tabiky and in February at Tsimanampetsotsa. Thus the evidence of migration is very inconclusive. (The dates that Delacour gives for Tabiky should read "November" instead of "June," and for Tsarakibany, "November" instead of "July.")

Newtonia brunneicauda brunneicauda (Newton)

Common Newtonia

DISTRIBUTION.—Found from sea level to 1800 meters; a common bird of the forest and brushlands, equally at home in the heavy forest and the secondary brush of the Oriental, the deciduous woodlands of the Occidental, and the brush of the Subdesert. In the heavy forest it frequented the tree tops and middle spaces and occasionally came into the ground-cover.

The western bird has been described as *inornata* Salomonsen[2] on the basis of its paler under parts and paler, more yellowish upper parts. This difference, however, is too slight for the race to be recognized. Worn birds from the sunny, arid southwest are of course very ragged and faded and very different in color from birds in comparable plumage from the humid forests, where they show little wear and fading. The birds from Mt. d'Ambre differ from those of the rest of Madagascar in being richer ochraceous below, but this again is too slight to be used in recognizing another subspecies.

HABITS.—The newtonia is usually to be found in small parties often associated with other small birds like *Neomixis*, and these very often form part of the big mixed flocks that range through the forest. The newtonia flits from twig to twig, gleaning small insects more in the manner of a titmouse, than of a flycatcher, though occasionally it catches insects on the wing. It is not at all shy and continues its feeding unmindful of one's presence.

Its song, surprisingly loud for the size of the bird, is one of the characteristic songs of the forest. It may be represented as "ter–tee ter–

[1] 1932, L'Oiseau et R. F. O., pp. 55, 56.
[2] 1934, Ibis, p. 382.

tee." A scolding note often heard is a buzzing "zee zee– – – –" or "cher cher– – – –." One bird that attracted my attention with this call was scolding a *Galidia elegans* that was some 5 meters up in a tree.

The breeding season probably extends at least from July to March, as the following data indicate.

July, 1930	Several males, testes enlarged	Maroantsetra, two days northeast
August 20, 1930	Male, testes enlarged	Andapa, one day west
September 30, 1929	Male, testes enlarged	Manombo (southeast)
September, 1930	Several males, testes enlarged	Vohemar
October 1–8, 1929	Two males, testes enlarged	Manombo (southeast)
October 24, 1930	Male, testes enlarged	Mt. d'Ambre
October 28, 1930	Female, laying	Mt. d'Ambre
November 15–25, 1930	Two males, testes enlarged	Anaborano
December 3, 1929	Female ready to lay	Iotry
January 2, 1931	Female, ovary enlarged	Ampasimena
March 2, 1931	Female, ovary enlarged	Namoroka

Newtonia brunneicauda monticola Salomonsen[1]

Mountain Newtonia

From an examination of the material in the American Museum it seems that this slightly differentiated mountain race may be recognized. It differs from *brunneicauda* in the average slightly darker gray upper parts, and the larger size, wing 57–61 against 52–58. It also has slightly more richly colored under parts than most specimens of *brunneicauda*, but the Mt. d'Ambre birds have still richer under parts. Mt. d'Ambre birds however have paler upper parts and are smaller, wing 52–55.

This race is apparently restricted to the forest on Mt. Ankaratra where we collected it from 1800 meters to 2000 meters.

HABITS.—Similar to those of the preceding race.

Newtonia amphichroa Reichenow

Dark Newtonia

DISTRIBUTION.—Found from 500 to 1800 m.; a forest species of the Humid East and Mt. d'Ambre. While *Newtonia brunneicauda* commonly frequents the tree tops and the middle spaces, and sometimes even into the ground-cover, this form frequents the ground-cover and the lower middle spaces, rarely reaching the tree tops. It was sometimes found in the denser secondary brush. This newtonia was usually much outnumbered by *Newtonia brunneicauda*, but on Mt. d'Ambre they were equal in number at least.

[1] 1934, Nov. Zool., XXXIX, p. 207.

HABITS.—The song of this species is richer, fuller, and louder than that of the preceding (*N. brunneicauda*). In feeding habits they are much the same, gleaning from the twigs and clinging to the sides of small branches, but this species is not so given to moving in small parties of its own kind or with other species as is *N. brunneicauda.*

The breeding season includes at least the months of August, October, and November, as the following data indicate.

August, 1929	Several males, testes enlarged	Ivohibe, one day north
August, 24, 1930	Male, testes enlarged	Andapa
October, 1930	Many specimens in breeding condition, including several females ready to lay	Mt. d'Ambre
November 1, 1930	Female, ovary enlarged	Mt. d'Ambre

Newtonia archboldi Delacour and Berlioz

Archbold's Newtonia

DISTRIBUTION.—A bird of the brush and low forest of the Subdesert, found in the same habitat as *Newtonia brunneicauda.*

HABITS.—Much the same in action as *Newtonia brunneicauda,* but the song is different enough to be rather easily distinguished.

***Newtonia fanovanae** Gyldenstolpe[1]

Fanovana Newtonia

The Fanovana newtonia probably inhabits the forest of the central part of the Humid East. This apparently very distinct species is known from but a single specimen from the Fanovana forest received with a collection of birds purchased from Herschell-Chauvin.

Pseudobias wardi Sharpe

Ward's Flycatcher

DISTRIBUTION.—Found from 170 m. to 1800 m.; a rather uncommon bird of the heavy forest of the Humid East. This flycatcher frequents the tree tops and upper middle spaces, seeming to prefer the edges of clearings or trails, occasionally perching on tops of bushes in secondary brush in clearings. Possibly it is commoner at higher altitudes.

HABITS.—Ward's flycatcher was usually solitary but on one occasion three were seen together in a tree in the secondary brush, and on another occasion one was shot from a large mixed flock of various species, moving through the tree tops. Its manners are those of a flycatcher like

[1] 1933, Arkiv für Zoologie, No. 2, pp. 1–3.

Tchitrea, sitting up straight on some twig until an unwary insect comes near, when it is secured by a sudden sally, and the bird returns to its perch.

Tchitrea mutata mutata (Linnaeus)

Eastern Madagascar Paradise Flycatcher

DISTRIBUTION.—Found from sea level to 2000 m.; a common bird of the wooded and brush areas of the Humid East. The paradise flycatcher is characteristic of the middle spaces in the humid forest, though found also in the tree tops and the ground-cover, and I saw one settle on the ground in the forest. It also frequents the scattered areas of secondary brush.

HABITS.—The paradise flycatcher is usually seen in couples; there are sometimes several birds together, and once nearly a dozen birds of this species were seen in a loose flock in the tree tops, mingled with such birds as *Newtonia*, *Neomixis*, *Coracina*, and *Cyanolanius*. But usually they seem independent of the large mixed flocks of various species moving through the forest, and their presence in these flocks usually seems merely accidental, as though they happened to be there when the flock came along.

This flycatcher feeds in a true flycatcher manner, sitting up rather straight, darting out to secure passing insects and returning to a perch. It is an active, restless bird, continually flitting from perch to perch, displaying and chattering. The adult male is a strikingly beautiful bird, flashing black and white, or red, black, and white, fluttering about a perch, darting across the glades in the sunlight, or hovering in the air to snap up an insect, the long tail undulating like a streamer.

The display indulged in by males in all plumages, and by females in the presence of other birds of either sex, often when chasing each other, and also when alone, consists of spreading the tail and slightly dropping the wings, as the bird moves about. The usual note, which is one of the characteristic sounds of the forest, is a loud chatter, sometimes ending in a pleasing warble.

The breeding season includes at least September and October, as the following data indicate.

September, 1929	Male, testes enlarged	Manombo (southeast)
October 4–8, 1929	Several males, testes enlarged	Manombo (southeast)

NATIVE NAME.—See under next race.

Tchitrea mutata singetra Salomonsen[1]

Western Madagascar Paradise Flycatcher

DISTRIBUTION.—The Subdesert and Occidental provinces, and the Sambirano and Mt. d'Ambre districts. A Vohemar bird has as white a back as any from the southwest. Delacour did not recognize this race because some white-backed forms of the black-and-white phase occur within the range of the black-backed form, but since for the most part this character is constant for *singetra*, it may be recognized.

HABITS.—This bird frequents the humid and the dry forests and the more densely wooded savanna, especially where it is brush-grown. In habits it is similar to the race *mutata*.

At Tabiky I watched a black-and-white male sitting on a perch a short distance above a little stream. Now and then it flew down and splashed into the water in the middle of the stream, then flew back to its perch and preened its feathers. It did this several times, apparently bathing.

Salomonsen[2] has discussed the different color phases of this bird. Some males in the black-and-white, and some males in all of the reddish-brown plumages, except the pale reddish-brown plumage of the young males which resembles that of the immature females, were found to have gonads enlarged, indicating breeding. The male at one of the nests was in a reddish-brown plumage.

The breeding season probably extends at least from October to January, as the following data indicate.

October, 1930	Several males, testes enlarged	Mt. d'Ambre
November 1, 1930	Nest ready for eggs	Mt. d'Ambre
November 14, 1929	Nest, three eggs	Tabiky
November, 1930	Several males, testes enlarged	Tsarakibany, 15 km. southwest
November 16–21, 1930	Several males, testes enlarged	Anaborano
December, 1929	Male, testes enlarged	Iotry
December 7, 1930	Male, testes enlarged	Ambiky (coast opposite Nossi Be)
January 20, 1931	Male, testes enlarged	Maromandia (one day east)

The nest found at Tabiky, November 14, 1929, was placed in the fork of a sapling about one meter above the ground, in rather heavily wooded country, near a small stream. The nest was a neat, dainty cup, composed of strips of herbaceous material and small pieces of white, rotten

[1] 1933, Bull. Brit. Ornith. Club, LIII, p. 119.
[2] 1933, L'Oiseaux et R. F. O., III, pp. 603–614.

wood, the outside of the nest nearly completely covered with a rather solid layer of whitish cobweb, holding together the bits of material that were used in the construction. The lining was of threadlike vegetable fiber and fine black rootlets. The nest measured: outside 60 mm. wide × 70 mm. deep, and inside 45 mm. wide × 40 mm. deep.

The nest at Mt. d'Ambre, November 1, 1930, was in the heavy forest, placed some six meters up in a trailing liana with stems supporting it on three sides. It was a solidly constructed nest, with thick walls of dry green moss and a thin firm basin-shaped lining of fine, dead vegetable fibers. Supporting the nest proper was a foundation of dry green moss filling the acute angle between the nest and the stems supporting it. The measurements of this nest are: nest proper, outside 90 mm. wide × 80 mm. deep, and inside 50 mm. wide × 40 mm. deep, with the foundation below the nest proper 30 mm. deep.

One clutch examined contained three eggs.

The three eggs from Tabiky, November 14, 1929, are ovate in shape; the shell, smooth, somewhat glossy. The color is a very pale "ivory yellow" marked with an irregular wreath of spots of rufous and secondary gray about the larger end, the rest of the egg sparingly marked with a few small spots and specks of the same colors. They measure: 18.4 × 13.7 mm., 18.0 × 13.7 mm., and 18.8 × 13.9 mm.

NATIVE NAME.—The native name for both this and the preceding race was usually some variation of the same word: "Rengetry" in the southeast among the Bara, "Tsingetry" in the central part of the island by the Hova and in the east and southwest by the Betsimisaraka and Masquer, "Tsingitriy" in the northeast by the Betsimisaraka and the Tsimihety, "Sikétry" in the north by the Antakara.

Saxicola torquata sibilla (Linnaeus)

Madagascar Stonechat

DISTRIBUTION.—Found from sea level to 1800 meters over most of the suitable habitats in Madagascar and probably is widespread except in the range of the next race which it completely encloses. It was a common bird of the scantily brush-covered areas, following the little clearings and open trails into the forests of the Humid East. It is less common at the lower altitudes; common in the open ground about the forest of Mt. d'Ambre. None was found in the Northern Savanna; rare in the Western Savanna and the Subdesert, though it was taken in the open savanna near Soalala, the damp grass and brush along the river margin at Ampotaka, and in the desert brush at Salara.

HABITS.—The stonechat is a solitary, somewhat shy bird, usually seen sitting quietly on some bush, or flying from perch to perch ahead of one. Occasionally it flies up to seize a passing insect or down to the ground to pick up something. Sometimes it hops about on the ground to pick up food.

The stonechat's song was seldom heard. It was sometimes given while the bird sat quietly on a perch, but was heard more often as the bird flew erratically about in irregular circles, "dancing in the air," a short distance above the ground, sometimes attaining a height of twenty meters. Once a bird flew straight up a short distance with undulating flight, singing the while, then dropped quickly to earth. Another time one sang while flying from perch to perch, close to the ground.

The breeding season probably extends at least from August to October, as the following data indicate.

August 26, 1929	Nest with three eggs	Ivohibe
September 19, 1929	Juvenile, only a short time out of nest	Ivohibe
October, 1930	Several birds, with gonads enlarged	Mt. d'Ambre
October 5, 1929	Two juvenile birds, on the wing	Manombo (southeast)
November 1, 1929	Juvenile, only a short time out of nest	Tabiky

The nesting season is probably much longer than these records indicate.

The nest (Ivohibe, August 26, 1929) was on the ground on a dry grassy hillside within a few feet of a trail where natives were passing continually. It was a cup-shaped structure placed in a little hollow in the ground at the base of a tussock of grass which overhung and partially concealed it. The outside of the nest was of rather coarse dead herbaceous materials, largely grass stems, and it was lined with fine grass. The nest measured: outside 110 mm. wide × 75 mm. deep, and inside 60 mm. wide × 50 mm. deep.

The one clutch contained three eggs.

The eggs were ovate in shape; shell smooth and glossy; the color, light greenish blue well marked toward the large end with small spots and specks of reddish brown and secondary grays, converging and overlapping to nearly cover the larger end, or to form a wreath. The markings diminish toward the smaller end which is very sparsely marked. Two of the eggs measure: 18.5 × 14.2 mm. and 17.3 × 14.2 mm.

The female at this nest was very wild, and on my first visit left the nest while I was more than fifty meters away, disappeared from sight

in a near-by valley and did not return in the fifteen minutes or so that I waited.

NATIVE NAME.—In the southeast this bird was called "Fitatra" by the Bara and Atamoor, a name used for *Copsychus* at Tabiky.

Saxicola torquata ankaratrae Salomonsen[1]

Ankaratra Stonechat

DISTRIBUTION.—Found from 700 to 2000 meters, and undoubtedly occurs higher, in the central part of the Humid East about Mt. Ankaratra and westward into the central part of the Western Savanna, to Tsiandro. Other parts of the island that rise to similar heights are inhabited by the smaller race. The material in the American Museum accords with Salomonsen's findings that this is a slightly larger race.

HABITS.—The habits of this race are similar to those of *sibilla*.

Pseudocossyphus imerinus (Hartlaub)

Madagascar Robin Chat

DISTRIBUTION.—This bird was restricted to the vicinity of the coast on the sandy brush areas in the Subdesert, where it was common.

HABITS.—The robin chat is usually a solitary bird, or seen in pairs at the most. It feeds on the ground, hopping about on the sand, even onto the edge of the beach. When alarmed it flies up and perches on the top of a bush, where its pose, with the bill pointed slightly upward, is characteristic. Its movements are rather deliberate and it was not heard to utter a sound. Several stomachs examined contained nothing but small green fruit.

The breeding season probably includes the months of December and February, as the following data indicate.

February 8–9, 1930	Several full-grown young still largely in juvenile plumage	Anakao
February 25, 1930	Two juveniles just out of nest and hardly able to fly	Tsimanampetsotsa

Pseudocossyphus sharpei sharpei (Gray)

Eastern Madagascar Robin Chat

DISTRIBUTION.—Found from 800 m. to 2000 m.; in the forest of the Humid East, where it frequented the forest floor and the lower shrubs, and occasionally out into the secondary brush. It was fairly common at Mt. Ankaratra but elsewhere rare. Salomonsen[2] has separated a

[1] 1934, Nov. Zool., XXXIX, p. 210.
[2] 1934, Nov. Zool., XXXIX, p. 211.

highland form *interioris*, from Mt. Ankaratra and the Betsilio country on the basis of its larger size.

Measurements of the material in the American Museum indicate that the birds from higher altitudes average slightly larger, but the overlap appears too great to recognize subspecies.

HABITS.—The eastern robin chat is a quiet, sedate bird, usually solitary and found hopping about on the forest floor. When alarmed it flies to a low perch and sits there quietly until the intruder has passed. Its usual food is probably insects, but I saw one feeding on the fruit of a small bush, and another had its stomach full of the pulp and seeds of a small fruit. None was heard to utter a sound.

The only evidence of breeding noted was at one day west of Andapa, September 2, 1930, when a male, testes enlarged, was collected. The breeding season is probably the rainy season.

Pseudocossyphus sharpei erythronotus (Lavauden)
Mt. d'Ambre Robin Chat

DISTRIBUTION.—Found commonly from about 1000 m. to 1300 m. in the rain forest on Mt. d'Ambre, to which this race is restricted, as is *Bernieria zosterops fulvescens*.

HABITS.—This robin chat is, like *Pseudocossyphus sharpei sharpei*, a solitary bird of the heavy forest, hopping about on the ground and in the trails and flying to a low perch when alarmed. It is usually silent, but several times I heard it sing a rich, short song, given from a low perch. It was heard most commonly at dusk, when one used to perch on a post in the clearing by camp, but sometimes it sang during the day.

During October, 1930, on Mt. d'Ambre, most of the specimens collected were in breeding condition; several females were laying.

Copsychus albospecularis albospecularis (Eydoux and Gervais)
Madagascar Magpie Robin

DISTRIBUTION.—This race was found only in the forest and neighboring secondary brush about the Bay of Antongil. It was probably tolerably common but much shyer than *Copsychus a. inexpectatus*, which it resembles very closely in habits.

Copsychus albospecularis inexpectatus Richmond
Southeastern Madagascar Magpie Robin

DISTRIBUTION.—Found from sea level to 1200 m. and probably occurring at higher altitudes; in the forests of the Humid East. This

bird is common and characteristic of the ground-cover in the heavy forest. With the advent of clearings it has taken kindly to the brushy areas, particularly favoring the tangled masses of fallen tree tops and the dense vegetation along the trails. Though a bird that likes cover, it comes out into the clearings and at Manombo (southeast) a bird used to give its song at dawn from the veranda of the rest house.

HABITS.—The magpie robin is usually encountered singly or in pairs, but sometimes one is found with the big mixed flocks of birds roaming through the forest. It is usually a rather shy bird though sometimes quite bold, feeding on the ground in the forest or in the trails, finding shelter in the ground-cover and in the tangled masses of brush, and mounting to a low perch to give its thin, elusive, sweetly whistled song, which was often heard while I was in the southern part of the Humid East (June to October). The song is often given SOTTO VOCE so that a singing bird but a few meters away would sound perhaps fifty meters off.

The only evidence of breeding was a female, ovary enlarged, taken October, 1929, at Manombo (southeast).

A display that was sometimes seen consisted of wings slightly spread and tail raised and slightly spread.

NATIVE NAME.—"Fítatra-ala" (the Fítatra of the forest) in the southeast by the Bara and the Atamoor, and "Todia" in the northeast by the Betsimisaraka.

Copsychus albospecularis pica Pelzeln

Madagascar White-bellied Magpie Robin

DISTRIBUTION.—Found from sea level to 1200 m. A common bird of the humid forest on Mt. d'Ambre and in the Sambirano, the deciduous forest and brush of the Occidental, and the brush of the Subdesert.

HABITS.—This magpie robin is a bird of the ground and low brush, hopping about with rather slow graceful movements. It is usually not very shy. Sometimes as the bird stops, on the ground or on a low bush, the tail is raised to a vertical position and then slowly depressed. When the bird is nervous, the tail is sometimes raised to the vertical by a succession of jerks. The male in display, with the tail somewhat raised and spread, and wings slightly spread so that the gleaming white contrasts strikingly with the black, is a beautiful sight. In flight, of course, the white outer tail-feathers and the white wing-markings are conspicuous.

Besides the sweetly whistled song similar to that of the other races, I have heard this form give another note, a buzzing "cheet."

The breeding season probably extends at least from September to December, as the following data indicate.

September 25, 1930	Female, nearly ready to lay	Vohemar
October 25, 1930	Female, laying	Mt. d'Ambre
November 10, 1930	One female, laying; two females, ovaries enlarged	Tsarakibany, 15 miles southwest
November 11, 1930	Two juveniles, out of nest	Tsarakibany, 15 miles southwest
November 18, 1930	Juvenile, out of nest	Anaborano
November 25, 1930	Female, laying	Anaborano, one day south
December 7, 1930	Male, testes enlarged	Ambiky (coast opposite Nossi Be)
December 27, 1930	Juvenile, out of nest	Ampasimena
January 19, 1931	Many juvenile birds, hardly fully fledged	Maromandia, one day west
February, 1929	Many birds in juvenile plumage	Tsimanampetsotsa

NATIVE NAME.—"Todina" or "Todia" in the north by the Sakalava or Antakara. At Namoroka and Iotry it was known as "Fítatra" by the Sakalava and Masquer, a name used in the Humid East for *Saxicola*.

Calamocichla newtoni (Hartlaub)

Madagascar Swamp Warbler

DISTRIBUTION.—Found from sea level to 1800 m. The swamp warbler was common in suitable habitats in the Oriental and Occidental provinces and into the edge of the Subdesert. It frequented the tall reeds and grasses (locally called "bararata") of the swamps, lakes, and river margins. Even when these habitats were of rather limited extent, as on the edges of a river which flowed through forested country, some of these birds were usually to be found. In the northwest two birds were seen in a mangrove swamp at some distance from any reedy or grassy area.

HABITS.—The marsh warbler was not very shy nor secretive and was often seen perched on the reeds or moving about through the vegetation. Its loud, liquid notes proclaimed its presence when the birds were not seen. Sometimes as I sat quietly in a pirogue among the reeds, one or a pair of these birds would come within arm's reach of me as it searched through the vegetation for its insect food. It was usually a solitary bird, but during the nesting season was seen in pairs.

The breeding season probably includes at least the months of September, December, March, and May, as the following data indicate.

September 4, 1929	Nest with eggs	Ivohibe
December 16, 1929	Nest with eggs	Iotry
March 2, 1931	Female, laying	Kinkony
June 1, 1929	Nearly full-grown young	Andreba

Besides the nest collected at Lac Iotry several others, both old and new, were seen there, all were very similar in location and construction. The nests were built in the forks of dead bushes, in the open marsh at the head of the lake. They were placed from .75 to 1.5 meters above the water, with no attempt at concealment, but the weather-beaten gray bark used in the construction of the nest rendered them very inconspicuous.

The outside of the nest collected at Iotry was rather loosely put together, particularly at the bottom, to fill the deep fork of the stem in which it was built. The materials used in construction were dead grasses and dead bleached strips of bark that weathering had softened; plant down and insect silk were scattered throughout the structure. The lining was composed of finer material of the same kind and a few feathers had been added, three of which were so arranged that the free ends curled up over the opening partly concealing the contents. This nest measured: outside, 90 mm. across × 110 mm. deep and inside, 50 mm. wide × 50 mm. deep.

A nest from Ivohibe, which was collected by a native, was built in the fork of a live bush projecting over the edge of a large stream. It was a neat, globular structure, composed outside of dead herbaceous stems, small roots, rootlets, and grass blades; bits of green moss were scattered over the outside of the nest. The lining was of fine grass or rice heads and feathers, the free ends of the latter curling over the opening to conceal the eggs. This nest measured: outside, 100 × 100 mm., and inside, 50 mm. wide × 55 mm. deep.

One nest contained two eggs, the other three. They were ovate in shape; the shell smooth with a slight gloss; ground color bluish white irregularly marked with small blotches, dots and speckles of olive and olive-brown and secondary grays, particularly about the larger end. The three eggs from Ivohibe measured 20.5 × 14.9 mm., 20.2 × 14.9 mm., and 19.4 × 14.4 mm. One of the two eggs from Iotry measured 19.1 × 14.2 mm. The female was usually rather shy, slipping away from the nest while the intruder was still some distance away and showing little interest, apparently, when the nest was visited.

NATIVE NAME.—"Voronbaráta" (reed bird) among the Sakalava in

the northwest. "Voronbéndra" (reed bird) among the Betsimisaraka and the Tsimihety in the northeast.

Nesillas typica typica (Hartlaub)

Tsikirity; Madagascar Brush Warbler

DISTRIBUTION.—From sea level to 2000 m. We found this species common in the southern and into the central part of the Humid East and into the eastern edge of the Western Savanna. Salomonsen[1] has resurrected the name *N. t. monticola* Hartert and Lavauden for the mountain bird, but the differences are too slight to merit recognition.[2] The ground-cover in the forest, the brushlands, and the scattered areas of brush on the grasslands were the favorite habitats of this bird.

HABITS.—The brush warbler is usually a solitary bird, found skulking about low in the brush, sometimes even descending onto the ground. The first intimation of its presence is usually its rattling or chattering call as the bird, keeping well concealed in the vegetation, retreats before you. However, it sometimes perches on the top of a bush in plain view, or it may express considerable interest in an intruder and come close in the brush, scolding.

The breeding season includes at least the months of July, August, September, and October, as the following data indicate.

August 24, 1929	Young, out of nest	Ivohibe
August, 1929	Several females, ovaries enlarged	Ivohibe
September 4, 1929	Nest with eggs	Ivohibe
September 24, 1929	Male, testes enlarged	Manombo
September 29, 1929	Young, out of nest	Manombo
September 30, 1929	Male, testes enlarged	Manombo
October 6, 1929	Young, out of nest	Manombo
October 7, 1929	Male, testes enlarged	Manombo

The one nest collected (Ivohibe, September 4, 1929), was on a grass and brush hillside. It was a deep cup-shaped nest placed amid the tall grass about one-half meter from the ground. The outside was loosely constructed of broad dead grass blades with an inner layer of finer grasses and a lining of fine grass. It measured: outside, 110 mm. wide × 110 mm. deep; inside, 50 mm. wide × 60 mm. deep. It contained two slightly incubated eggs. These were ovate in shape; the shell smooth, with medium gloss; ground color a wash of "pale brownish vinaceous" to "pale grayish vinaceous." Many heavily obscured

[1] 1934, Nov. Zool., XXXIX, p. 212.
[2] See also Delacour, 1933, Bull. Brit. Orn. Club, LIII, p. 95.

blotches of secondary gray gave the egg a darker appearance. The surface was marked with numerous irregular lines or pen markings, small spots and speckles of dark purplish brown. They measured 20.9 × 15.0 mm., and 20.8 × 14.9 mm.

NATIVE NAME.—"Parátaka" among the Bara and Atamoor; "Borátaka" among the Betsimisaraka at Fanovana.

Nesillas typica ellisii (Schlegel and Pollen)

Northwestern Madagascar Tsikirity or Brush Warbler

DISTRIBUTION.—From sea level to 1800 m.; in the central and northern parts of the Humid East; in the Mt. d'Ambre and in the Sambirano districts. This brush warbler was very common, frequenting the ground-cover in the forest and ranging out into the brushlands.

HABITS.—Its habits are much like those of the preceding race.

The breeding season includes at least the months of July, August, October, and November, as the following data indicate.

July 20, 1930	Female, ovary enlarged	Maroantsetra
August 12–13, 1930	Two females, nearly ready to lay	Andapa
October, 1930	Many birds in breeding condition	Mt. d'Ambre
November, 1930	Many birds in breeding condition	Anaborano
November 26, 1930	Two juveniles, a short time out of nest	Anaborano, one day south

NATIVE NAME.—"Borátaka" at Maroantsetra, by the Betsimisaraka.

Nesillas typica obscura Delacour

Dark Tsikirity; Dark Brush Warbler

DISTRIBUTION.—From sea level to 700 m.; in the Occidental. This species was rare in the Northern Savanna where it was found in the wooded plains and gallery forest, but it was common in the Western Savanna on the limestone hills where it haunted the ground-cover in the wooded areas.

HABITS.—The habits of this race are much like those of *Nesillas typica typica*, but due to the lack of dense leafy undergrowth in the western forests these birds are more easily observed than those in the humid forest of the Oriental.

The breeding season includes at least the months of November, February, and March, as the following data indicate.

November 9, 1930	Several females, gonads enlarged	Tsirakibany, 15 miles southwest
March, 1931	Several females, gonads enlarged	Namoroka
March 6, 1931	Young out of nest	Namoroka

Nesillas typica lantzii (Grandidier)

West Coast Tsikirity; Subdesert Brush Warbler

DISTRIBUTION.—The Subdesert; this bird was not found at Lac Iotry nor at Tabiky, but from Manombo south it was very common. The collecting of a single bird at Maintirano is not surprising when one considers that interrupted sandy areas with more or less intense desert conditions extend northward along the coast to north of Majunga. This subspecies frequented the ground-cover in the dry wooded areas, the brush forest on the calcareous hills, and the Subdesert brush on the sandy areas.

HABITS.—The habits of this form are much like those of the other races.

The breeding season includes at least the months of December and January, as the following data indicate.

February 9, 1929	A juvenile, only a short time out of nest	Anakao
February, 1930	Many juvenile birds	Tsimanampetsotsa

Thamnornis chloropetoides (Grandidier)

Kiritika; Thamnornis

DISTRIBUTION.—A bird of the more arid portions of the Subdesert. This species was fairly common in the low brush of the sandy areas and the forest on the low dry hills and calcareous plateaus, where it haunted the low brush and undergrowth; occasionally one was seen on the ground as it flew down to pick up some insect.

HABITS.—The habits of this bird were very like those of a *Nesillas*. At Ampotaka, it was common in little family parties of five to six, often in company with *Neomixis* and *Newtonia*, gleaning through the low brush for insects. At Iotry, two were seen in company with several *Foudia madagascariensis*, *Tchitrea mutata*, and *Newtonia brunneicauda*, scolding a snake that was curled under a root in the underbrush.

Its usual call was a rather loud rattle or chatter, sometimes running into a trill. At Lac Iotry, where it was common, I saw one mount to the top of a dead stub some six meters high, and sing. On another occasion I watched one sing at close range. It first gave a loud rattle, almost running into a trill, with its mouth wide open, then a few loud, clear, musical, whistled notes, its mouth opening and closing.

The breeding season probably includes at least the months of November and December, as the following data indicate.

November 16, 1929	Male, testes enlarged	Tabiky
December 19, 1929	Male and female in breeding condition	Iotry

Randia pseudo-zosterops Delacour

Rand's Warbler

DISTRIBUTION.—From 800 to 1200 m. We found this species to be a rare bird of the tree tops in the forest of the Humid East.

HABITS.—This bird was found in mixed flocks of other species such as *Newtonia, Zosterops, Neomixis,* and *Cyanolanius.*

A male collected at Andapa, August 15, 1930, had its testes enlarged.

Hartertula flavoviridis (Hartert)

Wedge-tailed Jery[1]

DISTRIBUTION.—From 500 m. to 800 m. We found this species in the forest of the central and southern parts of the Humid East where it was rare at Vondrozo, but not uncommon at Fanovana. None was found at the collecting stations about Maroantsetra though conditions seemed very suitable for its occurrence, and intensive collecting was carried on.

HABITS.—The wedge-tailed jery haunted the ground-cover and the lower middle spaces of the forest. It traveled in pairs or in small scattered flocks, often in company with *Bernieria zosterops* and often forming part of the lower strata of one of the big mixed flocks of birds which moved about through the forest.

Neomixis striatigula striatigula Sharpe

Stripe-throated Jery

DISTRIBUTION.—From sea level to 800 m. This species was a common bird of the brush and wooded areas of the Subdesert and was taken as far northeast as Ihosy. It frequents the tree tops and brush.

Salomonsen,[2] has described the pale form from the Subdesert as *N. s. pallidior,* saying that it is paler than *striatigula* from Fianarantsoa, Ankafana and Ihosy. There is no material from these localities in New York. It may prove to be distinct.

HABITS.—The stripe-throated jery gleaned its insect food from the twigs and leaves. During the breeding season the male sometimes mounted to a conspicuous perch to give its insignificant song, while *N. tenella* was not seen to do this. At Ampotaka in March, after the nesting season was past, this warbler was commonly seen in small parties or in company with *Newtonia, Zosterops, Neomixis tenella,* and *Thamnornis* in loose, scattered, feeding flocks.

[1] Salomonsen, 1934, Ann. and Mag. of Nat. Hist., (10) XIV, pp. 60–79, in a revision of the Madagascar timaline birds attempts to show that *Hartertula* and *Neomixis* also belong with them.

[2] 1934, Ann. and Mag. Nat. Hist., (10) XIV, p. 65.

The breeding season includes at least the months of November and December, as the following data indicate.

November 7, 1929	Male, testes enlarged	Tabiky
December 3, 1929	Male, testes enlarged	Iotry
December 11, 1929	Nest with five eggs, heavily incubated	Lac Iotry
December 19, 1929	Nest with three eggs	Lac Iotry
February, 1930	Family parties of fully fledged young birds commonly seen	Lac Tsimanampetsotsa
March, 1930	Family parties of fully fledged young birds commonly seen	Ampotaka

The two nests examined were in rather dense brush in the Subdesert brush country. They were placed in bushes some 1.75 meters above the ground. The description of one nest from Lac Iotry, December 11, 1929, follows: it was an oval, semipensile structure, supported by twigs on all sides and opening from the side near the top. The nest was composed of grasses, grass heads, and plant-down, held together by a coating of cobweb and plant-down to which many dead leaves were attached, making the whole look like a bunch of dead leaves. The lining was entirely of plant-down. The structure measured: outside, 90 mm. wide × 175 mm. deep; inside, cavity below opening 55 mm. wide × 35 mm. deep; opening 40 mm. across.

The eggs were ovate in shape; the shell smooth and glossy; ground color "bluish glaucous," irregularly marked with small spots and dots of dark brownish black. Two eggs of the set of five measure: 15.4 × 11.4 mm., and 15.2 × 11.1 mm.

In life this species can usually be distinguished from *Neomixis t. debilis* by its darker bill, darker markings on the throat, and more conspicuous markings on the face.

Neomixis striatigula sclateri Delacour

Sclater's Stripe-throated Jery

DISTRIBUTION.—From 800 to 1800 m. This warbler was a rare bird of the forests in the northern and central parts of the Humid East. Possibly it will prove more common at higher altitudes.

HABITS.—Like *Neomixis viridis*, this species gleaned through the tree tops in company with mixed flocks of various other species of small birds. Individuals usually were not identified until after they had been collected.

Neomixis viridis viridis (Sharpe)
Southern Green Jery

DISTRIBUTION.—Found at about 1000 meters in the forest of the southern part of the Humid East.

HABITS.—Similar to those of the following race.

Neomixis viridis delacouri Salomonsen[1]
Northern Green Jery

DISTRIBUTION.—From 1000 meters to 1800 meters; a fairly common bird of the forests in the northern part of the Humid East. Specimens from Fanovana are somewhat duller in color, showing an approach to the southern form, but are best included in *delacouri*.

HABITS.—The green jery was found gleaning through the tree tops in the forest and the brushland, usually in small parties or in mixed flocks of other species of small birds such as *Neomixis tenella*, *Zosterops*, and *Newtonia*.

The breeding season probably includes the month of September at least, as the following datum indicates.

September 4-5, 1930 Three males, testes enlarged Andapa, one day west

Neomixis tenella tenella (Hartlaub)
Northern Jery

DISTRIBUTION.—From sea level to 1200 m.; occurring in the northern part of the Humid East, Mt. d'Ambre, the Sambirano, the Northern Savanna, and the northern part of the Western Savanna. The center of abundance of this species seemed to be in the Northern Savanna. This little warbler was common and widespread in the tree tops and secondary brush of the humid forest and the drier woodlands. In the northwest it was found occasionally in the mangroves.

HABITS.—In the forest this warbler was usually confined to the tree tops but in the brushlands it frequented the shrubs and bushes close to the ground. Somewhat gregarious, it was usually found in parties of its own kind or in mixed flocks of other species of small birds. The northern jery fed on small insects gleaned from the twigs and leaves. The call of this bird was weak and lisping; and its song a weak "zee–zee– – – –."

The breeding season includes at least the months of September, November, January, February, March, and April, as the following data indicate.

[1] 1934, Ann. and Mag. of Nat. Hist., (10) XIV, p. 63.

September 24–25, 1930	Several specimens, gonads enlarged	Vohemar (one day north)
November, 1930	Many specimens, gonads enlarged	West of Mt. d'Ambre
November, 1930	Many specimens, gonads enlarged	Tsarakibany, 15 miles southwest
November, 1930	Many specimens, gonads enlarged	Anaborano
January, 1931	Male, testes enlarged	Marotony
February 24, 1931	Male, testes enlarged	Soalala
March 20, 1931	Female, building nest	Lac Kinkony
March 29, 1931	Male, testes enlarged	Ambararatabe
April 3, 1931	Male, testes enlarged	Bekipay

The nest at Lac Kinkony, March 20, 1931, was in a large "madera" tree which stood on the edge of a village. It was placed about three meters up in a cluster of twigs on the end of a branch. The nest was but partly finished, and the female (which I collected), accompanied by the male, was building. The structure was oval and semipensile, supported on all sides by twigs, with the opening on the side near the top. The nest of this race is apparently very similar to that of *N. t. debilis*.

NATIVE NAME.—"Kimimitsy" at Namoroka among the Sakalava.

Neomixis tenella decaryi Delacour

Western Jery

DISTRIBUTION.—A bird of the southern part of the Western Savanna. It was apparently fairly common.

Neomixis tenella debilis Delacour

Subdesert Jery

DISTRIBUTION.—A common bird of the brush and wooded areas of the Subdesert.

HABITS.—This bird has much the same habits as *Neomixis t. tenella*, gleaning through the trees and brush in small parties, sometimes even descending onto the ground in the brushlands. It was often accompanied by *Neomixis s. striatigula* and *Thamnornis*, and was not at all shy. At Tulear small parties were seen in the shade trees about the hotel.

The breeding season includes at least the months of October, November, and December, as the following data indicate.

October 27, 1929	Nest in construction	Tabiky
November 7, 1929	Male, testes enlarged	Tabiky
November 23, 1929	Male, testes enlarged	Befandriana
December 12, 1929	Nest in construction	Iotry
February, 1929	Many juveniles about, some still being fed	Tsimanampetsotsa

Both nests which I found were in large "madera" trees in native villages and were placed about three meters from the ground. One nest was in a cluster of twigs halfway out from the trunk of the tree, the other in the twigs on the end of a branch. The nest at Iotry, December 12, 1929, was an oval, semipensile structure supported on all sides by twigs and with an opening on the side near the top. The materials used in construction were almost entirely white, silky plant-down, and a little cobweb. The nest measured: outside, 70 mm. wide × 90 mm. deep, with an entrance 25 mm. across.

The nest, found on December 29, 1929, contained four eggs almost ready to hatch. The eggs were ovate in shape; texture smooth, somewhat glossy; ground color white, irregularly marked with spots and dots of dark blackish-brown and secondary grays, more heavily marked about the larger end.

NATIVE NAME.—"Kimitsy" among the Masquer at Lac Iotry and "Tsimimitsy" among the Mahafaly at Ejeda.

Neomixis tenella orientalis Delacour

Southeastern Jery

DISTRIBUTION.—From sea level to 1200 m. This species was found fairly commonly in the central and southern parts of the Humid East.

HABITS.—The habits of this race were much like those of *Neomixis t. tenella.* It fed in the tree tops and the secondary brush, in small parties of its own kind with flocks of other species. One loose flock of this species at Ivohibe contained about twenty birds.

The breeding season includes at least the months of July, August, September, and October, as the following data indicate.

July, 1929	Several males, testes enlarged	Vondrozo
September 19, 1929	Male, testes enlarged; and fledglings, out of nest	Ivohibe
October 1–12, 1929	Several males, testes enlarged	Manombo

NATIVE NAME.—The native name for this bird was "Zée–zée," at Ivohibe among the Bara. This name is obviously an imitation of the bird's song.

Cisticola cherina (Smith)

Madagascar Grass Warbler

DISTRIBUTION.—Found from sea level to 2000 m. The grass warbler was a common bird in all the biotic provinces wherever suitable habitat was available. It frequented grasslands, rice fields and other cultivated land, and grassy and reedy swamps, and was one of the few common birds of the central plateau. The grass warbler favored the vicinity of damper spots where the grass was more luxuriant, but was also common in the more sterile grasslands and in the scanty grass on the sand of the Subdesert. In the Humid East it followed the little grassy clearings and open trails into the forest.

HABITS.—The grass warbler was a conspicuous bird, perched on the top of grass stems or on some bush, uttering a few chirps of alarm. Its song, which was often heard, was delivered on the wing. The bird flew up a short distance, from three to twelve meters above the ground, at a low angle and with an undulating flight, giving a sharp "tint tint- - - -," then it darted back to earth. Several times a female was seen carrying nesting material, which was usually a conspicuous white fluff of plant-down. The male occasionally accompanied her and sang about the nest while she was building. When one approached the nest, or where young were hidden in the grass, the birds became quite excited, flying about closely, scolding the intruder with a sharp chipping note.

The birds probably breed throughout the year, as the following data indicate; but it is probable that this is not true in the arid Subdesert.

January 29, 1930	Nest with young	Tulear
March 7, 1931	Female, laying	Namoroka
March 13, 1931	Two nests with eggs	Namoroka
May 8, 1929	Young recently out of nest	Tananarive
June 3, 1929	Nest with young	Andreba
June 26–27, 1929	Several males, testes enlarged	Vondrozo
July 25, 1929	Juvenile, not long out of nest	Vondrozo
July 31, 1930	Nest in construction	Antalaha
August 11, 1930	Nest in construction	Andapa
September 3, 1929	Juvenile, not long out of nest	Iampasika (near Ivohibe)
September 25, 1929	Nest with eggs	Manombo (southeast)
November 7, 1929	Nest with three eggs	Tabiky
December 7, 1929	Nest in construction	Iotry
December 11, 1930	Nest in construction	Ambiky

The nine nests examined and the one that Mr. Lowe described,[1] which were found in the Humid East, the Western Savanna, and the

[1] Lynes, 1930, Ibis, Cisticola Suppl., pp. 114, 115.

Subdesert, were all very uniform in shape and construction, exhibiting none of the geographic variation recorded by Grandidier.[1] They were placed from 150 to 450 mm. from the ground in a tussock of grass in the open-ground, in the low grass in a dry rice field from which the crop had been harvested, in a low dense bush in a tussock of grass on the brush and sand desert, and in the rank grass by a little swampy stream. They were the ball type of nest described by Lynes (1930); that is a semi-pensile structure supported by the grass stems on the side; oval or pear-shaped with a side opening at the top. The outside of the nest was composed of a small amount of broad dead grass blades and much cobweb and plant-down, with an abundant lining of cobweb and plant-down. The measurements of three nests are as follows: (1) Namoroka: outside, 65 mm. wide × 130 mm. deep; inside, 45 mm. wide × 85 mm. deep; entrance, 50 mm. deep × 35 mm. across. (2) Manombo: outside, 70 mm. wide × 130 mm. deep; inside, 45 mm. wide × 95 mm. deep; entrance, 35 mm. deep × 40 mm. across. (3) Namoroka: outside, 70 mm. wide × 160 mm. deep; inside, 45 mm. wide × 90 mm. deep; entrance, 30 mm. deep × 40 mm. across.

The number of eggs in a clutch varied from three to five (four sets examined). The eggs were ovate in shape; the shell smooth with a medium gloss; ground-color pale greenish blue to very pale bluish white, well marked with small blotches, dots, and speckles of earthy red, brown, and secondary grays, the markings running together to form a wreath about the larger end.

The measurements of nine eggs, parts of three sets, follow: set of four from Namoroka: 16.3 × 11.8 mm., 16.3 × 11.9 mm., 16.4 × 11.7 mm., and 16.4 × 12.2 mm.; four of a set of five eggs from Namoroka, 14.9 × 11.4 mm., 15.0 × 11.5 mm., 14.5 × 11.0 mm., and 14.8 × 11.3 mm.; and one egg from a set of three from Tabiky, 15 × 11.7 mm.

NATIVE NAME.—Usually "Tit" or "Tint," from the bird's call, but the Sakalava at Namoroka called this bird "Kaladébo."

Dromaeocercus seebohmi Sharpe

Gray Emu-tail

DISTRIBUTION.—This is one of the few birds known only from the central highlands of the Humid East; found from 1800 to 2100 m. at Monjakatompo on Mt. Ankaratra and at about 1800 m. at one day west of Andapa, near Mt. Tsaratanand. It was very common locally, and

[1] Milne-Edwards and Grandidier, 1879, Hist. Nat. Madag., pp. 326–327.

it frequented the little grassy swamps and the neighboring heath and grasslands.

HABITS.—The gray emu-tail was an inconspicuous, solitary bird, creeping about through the grass and brush like a mouse, usually preferring to escape through the vegetation on foot rather than to fly, though it sometimes did fly. Several times birds that were in the grass almost underfoot or in a little bush surrounded with grass, did not fly but crept away unnoticed through the grass. It was sometimes impossible to flush them. These birds sometimes responded readily to squeaking, and on such occasions came up to within arm's reach. It would escape observation much oftener than it does if it were not for its loud chattering call, which it repeats continually when it is disturbed. The song, delivered from a low perch, is a series of rather clear whistles. One that I watched sing several times, just stopped in the middle of its talking chatter, raised its head, gave a curious little rattle, then followed with the whistled song, its throat pulsing the while. The food in several stomachs that I examined was entirely small insects.

The breeding season includes at least the months of August and September, as the following data indicate.

August 24 to September 7, 1930	Practically all of the birds collected were in breeding condition, including females laying	Andapa, one day west
September 6, 1930	Juvenile not long out of nest	Andapa, one day west

No nests were found, but judging from the actions of a bird that seemed to have a nest near-by, the nest was probably placed in the grass and sedge of a little swamp. When collected this bird proved to be a female nearly ready to lay.

Dromaeocercus brunneus Sharpe
Brown Emu-tail

DISTRIBUTION.—Found in the forest of the Humid East, at Fanovana (altitude about 800 m.) and in the forest of Sianaka. I saw none of these birds alive, but the natives who brought them in to us said that they frequented the ground-cover in the heavy forest; apparently they are fairly common in the Sianaka forest, judging from the number of skins in Chauvin's collection.

HABITS.—The natives said that this was a shy, retiring bird that lived in the brush close to the ground, and uttered a little rattling call apparently similar to that of *Dromaeocercus seebohmi*. One stomach examined contained small insects.

NATIVE NAME.—"Voron drívick" among the Betsimisaraka at Fanovana.

Mystacornis crossleyi (Grandidier)

Crossley's Babbler

DISTRIBUTION.—From sea level to 1800 m. We found this species in the Humid East, where it frequented the forest floor. It was not common in the southeast, but in the northeast at Andapa, one day west, it was very common. The bird was less common at the lower altitudes.

HABITS.—Crossley's babbler is a terrestrial bird, running about on the ground in the forest among the concealing cover, only taking wing when forced to do so, then, with strong, whirring flight, it goes but a short distance to light on the ground again. Occasionally one mounts to a low perch. It is usually a solitary bird, though in the breeding season birds were seen in pairs. It has a whistled note. In feeding habits it appears entirely terrestrial; four stomachs examined contained nothing but insect matter.

The breeding season includes at least the months of August and September, as the following data indicate.

September 3, 1929	Several birds in breeding condition	Iampasika (near Ivohibe)
August 23–27, 1930	Two females, ovaries enlarged	Andapa, one day west
September 5, 1930	Female, breeding	Andapa, one day west

NATIVE NAME.—This bird was known as "Talápeutána" (the one who whistles on the earth) in the northeast, by the Betsimisaraka and Tsimihety.

Oxylabes madagascariensis (Gmelin)

Foditany; White-throated Oxylabes

DISTRIBUTION.—From sea level to 1800 m. This is a bird of the forests of the Humid East, where it was not uncommon; Mt. d'Ambre, where it was very common; and the Sambirano, where a single example was secured.

HABITS.—*Oxylabes madagascariensis* is a shy retiring bird of the ground-cover in the forest, where it hops about through the lower growth or even on the ground. It is difficult to observe and is ever ready to dart out of sight when danger threatens. Occasionally several were seen moving about in loose parties or in company with *Bernieria madagascariensis*, or more often, with *Bernieria zosterops*, forming the lower strata of one of the big mixed flocks of birds. It has a clear whistled call

or song of several notes. Two stomachs examined contained nothing but insect matter.

The breeding season probably includes the months of August, September, and October, as the following data indicate.

August 15 and September 7, 1930	Several birds, gonads enlarged	Andapa, one day west
October 17, 1930	Female, just finished laying	Mt. d'Ambre
October 26, 1930	Female, ovary enlarged	Mt. d'Ambre

Oxylabes cinereiceps Sharpe

Gray-crowned Foditany; Gray-crowned Oxylabes

DISTRIBUTION.—This species was found at about 800 m., restricted apparently to the heavy forest of the central part of the Humid East.

HABITS.—At Fanovana this was a bird of the ground-cover in the forest, gleaning for insects through the low bushes, and associating with *Bernieria zosterops.*

Oxylabes xanthophrys Sharpe

Yellow-browed Foditany; Yellow-browed Oxylabes

DISTRIBUTION.—Known only from the central part of the forest of the Humid East, where M. Herschell-Chauvin has secured a considerable number of skins from the forest of Sianaka. This species probably is similar in habits to the preceding.

Bernieria tenebrosa Stresemann

Dusky Tetraka

DISTRIBUTION.—Two specimens from the forest of the central part of the Humid East were purchased from M. Chauvin. Probably this species is a bird of the ground-cover in the forest.

Bernieria zosterops fulvescens Delacour

Pale Short-billed Tetraka

DISTRIBUTION.—From 800 to 1200 m.; common in the humid forest on the summit of Mt. d'Ambre, to which it is restricted.

HABITS.—The habitat and habits of this race are much like those of *Bernieria z. andapae.*

October is probably near the beginning of the breeding season, as the following indicates.

October, 1930	Several birds in breeding condition	Mt. d'Ambre

Bernieria zosterops andapae (Salomonsen)[1]

Andapa Short-billed Tetraka

DISTRIBUTION.—Found up to 1800 m.; more common at the higher altitudes; this *Bernieria* was found in the forests of the northern end of the Humid East, about Andapa and one day to the west. It frequents the ground-cover and the lower middle spaces, rarely mounting to the tree tops as *Bernieria madagascariensis* often does.

HABITS.—*Bernieria zosterops* is an active bird, searching for its insect food among the bushes and shrubbery, usually in small parties, often in company with *Bernieria madagascariensis* and *Oxylabes*, and forming part of the lower strata of one of the big mixed flocks. It is not at all shy, sometimes feeding birds may be all about one. It has a chattering call, and possibly other notes heard in the forest are given by this bird.

The breeding season probably starts in September.

September 3, 1929 Male, testes enlarged Andapa, one day west

Bernieria zosterops maroantsetrae (Salomonsen)[1]

Maroantsetra Short-billed Tetraka

DISTRIBUTION.—Known from the forests of the Humid East in the vicinity of Maroantsetra near sea level, and from two days' journey to the northeast at 1000 meters where it was common.

HABITS.—Similar to those of the preceding race.

Bernieria zosterops zosterops Sharpe

Southern Short-billed Tetraka

DISTRIBUTION.—Found up to about 1000 meters in the forests of the Humid East from Fanovana south to Manombo and Ivohibe. A common bird.

HABITS.—Similar to those of the preceding races.

Bernieria zosterops ankafanae (Salomonsen)

Ankafana Short-billed Tetraka

DISTRIBUTION.—Apparently confined to the higher altitudes in the southern part of the Humid East, in the vicinity of Fianarantsoa.

These forms of *B. zosterops* are interesting as showing how a species can break up into "populations" though the habitat is continuous. Only *B. z. fulvescens*, a very pale race from the humid forest of Mt. d'Ambre, has an isolated range. The race *andapae* is intermediate between the

[1] See Salomonsen, 1934, Ann. and Mag. of Nat. Hist., (10) XIV, pp. 60–79, for a revision of the Madagascar timaline birds.

Maroantsetra form and *fulvescens* but closer to the former. The race *zosterops* differs from *maroantsetrae* in being slightly yellower and less olive; *ankafanae* (of which I have seen no specimens) is apparently simply paler than *zosterops*. Thus we have a very distinct subspecies, *fulvescens*, with an isolated range and apparently four closely related, less well defined races in the continuous forest of the Humid East.

Bernieria madagascariensis madagascariensis (Gmelin)
Tetraka

DISTRIBUTION.—From sea level to 1800 m.; common in the forest of the Humid East where it frequents the tree tops, the ground-cover, and the middle spaces.

HABITS.—The tetraka is a rather active bird, searching for insects among the branches, sometimes clinging to the sides of the tree trunks, craning its neck to see all about it. It is usually encountered in small parties of four to six, often in company with *Bernieria zosterops*, and frequently forms part of the big mixed flocks. Not at all shy, it continues feeding unmindful of one's presence. It is somewhat noisy and besides a chattering call, a "cha cha– – – ," has a rapid whistle, "treu treu treu– –."

The breeding season probably includes the months of September and October, as the following data indicate.

September 29 and October 8, 1929	Several specimens with gonads enlarged	Manombo (southeast)

NATIVE NAME.—"Toaiky" by the Betsimisaraka at Maroantsetra.

Bernieria madagascariensis inceleber Bangs and Peters
Western Tetraka

DISTRIBUTION.—From sea level to 1200 m., occurring in the wooded areas of the Occidental and the humid forests of the Sambirano and Mt. d'Ambre, common in the northern part of its range, becoming less so farther south.

HABITS.—This race has much the same habits as the preceding, *B. m. madagascariensis*. It travels in small parties, searching for insects through the branches.

The breeding season probably includes at least the months of October and March, as the following data indicate.

October 19, 1930	Female, laying	Mt. d'Ambre
March 31, 1931	Males, testes enlarged	Ambararatabe

NATIVE NAME.—"Tchiabé" at Maromandia, one day east, by the Sakalava and "Tre tréka" at Ambiky by the Sakalava.

Ixocincla madagascariensis madagascariensis (Müller)

Horovana; Madagascar Bulbul

DISTRIBUTION.—From sea level to 2000 m. This is one of the most common Madagascar birds, found in the forest and brush in all the biotic districts.

HABITS.—The bulbul is conspicuous and noisy, continually dashing about through the tree tops, usually in small parties, occasionally with the large mixed flocks of birds in the forests of the Humid East. It has a wide variety of chirps and chattering calls, and a whining "meu." The bulbul exhibits considerable curiosity and is easily squeaked up. Birds were often seen in the forest feeding in trees bearing small fruits. At Tabiky birds were seen hopping down to the stream to drink.

The breeding season probably extends at least from September to January, as the following data indicate.

September and October, 1929	Many specimens with gonads enlarged	Manombo (southeast)
October, 1930	Several females, laying	Mt. d'Ambre
October 27, 1929	Nest in construction, no eggs	Ankazoabo (southwest)
November, 1930	Several specimens, gonads enlarged	Sambirano
November 7, 1929	Nest, three eggs	Tabiky
November 12, 1930	Nest with three eggs	Tsarakibany, 15 miles southwest
January 5, 1931	Male, testes enlarged	Marotony
January 3–10, 1931	Several young birds, recently out of nest	Marotony

The three nests examined were in each case placed in the fork of a low tree or bush, two to three meters up, on the edge of a patch of forest or brush in savanna country. The nests were neat, rather thin cups, firmly but not densely constructed. In one nest it was possible to see light through it from below. All three nests examined had parts of snake skin in the foundation of the nest and one, in addition, had parts of shed lizard skins. The outside of the nests was composed of rather fine dead herbaceous and semi-woody material (one nest had some stems of compound leaves woven into the outside), and two were lined with fine yellow grass that contrasted beautifully with the color of the eggs. Another had a lining of fine dark grass and herbaceous stems.

One nest measured: outside, 110 mm. wide × 70 mm. deep; and inside, 70 mm. wide × 50 mm. deep.

Two clutches contained three eggs each. The eggs were ovate in shape; the shell, smooth and somewhat glossy; ground color pinkish, nearly "shell pink," to pinkish white, very heavily marked with spots, often overlapping, and speckles of reddish brown, olive-browns, and secondary grays. The three eggs of one set measured: 25.5 × 18.4 mm., 26.4 × 18.7 mm., and 25.2 × 18.9 mm. One egg from the other set measures: 25.6 × 18.0 mm.

NATIVE NAME.—The native name was some variation of "Horova," "Tsikorova," or "Tsikoreva."

Tylas eduardi eduardi Hartlaub
Kinkimavo

DISTRIBUTION.—Found from sea level to 1800 m.; not very common except at one day west of Andapa. This is a forest bird of the Humid East, occasionally ranging out into the denser secondary brush. It frequents the larger branches in the tree tops and upper middle spaces.

HABITS.—In actions and appearance this bird is somewhat like *Coracina cinerea*, rather slow in movements, and gleaning insect food from the branches. It was usually found in the large mixed flocks of various species of larger passerine birds, particularly *Artamella viridis*, though never more than one or two were seen with a flock, and one or two were almost always found in the flocks containing *Euryceros prevostii*.

Seven stomachs examined contained medium-sized insects.

The breeding season probably includes at least the months of August and September, as the following data indicate.

August 10, 1930	Female, ready to lay	Andapa
September 3, 1930	Female, in breeding condition	Andapa, one day west

NATIVE NAME.—The natives did not distinguish between this bird and *Coracina cinerea*, calling them both "Kikimavo."

***Tylas eduardi albigularis** Hartlaub
Gray Kinkimavo

DISTRIBUTION.—The central part of the Western Savanna. Apparently the birds from this area represent a pale race.[1] In the Rothschild Collection are two specimens from central-western Madagascar

[1] See Delacour, 1932, L'Oiseau et R. F. O., II, p. 70.

with entirely white under parts and no trace of olive on the upper parts. Both are labeled males and have wing measurements of 114 and 118 mm. *T. e. eduardi* appears to be slightly larger, ♂ 120–123. This form is evidently either rare or very local.

Coracina cinerea cinerea (Müller)

Madagascar Cuckoo Shrike

DISTRIBUTION.—Found from sea level to 1800 m. in the Oriental and Occidental provinces; common in the Oriental but less so in the Occidental. The cuckoo shrike is a bird of tree tops and upper middle spaces in the forest and the denser secondary brush. In the northwest it was occasionally found in the mangrove swamps on the coast.

HABITS.—The cuckoo shrike is often associated with the large mixed flocks of various species, either with the larger forms such as *Tylas*, *Artamella*, etc., or with the smaller birds like *Neomixis*, *Newtonia*, and *Zosterops*. Often two of three birds were found in one such flock. This bird searches for its food among the twigs and branches. It is rather slow and deliberate in its movements, turning its head now this way, now that, peering for its prey, usually medium-sized or large insects, which it beats into submission against a branch. Of three stomachs examined, one contained a locust; two, other large insects; and one a spider. Its call is a chattering "ki–ki–ki– – –" or "Keeee."

The breeding season includes at least the months of November, December, and March, as the following data indicate.

November 26, 1930	Female, ready to lay	Anaborano, one day south
March 6, 1931	Female, ready to lay	Namoroka
January 12, 1931	One young, not long out of nest	Anorontsanga

NATIVE NAME.—"Kikimavo" in the northern part of the island among the Betsimisaraka and Sakalava.

Coracina cinerea pallida Delacour

Subdesert Cuckoo Shrike

DISTRIBUTION.—Restricted to the Subdesert Province; not common. It frequents the upper parts of the trees in the more heavily wooded areas.

HABITS.—Similar to those of the preceding race.

The breeding season probably coincides more or less with the rainy season, since on November 14, 1929, a female, ready to lay, was taken at Tabiky.

Dicrurus forficatus forficatus (Linnaeus)

Madagascar Crested Drongo

DISTRIBUTION.—From sea level to 1800 m.; found in the wooded areas of all the biotic districts. Salomonsen described the western bird as *viridior* because of its greenish, not bluish gloss.[1] The difference seems too slight to warrant recognition. Usually rather common, but uncommon on Mt. d'Ambre, this drongo frequents the upper middle space and the tree tops of the forest and the brushland.

HABITS.—The crested drongo is often seen on some conspicuous perch, giving a wide variety of loud calls and whistles as well as softer whistled notes. It is ever ready to dart out and seize a passing insect in true flycatcher style. This bird is usually somewhat solitary, though several are sometimes seen in company or associated with various other species in the big feeding flocks in the Oriental Province. At Anaborano I watched a pair of these birds bathing in a marshy pool. They were perched on a bush at the water's edge and every now and then flew out over the pool, hovered for a moment about two meters above the water, and then dropped down into it, rising at once and flying back to a perch and preening their feathers. This was repeated several times. At first I thought they might be feeding on insects floating on the water, but they seemed to be bathing. In disposition the crested drongo is rather pugnacious and individuals were seen occasionally chasing hawks, once a *Buteo*, and again an *Astur francesii*. The food of the drongo is chiefly large insects, including wasplike insects and locusts, which are often taken on the wing. A female was seen feeding a locust to a full-grown young.

The breeding season probably extends from September to December, as the following data indicate.

September 29, 1929	Male, testes enlarged	Manombo (southeast)
November 2, 1930	A nest with three eggs	Tsarakibany, 15 miles southwest
November 3, 1930	Nest with two small young and one egg	Tsarakibany, 15 miles southwest
November 13, 1929	Nest in construction	Tabiky
November 16, 1930	Young bird only recently out of nest	Anaborano
November 23, 1930	A nest with eggs	Anaborano
November 24, 1929	Male, testes enlarged; one juvenile	Befandriana
November 28, 1930	Nest in construction	Bezona
December 10, 1930	Male, testes enlarged	Ambiky (coast opposite Nossi Be)
January 1, 1931	Juvenile, still being fed	Marotony

[1] 1934, Proc. Zool. Soc. London, I, p. 223.

The two nests from west of Mt. d'Ambre were 2.5 meters up in trees on the edge of wooded areas of the savannas; the one at Anaborano was on a limb 3 meters above a stream in the forest; and that from Tabiky was 12 meters up, in the wooded plain country. The nest in construction at Bezona was 5 meters up in one of a clump of mango trees in open brush country.

The nests were rather shallow, semipensile, saucer-shaped structures placed in a flat crotch. The nest that was collected was composed of rather fine dead herbaceous stems, grasses, and leaf stems. The whole outside was more or less held together by cobwebs. The lining was of finer grasses and herbaceous stems. The nest measured 115 mm. wide × 60 mm. deep outside, and 80 mm. wide × 45 mm. deep inside. Another nest of similar structure measured 120 × 60 mm. outside, and 80 × 40 mm. inside.

One nest contained three eggs; another nest, one egg and two young. The eggs were ovate in shape; the shell, smooth, somewhat glossy; color, "old ivory white," sparsely marked with small spots and dots of rufous brown and secondary grays, more numerous on the larger end, tending to form a wreath. The eggs of one set measured 24.4 × 18.3 mm., 26 × 18.4 mm., and 24.5 × 17.6 mm.; the single addled egg of the other set measured 25.8 × 17.6 mm.

NATIVE NAME.—"Rendovy" in the southeast among the Bara and Atamoor; "Lerova" and "Drongo" in the north among the Betsimisaraka and Sakalava.

Leptopterus chabert chabert (Müller)

Chabert Vanga

DISTRIBUTION.—From sea level to 1800 m.; found commonly in the Oriental and fairly commonly in the Occidental provinces, in the wooded and brush areas. This vanga frequents the tree tops in the forest, on the wooded plains, and in the brush. In the Humid East they seemed more common in the secondary brush and about the plantations, though this was perhaps more apparent than real since they were easier to observe there than in the tree tops of the forest.

HABITS.—The chabert vanga is usually seen feeding and moving about in flocks of its own kind, from four to twelve individuals in each flock; at Soalala, Du Mont saw a flock of about twenty-five birds. They were often seen in some tree top in the scattered brush. Their habit of sitting in trees along the trail and flying ahead to another tree at one's approach is characteristic; sometimes when at rest they "bob" their

heads. Their flight is undulating and often in flight they utter a sharp "tec–tec tec–tec tec–tec– – –." The food of this vanga, which consists largely of small and medium-sized insects, is secured among the twigs and branches. Two stomachs examined contained ants, beetles, and other insects. The breeding season probably extends at least from September to December, as the following data indicate.

September 6, 1930	Female, ovary enlarged	Andapa, one day west
September 24–29, 1929	Several birds with gonads enlarged	Manombo (southeast)
September 25, 1930	Male, testes enlarged	Vohemar, one day north
October 3, 1929	Male, testes enlarged	Manombo
November, 1930	Birds in juvenile plumage	Tsarakibany, 15 miles southwest
March, 1930	Birds in juvenile plumage	Ampotaka
March, 1931	Birds in juvenile plumage	Namoroka

NATIVE NAME.—"Tsa-tsak" or "Voron Tsa-tsak" in the southeast and northeast among the Bara, Atamoor, and Betsimisaraka; "Tsaramash" (good eye) in the north among the Antakara.

Leptopterus chabert schistocercus (Neumann)

DISTRIBUTION.—The Subdesert Province, where it is not very common. The habitat preferences of this race are much the same as those of the preceding, that is, the wooded areas, the desert brush, and into the edge of the savanna country.

HABITS.—The habits of this vanga are much like those of the preceding race, but these birds are usually seen in smaller parties.

The breeding season probably includes at least October and November, as the following data indicate.

October 28, 1929	Male, testes enlarged	Tabiky
November 9, 1929	Male and female, gonads enlarged	Tabiky
November 21–23, 1929	Male and female, gonads enlarged	Befandriana
February 1930	Several birds in juvenile plumage	Tsimanampetsotsa

Cyanolanius madagascarinus madagascarinus (Linnaeus)

Blue Vanga

DISTRIBUTION.—From sea level to 1800 m.; a common bird of the forest and larger second-growth brush of the Humid East, Mt. d'Ambre, and the Sambirano, less common in the wooded areas of the Occidental, becoming rare in the south and ranging into the edge of the Subdesert.

HABITS.—In the Oriental the blue vanga is a bird of the tree tops, often moving about in small parties, usually with mixed flocks of

smaller species, *Neomixis*, *Newtonia*, and *Zosterops*. It gleans through the smaller branches and trees, sometimes clinging upside down to a bunch of leaves on the end of a twig, in search of its food. The food of the blue vanga is apparently medium-sized and small insects; of the three stomachs examined all contained caterpillars and two contained other insects in addition.

The breeding season probably extends at least from September to November, as the following data indicate.

September 3, 1929	Male, testes enlarged	Ivohibe, one day north
September 20, 1929	Male, testes enlarged	Manombo (southwest)
October 3, 1929	Two females, ovaries enlarged	Manombo (southwest)
October 25, 1930	Male, testes enlarged	Mt. d'Ambre
November 4, 1930	Male, testes enlarged	West of Mt. d'Ambre

Artamella viridis viridis (Müller)

White-headed Vanga

DISTRIBUTION.—Found from sea level to 1800 m.; a common forest bird of the Humid East, where it frequents the tree tops.

HABITS.—The white-headed vanga is usually found in the tree tops, gleaning through the branches and twigs for its food, and is often one of the main components of the mixed flocks of the larger species which sometimes included *Tylas*, *Euryceros*, and *Oriolia*. From one such flock at Andapa, Du Mont and I shot twenty-five of this species. Two stomachs examined contained small chameleons and one of them also contained a few insect remains.

A male, taken August 19, 1930, at Andapa, had the testes enlarged, indicating the start of the breeding season.

Artamella viridis annae (Stejneger)

Western White-headed Vanga

DISTRIBUTION.—Fairly common in the wooded areas of the Occidental, the wooded and brush areas of the Subdesert, and the forest of the Sambirano district. In the northwest it was often seen in the mangrove swamps on the coast.

HABITS.—The western race of the white-headed vanga is much like the preceding race in habits, but is usually found in smaller parties, either in pairs or parties of four or five. Its call is a harsh scolding "chee–chee–chee– –."

The food of this bird is chiefly insects gleaned from the twigs and branches. Of five stomachs examined, two contained hairy caterpillars, and three, other insect matter.

The breeding season probably includes at least the months of November and December, as the following data indicate.

November 24, 1929	Male and female breeding	Befandriana
November 17, 1930	Male, testes enlarged	Anaborano
December 10, 1930	Male, testes enlarged	Coast opposite Nossi Be

Schetba rufa rufa (Linnaeus)

Rufous Vanga

DISTRIBUTION.—From 160 to 1800 m.; in the Humid East; common in some localities, rare in others without any obvious reason. The rufous vanga frequents the middle spaces in the heavy forest, rarely venturing into the tree tops.

HABITS.—The rufous vanga is rather inactive, usually found in parties of four or five sitting about in the forest, occasionally associated in flocks with other species. It is not at all shy, can be closely approached, and responds readily to squeaking. With a little care the whole party can be collected. Their notes include a tremulous whistle recalling that of *Euryceros*, and a chattering call.

The food of the rufous vanga consists of insects. Six birds taken at Vondrozo, 20 km. west, when locusts were passing in swarms, had their stomachs crammed with these insects. Eight birds that were taken when few locusts were present had various other insects in their stomachs.

Schetba rufa occidentalis Delacour

Western Rufous Vanga

DISTRIBUTION.—The Western Savanna; it was found in the low dry forest on the calcareous hills at Namoroka where it was common, and in the edge of the Subdesert in the open dry forest at Tabiky, where but three were seen.

HABITS.—The habits of the western race are much the same as those of the preceding. At Namoroka the parties usually consisted of one or two old birds and two or three young ones. Besides the tremulous whistle and the chattering call, this bird was heard to give a call that can be indicated as "Cop-cop-cop-hoo."

Four stomachs examined contained medium-sized insects.

At Namoroka during the first two weeks in March, many birds beginning to moult out of the juvenile plumage were taken, so that the breeding season is probably December and January at least.

NATIVE NAME.—"Karapohovava" at Namoroka among the Sakalava.

Oriolia bernieri I. Geoffroy Saint-Hilaire

Bernier's Vanga

DISTRIBUTION.—From 500 to 1000 m.; a rare bird of the forests of the Humid East. At Vondrozo one bird was secured from a flock of four of these birds that was in the larger limbs of the tall trees in the forest. In the northern part of the Humid East it was occasionally encountered in the tree tops or the upper middle spaces, associated with other species. When found, one or two were in a flock of larger passerine birds, which always contained *Euryceros*, *Tylas* and *Artamella*, having much the same feeding habits.

Five stomachs examined contained medium-sized insects.

Calicalicus madagascariensis (Linnaeus)

Red-tailed Vanga; Tit Shrike

DISTRIBUTION.—From sea level to 1800 m.; in the Oriental and Occidental provinces. The tit shrike was a common bird of the tree tops in the forest and in the brushland of the Oriental, less common in the wooded country of the Occidental and inexplicably absent from some localities.

HABITS.—The tit shrike moves about through the branches, searching for its insect food on the twigs and branches, usually in company with other species, and one of the big mixed flocks in the Oriental is almost sure to contain several of these birds. Its loud two or three-note call is one of the common characteristic sounds of the forest and is often a useful guide in the location of a flock of birds. At Tabiky, one, in company with several *Cinnyris sovimanga* and *Newtonia*, was scolding an *Asio madagascariensis*.

The food which this vanga gleans from the trees is apparently insects. Of four stomachs examined, two contained grasshoppers; one, small beetles; and one, a hairy caterpillar.

The breeding season extends at least from August to November, as the following data indicate.

August 17, 1930	Female, ready to lay	Andapa
September 1, 1929	Female, laying	Ivohibe
September 25–29, 1929	Female, ovary enlarged; male, testes enlarged	Manombo (southeast)
October 1, 1929	Several females, laying	Manombo (southeast)
October 11, 1930	Several females, laying	Mt. d'Ambre
November 11, 1930	Female, laying	Tsarakibany (15 miles southwest)
November 17, 1929	Three juvenile-plumaged males	Tabiky

The juvenile plumage of the young male resembles that of the adult female. A pair of birds at Ivohibe apparently had a nest in the secondary brush, judging from their actions.

Vanga curvirostris curvirostris[1] (Linnaeus)

Hook-billed Vanga

DISTRIBUTION.—Found from sea level to 1800 m.; a fairly common bird of the forest and the denser secondary brush of the Oriental and of the wooded areas of the Occidental. In the northwest it is tolerably common in the mangroves on the coast. This vanga haunts the forest from the tree tops to the ground-cover but it seems to favor the larger branches in searching for its prey. At Maroantsetra these birds were frequently seen in the town itself.

HABITS.—Usually a solitary bird, or found in pairs, the hook-billed vanga is sometimes seen in mixed flocks of other larger passerine species but usually on the edge of these. The hook-billed vanga is rather deliberate in its actions, moving slowly about through the trees, turning its head this way and that in search of its prey. It sometimes sits still for some time, continually calling—a long-drawn whistle, almost a monotone. When it is calling high up in a tree it is very difficult to locate and see. It has also a broken whistled call, loud and sharp, that sounds hawklike, and a harsh "whaa whaa." This vanga responds readily to an imitation of its note and can be called up from a considerable distance. It also responds readily to squeaking and this, taken in connection with its solitary habits, heavy bill, and its vertebrate prey, makes one think that they may eat young birds and small mammals. Of the 63 stomachs examined, 43 contained reptiles or amphibians (16, reptiles, largely chameleons and other tree lizards; 2, frogs; and 25, undetermined reptile or amphibian remains); 44 contained insects (6, locusts; 7, cicadas; 3, beetles; 11, flies; 17, other insects); and two contained spiders.

The breeding season probably extends from September to November at least, as the following data indicate.

September 5, 1930	Female, ovary enlarged	Andapa
October 21–23, 1930	Females, laying	Mt. d'Ambre
November 30, 1930	Females, laying	Anaborano
November 19, 1930	Female, egg in oviduct	Anaborano
January 1, 1931	Full-grown young	Andampy

A female, October 21, 1930, Mt. d'Ambre, and one November 19, 1930, at Anaborano, each had an egg in the oviduct. The eggs were

[1] *Vanga cristata* Reichenow is a synonym according to Delacour, 1932, L'Oiseau et R. F. O., p. 75.

white, marked with spots of pinkish brown more plentiful about the larger end.

NATIVE NAME.—"Vanga" over the greater part of the island, but "Voromareny" at Namoroka among the Sakalava and "Voronbanga" at Fanovana among the Betsimisaraka.

Vanga curvirostris cetera Bangs

Western Hook-billed Vanga

DISTRIBUTION.—Fairly common in the wooded areas of the Subdesert but not found in the Subdesert brush.

HABITS.—The habits and call of this race are much like those of the preceding.

Of the two stomachs examined, both contained chameleons, one of which was about 150 mm. long.

Xenopirostris xenopirostris (Lafresnaye)

Lafresnaye's Vanga

DISTRIBUTION.—The Subdesert Province; fairly common. This bird frequents the brush on the sandy areas in the arid part of the Subdesert, but was not found in the wooded areas, nor in the low forest on the calcareous plateau.

HABITS.—This vanga was usually seen sitting on a perch in a bush or tree though sometimes in a conspicuous place on the top of a bush. Its call, which was a sudden, sharp whistle repeated at intervals, was sometimes given from an exposed perch. Though usually solitary, or in pairs in the breeding season, a party of five of these birds was seen at Anakao, which was possibly a family group.

The specimens from Lac Iotry in December showed signs of breeding.

Xenopirostris polleni (Schlegel)

Pollen's Vanga

DISTRIBUTION.—Apparently a rare bird of the forest of the Humid East; our only specimen was secured by a native hunter who shot it with a blow gun (altitude about 800 m.).

***Xenopirostris damii** Schlegel

Van Dam's Vanga

Evidently a bird of the wooded parts of the Western Savanna. This bird was first found on the mainland near Nossi Be by Pollen and van

Dam, and has recently been collected (1928 and 1929) by Lavauden[1] on the Plateau of Ankarafantsika, southeast of Majunga.

Euryceros prevostii Lesson
Helmet Bird

DISTRIBUTION.—From sea level to 1800 m.; in the forests of the northern part of the Humid East from Fanovana north, where it was fairly common. None was found in the forests of the coastal plain though it was present in the hills that rise from them.

HABITS.—The helmet bird was usually found moving rather actively through the tree tops in parties of from five to ten, almost always associated with numerous *Artamella*, a few *Tylas*, sometimes an *Oriolia*, as well as various other species. These feeding flocks move quickly through the trees and it is difficult to follow them when one has to force a way through the tangled shrubbery and to clamber across ravines. Occasionally a solitary bird of this species was found perched low down in the forest.

The usual call of the helmet bird was a tremulous whistle, recalling that of *Schetba rufa*.

The helmet bird secures its food from the smaller branches of the tree tops as the birds move about through the forest. Of the twenty-four stomachs examined, twenty-one contained insects (4, beetles; 2, locusts; 21, other insects, mostly of medium size), and seven contained vertebrates (3, frogs; 4, bones of reptiles or amphibians).

The bill of the young is black, or black with a white spot near the tip, and the beautiful iridescent blue comes in as a margin at the base, spreading forward over the bill until the adult condition is reached.

NATIVE NAME.—"Tsingetribé" among the Betsimisaraka and Tsimihety.

Falculea palliata I. Geoffroy Saint-Hilaire
Sicklebill; Falculea

DISTRIBUTION.—A common bird of the wooded areas and denser savannas of the Occidental and the Subdesert; very common in the Northern Savanna, but not common in the Subdesert brush. In the northwest *Falculea* was found commonly in the mangrove swamps and islets on the coast.

HABITS.—The sicklebill is gregarious, and except in the nesting season was always found in flocks, sometimes containing as many as

[1] 1932, Bull. Mus. Paris, pp. 638, 639.

twenty-five or more birds. West of Mt. d'Ambre one of the flocks contained young that were barely able to fly. They were not wary, and exhibited some degree of curiosity, responding readily to squeaking. When one of their number was shot they sometimes gathered about scolding, and it was possible to shoot a number from the flock before the others became alarmed and departed. At Namoroka and at Ambiky a flock of sicklebills often came into the trees in the village.

One of their calls is a loud "waugh," that sounds like the cry of a child at play, and from which the bird gets its name of "bird baby." When disturbed they break into a scolding chattering note.

Falculea searches for its food through the branches of the trees. The fourteen stomachs examined all contained large insects, some of them locusts.

The breeding season probably extends at least from September to December, as the following data indicate.

September 19–29, 1930	Practically all of the birds taken were in breeding condition, including females ready to lay	Vohemar-Diego Suarez
November 3–7, 1930	Several males, testes enlarged	West of Mt. d'Ambre
November 5, 1930	Juveniles just out of nest	West of Mt. d'Ambre
November 23–24, 1929	Several females, breeding condition	Befandriana
November 23, 1929	Nest in construction	Befandriana
December 10, 1929	Male and female, breeding condition	Iotry

At Befandriana I watched a female, closely followed by a male, gathering slender dead twigs from trees and low bushes and carrying them to a nest. The nesting site was on a limb of a large tree some twelve meters up, concealed from the ground by a bunch of leaves. This was in an open wooded plain.

West of Mt. d'Ambre, November 5, 1930, when we found young birds barely able to fly, not only the parents but several other birds came about, scolding and expressing great concern over the fate of the young.

NATIVE NAME.—Usually known as "Voronzaza" (bird baby) because of the resemblance of its call to that of a child.

Hypositta corallirostris (Newton)

Madagascar Nuthatch; Coral-billed Nuthatch

DISTRIBUTION.—Found from nearly sea level to 1800 m.; perhaps more common at the higher altitudes; a bird of the forest of the Humid

East region where it was fairly common. Though it was found to nearly sea level, none was taken in the forest on the narrow coastal plain.

HABITS.—In habits, the coral-billed nuthatch is very creeper-like, hunting for its insect prey chiefly on the upper halves of the trunks of the forest trees, sometimes out onto the larger limbs. It clings to the bark, climbing up one trunk, then flying down to the next, and continuing its search. It is rather active, continually moving about, but was not seen to cling head down. Two or three were often seen accompanying the mixed flocks of birds that move through the forest.

The breeding season probably includes at least the months of August and September, the start of the breeding season in the northern part of the Humid East, as the following data indicate.

August 8, 1930	Female, ovary enlarged	Andapa
August 21, 1930	Female, laying	Andapa, one day west
September 3, 1930	Female, laying	Andapa, one day west

The plumage of the young male resembles that of the female.

NATIVE NAME.—"Foudi dick" at Fanovana among the Betsimisaraka.

Cinnyris notatus notatus (Müller)

Madagascar Green Sunbird

DISTRIBUTION.—From sea level to 1800 m.; a fairly common bird of the forest and brush of the Oriental and Occidental, ranging rarely in the Subdesert Province. In the Humid East this bird was very common on the coastal plain, among the traveler's trees, and was abundant 20 km. southwest of Maroantsetra. It was less common on the forested mountain slopes where it was found most frequently about the clearings and banana plantations, though also in the heavy forest, at all altitudes.

HABITS.—This beautiful, glistening sunbird is restless and active and is frequently seen perched on a tree top. It frequents the blossoms of the banana plants and other trees and at Maroantsetra (two days northeast), it was feeding in a tree bearing flowers with long corollas which *Neodrepanis* frequented but where *Cinnyris sovimanga* with its shorter bill was unable to feed. Sometimes the feathers about the bill of this bird were heavily dusted with red pollen as in *Zosterops* and *Cinnyris sovimanga*. In addition to feeding at flowers, this species gleans through the twigs and branches for insects, sometimes creeping along the trunks and larger branches. Its sharp chirp is quite distinctive.

The breeding season probably extends from August to November, as the following data indicate.

September 28, 1929	Male and female, gonads enlarged; and natives brought in nestling birds	Manombo (southeast)
November 18, 1930	Male, testes enlarged	Anaborano

NATIVE NAME.—Usually not distinguished from *Cinnyris sovimanga*, though sometimes the male was called "Shoey manga" (or soui manga) meaning the "pretty sunbird."

Cinnyris sovimanga sovimanga (Gmelin)

Souimanga Sunbird

DISTRIBUTION.—From sea level to 2000 m.; very common in the forest and brush areas of the Oriental and Occidental. The sunbird frequented the tree tops in the forest, the brush in the clearings, and the scattered areas of trees and brush in the open ground. In the northwest it was occasionally found in the mangrove swamps on the coast.

HABITS.—The souimanga sunbird is an active, restless little sprite continually moving about, perching this way and that on a limb. It is usually found in parties of four to five, often associated with other species, moving about in the large mixed flocks that are so characteristic of the birds of the forest of the Humid East. It gleans for insects on the twigs and leaves, sometimes hovering about the end of a twig like a humming bird. The flowering trees and shrubs and even the larger flowering herbs held great attractions for this bird, and sometimes fifteen or twenty or more gathered in a single tree or bush in bloom. Some specimens had the "face" powdered red from the pollen of flowers.

This sunbird's calls are common sounds of the forest at any season; its repertoire includes a weak song, a mewing call, and a little chattering call. A female that was carrying nesting material gave a "chip chip chip---."

The breeding season probably extends at least from September to October, as the following data indicate.

September 20, 1929	Nest with two eggs	Ivohibe
September 25–30, 1929	Several birds, gonads enlarged	Manombo (southeast)
November 1, 1930	Nest in construction, nearly finished	Mt. d'Ambre
October 23–29, 1930	Several specimens, gonads enlarged	Mt. d'Ambre
November 15, 1930	Male, testes enlarged	Anaborano
December 7, 1930	Female bringing nesting material	Ambiky (coast opposite Nossi Be)

On September 13, 1929, at Ivohibe, I discovered a nest in open brush country by watching the female that was building it. The nest was attached to a bracken frond and was complete but for the lining of plant-down, which the female was adding. She was making regular trips at rather long intervals, about ten o'clock in the morning, taking the same route and direction each time. Her return was heralded first by the singing of the male who accompanied her in search of material but did not approach the nest, nor carry material, then by the "chip chip chip" of the female as she appeared carrying a fluff of plant-down. She went directly to the nest, where she stayed for a short time. (The female carrying nesting material at Ambiky was not accompanied by a male.)

This nest contained two fresh eggs on September 20. A nest at Mt. d'Ambre, nearly completed on October 18, 1930, contained no eggs on November 1, 1930. This nest was three meters up in a bush on the edge of a clearing in the forest.

The nest at Ivohibe was a beautiful pensile structure, oval in shape, with a porchlike roof projecting over the entrance, which was on the side, high up. The top of the nest was woven about the supporting bracken frond. The walls were firm and thick, constructed largely of plant-fiber and bits of bark, with bits of bark stuck onto the outside, giving it an old disused appearance. A preliminary lining was of fine grass heads, which projected to form the "porch roof" over the entrance. Inside was a thick complete lining of silky plant-down. The nest measured: outside 90 mm. wide × 135 mm. deep, inside 54 mm. wide × 70 mm. deep; the "roof" projected 40 mm., and the entrance was 30 mm. deep × 35 mm. wide. The nest from Mt. d'Ambre was similar but with considerable cobweb, moss, and leaves stuck over the outside and a few feathers had been added to the lining. It measured: outside 85 mm. wide × 150 mm. deep; inside 60 mm. wide × 70 mm. deep with an entrance 45 mm. across. The two eggs of the one set obtained were ovate in shape; shell smooth, fairly glossy; color whitish, heavily marked with small irregular spots and specks of olive-brown or lightly obscured secondary purplish grays, the spots converging to form a wreath or ring about the larger end. They measured 15.3 × 11.0 mm. and 16.2 × 11.3 mm.

NATIVE NAME.—"Sobítiky" or "Bítiky" in the southeast among the Bara and Atamoor, "Shoey" in the northeast among the Betsimisaraka.

Cinnyris sovimanga apolis Hartert

Subdesert Souimanga Sunbird

DISTRIBUTION.—From sea level to 800 m.; in the wooded and brush areas of the Subdesert; common.

HABITS.—Similar to those of *C. s. sovimanga*, except that during the nesting season it was seen only in pairs.

The breeding season probably includes at least the months of October and November, as the following data indicate.

October 13, 1929	Male, testes enlarged	Ihosy
October 31, 1929	Nest with one young ready to leave it	Tabiky
October 31, 1929	Nest in construction	Tabiky
November 2, 1929	Nest with two eggs	Tabiky
November 5, 1929	Nest with two young	Tabiky

The four nests were all about one meter up on low bushes in dry brush country. The nests and eggs were similar to those of *Cinnyris sovimanga sovimanga*. The normal clutch seemed to be two.

The male and female were both feeding the young birds and showed a certain amount of anxiety when the nest was disturbed, but they were not very demonstrative.

Neodrepanis coruscans Sharpe

Wattled Sunbird

DISTRIBUTION.—From sea level to 1800 m., in the forest of the Humid East; fairly common, especially at the higher altitudes. This little sunbird ranged through the forest from the tree tops to the ground-cover and out into the denser secondary brush.

HABITS.—The wattled sunbird was usually a solitary, rather quiet bird, sometimes sitting quietly low down in a dark place in the forest, occasionally moving about more actively, but never as active as *Cinnyris sovimanga*. When feeding it was usually seen searching for small insects on the bark of twigs and branches. Only once was this species seen feeding about flowers. During the parts of June and July, 1930, spent two days northeast of Maroantsetra, these little birds were found coming into a flower tree, apparently gathering nectar or insects, perhaps both, from the blossoms. They usually came and went singly, though two or three were sometimes in the tree together. During the stay at this camp sixteen specimens were collected from this one tree and perhaps as many more seen in it. Continuous hunting in the forest elsewhere yielded but a single specimen. The blooms of the tree which they visited had very long corollas, and the long bill of this bird was apparently

especially suited to feeding in them, for *Cinnyris sovimanga* with its short bill did not feed in this tree, although it was common in the vicinity, and *Cinnyris notata* with its longer bill occasionally fed in these flowers. The only call that I heard this bird give was a soft, hissing "Shee-shee – – –."

Several stomachs examined were filled with very small insects.

A male, testes enlarged, was taken August 23, 1930, one day west of Andapa, indicating the start of the breeding season.

NATIVE NAME.—"Tackabodamazing" at Fanovana among the Betsimisaraka who seemed well acquainted with this species, distinguishing it from other species and collecting many for us with blow guns.

*Neodrepanis hypoxantha Salomonsen

Small-billed Neodrepanis[1]

This species, from the central forests of the Humid East, was described from two skins in the British Museum, the only specimens known.[2]

Zosterops maderaspatanus maderaspatanus (Linnaeus)

Dark Madagascar White-eye

DISTRIBUTION.—A common bird of the forest and brush of the Humid East, except Mt. Ankaratra. It was sometimes abundant.

HABITS.—The tree tops and brush are sometimes alive with these birds, often in company with other species of small birds such as *Newtonia*, *Neomixis*, and *Cinnyris sovimanga*. They glean through the branches for small insects, often clinging upside down to a bunch of leaves or the tip of a twig, or they feed on small fruit which they sometimes swallow whole. When feeding about flowers, probably for the insects gathered there, their faces become dusted with pollen. The white-eye is a noisy bird, continually calling. Besides its call it has a loud pleasing song.

The breeding season includes at least the months of September and October, as the following data indicate.

September 9, 1929	Female, nearly ready to lay	Ivohibe
September 19, 1930	Male, testes enlarged	Vohemar
September 24–28, 1929	Several birds, gonads enlarged	Manombo (southeast)
October 1, 1929	Nest with three eggs	Manombo (southeast)
October 4, 1929	Female, breeding	Manombo (southeast)

[1] 1933, Bull. B. O. C., LIII, p. 182.
[2] This genus is discussed by Salomonsen, 1934, L'Oiseau et R. F. O., pp. 1–9.

A nest brought in by a native at Manombo (southeast), October 1, 1929, was placed in a fork of a branch and was said to have been situated about three meters up in the secondary brush. It was a firm, shallow, basin-shaped structure of grass and grass heads, with a few bits of plant-down and moss stuck on the outside, and was lined with fine grass and rootlets.

The clutch contained three eggs. The eggs were ovate in shape; the shell, smooth and somewhat glossy; color, pale greenish blue, light "pale Niagara green." They measured 15.3 × 12.4 mm., 16.4×12.3 mm. and 16.4 × 12.3 mm.

NATIVE NAME.—"Ramanjerick" and "Sobiry" among the Betsimisaraka in the northeast.

Zosterops maderaspatanus ampotakae Salomonsen[1]

Pale Madagascar White-eye

DISTRIBUTION.—The Subdesert and Occidental provinces, the Sambirano and Mt. d'Ambre districts up to 1000 meters. This is a slightly more yellowish race than *maderaspatanus*. The Mt. d'Ambre birds are very similar to the birds from the extreme southwest, those from intermediate points in the west are slightly darker.

HABITS.—A bird of the humid forest, dry forest, secondary brush, and Subdesert brush, sometimes very common; its habits are similar to those of the preceding race.

The breeding season includes at least the months of October, November, and January, as the following data indicate.

October 24, 1929	Male, testes enlarged	Tulear
October 14–23, 1930	Several males, testes enlarged	Mt. d'Ambre
November 22, 1930	Female, ovary enlarged	Anaborano (one day south)
November 28, 1930	Male, testes enlarged	Bezona
January 2–5, 1931	Two males, testes enlarged	Marotony

Zosterops maderaspatanus analoga Salomonsen[2]

Mountain Madagascar Zosterops

DISTRIBUTION.—Known only from the forest on Mt. Ankaratra, altitude 1800 to 2000 meters, and Tsiroanamandidy, alt. 1000 meters. This is a slightly larger mountain form. A single specimen from Tsiroanamandidy in the American Museum agrees with *analoga* in size but is as yellowish as the race *ampotakae*. However, I think it inadvisable to separate it on this slight difference. If the range of this form is the

[1] 1934, Proc. Zool. Soc. London, I, p. 222.
[2] 1934, Nov. Zool., XXXIX, p. 208.

wooded areas in the central part of the island, its distribution must be extremely discontinuous as the greater part of this area is treeless; wooded areas being few and scattered.

HABITS.—Similar to those of the preceding race.

***Zosterops hovarum** Tristram

Hova Gray-backed White-eye

This white-eye is known only from the type, which was purchased with a parcel of apparently unlabeled Madagascar bird skins and assumed also to have come from there.[1]

Motacilla flaviventris Hartlaub

Madagascar Wagtail

DISTRIBUTION.—From sea level to 1800 m.; a bird of the open ground and open brush, favoring the vicinity of water. The wagtail was found in the Oriental Province and in the Occidental as far south as Befandriana. In the Oriental Province it was common in the open ground in the vicinity of water, following the little clearings into the forest. It was one of the few characteristic birds of the central highlands. In the Northern and Western Savannas the wagtail was common as far south as Lac Kinkony and Namoroka, but farther south only a single bird was seen, at Befandriana.

HABITS.—The wagtail is an attractive, familiar bird, walking with quick, short steps, bobbing its tail, running now this way, now that, to catch an insect. Fond of the vicinity of water, the wagtail is usually seen near some little stream or swamp, feeding along the margin or walking about on the stones in the stream, or about some flooded rice field. At Kinkony one or a pair were often seen walking about on the floating lily pads, invading the habitat of jacanas and water hens. The wagtails were commonly seen in the villages perched on the houses or walking about in the yards. Sometimes one came into the house where we were skinning, and caught flies and spiders from the floor or walls. This species was very common in the palm-plains of the Northern Savanna.

The wagtails are commonly found by two's, which when collected prove to be male and female. This happened when neither bird showed any signs of breeding. Along the open trails through the forest a pair was to be found at short intervals. When alarmed they perch on houses, telegraph poles, or the tops of trees. Their usual calls are a whistled call of two notes, and a sneezing "Cher–chee."

[1] 1887, Ibis, p. 235.

At Vohemar I saw a mating display. Two birds were walking about in the yard. One would raise its tail to the vertical, depressing the fore part of the body, and would take a few steps. Several times while doing this, it raised its wings over its back until they were nearly touching. Again it stretched its neck forward and upward, its bill in line with its neck, as it stepped about.

The following data indicate that eggs are laid at least in August, September, and January.

September 3, 1929	Nest with two small young	Ivohibe
September 8, 1930	Nest with two very small young	Andapa
September 19, 1930	Nest with three eggs, two-thirds incubated	Vohemar
September 25, 1930	Nest in construction, no eggs yet	Vohemar, one day north
January 24, 1931	Female, laying	Maromandia
January 26, 1931	Male, testes enlarged	Maromandia

One nest, Ivohibe, September 3, 1929, was in the fork of a branch about five meters above the stream at the edge of a village. The nest from Andapa, September 8, 1930, was built in the cornice of a house. At Vohemar, September 19, 1930, the nest was built in a corner under the roof of the veranda of the office of the Chef de Canton, where people were passing continually. Another near Vohemar, one day north, September 19, 1930, was under the eaves of a grass hut, on the end of a dead palm leaf that was leaning against the hut. Probably in the palm-plains, where the bird was very common during the nesting season, the nest was placed on the broad platform afforded by the base of a palm leaf that had dropped down but had not fallen.

The nest is an unsymmetrical affair with untidy ends of material hanging down, particularly when built in the cornice of a building, when the bottom and back of the nest are made to fit the cornice. The outside of the nest is loosely put together of a variety of coarse materials: dead herbaceous stems, grasses, rootlets, bits of cotton. One nest had a quantity of Malagasy hair sticking into the edge of the nest. In one there was some coarse string and a small piece of cloth. Feathers were used in the nest from Ivohibe, but they were not in the inner lining. Loose ends were left sticking out. The rather thick lining was of fine grass and plant fibers. One nest had some shreds of cloth in the lining. One nest measured: outside, (including untidy streamers) 140 mm. wide $\times$ 70 mm. deep; inside, 50 mm. wide $\times$ 35 mm. deep. Another nest measured: outside, 110 mm. wide $\times$ 85 mm. deep; inside, 60 mm. wide $\times$ 45 mm. deep. One nest contained three eggs, two nests contained two

young birds each. The three eggs from the nest at Vohemar, September 19, 1930, were ovate in shape; shell smooth and glossy; color, bluish white, heavily marked with small spots and specks of various shades of brownish olive and secondary grays, the spots often overlapping or converging and abundant enough on the larger end nearly to cover it. The three eggs of one set measure 21.4 × 15.7 mm., 21.4 × 15.0 mm., and 20.4 × 15.2 mm.

The young have long gray down on the vertical feather-tracts as well as on the dorsal surface.

NATIVE NAME.—This bird was usually known as "Trío-trío" (from the bird's call) or some slight modification of that.

Mirafra hova Hartlaub

Madagascar Bush Lark

DISTRIBUTION.—From sea level to 2000 m. A bird of the open ground, widespread over most of the island except in the wooded areas. Very common on the plateau, the open ground and, scattered brush of the Oriental, Occidental, and Subdesert provinces.

HABITS.—This is one of the conspicuous birds of the grasslands and open savannas as it runs about on the ground or flushes ahead of one. The larks like to sit in the roads, and often when I was motoring in the evening or in the early hours before dawn they rose from the road where they had been sleeping.

The song is delivered on the wing. The bird flies up at an angle and flies about in irregular circles fifty to one hundred meters overhead, alternately flapping and sailing, and singing "chea" as the wings are held motionless for a moment, or giving a more rapid "cher-chee." If a breeze is blowing the lark may not circle, but, facing the breeze, may remain in the same place in the air or may drift sideways with the breeze, singing the while. The performance may last for some moments, then the bird drops quickly back to earth with wings partly closed. Sometimes the descent is slower and the bird will sing on the way down. Sometimes it descends some distance from the point where it started.

The lark eats both insects and seeds. Of seven stomachs examined, four contained grass seeds; two, rice; one, a grasshopper; two, quartz sand. The rice was probably waste rice that had been picked up in the roads where the birds were shot. One lark was seen on the trail, beating a large grasshopper to pieces.

The breeding season includes at least the months of February, April, August, September, and October, as the following data indicate.

March 3, 1930	One nest with two small young	Androka
March 3, 1930	One full-fledged, short-tailed young	Androka
May 5, 1929	Nest with two eggs, one-third incubated	Tananarive
August 24, 1929	Nest with two eggs	Ivohibe
September 25, 1930	Nest nearly finished, no eggs yet	Vohemar, one day north
October 4, 1929	Nest	Manombo (southeast)
October, 1929	Female, ovary enlarged	Tulear

At Tananarive, in May, when the nest was found, many apparently adult birds showed no indication of breeding.

The nest at Vohemar September 25, 1930, was on a grassy bank on the edge of the beach. At Androka the nest was in a hummock in a flat grassy area on the coast that was partly flooded by the high tide. The other nests were in dry, rather scantily grass-covered areas. The five nests examined were all very similar, cup-shaped structures placed in hollows scraped in the sand or soil, sometimes partly covered by a tussock of grass or by a bit of wood. The nest was usually of fine grass lined with the same material. The nest at Androka, on the coast, was composed partly of weathered red fibers of bark from drift wood, as well as grass. At the entrance there was in each case some "pavement" of lumps of mud, bits of bark or wood. One nest measured: outside, 105 × 70 mm. deep and inside 65 × 50 mm. deep.

Two eggs seemed to be the full set as two nests contained two eggs each and one nest two young. The eggs were ovate in shape; the shell smooth and glossy; the ground color whitish, heavily marked with small spots and dots of light brown, between a light "cinnamon brown" and a light "Dresden brown," and secondary grays. They were more heavily marked on the larger end, where overlapping spots tended to form a wreath. The amount of the spotting and the shade of brown vary in the two eggs of a set. Two eggs of one set measure 20.5 × 15.3 mm. and 20.3 × 15.3 mm., one egg of another set measures 20.9 × 14.6 mm.

When the nest was approached, the bird sometimes flew from the nest, but more often ran off with the wings spread above the back, or with wings fluttering, sometimes half flying, half running.

NATIVE NAME.—"Sorítra" on the plateau by the Hovas and at Namoroka by the Sakalava. "Boría" at Ivohibe by the Bara.

Nelicurvius nelicourvi (Scopoli)
Nelicourvi Weaver

DISTRIBUTION.—From sea level to 1800 m.; a fairly common bird of the wooded parts of the Oriental Province. This wood weaver favors particularly the middle spaces in the forest, also ranging into the tree tops and ground-cover and out into larger secondary brush.

HABITS.—The nelicourvi weaver searches for its insect food amid the twigs and branches; two or three are usually found together, often in company with various other species of birds or in the big mixed flocks characteristic of the humid forests, but it does not band together in flock of its own kind. Grandidier's[1] account of the habits of this species undoubtedly refers to *F. sakalava*. The measurements he gives for the eggs also suggest this.

The four stomachs examined contained insects, including some grasshoppers.

The breeding season probably extends at least from August to November as the following data indicate.

August 2, 1930	Female, ready to lay	Antalaha
August 28, 1930	Female, ovary enlarged	Andapa, one day west
September 24, 1929	Male, testes enlarged	Manombo (southeast)
October 6–11, 1929	Several males and females, gonads enlarged	Manombo (southeast)
October 10, 1930	Several breeding birds, including a female laying	Mt. d'Ambre
November 17, 1930	Nest in construction	Anaborano

The nests of this weaver are common and conspicuous features of the forest, many old nests and many new nests in construction being seen. They are usually solitary, though two nests in the process of construction were found within a few feet of each other. No groups of nests were seen. The nests are attached to a liana or bough, usually over a stream or a clearing, from six to twenty-five feet from the ground. One nest at Mt. d'Ambre was attached to the loose end of a vine that had fallen from a branch over a glade in such a way that the nest hung on a cord some two meters from the branch above and six meters from the ground, with no surrounding vegetation near it.

The nest is the finest example of any of the Madagascar weaver birds' nests. It is a retort-shaped structure, that is, an oval nest proper with a tunnel or spout entrance twice the length of the nest, hanging from the side near the top. The nest is attached by a "rope" from 150 to

[1] 1879, Hist. Phys. Nat. et Pol. Madag., Oiseaux I, p. 447.

300 mm. long. The nest itself is firmly constructed of grass, sedge, and long palm fibers, with a scanty lining of thread-like palm fiber in the bottom of the nest for the eggs. The spout is of the same material, firmly woven, quite dense where it enters the nest but a rather open mesh-work at the mouth. The mouth of the tunnel is usually ornamented with fresh green material.

A nest from Manombo (southeast), October 12, 1929, measured: outside, nest proper, 105 mm. wide × 190 mm. deep; inside 95 mm. wide × 135 mm. deep; tunnel 110 mm. wide at the middle and 435 mm. long, widening somewhat where it enters the nest, and at the mouth. The tunnel entered the nest 60 mm. above the bottom of the inside of the nest.

The only nest with eggs that we examined contained three eggs. They were ovate in shape; the shell, smooth and rather glossy, with very small scattered pits; color, pale greenish blue, "pale Niagara green."

The three eggs of one nest measure, 19.3 × 14.6 mm., 19.2 × 14.4 mm., and 19.2 × 14.6 mm.

NATIVE NAME.—"Foud-sáhy" almost universally where known, or variations of this, such as "Foud schí," or "Foudi síng."

Foudia madagascariensis (Linnaeus)

Madagascar Fody; Red Fody

DISTRIBUTION.—From sea level to 2000 m.; common over the brushy open-ground and areas of rank herbaceous growth in all the biotic provinces. The red fody is equally at home in the brush and grass of the little clearings in the humid mountain forests of the Humid East and in the arid Subdesert brush.

HABITS.—The red fody is gregarious and the birds congregate about feeding places and fly up in flocks to perch in trees and bushes. In the Humid East it favors particularly the little marshes or rice fields, where it sometimes congregates in considerable numbers; near Tananarive the flocks in the marshes contained hundreds of birds. It is a familiar bird about the villages, and birds were seen about the parks in Tananarive and in the gardens at Majunga. At Befandriana non-breeding birds were roosting in the reeds of a marsh in considerable numbers, and elsewhere many non-breeding birds were noted roosting in mango trees on the edge of the marshes.

The song given by the male in full plumage is a thin metallic "chit–chit–chit– – –," almost a trill and rather insect-like. It is usually delivered from a conspicuous perch. The fody's call is a sharp, thin "tic" or "tic–tic."

The usual food of this bird is seeds of herbaceous plants, which they extract from the plant or pick up from the ground. The fody eats much rice, both waste rice and rice from the fields. The destruction to the standing rice, both when ripe and when in the milk stage, is so important that natives are often stationed in the fields to drive these birds away. One device used is a crude set of chimes set up in various parts of the field. These chimes are made of lengths of bamboo threaded on a cross-stick. These are sounded by ropes which lead to a little hut placed where a good view of the field may be had. Besides grain, insects are sometimes eaten. At Befandriana numbers of non-breeding birds perched in the reeds of a marsh at dusk were feeding on the little moths that were rising in abundance, the birds flying up and catching them on the wing. Of the nine stomachs examined, seven contained rice; two, small seeds; one, a small quantity of sand; in the gullet of one female were nine caterpillars 25 mm. long and one spider. This last food was possibly for young birds in the nest.

The breeding season includes at least the months of September, December, January, February, March, and May, as the following data indicate.

September 18, 1930	Male, testes enlarged	Vohemar
December 20, 1930	Male, testes enlarged	Ambiky
January 12, 1931	Male, testes enlarged	Anorontsanga
January 3, 1931	Male, testes enlarged	Marotony
February 2, 1930	Male, testes enlarged	Tulear
February, 1931	Many males in full plumage	Soalala
March 13, 1931	Nest with four eggs	Namoroka
March 31, 1931	Nest with four eggs	Ambararatabe
March 3, 1931	Nest, two small young, one egg	Ambararatabe
March 11, 1930	Nest in construction	Ampotaka
April 2, 1931	Nest in construction	Ambararatabe
May 6, 1929	Male, testes enlarged	Tananarive
May 6, 1929	Female, breeding	Tananarive
May 18, 1929	Nestlings brought in by natives	Monjakatompo

From June to October in the southeast (Ivohibe to Manombo) none was found breeding nor in the red plumage, though the birds were very common. The natives said that the fody became red when the rice became ripe, that is, in November. At Tananarive in May most of the birds were in dull plumage.

The five nests examined were from one to two meters from the ground, in grassy brushland, in a cultivated field, or on the edge of a marsh. They were semipensile structures supported on all sides by small twigs; oval in shape with the opening on the side near the top, and

projecting material forming a penthouse-roof structure over the opening. The walls were fairly firm but sometimes the nest was rather untidy. The materials used in the nests were grasses, grass heads and other herbaceous material, and a few twigs. The grasses of the walls of the nest formed the lining. One nest measured: outside 110 mm. wide × 180 mm. deep; cavity inside 70 mm. wide × 130 mm. deep; the penthouse roof projected 60 mm.; and the opening was 55 mm. across and 80 mm. deep. At one nest that I watched being built, the female did all the building, gathering the material near-by while the male sat on a conspicuous perch near-by singing.

Two complete clutches contained four eggs each; one nest contained one egg and two small young. The eggs were ovate in shape; shell, smooth and fairly glossy with very small scattered pits; the color was light "pale glaucous green." One set of eggs measured: 18.2 × 13 mm., 17.4 × 12.6 mm., 18.7 × 13.0 mm., and 18.2 × 12.8 mm. Another set measured 18.2 × 13.0 mm., 18.0 × 12.8 mm., 17.8 × 12.8 mm., and 17.6 × 12.8 mm.

NATIVE NAME.—Universally known as "Foudy." The bright male was sometimes known as "Foudy lahi mena," the "red male fody" and the dark-plumaged bird was known as "Foudy vavy" meaning "female fody."

Foudia omissa Rothschild

Rothschild's Fody; Red Forest Fody

DISTRIBUTION.—From sea level to 1800 m.; in the wooded areas of the Humid East and Mt. d'Ambre.

HABITS.—The forest fody ranges through the tree tops and the upper middle spaces of the forest in company with other species of birds in big mixed flocks, and is also found out into the brush and grasslands on the edge of the forests, where it is sometimes seen in the same flocks as *Foudia madagascariensis*. At Maroantsetra, two days northeast, where the villages and the clearings about them were surrounded by forest, this bird was common in the rice fields along with *Foudia madagascariensis*.

NATIVE NAME.—Not distinguished from *F. madagascariensis*.

Foudia sakalava sakalava (Hartlaub)

Northern Sakalava Fody

DISTRIBUTION.—The Northern Savanna; this species was found commonly in and about the villages and occasionally seen in low brush

in the palm-plains with here and there areas of brush and trees. It was only found to the southeast of Mt. d'Ambre; though the country to the southwest seemed equally suitable, none was seen there.

HABITS.—We encountered this bird only while we were traveling, consequently notes on its habits are meager. Its nests were commonly noted in the villages, but during the day the birds were seldom seen, with the exception of one morning about nine o'clock when birds were seen building. We arrived at Rodo, September 29, 1930, about midday, and though nests were numerous, no birds were seen until about a half hour before dark when they began to come into the villages in small flocks of three or four, or sometimes up to ten. More than fifty came into the village. They perched in the trees until darkness fell, when all went into the nests. All of these were adults. The next morning we were but a short distance from the village, passing through an area of brush, when a large flock of immature birds were seen feeding on the ground.

The breeding season probably includes at least the months of September and October, as the following datum indicate.

September 27–30, 1930	Many specimens were taken that showed greatly enlarged gonads, and many nests in construction were seen, though no eggs were found.	Between Vohemar and Diego Suarez

The nests were all in the villages and were usually attached to the fronds of coconut palm, often eighteen meters or more above the ground, though some were not more than two meters above the ground. The nests were usually in groups, sometimes twenty or more in one group, though some were scattered through the tree, attached by a short "rope" to the fronds of the palm.

The nests were retort-shaped; i.e., an oval nest proper with a long tunnel or spout leading up to it, which entered from the side at the top. The nests were thin, firm-walled structures. The following are the measurements of one nest from Vohemar, one day north, September 28, 1930: nest proper, outside 130 × 85 mm.; length of tunnel 250 mm., width 85 mm.

NATIVE NAME.—"Foud sáhy" or "Foud séhy," by the Antakara.

Foudia sakalava minor Delacour and Berlioz

Lesser Sakalava Fody

DISTRIBUTION.—The Western Savanna and the Subdesert. This fody was common and widespread in the Subdesert, though in the Western Savanna its distribution seemed very local, but it was some-

times very common. It frequented the low brush, the wooded calcareous plateau, and the wooded areas of the arid Subdesert. It was also found in the wooded plains and forests of the Western Savannas and was a common nesting bird in some of the villages in rather open savanna country.

The distribution of this weaver was sometimes extremely local even when habitats seemed suitable for wider distribution. There was a colony at Bekatrobaka but none was found during two weeks collecting at Namoroka, only one-half day's journey away and in the same type of country. Possibly the reason for not finding them in certain areas was their extreme localization.

HABITS.—Most of our time spent in the range of this weaver was during the breeding season and most of our notes were made about nesting colonies. Away from its nesting sites this bird is not conspicuous and it probably does not go far from its centralized nesting grounds. Even at Lac Iotry, where there were several large nesting colonies within half a mile of my usual collecting grounds, they were seldom seen. Occasionally large flocks of immature non-breeding birds were observed, feeding on the ground or perched in low bushes, or a few adult birds were noted gleaning insects from the branches of trees. At Befandriana one such flock of perhaps a dozen birds in breeding condition was accompanied by several *Foudia madagascariensis*. At Tabiky, before the local birds were breeding, at Lac Tsimanampetsotsa (February), and at Ampotaka (March), after the breeding season of that locality, occasional solitary birds or small flocks were observed feeding on the ground or perching in the trees. At Tabiky (October) a lone bird came down to the little stream by camp to drink; at Tulear (January and April, 1930) flocks were often seen feeding in shade trees about the hotel in the center of the town.

This species feeds on small seeds, rice, and insects. Females were carrying insects and spiders to the young. Though rice was found in a number of stomachs examined, field observations show it to be largely waste rice picked up in the villages. They were not seen in large flocks in the rice fields like *Foudia madagascariensis*, whose depredations assume serious proportions. Added proof of this is seen in that large colonies are allowed to nest unmolested in the native villages where the near-by rice fields yield the principal food of the inhabitants.

This bird usually nests in colonies and this conspicuous mode of nesting makes observation at the nest easy, and its many phases make the study especially interesting.

About their nesting the birds are noisy and conspicuous. The males are much more in evidence than the females. They were continually about, singing, fluttering their wings, carrying about bits of green material which they may add to the mouth of the nest, and are always ready to vie with their fellows in courting any female that may appear. Even females that were feeding young were persistently courted. The song, which I have heard only full-plumaged males give, is a buzzing "chee–chee–chee–chee – – –," or sometimes a more rapidly given "che, che che – – –," usually accompanied by somewhat drooping, fluttering wings. This was often a sort of courting display performed as a male approached a female. At other times a piece of green leaf or grass head was held in the male's bill as he approached the female with fluttering wings. The female usually escaped into the nest, but one female that was working on a nearly completed nest and had been making continued advances to the male, hopping up to it with fluttering wing, and then going into the nest when pursued, was followed by the male on one occasion, though he remained in the nest but a moment.

The following data on the time of breeding was secured.

November 11, 1929	Nest with eggs	Marovoay
November 23, 1929	Male and female, in breeding condition	Befandriana
December 12, 1929	Female, ready to lay	Lac Iotry
December 29, 1929	Female, feeding young in nest	Lac Iotry
January 20, 1930	Nest with four eggs	Tulear
February, 1930	Males going into winter plumage	Lac Tsimanampetsotsa
March, 1930	Males in nearly full winter plumage	Ampotaka
February 28, 1931	Several nests with young	Bekatrobaka
March 14, 1931	Several nests with young	Bekatrobaka
March 14, 1931	Several nests with eggs	Bekatrobaka
April 7, 1931	Several birds in breeding condition	Marovoay

The nesting season coincides more or less with the rainy season. The species was found breeding from November 11 to April 7, but there is probably considerable variation in the length of the breeding season in the various parts of the island, depending directly on varying climatic conditions.

In the region about Majunga, where abundant rainfall during the wet season produces a luxuriant vegetation and consequently an abundance of insects for feeding the young, the nesting season is prolonged and probably more than one brood is raised. Archbold found them breeding about Marovoay, November 11, 1929; and on April 7, 1931 some birds, both males and females, were still in breeding condition there, though

males going into winter plumage were taken also on the same date. At Bekatrobaka some of the nests contained young on February 28, 1931, and in the same colony, March 14, 1931, nests were examined containing young birds, and others, fresh eggs. In the southwest, where arid conditions are more intense and the rainfall is scanty, even during the rainy season, the breeding season is probably shorter. Birds collected on November 23, 1929, at Befandriana, in the savanna country, had already laid; but nests examined in a colony at Lac Iotry on the edge of the Subdesert, December 12, 1929, contained no eggs though a female taken was ready to lay. A nest collected at Tulear, January 28, 1930, contained eggs. In February at Lac Tsimanampetsotsa and in March at Ampotaka, 1930, the breeding season was past and male birds were in nearly full winter plumage.

The birds are usually gregarious in their nesting habits, the nests being grouped together in part of a tree or in scattered groups through the tree. More rarely, solitary or a few scattered nests were seen. A group of nests was seen under the veranda of a native house. The colonies are conspicuous, sometimes with as many as seventy-five to a hundred nests in a tree, and are particularly striking about Bekatrobaka and Marovoay, where long strips of palm leaves were sometimes attached to the spout. At Lac Iotry several colonies had one group of nests placed below a hawk's or crow's nest, the other nests scattered in smaller groups through the trees. At Marovoay, a group of eighteen nests was placed under the roof of a veranda. The number of nests in a colony varies from half a dozen to fully a hundred. Sometimes each of several near-by trees will have a colony. Nests were sometimes within a few feet of the ground, and at other times were from fifteen to twenty-five meters up.

One colony of about seventy-two nests, at Lac Iotry, was in a tree containing a nest of some large bird, twenty meters up in the tree. It was in a scantily wooded area at the edge of the Subdesert brush. Thirty were in a close group attached to the under side of this large nest. Another group near-by contained eighteen, another fourteen nests, and there was another scattered group of ten nests. On the ground beneath were more than a hundred old nests that had fallen. Many of the nests in the trees were obviously old ones, but they were all between fifteen and twenty-three meters above the ground, and it was impossible to tell more about them. A few females were in evidence and at least twenty males were about.

Four other colonies near-by in similar country had much the same

size and arrangement. One had the occupied nest of a crow (*Corvus albus*) for its nucleus, another that of a buzzard (*Buteo brachypterus*), another that of a kite (*Milvus migrans*), and another, a mass of rubbish lodged in the branches. At Iotry two deserted nests, some six feet apart, were in a mango tree some distance from any colony. At Tulear, on the edge of an irrigation ditch between a banana plantation and brushland, some half dozen solitary nests were attached to the midribs of as many banana leaves, where the wind had split the blade.

At Tsimanampetsotsa on the calcareous plateau, a deserted group of four nests was attached to a large, unidentified nest; and another group of fifteen deserted nests was attached to the branches of a tree some twenty feet up.

In the west, the colonies were usually established in the villages. A colony of about a hundred and seventy-five nests was observed in the large village of Bekatrobaka. This was in a rich, grassy savanna country. One tree had more than a hundred nests in a radius of two meters. They were attached to twigs and branches, the lowest within 1.6 meters of the ground. Of the three other trees within one hundred meters, one had about ten nests strung out from near the ground to twelve meters up, another had about forty nests irregularly scattered through it and another had twenty-five nests in a loose group.

Another similar colony in the village of Bemarivo, one day south of Marovoay, had about one hundred and fifty nests in four trees, close together. The colonies were not confined to the village at Marovoay, for on the edge of the Marovoay River a colony of twenty nests was noted in a mango tree leaning over the water. In a little village near-by in the midst of rice paddies, twenty nests were attached to the fronds of a tall palm.

At Mevatanana some twenty-five deserted nests were in two groups in a mango tree by a little stream. The lower group contained eight nests, only two of which were lined.

The colonies are used year after year, for at several colonies there were more old nests on the ground than in the trees, and many of the nests in the trees were old.

The shape of the nest is that of an inverted retort, that is, an oval or pear-shaped nest proper with a spout or tunnel that leads up and enters from the side near the top. They are attached by a short "rope" or by having the nest woven directly about the twigs. Those in the Subdesert have short tunnels that do not reach below the bottom of the nest. The tunnel broadens where it enters the nest and is ornamented with green

grass heads or "madeira leaves" about the mouth. Those from the village of Bekatrobaka and those from near Marovoay have tunnels generally more than twice the length of the nest, usually enlarged somewhat at the mouth as well as where they join the nest. These tunnels are mostly decorated with long streamers, strips of palm leaves gleaned from the thatching material used in the villages. Colonies not in the villages, where thatching material was not available, did not have these long streamers of palm leaves.

The nests are composed of the materials near at hand, grasses, leaf stems, strips of palm leaves from thatching and weaving materials in the villages, small vines, and herbaceous stems, varying with the local conditions. Sometimes finer grasses and grass heads were woven into the inner surface of the nest and into the tunnel. There is a lining of soft vegetable fiber at the bottom of the nest for the eggs. One nest, at Tulear, attached by a short rope, was firmly woven with rather dense walls through which one could barely see light, and was composed of grasses and slender woody vines with some fine, freshly withered grass on the inner surface of the nesting cavity. The lining at the bottom of the nest included some soft bark. The tunnel, of the same material as the nest, was rather densely woven and had about the mouth five large grass heads, with the grain intact, which had been placed there when green. A nest from Bekatrobaka, new throughout and containing eggs, was typical of these from the villages in that locality. This nest was retort-shaped with a long tunnel, and was composed largely of palm-leaf fibers and the stems of compound madeira leaves and a few grass heads. The nest was firmly woven but against the light one could plainly see the extent of the lining. The tunnel was of the same materials but was more open, the long fibers woven back and forth to form an open meshwork, somewhat denser where it joined the nest. The lining for the eggs was largely soft vegetable fiber with a few grass heads and threadlike palm fibers. The streamers formed a conspicuous feature of this nest. There were strips of palm leaves six or seven hundred millimeters long attached to the side of the tunnel, some even to the nest itself, so that they fell three hundred to five hundred millimeters below the mouth of the tunnel. In this nest there were about thirty-nine streamers.

Four other nests from the same locality were very similar but were collected to illustrate slight variations. Some had more grass heads used in the construction. The number of streamers was often less, in one case only six. In this nest the tunnel was very short and the nest

was partly attached to the streamers of the nest above it. Many of the nests of similar construction lacked the lining for eggs. Another nest which contained eggs was obviously old, and the nesting cavity had been relined with madeira leaf stems and a few grass heads, the latter used particularly inside of the tunnel. Some new palm leaf fibers had been worked in about the mouth of the tunnel, but apparently no new streamers had been added.

The streamers varied from six to thirty-nine in number in the nests examined, and varied in width from three to eleven millimeters. These were strips of palm fiber attached to the side of the tunnel, sometimes largely on the under parts, sometimes to the nest itself. Some were woven into the structure of the nest, others were more loosely attached, and some were attached but for a short distance, falling free for the rest of their length, below the tunnel. These palm fibers are apparently added solely for ornament, as their stiffness makes it difficult to attach them to the nest. The finer fibers have to be woven about them to hold them in place.

It was difficult to estimate how many of the nests were in use; but at Bekatrobaka twenty-five per cent or less contained eggs, and many of the nests with eggs were old remodeled nests. Only about twenty-five per cent of the nests at this locality contained a lining; and though some of these unlined ones were new and possibly were being prepared for eggs, many of them were several seasons old. Many of the nests that contained eggs or young were old structures that had had a lining in them before but were newly relined, while others had been old unlined nests that had received a new lining.

The following are the measurements of a typical nest from Bekatrobaka with the extreme measurements taken from four other nests from the same place: nest proper, outside, 155 × 105 mm. (extremes 180 × 110 mm. and 140 × 100 mm.); nesting cavity inside, 120 × 90 mm. (extremes 145 × 90 mm. and 80 × 60 mm., the latter an old relined nest); cup-shaped lining at bottom of cavity, 95 × 75 mm. (extremes same and 80 × 60 mm.); inside entrance of tunnel to nest, 75 mm. (extremes 100 and 75 mm.); tunnel, length 400 mm. (minimum 220 mm.) tunnel width at junction with nest, 120 mm. (extremes 150 and 110 mm.); width at middle, 85 mm. (extremes 100 and 80 mm.); width at mouth, 90 mm. (maximum 110 mm.). Number of streamers, 39 (varying in number down to 6) length of streamers, 400 mm. (extremes 440 and 360 mm.) variation in the width of the streamers, 3 to 7 mm. (in another nest they vary from 2 to 11 mm. in width).

The nests from the Subdesert were much smaller, with shorter tunnel and streamers. The measurements of a nest from Tulear are as follows: nest proper, outside, 140 mm. deep × 95 mm. wide, nesting cavity inside, 110 × 70 mm.; lining at bottom of cavity, 70 × 60 mm.; inside entrance of tunnel to nest, 60 mm.; tunnel length, 170 mm.; width of tunnel at junction with nest, 100 mm.; width at middle, 60 mm.; width at mouth, 60 mm.; the streamers project 130 mm. beyond the entrance.

When the colonies were in the villages the *Foudias* were extremely familiar birds, perching on the roofs of the houses, feeding on the spilled rice about the houses, and gathering nesting material in the yards. Both sexes work at nest building but the extent of the labors of each was not determined. Some first-year birds still in the immature plumage breed, as individuals of this sort were seen building nests and when collected had gonads enlarged. The skulls of these were not completely ossified. One immature male was working at a nest less than half done, another on the tunnel of a nearly completed nest. A female was working on the tunnel of another nearly completed. One dull-plumaged bird, apparently a male, worked alone while building, carrying long fibers into the tunnel, attaching one end, then seizing the fiber a few inches down, working that into place and so on, all from the inside. A female that was working on a nearly completed nest building in apparently the same manner received no assistance from a male that was actively courting her whenever opportunity arose. Neither did he follow her on trips for nesting material. The nest proper apparently is built first and then the tunnel is added. At Bekatrobaka, many of the long streamers were apparently added while the nest was being built. While I was there on parts of two rainy days, no streamers were being added. But at Iotry and Tulear, the males were continually adding decorations of green grass heads and "madeira" leaves even to nests that contained eggs in the process of incubation. Though the females build or help build nests, it seems that they sometimes use nests made or repaired by the males. Possibly the females only add the lining.

At Iotry one of two of these weavers' nests in the tree above my tent had been taken possession of by two *Spermestes nana* who relined it, and laid three eggs. Then a full-plumaged *Foudia sakalava* arrived, he threw out the eggs and lining and trimmed the entrance with green "madeira" leaves. Later in the day a female appeared and inspected the nest. The male slept alone in the nest that night. As camp was moved the next day there was no opportunity to follow subsequent proceedings.

During the nesting season at least, both males and females sleep alone in the nests, as I found by collecting a number of nests at night, capturing the birds by closing the mouth of the tunnel. Many of the females were in nests with eggs or with young, or in nests that were being made ready for eggs. The males were usually in unlined nests. At Bekatrobaka, nearly an hour before dark, while some birds were actively building and others feeding young, it began to rain hard. All of the birds immediately retired into the nests, from which they could be dislodged only with considerable difficulty.

The number of eggs in a nest varied from one to four, as did also the number of young birds. One set from Tulear contained four eggs; of four nests from Bekatrobaka, two contained three eggs; another, two; and the fourth, one egg. Two nests contained three and four young, respectively.

The eggs vary but little from ovate in shape, with a smooth, somewhat glossy surface, marked with scattered minute pits. The color of those from Tulear is a greenish blue, the "light Niagara green" of Ridgway, that of those from Bekatrobaka, somewhat paler, "pale Niagara green."

The eggs from Tulear (one clutch) measure 21.8 × 15.5 mm., 21.9 × 16.1 mm., 22.0 × 15.8 mm., and 21.4 × 15.7 mm. Those from Bekatrobaka (six eggs from three sets) were somewhat smaller; first set, 19.6 × 14.8 mm., 20.0 × 15.0 mm.; second set, 20.4 × 14.7 mm.; third set, 19.4 × 14.2 mm., 19.7 × 14.6 mm., and 19.0 × 14.4 mm.

On March 14, 1931, at Bekatrobaka a nest contained two young and one pipped egg at one o'clock in the afternoon. At two o'clock the chick was out. The shell had been rather evenly broken, near the middle, and the egg shell, with the smaller end tucked in the larger, was still in the nest.

The young when hatched have down on the capital, dorsal, crural humeral, alar, and femoral feather tracts and on the ventral tract. The down on the head is dark gray, that on the body is lighter gray. The juvenile plumage of both sexes resembles the adult plumage of the female. Though some young birds may acquire their full plumage the first year, many do not. Some breed at the end of the first year in low immature plumage, as at Bekatrobaka low-plumage males with skulls not completely ossified, some with testes slightly enlarged, others with testes greatly enlarged, were taken in the nesting colonies. These probably represent the birds that were hatched early the season before, and are able to breed, whether or not they do. While some of the young

of the year before do breed, it seems that the majority do not, for at Lac Iotry during the nesting season large flocks of fifty or more individuals in immature plumage were seen. A single discharge into such a flock killed nine birds. They were juveniles, with the skull incompletely ossified, and none showed any enlargement of the gonads. They probably would not obtain their full plumage until the second year.

After the nesting season the males lose the yellow plumage of the head and go into a plumage similar to that of the female. Males taken at Tsimanampetsotsa in February, and others taken at Ampotaka on March 17, 1930, and at Marovoay, April 8, 1931, had lost most of the yellow feathers of the head.

NATIVE NAME.—In the southwest about Lac Iotry this bird was known as "Jaky" by the Masquer. In the west it was known as "Foudi-sahy," or "Foudi-sehy" by the Sakalava, a name applied to *Nelicurvius* by the Betsimisaraka.

Spermestes nana (Pucheran)

Madagascar Mannikin; Nana

DISTRIBUTION.—From sea level to 1800 m.; common in the brush-lands of all the biotic districts.

HABITS.—The nana frequents the grasslands interspersed with brush, into the edge of forest and into the grassland, and about Lac Kinkony was tolerably common in the palm-plains. In the Humid East, one was likely to encounter some of these birds in almost any little clearing in the forest that contained herbaceous plants. Cultivated fields of maize or manioc, and rice where weeds were abundant, were favorite haunts. These birds are frequently seen about the villages where they feed on the seeds of the luxuriant growth of weeds around the outskirts, or they gather about the rice pounding-block to pick up weed or grass seeds winnowed out of the rice. At Tulear birds were occasionally seen perched on the telephone wires and on buildings. Several were feeding on the seeds of a half-submerged plant in the edge of the Ifasy River at Anaborano.

The nana is a gregarious bird, usually seen in parties or flocks of three or four up to twenty or so, feeding on seeds of herbaceous plants, either on the ground or on the plants and keeping together when they fly. When these birds light in a bush they like to sit side by side on the same branch, hopping close together, and sometimes five or six may be ranged on a twig, side by side, touching each other.

The breeding season probably includes at least the months of Octo-

ber, December, January, March, April, and June, as the following data indicate.

May 8, 1929	Juvenile, recently out of nest	Monjakatompo
June 11, 1929	Male and female, gonads enlarged	Vondrozo
June 28, 1930	Nest, four eggs	Maroantsetra
October 20, 1930	Female laying	Mt. d'Ambre
December 7, 1929	Nest in construction	Iotry
December 11, 1929	Female ready to lay	Iotry
December 23, 1929	Nest, three fresh eggs	Iotry
January 11, 1931	Nest with eggs	Anorontsanga
March 22, 1930	Nest, seven fresh eggs	Ampotaka

The nest may be either a complete structure made by the bird, or the bird may reline an old nest of a fody; three of the former type and two of the latter were found. The three nests of the first type were from one to four meters above the ground in brush country. One nest, at Iotry, was shaped like a flask lying on its side and placed on the horizontal part of a palm leaf supported by the leaflets on each side. It was composed largely of threadlike fibers from palm leaves. It was never finished. One nest four meters up in a small tree in brush country at Ampotaka was a semipensile structure supported on all sides by twigs, oval in shape with a porch-rooflike projection over the entrance which was on the side near the top. It was composed, outside, of a few dead grass blades but the bulk of the structure was of dry grass heads very firmly put together. The floor of the nest was lined with hen feathers so arranged that the free ends curled up and nearly roofed the cavity. It measured: outside, 110 mm. wide × 140 mm. deep; entrance 35 mm. across; the walls were 20 mm. thick on the sides and thicker on the bottom. A nest at Maroantsetra, placed in the top of a coffee bush one meter up, was similar to the preceding but very untidy in construction. Cotton blown from a skinning table had been used in the lining. Of the two nests of the second type, the first was at Lac Iotry, where a pair of birds had lined an old *Foudia sakalava* nest with long palm fibers and laid three eggs. When the fody reappeared he threw out the eggs and lining and remodeled it for himself. The next night both nanas slept together in another near-by *F. sakalava* nest. A similar case was noted at Anorontsanga where a pair of nanas had relined an old *Foudia madagascariensis* nest and laid several eggs in it. Much of the nesting material was picked up from the ground. At Iotry, when a pair of these birds were relining an old *F. sakalava* nest, one bird stayed in the nest much of the time, while the other often entered, with or without nesting material, and sometimes stayed some little time. Two full sets contained four and

seven eggs each. The eggs are ovate in shape; the shell smooth, with a slight gloss; color, white; when fresh the yolk shining through makes them appear pinkish. The set of seven eggs measured 14 × 10.8 mm., 13.8 × 11 mm., 14.7 × 11.1 mm., 14.2 × 11 mm., 13.5 × 11.2 mm., 13.4 × 11 mm., and 15 × 10.4 mm.[1]

At Maroantsetra both birds slept in the nest even when the eggs were being incubated.

NATIVE NAME.—"Tsakapia" among the Bara in the southeast; "Tsipiry" with the Masquer at Iotry; "Tsipíritika" by the Antakara in the north.

Hartlaubius auratus (Müller)

Madagascar Starling

DISTRIBUTION.—Found from sea level to 1800 m.; a common bird of the wooded areas of the Oriental and Occidental, taken as far south in the Western Savanna as Tsiandro, and two were observed at Tabiky. In the Humid East it was very common in the forest of the coastal plain, much more so there than on the wooded mountains that rise from it.

HABITS.—Flocks of four to twenty starlings were usually seen perched in the tree tops in the forest or along its edge. When alarmed the whole flock flew off together over the forest. In the tree tops the starling fed on small fruit; of the seven stomachs examined all contained seeds and flesh of small fruit.

The breeding season probably extends at least from September to November, as the following data indicate.

September 24–25, 1929	Several males and females, gonads enlarged	Manombo
November 22,	Female, laying	Anaborano, one day south
November 26–28	Young birds flying about	Anaborano, one day south

The eggs are probably laid at least in September, October, and November.

NATIVE NAME.—Called "Vorotenomby" in the north by the Betsimisaraka and Sakalava.

Acridotheres tristis tristis (Linnaeus)

Indian Myna

DISTRIBUTION.—This introduced species is apparently succeeding very well about the towns and in the surrounding secondary brush along

[1] Grandidier (1879, Hist. Phy. Nat. et Pol. Mad., Oiseaux, I, p. 456) appears to have had the eggs of some other species.

the coast of the central part of the Humid East. It was common in and about Tamatave and was seen as far south as Brickaville where it was fairly common. Two mynas were seen at Fenerive and Du Mont saw a tame one at Maroantsetra. The natives may thus aid its spread.

Corvus albus Müller

Pied Crow

DISTRIBUTION.—Found from sea level to 2000 m.; common over the greater part of the island, particularly in the open ground and about villages, but occasionally seen over the forest and in the little forest clearings. In the southwest this bird was common along the beaches.

HABITS.—The pied crow was sometimes very familiar about the villages, perching on the houses and feeding on the offal in the yards. At Tsiandro, Delacour noted a thousand coming to roost for the night in the trees in the villages; and at Befandriana, I saw perhaps 200 gather into a few trees in the village for the night.

Near Ivohibe the crows followed the swarms of locusts, feeding on them; and their daily abundance was governed by the locusts. In the west they were sometimes destructive to the corn grown by the natives. The natives sometimes put up "scarecrows," tattered garments stuffed with straw, or tied live crows to poles over the fields, or even stationed themselves in the fields to drive the marauders away. One stomach examined contained rice and part of a small insectivorous mammal.

The pied crows' notes include a harsh "cark" and a soft gulping call.

The breeding season includes at least the months of October and December, as the following data indicate.

October, 1929	Several nests with crows incubating	Near Tulear
December 4, 1929	Male, testes enlarged	Iotry
January 11, 1931	Juvenile recently out of nest	Anorontsanga

The several nests seen near Tulear, but not climbed to, were bulky structures of sticks from twelve to ninteen meters up in trees in an open, wooded valley. Several old nests, probably of this species, were seen in tall blue gum trees planted along the roads on the central highlands.

NATIVE NAME.—"Guaka" almost universally, but sometimes called "Ga-ga," both names apparently from the bird's call.

HYPOTHETICAL LIST

In many early collections from Madagascar, the exact locality from which specimens came was considered of little importance. Specimens were sometimes unlabeled and the whole shipment was presumed to be

from Madagascar, since most of it consisted of unique Madagascar species. However, specimens of birds since found to be common elsewhere and not found since in Madagascar were included in some of these collections, so that many early records must be considered erroneous, while others must await confirmation before being accepted.

Perhaps as an example could be cited the case of Bojer's supposed collection of four East African species in northwest Madagascar, and many of Verreaux's records. In the following list not all the species that have been recorded from Madagascar are included. Many records have long been recognized as erroneous, and the following species are only those which are still sometimes quoted as occurring in Madagascar.

Puffinus lherminieri bailloni Bonaparte
Baillon's Little Shearwater

The occurrence of this petrel in Madagascar is listed by Delacour (1932, L'Oiseau et R. F. O., p. 86) as being doubtful.

Procellaria aequinoctialis Linnaeus
Cape Hen

The range of this species includes the Cape Seas but the only Madagascar record is one by J. Verreaux (see Hartlaub, 1877, 'Die Vögel Madagascars, etc.,' p. 374), whose records are often of doubtful authenticity.

Adamastor cinereus (Gmelin)
Great Gray Shearwater

Sclater gives the range of this bird as southern oceans between 30° and 55°, and breeding on Round Island near Mauritius (1924, 'Systema Avium Aethiopicarum,' p. 10), so it may straggle to Madagascar, though there are no definite records (see Delacour, 1932, L'Oiseau et R. F. O., p. 86).

Pterodroma aterrima Bonaparte
Mascarene Black Petrel

The range of this petrel is the western Indian Ocean, including the Mascarene Islands, so it can be expected on theM adagascar coasts, though not positively recorded up to now (see Delacour, 1932, L'Oiseau et R. F. O., p. 86).

Daption capensis Linnaeus

Cape Pigeon

The Cape pigeon is a bird of the southern oceans up to the southern tropic and occasionally wanders north so it could be expected in Madagascar, though there are no definite records (see Delacour, 1932, L'Oiseau et R. F. O., p. 86).

Thalassarche melanophris (Temminck)

Black-browed Mollymauk

The range of this species is the southern oceans, including the South African coast to Durban, so it could be expected in Madagascar, but Delacour (1932, L'Oiseau et R. F. O., p. 86) gives it as without definite record there.

Thalassarche chlororhynchos (Gmelin)

The Cape Yellow-nosed Mollymauk

On the South African coast this bird comes only as far north as East London. Its occurrence on the Madagascar coast, where it has been doubtfully recorded, would be unusual (see Delacour, 1932, L'Oiseau et R. F. O., p. 86).

Sterna maxima albididorsalis Hartert

Royal Tern

This tern lives on the west coast of Africa and, though reported, there are no definite records for Madagascar (Delacour, 1932, L'Oiseau et R. F. O., p. 86).

Pelecanus rufescens Gmelin

Pink-backed Pelican

This African species is reported from Madagascar only on the basis of Verreaux's record (see Grandidier, 1879, 'Hist. Nat. Madagascar, Oiseaux,' p. 687.

Ardea melanocephala Vigors and Children

Black-headed Heron

Grandidier (1879, 'Hist. Nat. Madagascar, Oiseaux,' p. 547) records this African species as not rare in Madagascar, at least on the west coast, and Sclater (1924, 'Systema Avium Aethiopicarum,' p. 24) gives its range as including Madagascar; but it has not been recorded in recent years.

Pernis apivorus (Linnaeus)
Honey Buzzard

Hartlaub (1877, 'Die Vögel Madagascars, etc.,' p. 25) records a single juvenile specimen of this bird sent to the British Museum by A. Smith.

Elanus caeruleus (Desfontaines)
Black-shouldered Kite

The only Madagascar record is one by Humblot (1882, Arch. Miss. Sci. et Lit., pp. 153–157) who also collected the only *Upupa e. epops* from Madagascar. Humblot was shipwrecked near Gardafui and may have secured these specimens there.

Milvus migrans migrans (Boddaert)
Black Kite

Grandidier (1879, 'Hist. Nat. Madagascar, Oiseaux,' p. 200) states that the record given by E. Newton in the Ibis, 1863, p. 336, for this bird is a mistake due to a confusion of the juvenile birds.

Circus humbloti Milne-Edwards and Grandidier
Humblot's Harrier

Delacour, 1932, L'Oiseau et R. F. O., p. 40, considers this harrier, of which the unique type cannot be found, as an abnormal example of *C. a. macrosceles* Newton.

Geopelia striata (Linnaeus)
Barred Ground Dove

This East Indian dove was introduced into Madagascar and became common (see Grandidier, 1879, 'Hist. Nat. Madagascar, Oiseaux,' p. 470) but now has apparently disappeared.

Streptopelia capicola tropica (Reichenow)
East African Ring-necked Dove

Sclater (1924, 'Systema Avium Aethiopicarum,' p. 164) gives the range of this dove as including Madagascar, where it was perhaps introduced. We found no evidence of its occurrence.

Tympanistria tympanistria fraseri Bonaparte
African Tambourine Dove

The range given by Sclater (1924, 'Systema Avium Aethiopicarum,' p. 171) as including Madagascar is probable due to an error.

Upupa epops epops Linnaeus
European Hoopoe

Humblot is said to have collected five specimens of this species in Madagascar (see Grandidier, 1879, 'Hist. Nat. Madagascar, Oiseaux,' pp. 269, 270).

Coracias garrulus garrulus Linnaeus
European Roller

The only basis for including this in the list of Madagascar birds seems to be Verreaux's record (Hartlaub, 1877, 'Die Vögel Madagascars, etc.,' pp. 66, 67).

Oenanthe isabellina (Temminck)
Isabelline Chat

This bird has been recorded but once from Madagascar, by Humblot (1882, Arch. Miss. Sci. et Lit., pp. 155, 156), who also gave the only record of *Elanus caeruleus* and *Upupa e. epops*.

Oriolus oriolus oriolus (Linnaeus)
European Golden Oriole

A specimen of this bird was supposed to have come to Verreaux from Île Ste. Marie through Sganzin.

Andropadus insularis insularis Hartlaub
Zanzibar Sombre Bulbul

Delacour includes this among the birds recorded with certainty from Madagascar (1932, L'Oiseau et R. F. O., p. 86). The only record for Madagascar seems to be from Bojer's collection made in 1824, which also included as coming from Madagascar *Dryoscopus affinis*, *Ceuthmochares aereus australis*, and *Batis pririt*. Bojer also collected in Zanzibar and Pemba at about the same time, and these probably were collected there. (See Grandidier, 1879, 'Hist. Nat. Madagascar, Oiseaux,' pp. 138 and 371.)