

**Article III.—THE MARINE ORNITHOLOGY OF THE CAPE
VERDE ISLANDS, WITH A LIST OF ALL THE BIRDS
OF THE ARCHIPELAGO**

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INTRODUCTION

The present paper is an indirect result of a brief visit which the writer made to the Cape Verde Islands in September 1912. It is more immediately linked, however, with a collecting trip undertaken during part of the spring and summer of 1922 by Mr. José Gonçalves Correia, of New Bedford, Mass., whose specimens, numbering some three hundred skins of twenty species, have all been received by The American Museum of Natural History. As Correia's predominant object was to acquire adequate series of water birds, the terrestrial species of the Cape Verdes are but scantily represented in his collection, which is supplemented, to a certain extent, by a small number of specimens obtained by the writer in 1912.

Notwithstanding the relatively limited material available for study, it has been thought advisable to include within this paper a systematic list of all the birds known from the Cape Verde Islands. The latest faunal contribution is that of Salvadori (1899). Not only have additions to the avifauna been made since that date, but also forms new to science, including several endemic races, have been described. Moreover, numerous nomenclatural changes made necessary because of the researches of Hartert ('Vögel der paläarktischen Fauna,' 1910-22) and other workers increase the need for a new list.

During the course of his study, the writer was materially assisted by the following colleagues, to each of whom he extends his hearty thanks: Dr. Joseph Bequaert, of Harvard Medical School, who translated a

Dutch paper by Keulemans; Dr. Henry B. Bigelow, of the Museum of Comparative Zoölogy, who read the text of the oceanographic discussion and made many useful suggestions; Dr. James P. Chapin, of The American Museum of Natural History, whose critical opinion of African taxonomic and faunal relationships was of constant aid; Dr. Frank E. Lutz, also of the American Museum, who suggested and helped to work out the statistical treatment of *Calonectris kuhli edwardsi*; and Mr. Paul Vanorden Shaw, who read all of Correia's Portuguese field notes and dictated an English translation.

HISTORICAL SKETCH OF CAPE VERDE ORNITHOLOGY

Although Barboza du Bocage (1898) refers to bird collecting as early as the year 1784, the science of ornithology in the Cape Verde Islands may be said to date from January 1832, when the 'Beagle,' with Charles Darwin on board, visited São Thiago (St. Jago). The birds obtained by Darwin and the naturalists associated with him were subsequently reported upon by Gould.

In 1856 Carl Bolle published the first general account of Cape Verde ornithology, based upon his visit to the islands four years earlier.

In 1865, Dohrn, of Berlin, collected at several of the islands. His companion and assistant was a young Hollander, J. G. Keulemans, who subsequently attained world-wide fame as one of the most successful portrayers of birds. Keulemans' field notes of the Cape Verde trip were published in Dutch in 1866, five years in advance of the report of the leader. They give an excellent account of the life history of species which came under his notice, although Dohrn, perhaps somewhat piqued that the youthful artist and taxidermist should have burst into print ahead of the leisurely professor, states that Keulemans' article is untrustworthy as to the identification of the birds as well as in other respects.

During July and August, 1873, the 'Challenger' put into port at São Vicente and São Thiago, affording Moseley an opportunity to gather miscellaneous notes regarding the native birds ('Notes by a Naturalist on the 'Challenger,' 1879).

In 1883 Oustalet described the large shearwater which is the most important of the endemic water birds.

In 1897 Boyd Alexander, accompanied by a corps of assistants, visited all the islands of the group. His observations were published in two papers, which appeared in the *Ibis* during 1898. Alexander had evidently not familiarized himself with the earlier literature relating to

his chosen field, for his articles are characterized by faulty nomenclature, the omission of synonymic and bibliographic references, and by several unwarranted designations of supposedly new forms. He nevertheless discovered and described a remarkable species of lark (*Spizocorys razæ*), which is endemic, and by his energetic collecting he greatly extended the list of migratory birds known to occur on the islands. Moreover, his writings give by far the best record of the habits of Cape Verde birds, while his terse descriptions of the islands themselves, as well as of biotic conditions and the human inhabitants, possess a literary quality which give the author high rank among those who have published upon the natural history of the group.

In the same year the article by Barboza du Bocage made its appearance—a nominal list with a useful tabulation of vernacular names and insular habitats.

Salvadori's short but scholarly paper (1899) is based upon the collections and communications of Fea, who had traveled in the Cape Verdes during the previous year. Eleven birds were added to the known avifauna, one of these being a new subspecies of petrel (*Pterodroma mollis feæ*). Salvadori searched the writings of previous authorities, including several little-known Portuguese commentators, and he prefaced his discussion of each of the forty-seven species obtained by Fea with an exhaustive synonymy which rendered the paper indispensable to subsequent workers.

THE VISITS OF CORREIA AND THE AUTHOR

The writer's only opportunity to visit the Cape Verdes came during an expedition¹ to South Georgia made in the whaling brig 'Daisy,' under the joint auspices of the Brooklyn Museum and The American Museum of Natural History. On September 15, 1912, the welcome cry of "Land ho!" rang out from the masthead, and we soon made out the heights of Santo Antão, the first landfall since the vessel had passed Sombbrero, West Indies, forty-five days before. At evening the brig stood off shore, but during the small hours of the next morning she bore again toward land.

A heavy mist lay along the windward side of the island, and we could at first make out only the western point of Santo Antão. Later, however, we saw that the cloud bank hung nearer the bottom of the land than the top, for far above the veil stretched the blue crest of the mountains. We approached the island from the northeast. Except for short

¹1914, Brooklyn Mus. Sci. Bull., II, No. 4.

periods in the early morning and at sunset, clouds and mist hid the lower face of the hills, and it seemed to be raining in every valley. In a gorge west of Punto do Sol two slender cascades, several hundred feet in length, were streaming from high ledges. A thin coating of bice-green foliage lay on the slopes, although the bare rock showed through in most places. A number of villages, consisting of stone buildings with tile roofs, stood out against a background of verdant terraces and almost perpendicular garden plots. The surf broke furiously upon beachless shorelines, while from the foam basaltic dikes rose like buttresses against the steeps above.

The well-watered appearance of Santo Antão hardly prepared a visitor for the desolation of the neighboring island of São Vicente, which, in the words of the Yankee whalers, is "hell with the fires burnt out." Bird Rock with its surmounting lighthouse, in the harbor of Porto Grande, was visible from afar. Behind it naked, brick-red hills were piled up indiscriminately, with sharply marked laminae lying at every angle, and all ending in peaked and crumpled summits. The strength and irrationality of attachment to a homeland were brought forcibly to the writer's attention when this forlorn island first came into view, for several native sons from the 'Daisy's' fore-castle, who had beheld without emotion some of the world's fairest spots, began to dance with patriotic joy.

Mr. Correia was a member of the 'Daisy's' crew at this time, and during our short stay at São Vicente he and the writer lost no opportunity to collect birds in the environs of Porto Grande.

Through the efforts of the American consular agent, Mr. J. B. Guimaraes, a permit was issued which granted us permission to shoot any species except quail. The latter, we were informed, had just begun to breed with the advent of the so-called rainy season and were considered worthy of protection. It should be gratefully noted here that Mr. Guimaraes continued his good offices for the American Museum ten years later when, on the occasion of Correia's second visit, he extended every courtesy within his power.

São Vicente was the 'Daisy's' only port of call in the Cape Verdes. On the day after our departure, however, we sailed close by Brava and saw the smoking cone of Fogo (9760 feet) looming up to eastward. The interest aroused by the brief visit, and particularly by the numbers of Tubinares, Steganopodes, and other sea birds observed in the waters about the archipelago, led long afterwards to the expedition entrusted to Correia.

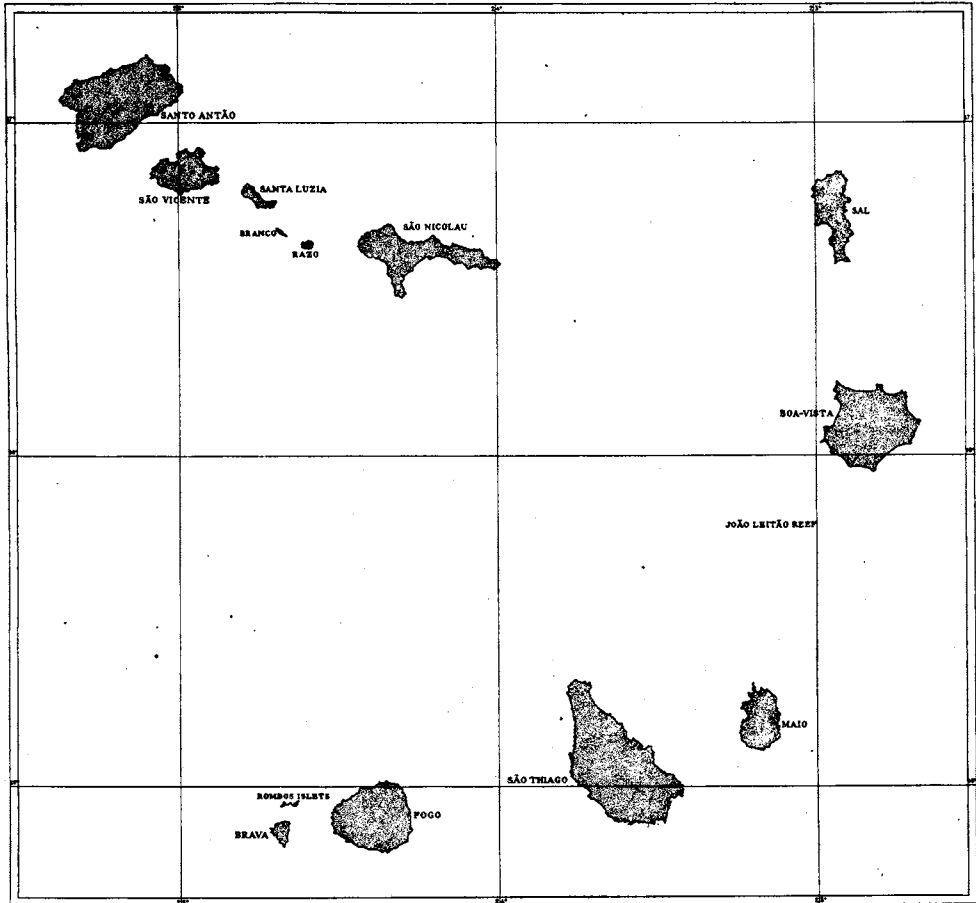


Fig. 1. Sketch Map of the Cape Verde Islands.

The field work undertaken by Correia in 1922 followed a stay of some months at his boyhood home in Fayal, Azores. He arrived at São Vicente, Cape Verdes, on May 4, and during the balance of the month paid visits to the neighboring islands of Branco, Razo, and Santa Luzia. Leaving São Vicente again on June 1, he made a voyage in a sailing vessel to Brava, calling en route at São Thiago and Fogo. On June 14 he crossed from Brava to the Rombos Islets, where he remained until July 4. Ten days more were then spent in collecting at Brava, and an additional ten days at São Vicente, before he sailed on July 26 for the Canary Islands.

Mr. Correia observed the breeding of most of the native sea birds and obtained the eggs and young of several species. He believes, nevertheless, that he reached the Cape Verdes too late to take advantage of the height of the nesting season, which, among the petrels at least, occurs in March. Correia's field journal has proved of no less importance than his specimens, and in the following pages the more valuable portions of the notes are quoted in freely translated form. His text has been somewhat abbreviated, but the sense is unchanged. Even in two or three instances in which certain statements seem to rest upon inconclusive observation, the testimony is given as originally recorded.

THE GEOGRAPHIC ENVIRONMENT

The Cape Verde group lies from 313 to 475 nautical miles from the west African coast between the parallels of $14^{\circ} 46'$ N. and $17^{\circ} 13'$ N., and the meridians of $22^{\circ} 40'$ W. and $25^{\circ} 22'$ W. The total land area is a little under 1500 square miles. The islands, with the exception of certain sedimentary rocks on Maio, are of submarine volcanic origin and of middle Tertiary age.¹ Fogo alone still has an active crater, which has been in eruption as recently as 1847.

Like the Canary Islands, the Cape Verdes rest upon the broad and deeply submerged shelf that extends from the African coast, the 2000-fathom line lying entirely to westward of both archipelagoes. The Cape Verdes comprise ten main islands and the uninhabited islets of Branco, Razo, and the Rombos or Seccos Rocks north of Brava. Santa Luzia, Razo, and Branco, which are situated between São Vicente and São Nicolau, are often called collectively the Desertas. In maritime terminology, the southerly islands of Maio, São Thiago (St. Jago, Santiago), Fogo, and Brava, constitute the leeward (*sotovento*) portion of the archipelago; the other six, namely Santo Antão (St. Antonio), São Vicente (St. Vincent), Santa Luzia, São Nicolau (St. Nicholas), Sal, and Boa-Vista, are the windward (*barlovento*) group. An orogenic classification would be somewhat different, for the islands fall into three natural subdivisions, each composed of rocks emerging from a common platform and each separated from the others by deep channels. Thus Santo Antão, São Vicente, Santa Luzia, Branco, Razo, and São Nicolau, rise from one bank; Sal, Boa-Vista, Maio, and São Thiago form a like aggregation; and Fogo and Brava, with the Rombos Islets, make the third. As might

¹Late Tertiary or recent changes in level have taken place along many shorelines of the islands. These account for beds of marine deposits such as those near Porto Praia described by Wilkes (1845, 'Nar. U. S. Expl. Exp. 1838-42,' I, p. 30).

be expected in a volcanic group, the meteorological conditions, as determined by the prevailing wind, have apparently exercised a greater influence upon the distribution of the insular life than have the geologic interrelationships of the land areas.

It would be out of place to describe in detail the various islands of the Cape Verdes,¹ but such features of the lesser known members as have a relation to the marine bird life will be of interest.

In the northern group, Santa Luzia has an area of ten square miles and an altitude of 1209 feet. The coast is mainly unapproachable, but there is a harbor on the southwest. Branco is two miles long by a half mile in breadth. Razo, sometimes called Rodonda from its outline, lies three miles southeast of Branco, and is about five miles in circuit.

Alexander (1898, pp. 105, 109) visited these islands during the months of April and May, and describes them as follows:

"The small islands known as the Desertas are three in number: Raza, Branca, and Santa Luzia. The two former, devoid of water, are uninhabited; no hostile influence coming to mar the peace of the many sea-birds that have made them their home, save perhaps at random times when fisherfolk land and employ the day in catching fish.

"Raza was the first island we visited, and all the time we remained on it the schooner was obliged to beat backwards and forwards, there being no anchorage. Landing is effected with difficulty (at times being well nigh impossible), and only then on the south side, upon a broad band of low flat rock. This island possesses an area of about three square miles, the larger portion of which is flat, strewn, however, with stones of all sizes, the boulders in many instances being undermined by Shearwaters; but here and there, amid this expanse of stones, there are patches of smooth ground, toned with fine dead grass, and with a creeping plant bearing a prickly fruit (*Tribulus cistoides*). On the north side, hills descend abruptly to the sea; while the low flat ground on the south is terminated by an almost perpendicular face of rock, at the most thirty feet in height, and rent with wide fissures and jagged scars.

"Branca is nothing more than a small irregular chain of lofty, craggy hills, rising up from the sea with extraordinary abruptness on its north side, while about halfway down its height this chain has almost a glacis-like slope down to the sea. This slope is honeycombed by Petrels. We found the White-breasted Petrel (*Pelagodroma marina*), *Puffinus*

¹A recent authoritative account of the archipelago is the following: 'Cape Verde Islands.' Handbooks Prepared under the Direction of the Historical Section of the Foreign Office, No. 117. London, H. M. Stationery Office, 1920.

assimilis, and *Oceanodroma cryptoleucura* [= *castro*] breeding, all having young. *Puffinus mariæ* [= *edwardsi*] also inhabits the island. From several Petrels-holes we pulled out Cocteau's skinks, but, there being few of these lizards, the Petrels have made the island their home. There is not a doubt that Raza was also a breeding-place before the skinks became numerous there, for we found many disused Petrel's holes on that island."

The following is extracted from Correia's field journal:

Santa Luzia has served in the past as a whaling station, and the ruins of sperm try-works still stand there. The only occupied dwelling on the island is the home of a family from São Nicolau who have charge of cattle and goats. These residents rely upon the fishermen from São Vicente for their communication with the outside world.

Since there is practically no rainfall, Santa Luzia produces no crops. The only drinking water comes from one small spring of fresh water on the eastern shore and two brackish wells. The island is therefore exceptionally barren and gloomy, and the vegetation which the animals need can be found only in the cloud-zone of the heights.

Only to the fishermen is Santa Luzia of great value, for the straits toward São Vicente and Branco teem with fish. However, fishing can be conducted with success only for about an hour during the flood and ebb, respectively, for the tidal currents about the island are extraordinarily strong and treacherous.

Only two sea birds, the booby and the white heron, appear to inhabit Santa Luzia in large numbers, and of other kinds I noted none but sparrows, kestrels, and curlews.

Branco, meaning white, lies next toward the southeast, and takes its name from extensive areas of a white mineral in the rock at the northern end, and perhaps also because of a white strip of sand on the western side. Its hills rise to a height of five hundred feet or thereabouts. The western side is like a wall, but one may land at the north point or at several places along the easterly coast. At the southern point is a cove about a hundred yards in depth which is much used by fishermen. At the very margin of the sea there are here two springs which are exposed only at low tide. The water is not particularly palatable, but one must drink it or nothing, and the fishermen land when opportunity offers to fill their kegs and canteens.

Branco is a place of strong winds, tumultuous seas, and poor anchorages. There is no shelter whatsoever when windstorms whip the waves over the narrow strands and rocky points, so the fishermen usually make their visits short.

Numerous petrels and shearwaters nest in the hills of Branco, according to the fishermen, but I made no collections here.

A few miles farther southeastward is Razo, circular in form, with a low tableland at the northern end, and rock-strewn coast to southward. There is no sandy beach and no fresh water. The name Razo, meaning shallow, refers to the fact that the sea sometimes sweeps over large parts of the island. It is possible to land at two places on the northern coast, and groups of fishermen from São Vicente and São Nicolau sometimes go there with food and water for a week's stay, returning with fish which they have dried.

To Razo great numbers of maritime birds come to breed, and the human visitors often kill more birds than fish. I saw altogether fourteen species of birds on the island, namely, booby, tropic bird, large shearwater, small shearwater, Mother Carey's chicken (*Oceanodroma*), black petrel (*Bulweria*), turnstone, white heron, osprey, kestrel, swallow, raven, lark and sparrow.

North of Brava are the six Rombos Islets, a second great center of marine bird life. Correia writes:

These islands extend from east to west for about five miles. The first on the east is known as Rombo, Cima, or Ilheu de Fora. It is close to three miles round, but very narrow—hardly more than a hundred yards at the widest point. At the southwestern end is a high peak. This is the home of the boobies, the birds which produce guano used by the inhabitants of Brava on their intensively cultivated fields. The guano of Cima has gone even farther, for in past years vessels from both Lisbon and the United States have loaded their holds here.

There are thousands of boobies on this island, although the fishermen slaughter great numbers for food. Besides these and other birds, there are sea turtles, crabs, and many kinds of shell-fish. The vegetable productions include grasses, small shrubs, and gourds. There is no fresh water, and the strength of the trade wind over the generally flat surface makes life uncomfortable.

The next islet is called Lesser Rombo, and is only three hundred feet distant in a northwesterly direction. Hereabouts are other small rocks called Seccos, all without vegetation and inhabited by numbers of boobies and tropic birds.

At the western end of the series is Baixo, Ilheu de Dentro or Ilheu Grande, which was once a port of much consequence to American whalers recruiting at Brava. Here many foreign sailors, including Yankees, have been buried. The island is about two miles in diameter, nearly circular, and forms mostly a uniform plateau, but with a high peak toward the southeastern point. No birds live upon it. Formerly it was cultivated by a resident family, but lack of rains for several successive years caused them to abandon the island. The ruins of the home and cistern are all that remain, yet in spite of the dryness, much of the ground is covered with grass and other green vegetation.

Alexander (1898, pp. 94, 95) writes of this same island:

"Its general character is flat, save for a lofty hill of a sugarloaf shape that rises up about its centre, while creeks and small bays make indentations along the coast-line. In many places its surface is strewn with ironstone, while there are several creeks that hold nickel and copper.

"A few wild goats inhabit the island, while the only birds we came across were a solitary Vulture and a Kestrel. Petrels used to breed here in numbers until they were driven away by the descendants of a pair of cats brought over by the goatherd."

The birds which Correia observed on Cima or Greater Rombo were the following: booby, tropic bird, small shearwater, black petrel (*Bulweria*), Mother Carey's chicken (*Oceanodroma*), gray petrel (*Pelagodroma*), white heron, Egyptian vulture, osprey, kestrel, raven, sparrow, and blackcap (?).

General references to the aridity of the climate of the Cape Verdes should not lead to the supposition that all of the islands lack vegetation and diversified, even bucolic, scenery. Alexander (1898, p. 90), for

example, has given the following cheerful picture of Brava, which has an area of but 22 square miles and a maximum altitude of 3609 feet:

“Brava is the smallest inhabited island of the whole group—about six miles long and four broad—and also, in proportion, the most thickly populated. Being very mountainous, volcanic in nature, and bare of woodgrowth, there is hardly a stretch of tableland on the whole island; the coast is steep and rugged—no shore-line to speak of, except for a short length of low-lying rock near the harbour. Wherever the hillsides are climbable every inch of ground is cultivated, being either sown with maize or planted with yams, while in the valleys there are small sugar- and coffee-plantations, orange-groves, etc. The harbour is small, but ships of considerable size can anchor within a few yards of the steep volcanic-looking cliffs. Three miles inland from the harbour, Povação, the principal town, is situated. A fine paved road leads up to it, but is so steep in places that it becomes well-nigh impossible to climb it either on horseback or on donkeys. In the larger valleys monkeys abound, doing much havoc among the sugar-cane.”

Again, Moseley, who was assuredly in a position to judge fairly, considered the Santo Domingo Valley of São Thiago one of the finest of all mountain valleys.¹ Santo Antão, which is still perhaps the least known member of the group, contains many regions of notable beauty, and is, moreover, more than locally famous for its fruits and other agricultural products, being one of a large number of tropical localities credited with producing the “world’s best oranges.” The island is said to have numerous areas of woodland at high altitudes. Its ruggedness and general inaccessibility are indicated, however, by a Portuguese proverb—“To be dashed to pieces on the rocks is a natural death in Santo Antão.”

The flora of the Cape Verdes is markedly Sudanese in character, most of the indigenous plants being common to the neighboring African littoral. Xerophilous types are, naturally, abundant. Notable among the unusual plant forms is the now rare dragon tree (*Dracæna Draco*), which is peculiar to the Cape Verdes, the Canaries, and Madeira. Tropical vegetation from America and the Orient, and European temperate zone forms, are thoroughly established on the insular lowlands and mountain tops, respectively. There are apparently no native mammals, but boars and African monkeys seem to have been introduced into the southerly islands as early as the fifteenth century. The reptiles, which include several endemic species, are all Ethiopian types.

¹ Notes by a Naturalist on the ‘Challenger,’ 1879, p. 64.

OCEANOGRAPHY AND CLIMATE

The Cape Verdes lie midway in the course of the northeast trade wind, and many floral and faunal characteristics, as well as the climate, are determined by the fact that the islands are to leeward of relatively cool ocean waters. The upper layers of the Atlantic about the group, and *pari passu* all forms of marine life, are materially affected by the southward-flowing Canary Current, which, to northeastward and nearer the shores of Africa, is marked by continuous upwelling of water from lower strata. South of the islands, as well as to westward or off shore, the average temperature of the ocean surface becomes warmer, a condition which obtains as far as equatorial latitudes, where the cooling effect of the Agulhas or West African Current can be observed. The data in Table 1 indicate that throughout the year the surface of the ocean within a five-degree rectangle on the northeastern side of the Cape Verdes is from 2° F. to 6° F. cooler than that within an equal area immediately southwest of the archipelago. The difference is most pronounced during periods of strong trade winds, and least between August and November. Water temperatures along a line drawn northeastward from the islands continue to decrease steadily as the continental coast is approached.

Average Surface Temperatures

	5-degree square N. E. of C. V. I.	5-degree Square S. W. of C. V. I.
January	70°F.	76°F.
April	71	76
June	72	77
September	79	81
December	74	79

Table 1.—Normal surface temperatures for periods of five years in the ocean to the northeastward and southwestward, respectively, of the Cape Verde Islands. The number of observations for each 5-degree rectangle averages about 100. Data from the Meteorological Charts of the North Atlantic Ocean, published by the United States Weather Bureau.

According to the 'North Atlantic Pilot' of the United States Hydrographic Office, the Canary or North African Current sets toward the southwest in the vicinity of the Cape Verde Islands at a rate of from fifteen to twenty nautical miles a day, being most perceptible near the easterly isles of Sal, Boa-Vista, and Maio (cf. Fig. 2). This oceanic stream is a homologue of the California Current, and, for the same geo-

physical reasons which control the latter, the belt of littoral surface water which it cools is much broader¹ than that affected by the northward-flowing Agulhas Current, or by the Humboldt Current of Peru, which is a counterpart in the Western Hemisphere of the Agulhas Current. Therefore the Cape Verdes, despite their low latitude and their distance from the continent, lie barely south of the isotherm of 68° F. for the surface of the ocean during the coldest month. Owing to the influence of the Atlantic trade wind drift, and the resultant Gulf Stream, this same isotherm passes far to the northward of the West Indies and touches the eastern coast of America at a point approximately twelve degrees of latitude north of its position near the African coast.

In general, the boundaries of the breeding ranges of tropical sea birds are fixed by water temperatures rather than by atmospheric temperatures (although, as will be explained later, the relationship is not a direct one). A further comparison of conditions on the two sides of the North Atlantic may, therefore, throw light upon problems of distribution. Toward the eastern side of the ocean the sequential isotherms of both air and water spread widely apart from one another; in other words, the gradation of temperature is slight through long distances on the meridians. Toward the western shores, on the other hand, short distances along north-south lines yield a high gradient, so that at all seasons of the year the isotherms tend to crowd together. Because of the greater latent heat of water these facts are correlated with the phenomenon that at most points in the eastern subtropical and temperate North Atlantic the average temperature of the surface of the ocean is lower than that of the air; whereas in the western part the water is prevailingly warmer than the air. Examination of plotted isotherms of air and water extending from northwest Africa to the Caribbean region and southern North America will reveal these striking differences between the two sides of the Atlantic. They are not without significance when we consider that frigate birds (*Fregata*) and boobies (*Sula*) in-

¹The tangential friction of the wind drives the surface layer of the ocean before it, but, owing to the fact that the eastward linear velocity of the earth varies with latitude, the direction which the moving water tends to take is to the right of the line of impulse (if the locality is north of the equator).

The distance off shore of the zone of maximum upwelling, along seacoasts which have prevailingly parallel winds, depends, therefore, upon (1) the latitude, (2) the trend of the coastline, (3) the constancy of the wind, and (4) the configuration of the ocean bottom. The Agulhas and Humboldt Currents impinge against shorelines which project into their paths, and consequently the active upwelling of water, to replace surface layers driven off shore by the wind, occurs within three or four miles of the coast, and the belt of cool and heavy water on the shoreward side is relatively narrow. The California Current, on the contrary, draws away from a coast which trends to the east of south; the principal zone of upwelling is 70 miles from shore, and the belt of cooled water is extremely broad. In like manner, the northeast trade wind and the southward bend of the African coast at latitude 22° N., form a combination which produces a very broad belt of relatively cool water to the northeastward of the Cape Verde Islands.

The writer has discussed this whole subject, in so far as it applies to the western coasts of North and South America, in the *Geographical Review* for January 1923, pp. 64-85 (reference on pp. 76 and 77).

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Mean temperature	71.1	70.3	70.9	71.2	72.7	74.3	76.3	79.0	79.5	78.8	76.5	73.4	74.5° Fahr.
Mean daily maximum	75.4	74.8	75.7	75.7	77.2	79.0	81.5	84.0	84.4	83.5	81.1	77.9	79.2
Mean daily minimum	66.7	66.4	66.4	67.1	68.2	70.2	71.8	74.3	74.8	73.9	72.1	68.9	70.0
Mean of (absolute) extremes, max.	79.7	79.9	80.2	78.3	80.4	81.9	85.5	87.8	88.5	87.4	85.3	81.5	89.6
Mean of (absolute) extremes, min.	61.7	62.8	62.4	63.7	65.5	68.2	68.5	71.1	70.0	68.9	67.1	62.6	59.4
Mean relative humidity	70	71	69	71	71	73	73	78	76	76	72	71	%
Mean cloudiness	4.4	3.8	3.1	3.1	3.0	3.5	4.7	5.1	4.2	4.1	4.3	4.3	4.0
Average precipitation	0.16	0.08	0.04	0.04	0.00	0.00	0.31	2.01	2.32	1.46	0.55	0.55	7.52 Inches
Number of days with rain, average	1.9	0.7	0.7	0.5	0.0	0.1	1.5	6.3	4.2	2.7	1.5	1.9	22.0
Number of days with thunderstorm, average	0.4	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.8	0.3	0.2	0.1	2.5

Table 2.—Summary of meteorological observations made at São Vicente, Cape Verde Islands, during ten years (period not known).
Data from the Meteorologische Zeitschrift, May, 1909, p. 232.

habit the Bahamas, and tropic birds (*Phaëthon*) even reach Bermuda, whereas all of these forms find at the Cape Verdes their northernmost breeding stations in the EASTERN Atlantic. To the oceanographic conditions we must ascribe the absence of such wide-ranging birds from the Canary Islands.

As regards atmospheric temperatures, the Cape Verde Islands lie well south of the annual isotherm of 68° F. The influence of the Canary Current is apparent, however, in the relatively cool summer weather that prevails at the group. For all of the islands the monthly means range between 70° F. and 80° F. during the course of the year. The winter climate (October to March) is therefore similar, so far as temperature is concerned, to that of the Greater Antilles, in the same latitude; but, owing to the effect of the trade wind blowing from a cool ocean, the average atmospheric temperatures of July and August are comparable rather with those of Norfolk, Virginia.

The Cape Verde Islands lie within the field of the North Atlantic anticyclonic center, and in their vicinity the trade wind blows pronouncedly from November to May. During the "rainy" season, August to October (the "sickly" or malarial season of São Nicolau, Fogo, etc.), the southern limit of the trade wind zone closely approaches the islands from the south, and at this period the prevailing circulation is frequently interrupted, severe southwest gales sometimes occurring.

Effective droughts of great length are experienced in many of the islands, and famines cause considerable loss of life at intervals of a few years. Conditions were serious for lack of water at São Vicente during Correia's visit in 1922. The lack of precipitation here and at several other members of the group is determined in part by the topography of islands to windward. Thus São Vicente, as has been previously inferred, is particularly arid and sterile because it is largely shut off from the moisture of the trade wind by the lofty ridge of Santo Antão. The same applies in a lesser degree to the southerly or leeward slope of Santo Antão itself. Three or more years without appreciable rainfall may pass at São Vicente, but when sporadic showers eventually reach the island, it is said to turn green as if by magic. During the period between July and November, the average barometric pressure at São Vicente is slightly lower (29.9–30 inches) than that of other months, and it seems likely that the bulk of its scanty rainfall is brought by winds proceeding from the warmer ocean to southward.

The easterly islands of the archipelago are, for somewhat different reasons, fully as dry as São Vicente. Alexander (1898, pp. 109, 110)

records his impressions of Sal and Boa-Vista, for example, in the following words:

"The greater portion of the island [Sal] is flat, with a loose stony soil, sandy in places and devoid of all tree-growth, while towards the interior it is bosomed with brown-looking semiglobular hills. Of the whole group this island is the poorest in the way of bird-life.

"The next island we visited was Boavista, which is nothing more than a sandy desert, with the exception of a few stone-strewn levels and several hills of considerable altitude. This desert of silver-white sand abounds in shallow hollows scooped out by the wind, and sand-dunes, the sides of which near the shore-line have been fashioned by the sea into high embankments, while in many places along the entire coast long narrow tongues of stony ground shoot out into the sea, making deep low-coasted bays. Clusters of tall gaunt-looking coconut-trees grow in many of the sand-dells, and about their trunks nestle banana plants with their large leaves torn into a thousand shreds by the wind, while on the flat expanses are clumps of lavender-bushes and scattered acacia-trees, stunted and ill-grown."

The marked aridity of these islands nearest Africa, which have no high windward neighbors to intercept their rainfall, is doubtless to be ascribed more directly to the effect of the Canary Current. Sal, Boa-Vista, and Maio are less mountainous than the western and southern islands, their highest altitudes not exceeding 1300 feet. The parts of the trade wind which cross these land areas have had their temperature lowered by traveling above waters in which active upwelling occurs even at a considerable distance from the continent. When such air reaches the heated, radiating surface of the barren islands, it expands and its saturation point is raised. The hills, unlike the ranges of Santo Antão (7400 feet) and São Thiago (5000 feet), are not sufficiently lofty or massive to cause adiabatic cooling to the stage of precipitation.

Like most other groups of high, isolated islands, the Cape Verdes are subject to sudden gusts and squalls, so that navigation in small boats is hazardous, as Correia learned on several occasions during his short visit. On the other hand, calms often prevail in the lee of the land even when strong winds are blowing over the open sea. The channels between the various islands are mostly free from obstruction, an exception being produced by the extensive Baixo de João Valente or João Leitão, a coral reef between Maio and Boa-Vista. Several of the straits, such as that between Santo Antão and São Vicente and those around Santa Luzia, have rapid tidal currents and dangerous rips. Finally, a

curious state of low visibility is produced at certain seasons by the harmattan, or dust-laden breeze from Africa. This condition is to be expected between December and February, when the winds often have a pronounced easterly slant. The coasts and mountains of the Cape Verdes are at such times so obscured by a reddish haze that to one on shipboard the first warning of the proximity of land is given by breakers on a still indiscernible shore. The air of the harmattan¹ is intensely drying, and the particles of dust not only veil the sun but, through their high conductivity, they also cause the days to be exceptionally hot and the nights exceptionally cool.

GEOGRAPHIC RELATIONSHIPS OF THE BIRDS

Alfred Russell Wallace (1876, pp. 214, 215) considered the affinities of the insects, land shells, and birds of the Cape Verde Islands and came to the conclusion that the archipelago had probably derived its fauna "from the desert and the Canaries to the northeast . . . rather than from the fertile and more truly Ethiopian districts of Senegal and Gambia to the east." He grants a mingling of the two faunas but states that the preponderance is with the Palæarctic rather than with the Ethiopian. Of the 15 species of breeding birds known to him, he considers 7 as Palæarctic, 3 as endemic but of Palæarctic affinities, and 3 as Ethiopian, the remaining 2 being introduced forms from the West African subregion. Wallace's data on Cape Verde Coleoptera still further bore out his belief, for he states that "out of 275 species 91 were found also in the Canaries and 81 in the Madeiran group; a wonderful amount of similarity when we consider the distance and isolation of these islands and their great diversity of climate and vegetation."

Insect life may perhaps be readily transported by trade wind and ocean current. Regardless of the affinities with the Mediterranean subregion shown by the Côleoptera, Bannerman (1920, pp. 560, 561) differs with Wallace and concludes that the ornithology of the Cape Verde Islands is definitely Ethiopian. He writes:

"The Cape Verde Archipelago has very few connecting links with the Canaries, the only Resident birds common to both being the Spanish Sparrow, Madeiran Spectacled Warbler, Egyptian Vulture, Osprey, Courser, and Migratory Quail.² Ethiopian types prevail in the Cape Verde Islands, as is only to be expected, and this Archipelago cannot by any stretch of imagination be included in the Palæarctic region."

¹For an excellent description of this type of dust storm at Gran Canaria see Bannerman's 'The Canary Islands,' 1922, pp. 215, 216, and also Appendix A (pp. 321-327), in which the African source of the æolian material is discussed by W. C. Smith.

²The Cape Verde Island courser and quail have since been described as endemic races.

Neumann (1819, p. 235) also grouped the Cape Verde birds in such a manner as to show but three purely Palæartic types, as against ten purely African and twenty neutral types. This author, however, made the mistake of including introduced species as well as pelagic birds in his reckoning.

In the writer's opinion, both Bannerman and Neumann have stressed the Ethiopian claims far too strongly. An analysis of the avifauna may prove of interest.

Of the 75 forms of birds recorded from the archipelago, 38 are residents and 37 are seasonal visitants from more or less distant breeding grounds. The latter group must be disregarded in a consideration of zoögeographical affinities. Three of the resident forms, namely, *Numida galeata*, *Columba livia*, and *Estrilda astrild*, have been introduced by man, leaving a balance of 35 species and subspecies, of which the following 15 or 16 are here treated as endemic:

- | | |
|--|---|
| 1. <i>Puffinus assimilis boydi</i> . | 9. <i>Tyto alba detorta</i> . |
| 2. <i>Calonectris kuhli edwardsi</i> . | 10. <i>Micropus unicolor alexandri</i> . |
| 3. ? <i>Fregata magnificens</i> (?) subsp. | 11. <i>Ammomanes phænicura cinctura</i> . |
| 4. <i>Buteo buteo bannermani</i> . | 12. <i>Spizocorys razæ</i> . |
| 5. <i>Cerchneis tinnuncula neglecta</i> . | 13. <i>Pyrhulauda nigriceps</i> . |
| 6. <i>Coturnix coturnix inopinata</i> . | 14. <i>Calamocichla brevipennis</i> . |
| 7. <i>Cursorius cursor exsul</i> . | 15. <i>Corvus ruficollis ruficollis</i> . |
| 8. <i>Halcyon leucocephala acteon</i> . | 16. <i>Passer jagoensis</i> . |

From the list of 35 native birds, 9 marine species (6 Tubinares and the *Sula*, *Phaëthon*, and *Fregata*) must still be eliminated on the ground that they are representatives of wide-ranging, pelagic, and insular forms which have no value as indicators of the faunal regions of Wallace. This leaves the small residue of 26 species, which the writer would place in three categories, as follows:

1. PALÆARTIC ELEMENT.—*Marmaronetta angustirostris*, *Buteo buteo bannermani*, *Milvus migrans migrans*, *Pandion haliaëtus haliaëtus*, *Charadrius alexandrinus alexandrinus*, *Sylvia atricapilla atricapilla*, *Sylvia conspicillata bella*, *Passer hispaniolensis hispaniolensis*. Total, 8 species.

2. ETHIOPIAN ELEMENT.—*Phalacrocorax carbo lucidus*, *Bubulcus ibis ibis*, *Halcyon leucocephala acteon*, *Spizocorys razæ*, *Pyrhulauda nigriceps*, *Calamocichla brevipennis*, *Passer jagoensis*. Total, 7 species.

3. NEUTRAL ELEMENT.—*Egretta garzetta garzetta*, *Phænicopterus antiquorum*, *Neophron percnopterus percnopterus*, *Cerchneis tinnuncula neglecta*, *Coturnix coturnix inopinata*, *Cursorius cursor exsul*, *Tyto alba detorta*, *Micropus unicolor alexandri*, *Alæmon alaudipes alaudipes*,

Ammomanes phænicura cinctura, *Corvus ruficollis ruficollis*. Total, 11 species.

In explanation of the last and largest of these three groups, it may be said to comprise birds of five classes, namely: 1, those whose breeding ranges extend from areas north of the Mediterranean southward more or less into Africa (e.g. *Phænicopterus antiquorum*, *Neophron percnopterus*); 2, those which range even south of the forest belt in parts of Africa, but which breed also from southern Europe eastward into Asia (e. g., *Egretta garzetta*, which is resident in India and Ceylon); 3, those which are alike related to representative forms to northward and to southward (e. g., *Cursorius cursor exsul*, *Tyto perlata detorta*, the latter of which is a member of an almost cosmopolitan species); 4, those characteristic of the northerly part of the desert zone, some of which have close relatives in Egypt, Arabia, or southwestern Asia (e. g., *Alæmon alaudipes*, *Corvus ruficollis*); 5, those which may have the greater proportion of their congeners in South Africa, but which, nevertheless, show closest affinity with species found along the northern border of the Sahara (e. g., *Ammomanes phænicura cinctura*).

It would seem, therefore, that from an ornithologist's point of view the Cape Verdes can be stamped neither as Ethiopian nor as Palæarctic, though the latter region has perhaps a shade the better claim. The archipelago possesses rather a typical borderline or transition avifauna, in which "neutrals" predominate, and in which desert types occupy a conspicuous place.

According to our present very imperfect knowledge of Cape Verde birds, São Thiago has the largest number of resident species, viz. 29. Boa-Vista comes second, with 23, the record for the other islands being as follows: São Vicente and São Nicolau, 20; Brava, 19; Razo, 16; Santo Antão and the Rombos Islets, 13; Fogo, 9; Sal, 7; Branco, 6; Santa Luzia, 3; and Maio, 2. From Boa-Vista 17 species of winter visitors are also known; São Thiago has a list of but 8, and no other island more than 6.

Turning now to a consideration of the marine birds, an outstanding feature of the Cape Verde avifauna is the absence of Laridæ, particularly of terns. The archipelago doubtless lies in the migration route of certain northern species, and the writer, in fact, observed a flock of small terns feeding with boobies a few miles west of Brava on September 19, 1912. It appears sure, however, that the Cape Verdes lack a single resident species of this cosmopolitan family, a fact all the more remarkable when we make note of the abundance of noddies (*Anous* and *Mega-*

lopterus), sooty terns (*Sterna fuscata*), bridled terns (*Sterna anætheta*), and fairy terns (*Leucanous*) at one or another of the insular groups which lie toward the southeast, south, southwest, or west. Moreover, a north-temperate, circumpolar species, *Sterna hirundo*, breeds at the Canaries and Madeira to northwestward, while the Azores have in addition a native gull (*Larus fuscus atlantis*).

Why should the Cape Verde Islands share the brown booby and the tropic bird of the West Indies, Fernando Noronha, St. Paul's Rocks, Ascension, and the islands of the Gulf of Guinea, and yet lack the noddy and the sooty tern? Climatically and topographically the archipelago might well be occupied by such vast colonies of tropical terns as cover parts of Ascension or of islands in the Caribbean. What, then, is the nature of the invisible barriers which stand, for example, against *Anous stolidus* on the south and west, and against *Sterna hirundo* on the north?

To oceanographic factors we must look again for an explanation. A broad belt of ocean water divides the nesting latitudes of equatorial and Holarctic terns, and the cause of this separation is correlated with the fact that the surface water of the dividing belt is of too low mean temperature to be favorable to the former sea birds and of too high mean temperature for the latter. Keeping in mind the previous discussion of the subject (pp. 222-224), it will be seen that this belt is more southerly in position, as well as of greater latitudinal breadth, in the eastern Atlantic than in the western Atlantic. The Cape Verde Islands and Bermuda lie within the neutral zone; the Canaries and Cape Hatteras lie north of it; the Gulf of Guinea and the Bahamas lie south of it. The hiatus between the breeding ranges of *Anous stolidus* and *Sterna hirundo* is fifteen hundred geographic miles wide in the eastern Atlantic, and less than six hundred miles wide in the western Atlantic.

If we plot the mean surface temperatures of this ocean for the month of June, as in figure 2, the crowding together of the lines in the western Atlantic, which is equivalent to a narrowing of the zone, becomes apparent. Moreover, it will be observed that the isotherms of 70° F. and 80° F. practically coincide with the borders of the neutral ground between the ranges of tropical and north temperate terns.

It need not be surmised from the above that varying temperatures of ocean water, within small absolute limits, have a direct bearing upon the distribution of sea birds. The whole matter belongs to the sphere of marine ecology, and the chain of causal relationships may well be long and intricate. The factors are evidently highly specific in their action, for we have already seen that conditions true for certain tropical Laridæ

do not apply in the same degree to the Steganopodes. It is conceivable that the question has to do entirely with the geographical distribution of the food of the sea birds, although such a suggestion merely restates the problem. In the absence of exact knowledge about the food supply, we can say only that the ranges of the birds appear to be closely correlated with certain isotherms of surface temperature.

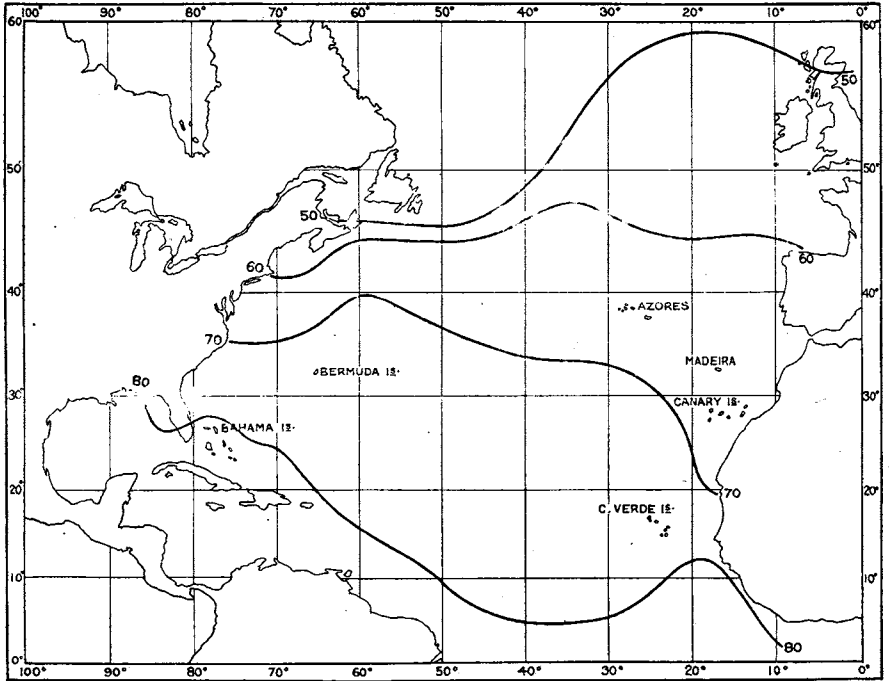


Fig. 2. Lines of equal mean temperature of the surface of the North Atlantic Ocean during June. The isotherms of 70° F. and 80° F. for this month coincide, respectively, with the southern limit of the breeding range of *Sterna hirundo* and the northern limit of the breeding range of *Anous stolidus*. The same isotherms show also the thermal effect of the Canary Current.

As to the presence of sufficient and appropriate food for a great population of boobies, tropic birds, petrels, etc., at the Cape Verdes, it is likely that the topography of the surrounding sea bottom, in conjunction with currents and vortices produced by the submarine slopes of the islands, is fully as important as the physical character of the sea water; for such circumstances compel a constant and plentiful store of varied food organisms to approach the surface in the vicinity of the birds'

nesting grounds. Conditions of this kind explain, for example, the abundance of the surface plankton in the Straits of Messina. Again, at the small island of Laysan, in the Pacific, Fisher¹ estimated that the consumption of cephalopods by the breeding albatrosses amounts to six hundred tons daily, and it is fair to assume that the mere shallowing of the ocean about the island accounts in large measure for the concentration of the avian food supply in the only layer in which it can become available, namely, the uppermost.

Of the six species of Tubinares which nest in the Cape Verde group, three (the *Oceanodroma*, *Bulweria*, and *Puffinus*) are essentially tropical types and members of species widely distributed in the Pacific as well as in the Atlantic. *Pelagodroma* and *Pterodroma mollis* are of somewhat more austral affinities, with representative forms not only elsewhere in the tropics but also southward to the border of subantarctic oceans.

The large shearwater (*Calonectris*) is more difficult to place, for it has close kin at more northerly oceanic islands, in the Mediterranean Sea, the Indian Ocean, and the eastern Pacific. It is best described as a small-sized, rather long-tailed representative of the well-known shearwater of the Azores and Canaries. Naturalists who cherish belief in the direct action of environment in the "speciation" process should note the fact that this bird is the darkest in coloration of its group, although it inhabits the most arid region of all. It is probably worthy of being ranked as a distinct species, but, for reasons stated below, the writer has preferred to treat it as a geographic race of *Calonectris kuhli*.

Several of the Cape Verde petrels, such as the *Bulweria*, the *Oceanodroma*, and the *Pelagodroma*, offer remarkable illustrations of discontinuous distribution, since colonies or aggregations of them are to be found only here and there throughout two or more of the great oceans. Bannerman (1914, pp. 442-444) has sought to explain the phenomenon upon the hypothesis of geological changes that have produced land barriers. After referring to the antiquity of the Tubinares, and the varying relations of land and water during the Tertiary, he adds:

"In former days the petrel family must have had a very extended range, which is yearly becoming more circumscribed. The birds which at one time ranged universally from the north Atlantic to the south Pacific are now becoming isolated in often widely distant localities. Intermediate colonies may be totally wiped out, for it has been often proved that all the Tubinares have a highly-developed homing-sense and become strongly attached to the particular breeding-station to

¹Fisher, W. K., *Auk*, 1904, p. 15.

which they resort. The birds will return year after year to the same small island no matter to what extent they are subjected to persecution from man, rats, mice, mongooses, or the other innumerable enemies with which ground-nesting birds have to contend."

In the same vein, Loomis¹ writes:

"In the remote past Tubinarine species became established in their habitats and have been able to hold them against all competition. Their success is perhaps due chiefly to the isolated character of their breeding stations, where predaceous land mammals are absent and food is plentiful. The discontinuous distribution of Harcourt's and Bulwer's petrels ceases to be an enigma when viewed from the standpoint of a water way between North and South America, which geologists tell us existed as late as the Miocene Period."

On the other hand, without resorting to such long periods of time, or such great secular changes, for an explanation of existing conditions, we might attribute the scattered tropical distribution of these birds to the loss of migratory instinct. During an age of more extensive glaciation in the southern hemisphere, the various species of petrels (which have obviously had their main center of dispersal in the south) may have made prolonged northward flights, just as *Oceanites oceanicus* and certain other Tubinares do to-day. The mere presence of available islands within the tropics would lead inevitably to colonizing by the more adaptable sea birds, and the continuance of a congenial environment would as surely bring about ultimate abandonment of a return migration to high southerly latitudes.

In the light of this hypothesis, the presence of *Oceanodroma castro* at the Atlantic islands, Hawaii, and the Galapagos, becomes scarcely more difficult to understand than the existence of a non-migratory species of penguin at the last-named archipelago.

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SYSTEMATIC LIST OF THE BIRDS

Since the publications of Alexander are in English and readily accessible, no attempt is made to repeat this ornithologist's excellent accounts of the land birds of the archipelago. Pertinent information in the writings of Bocage, Bolle, Dohrn, Keulemans, and Salvadori has, however, been freely transcribed.

In the case of the sea birds, the descriptions which are scattered through Alexander's papers have been brought together and quoted in whole or in part. Likewise, an effort has been made to incorporate all data of importance from the text of the other authors.

Pelagodroma marina hypoleuca

Thalassidroma hypoleuca WEBB, BERTHELOT, AND MOQUIN-TANDON, 1841, 'Hist. Nat. Iles Canar. Zool., Orn.', p. 45 (Tenerife).

Pelagodroma marina ALEXANDER, p. 117, etc.

Pelagodroma marina hypoleuca BANNERMAN, 1914, p. 464.

LOCAL NAMES.—*Pedreiro azul*, *passaro azul*.

A resident species, recorded from Branco and the Rombos Islets.

The type locality of the species *Pelagodroma marina* is off the mouth of the Rio de la Plata (lat. 35° S.), and the breeding grounds of the

typical race are at the Tristan da Cunha group in the South Atlantic Ocean.¹ The North Atlantic form, which is said to differ from *P. marina marina* in its longer bill and lighter coloration, nests upon the Salvages as well as at the Cape Verdes.

Correia collected eighteen examples of this petrel at Cima, one of the Rombos Islets, between June 17 and 29, 1922. He also noted the presence of the species at sea in other parts of the archipelago.

Unfortunately, most of the collector's skins are of full-grown fledglings, as indicated by the character of the plumage and the flexibility of the cranial bones. It is not certain, in fact, that a single one of the specimens is an adult. Under these circumstances, a comparison with examples from colonies nearer the type locality loses critical value. Nevertheless, it is worth noting that all our Cape Verde birds differ from a pair of adults obtained at Great Salvage Island on April 29, 1895, in being grayer (less sooty) on the upper surface and in having a much broader white forehead. The breadth of the band from the base of the culmen is 6 mm. in the two Salvage specimens, and approximately 15 mm. in most of the Cape Verde birds. The difference may be due to a juvenal characteristic, as is doubtless the fact that the wings of the Cape Verde specimens are 10 mm. shorter than those of the Salvage birds.

Extreme and average measurements of the Rombos series follow.

8 males.—Wing, 141–149 (144); tail, 63–74 (66.5); exposed culmen, 17.4–19 (18.1); tarsus, 41–45 (44); middle toe with claw, 33.7–38 (36.4 mm.).

3 females.—Wing, 140–142 (141); tail, 62–70 (65.6); exposed culmen, 17–18.8 (17.8); tarsus, 43–46.5 (45.2); middle toe with claw, 35–40 (37 mm.).

Undoubted fledglings, with gray down still clinging to their bellies, have distinct white edgings on the upper tail coverts, the greater wing coverts, and the terminal parts of the secondaries and inner primaries.

Correia arrived at the Cape Verdes too late to find the eggs of this species, which had been previously taken by Alexander on March 15, 1897. Writing of the Cima Islet, that author reports (1898, p. 95):

“On the Brava side this island culminates in a rocky headland of considerable altitude, serving as a screen to hide from view the low, flat, gravelly land directly behind it, in length about two miles, and one in width at its broadest part. This portion was literally honeycombed by Petrels, causing the ground-underfoot to give way at nearly every tread. The first species discovered was the elegant White-breasted Petrel

¹Judging from Dabbene's recent notes ('El Hornero,' II, pp. 246, 247, map on p. 254), birds referred to the typical South Atlantic race have been taken only twice at a distance from the breeding grounds, viz. off the coasts of Uruguay and northern Patagonia.

(*Pelagodroma marina*). We found it breeding in considerable numbers, the eggs being in an advanced stage of incubation. The nestholes had an average depth of 8 inches and a length of 2 feet. We are inclined to think that the female does the entire incubation, since every bird taken off its egg proved to be of that sex. The only three males obtained were in company with females and were not incubating.

"In unearthing these Petrels several managed to escape us. They ran along the ground in a dazed condition, and before we could rescue them they were pounced upon and carried off by Kites."

Alexander adds that this petrel's call notes are "grating noises like those of a pair of rusty springs set in motion."

Fea (*vide* Bannerman, 1914, pp. 464, 465) mentions that *Pelagodroma marina* was not breeding on Cima during his visit in the months of August and September.

Correia's field notes on the species, as translated from the Portuguese and somewhat shortened, follow.

I found the *pedreiro azul* ("blue stone-mason") chiefly in the vicinity of the Rombos Islets, but also saw two east of São Vicente. This bird flies very close to the water, frequently dragging its feet as though about to alight. It often travels by leaps from wave to wave, striking the water vigorously with its webs. When stopping to feed, it stands upon the surface as though the ocean were stone, the body being held lightly above by the extended wings. I did not discover the particular nature of its food, for the stomachs of the birds examined contained only a black oil.

On the Rombos Islet where this species nests, it seeks places in which the ground can be readily drilled, and then digs nearly straight down for three or four inches before beginning the lateral tunnel which may be a yard or more in length. The nest is unlined. The breeding birds are much persecuted by a kind of crab, which kills and eats them in their burrows. This enemy is a sand crab of a light yellow color, which carries itself well above the ground, and which is found not on the rocks but upon sand or earth. Indeed, it occurs only on islands which have sandy beaches and not at all upon those of sheer rock. When they are at rest the crabs excavate pits in the soil and disappear from view. These crabs seem to subsist mostly upon the flesh of petrels, which they hunt in their holes at night. I found many birds torn to pieces in the nest chambers, and afterwards I saw crabs picking bird bones, or dragging out fresh victims that they had captured. This caused me to observe more closely, and I noticed that the crabs regularly introduced themselves into the burrows at evening, leaving at once and moving to another nest if their search was not rewarded. Sometimes they would spend a whole night hunting in this way, often gathering a rich harvest.

Bird-eating crabs brought back by Mr. Correia have been identified as *Ocypode ippeus*, a widely distributed North African and southern Mediterranean crustacean.

Oceanites oceanicus oceanicus

Procellaria oceanica KÜHL, 1820, 'Beiträge Zool. Vergl. Anat.,' p. 136 (ex Banks, Icon., Tab. 12) (South Atlantic Ocean, off the mouth of the Rio de la Plata).

A probable summer visitor, observed by the writer both to the southward and to the northwestward of the archipelago.

Oceanodroma leucorhoa leucorhoa

Procellaria leucorhoa VIEILLOT, 1817, 'Dict. d'Hist. Nat.,' nouv. éd., XXV, p. 422 (Picardie, France).

Oceanodroma leucorhoa BANNERMAN, 1914, p. 451; MURPHY, 1915, Auk, XXXII, p. 171.

A winter visitor to the archipelago.

Numerous specimens of Leach's petrel were obtained among the Cape Verde Islands by Dr. P. R. Lowe, of the British Museum, on January 13 and 14, 1906, as recorded by Bannerman. Others were collected by the writer south of Fogo, in lat. 10° 46' N., long. 24° 38' W., on September 27, 1912.

Oceanodroma castro castro

Thalassidroma castro HARCOURT, 1851, 'Sketch of Madeira,' p. 123 (Desertas Islets, Madeira).

Thalassidroma jabe-jabe BOCAGE, 1875, Journ. Lisb. V, p. 120.

Oceanodroma cryptoleucura ALEXANDER, p. 117, etc.

Oceanodroma castro SALVADORI, p. 301; BANNERMAN, 1914, p. 459.

LOCAL NAMES.—*Jabe-jabe*, *pedreirinho*.

A resident species, recorded from Branco, Razo, São Nicolau, and the Rombos Islets.

This species, which is widely distributed in both the Atlantic and the Pacific, nests at Madeira, the Salvages, the Azores, and the Cape Verdes, as well as at St. Helena, or, as Bannerman has pointed out (Ibis, 1920, p. 561), at all of the so-called North Atlantic Islands except the Canaries, although the latter islands lie near the center of its breeding range.

Correia collected examples at Razo between May 17 and 26, 1922, and at the Rombos Islets between June 17 and 29. The series of eighteen skins includes both adults and young, in addition to eggs from Razo. The adults are in all respects identical with a male obtained at Porto Santo, Madeira, on June 12, 1903.

Measurements of the adult birds in the series from the Cape Verdes follow:

6 males.—Wing, 142–155 (148); tail, 64–74 (68.5); exposed culmen, 16–17 (16.2); tarsus, 22–24 (23); middle toe with claw, 22–23.5 (22.7 mm.).

6 females.—Wing, 143–157 (150.4); tail, 66–74 (69.8); exposed culmen, 15–16.6 (15.8); tarsus, 21.6–23.5 (22.6); middle toe with claw, 22–23.5 (22.5 mm.).

Three of the pure white eggs of this petrel, partly incubated, were taken at Razo, between May 17 and 26. They were cracked in transit, but two which can still be measured have the following dimensions: 24×31 and 23.6×31 mm.

Bannerman (1914, pp. 459, 460) sums up the published information regarding the status of *Oceanodroma castro* at the Cape Verdes, and shows that the known breeding season occurs between March and May.

Writing of this species on Cima, of the Rombos cluster, on March 16, 1897, Alexander (1898, p. 95) states: "In close proximity to *Pelagodroma marina* was a colony of *Oceanodroma cryptoleucura* [= *O. castro*], the burrows of which, however, ran further into the ground, besides being more tortuous. Many had young, while most of the eggs were well incubated."

Correia's field notes are as follows.

In the Cape Verdes the *pedreirinhos* ("little stone-masons") breed upon Cima, Brava, Razo, and São Nicolau. At Razo, where the ground is stony, they do not burrow to make a nest, but seek the shelter of projecting slabs of rock, beneath which they brood over their single egg. At Cima, however, they breed only in burrows and in soft soil. The nest-hole is about two inches in diameter and from six inches to a foot in depth, from where it may extend laterally two feet or more.

Bulweria bulweri bulweri

Procellaria Bulwerii JARDINE AND SELBY, 1828. III. Orn., II, plate XLV and text ("Madeira or the small islands adjacent.").

LOCAL NAME.—*João Preto*.

A summer resident, known from Razo and the Rombos Islets.

Bulweria bulweri, like *Pelagodroma marina* and certain other petrels, has a range of vast extent in both the Atlantic and the Pacific. The typical race is known to breed at Madeira and its outliers, at the Salvages and the Canaries, but it has apparently not hitherto been recorded as a resident of the Cape Verde Islands. Bannerman (1914, p. 443 and footnote on p. 489) lists it as only a "very rare straggler," this status being based upon Bocage's record of a single bird from Razo.

In view of the fact that Correia found *Bulweria* to be a not uncommon breeding petrel, well-known to the native fishermen by the folk-name of "Black John" (*João Preto*), it is rather surprising that neither Fea nor Alexander discovered it. A possible explanation is that the bird nests relatively late in spring, and "is not found inhabiting the north Atlantic Islands throughout the year" (Bannerman, 1914, p. 489).

Correia's twenty specimens comprise fifteen adult birds, together with twenty-five eggs, collected at Razo between May 17 and May 26, 1922, and two adults and three downy young obtained at Cima, Rombos Islets, between June 22 and July 2. His brief notes on the species state merely that the *João Preto* nests among loose stones, and that he seldom saw more than a pair, or at most four birds, in flight over the sea together.

The May birds, from Razo, have rather fresh tail and wing quills, and in at least one example the molt had obviously been recent. The Rombos specimens, which were taken a month later and which were caring for well-grown young instead of eggs, illustrate how greatly the abrasion of plumage is accelerated during the breeding season, when the adult birds are continually crawling in and out of rugged nest chambers. Not only the feathers but also the feet of the Rombos specimens show the effects of several weeks of partly terrestrial life, for the claws of these birds are worn down close to the ends of the toes.

Correia's series of *Bulweria bulweri bulweri* agree in appearance and dimensions with summer birds from Madeira and the Canary Islands. Measurements of the adult specimens from the Cape Verde Islands follow.

11 males.—Wing, 183–204 (193); tail, 100–112 (105.2); exposed culmen, 22–23 (22.5); tarsus, 27–29 (27.6); middle toe with claw, 29–32 (30.7 mm.).

6 females.—Wing, 189–202 (192.8); tail, 102–111 (106.6); exposed culmen, 21.2–23 (21.9); tarsus, 27–28 (27.5); middle toe with claw, 29–32 (30.7, mm.).

The pure white eggs show considerable variation in proportions, some of them approaching a conical shape. Six examples have the following dimensions: 31×45, 31×41, 30×43, 31×42, 31×44, and 30×43 mm.

Pterodroma mollis feæ

Æstrelata feæ SALVADORI, 1899, Ann. Mus. Civ. Genova, (2) XX, p. 305 (São Nicolau, Cape Verde Islands).

Æstrelata mollis feæ BANNERMAN, 1914, p. 488.

Pterodroma mollis feæ HARTERT, 1920, p. 1431.

LOCAL NAME.—*Gon-gon*.

A North Atlantic subspecies, recorded from São Nicolau and Fogo.

This race of *Pterodroma mollis* breeds as far north as Madeira, Porto Santo, and the Desertas. The South Atlantic breeding grounds of the typical form, *P. m. mollis*, are apparently still to be discovered.

Bannerman sums up the information on the status of this species in the Cape Verdes as follows: "Fea's Soft-plumaged Petrel is even a rarer bird in the Cape Verde Group than it is in the Madeira Islands,

and although no eggs or young have been taken, it must undoubtedly breed there. In this archipelago it is restricted to the islands of St. Nicholas and Fogo, where Fea discovered it living on the former island 'always at an altitude of 500 metres.' This same traveller says it is to be found also on Fogo, *vide* Salvadori (Ann. Mus. Civ. Genov. ser. 2, vol. XX, 1899, p. 305). I gather from Fea's own account that he did not himself meet with the bird on Fogo, but constantly heard it spoken of by the natives of this island. Boyd Alexander did not come across this Petrel during his expeditions in 1897, but I have found an interesting note referring to this species in one of his private diaries, which I have been privileged to read. Under the date May 27th, while on a voyage down the west coast, he writes:—'Lat. 11° 10' N. "Black" Petrels still following in numbers, this afternoon great numbers of Shearwaters (*Estrelata mollis*) suddenly appeared, they kept circling low over the water, soon all were left behind. . . . May 28th. Arrived Sierra Leone.' This entry is of particular interest, as it is the most southerly point that *O. m. feæ* has been noted, and is, moreover, the only occasion on which the bird has been seen in the month of May."

This petrel was not encountered by Correia. During September 1912, however, the writer saw considerable numbers of the birds at sea. They were first observed from the brig 'Daisy' on September 12, in latitude 23° 17' N., longitude 28° 19' W., upwards of three hundred miles from the islands. As the vessel neared the group, the petrels became increasingly common, and on September 15, the date on which we sighted Santo Antão, they were about in good-sized flocks. The following note of the same date is from the writer's field journal:

Mutton-birds (*Æstrelata mollis*) flew about singly or in pairs. They did not approach the brig of their own accord, but we came within half a length of one that was feeding upon what appeared to be the carcass of a large squid. The bird stood on the dead animal with raised wings and pecked rapidly. It did not fly off until we had come abreast of it.

In their manner of flight the petrels reminded me of marsh hawks. Any one who has seen a harrier foraging over windy salt meadows, alternately soaring and beating its wings, now rising, now just skimming the pulsing waves of green thatch, wandering capriciously and of a sudden darting downward, can imagine the way in which *Æstrelata mollis* hunts above the waves of the ocean. Of course the petrel is relatively longer-winged and shorter-tailed than the hawk, but the impression is similar.

On the following day we saw many flocks sitting on the water, facing the wind, with other birds sailing back and forth in air close to the cliffs of Santo Antão.

South of the archipelago, to about 9° north latitude, we saw more of these petrels on September 28 and 29.

Puffinus assimilis boydi

Puffinus l'herminieri boydi MATHEWS, 1912, 'Birds Austral.,' II, p. 70 (Cape Verde Islands).

Puffinus assimilis ALEXANDER, p. 117, etc.

Puffinus sp., SALVADORI, p. 303.

Puffinus l'herminieri boydi BANNERMAN, 1914, p. 483.

LOCAL NAMES.—*Pedreiro* (São Vicente), *batitu* (Brava and other southerly islands), *cagarra*.

An endemic subspecies, recorded from Branco, Razo, Rombos, São Thiago, and Fogo.

The Cape Verde race of *Puffinus assimilis* is the most southerly of all the Atlantic forms of the species. It has been recognized by Hartert ('Vög. paläarkt. Fauna,' II, 1920, p. 1422) as distinct from *P. a. godmani*, the race inhabiting the more northerly African islands, in the uniformly gray-brown under tail coverts, some of which have white borders, and in the darker inner vanes of the primaries. A comparison of Cape Verde skins with Madeiran specimens in the American Museum shows that the distinction is constant and well marked. I cannot follow Bannerman, however, in placing the Cape Verde shearwater closer to *P. l'herminieri* than to the *Puffinus* of Madeira.

Correia collected examples of this species at Razo between May 16 and 26, 1922, and at Cima, Rombos Islets, between June 22 and July 2. Among his twenty-three skins there are, unfortunately, but two adult breeding birds, all of the others being nestlings. Most of the latter are nearly full-grown, downy chicks, but several have molted all of the down and are distinguishable from the adults chiefly because of the rich blackness of their new feathers. Since a number of these fledglings are quite as large in all dimensions as the old birds, I have included the measurements of four of them in the tabulation summarized below:

3 males (1 adult, 2 young).—Wing, 169–180 (173); tail, 71–78 (75.3); exposed culmen, 25–29 (26.7); tarsus, 37–39 (38); middle toe with claw, 42–44 (43 mm.).

3 females (1 adult, 2 young).—Wing, 171–176 (173); tail, 75–80 (78.3); exposed culmen, 24–28 (25.8); tarsus, 37 (37); middle toe with claw, 40–43 (41.7 mm.).

This shearwater is apparently a permanent resident at the Cape Verdes. Fea obtained specimens at Razo as late as the end of October. Alexander collected eggs at Cima on March 15, while Correia's most advanced nestlings, which were doubtless ready to fly, bear the date of July 2.

Writing of his visit to Cima, Alexander (1898, p. 95) states that towards the rocky headland of the island he "discovered *Puffinus assimilis* breeding, not only in holes, but many beneath rocky boulders and

in small clefts and overhanging rocks, while in one instance a bird had made its nest beneath the boards of a tumbledown hut. In this last case the nest contained a quantity of dry grass."

At sea near the islands Alexander (p. 109) "saw numbers of *Puffinus assimilis*, and at intervals one of them would disappear and swim after some small fish just beneath the surface of the water, after the manner of a Penguin."

Again (p. 97), he writes:

"When the night shadows began to brood vaguely over this lone waste of an island, the Petrels came abroad and filled the still air with their weird cries. They mustered strongly, flitting to and fro over the low-lying ground in hundreds. Among the number the most noticeable was *Puffinus assimilis*, as it glided like some large soft-winged bat over the small sandhills, and even sometimes brushing past our camp-fire, forever uttering its weird cry "karki-karrou, karki-karrou, karki-karrou. . ."

"As the night wore on, the cries of these Petrels died away, only to recommence, however, with redoubled energy just as dawn arrived, and then, as soon as the dusky light waxed clear, these voices ceased as suddenly as they had commenced, indicating that their owners had crept noiselessly into their dark retreats, there to remain till the heat had once more abated."

Correia's field notes follow:

I saw these shearwaters about many islands of the Cape Verdes, but never in large flocks like those of some of the other petrels. Their flight is exceedingly rapid and always close to the surface of the sea. When feeding, they spend much time below, sometimes emerging at a great distance from the spot at which they had disappeared.

On land the only examples that I saw were at Razo and Cima. Razo has a great population of them, and the fishermen said that there were also many at Branco. I was at Razo in May, and every night these birds fluttered and criss-crossed over their breeding grounds, chattering continually. Most of the chicks in the nests had changed from down to feathers, and were about ready to fly.

At Razo these shearwaters nest under fragments of stone, but at the Rombos Islets they live in burrows. They feed themselves on small fish. The inhabitants of the northern islands call this bird the *pedreiro*, but to the people of Brava it is the *batitu*.

Calonectris kuhli edwardsi

Puffinus Edwardsii OUSTALET, 1883, Ann. Sci. Nat., (6) XVI, Art. 5, p. 1 (Branco, Cape Verde Islands).

Puffinus mariæ ALEXANDER, p. 92.

Puffinus edwardsii, SALVADORI, p. 302.

LOCAL NAME.—*Cagarra*.

An endemic subspecies, recorded from Branco, Razo, and Brava.

This very distinct shearwater, known only from the Cape Verde group, was described in 1883, but it has been generally overlooked, and its name has appeared in no systematic account of the Tubinares except Godman's 'Monograph of the Petrels' (1908). As will be shown below, this *Calonectris* differs so greatly from the related shearwater of the Azores and the Canaries that it may well merit the specific rank given by Oustalet. Lacking material, however, for a study of the four or more representatives of *Calonectris kuhli*, the writer prefers for the present to regard the Cape Verde form as one of the geographic races.

Alexander found that this shearwater did not inhabit the Rombos Islets, but that it occurred on Brava and on outlying rocks. He writes (1898, p. 108):

"Raza and Branca may be looked upon as the chief habitat of this species. Before landing on Raza we saw a large flock in a wedge-shaped formation sleeping on the water. They frequent chiefly the hollows in the cliffs, but we found some on the higher ground in holes made by the birds themselves underneath large boulders, where the entrances were strewn with small stones and flakes of rock, evidently brought there by the birds, since the soil is of a fine nature.

"These Shearwaters appear to prey upon smaller birds, for in many instances the vicinity of their holes was strewn with bones and feathers. While on Brava, we constantly heard this bird at night among the hills; its weird cry, only enhanced by the silence, is like the whistling cry of the Wigeon. When fishermen land on Raza, they capture many of these birds for eating purposes, sometimes taking away almost a boat-load to their homes."

During his second visit to the Cape Verdes, Alexander found the shearwaters breeding (1898, p. 284):

"While on Raza we found that this Shearwater had young. The eggs are laid in September, and should the first be taken another is laid. Albinism occurs in this species, but unfortunately I arrived on the scene too late to prevent the destruction by some fishermen of a perfect albino specimen. However, we managed to obtain several specimens which exhibit a distinct tendency towards albinism. During the two weeks we stayed on Raza over 3000 of these Shearwaters were captured by the fishermen, who prepared them for food."

Correia obtained a beautiful series of the shearwaters at Razo, between May 16 and 24, and on Brava and its islets, between July 4 and 6. On the latter dates he collected also a large number of eggs,

proving that the nesting season begins much earlier than was surmised by Alexander. Although his visit was too early for him to see living young birds, he found the mummy of a nestling of an earlier year in which the gray down, whitish on the belly, is perfectly preserved. This chick resembles closely young specimens of *Calonectris kuhli borealis* from the Azores, except that the down of the Cape Verde bird is of a lighter and clearer gray. Correia noted that the species has its greatest center of abundance on Razo, but that it is common also on the southern and western coasts of Brava, and on the rocks off shore. Like earlier visitors, he found none on the Rombos Islets. His account of the habits of the shearwater follows.

The *cagarra* is one of the most curious of the birds I encountered. It leads an entirely different life from the other sea fowl. The open ocean is its home during the day, but if by chance any remains on land, no eye sees it for it hides in deep cavities of the rocks.

Before daybreak the cagaras leave the holes which have served them as resting places for the night, and when they have banded into a large company (which takes half an hour or more of flying from side to side along the rocks), they depart to sea, sometimes five or six hundred together. All this is before sunrise. Those which still happen to remain in their hiding places after dawn, do not leave at all on that day, but wait over until the following; nor do those which have flown to sea return until after the setting of the sun.

When the cagaras come back at nightfall, they do not all go directly to their retreats. Some remain in the vicinity of the shores, sailing about for hours; others fly far into the interior parts of the islands, and while on the wing they are never silent, for their 'Ha-oo!' rings out constantly. While the night is still young, however, they all settle down to sleep, and then they remain in silence until the hour before dawn. Not all of them seek a hole in which to pass the night, for some are content with ledges of the cliffs or undercuttings of the rocks. Most of these sleeping quarters, by the way, seem to be different from the cavities and burrows in which they lay and hatch their eggs.

Another curious circumstance is that these birds come to land only on dark nights, except during the breeding period. In the season of moonlit nights they ordinarily remain at sea during both daylight and dark, and only after the moon is well on the wane do they begin to return in numbers to sleep ashore.

I observed that the cagaras do their courting at sea. They rest on the water in large congregations, sometimes forming rafts of birds a hundred feet square, and at such times the love-making goes on with much caressing of bills and necks. During the amorous pursuits of one bird after another, conflicts take place which often involve more than the single pair. Sometimes I saw regular battles between groups of the birds.

The cagaras hunt their food while flying about in seemingly unorganized flocks. It appears to consist entirely of fish, of which I was able to recognize in their stomach contents four kinds, namely, *cavalla* (mackerel), *sardinha* (herring), *chicharro*, and *voadór* (flying-fish).

During the period when the single large white egg is in the burrow or rocky chamber, the female bird is always brooding, the male cagarra bringing her nourishment when he returns from sea in the evening. He carries the fish not in his beak, like the tropic birds, but in his stomach, and he ejects the food into the mouth of his mate while she sits upon the egg. I observed all this one night when I sat up with the object of seeing their intimate home life. I had a lantern which I uncovered only when one of the birds alighted at its nest, and from a distance of a yard or so I saw the birds which had just come in, and which were recognizable from their wet feet, vomit the fish into the beaks of their mates.

The measurements of the Cape Verde shearwaters will be found tabulated below. The eggs (Fig. 8) collected at Brava are uniformly clear white and of fine texture. They are characteristically variable as to size and contour. Ten, selected for variation, measure as follows: 43×59 , 45×68 , 44×64 , 44×57 , 46×65 , 41×61 , 46×60 , 44×62 , 46×69 , 45×68 mm.

Of the four forms of *Calonectris kuhli*, the writer has now studied large series of *edwardsi* from the Cape Verdes and of *borealis* from the the Azores, as well as six specimens of the typical Mediterranean race.¹ He has, however, seen no examples of *C. k. flavirostris*, which is supposed to breed at Kerguelen Island or elsewhere in the Indian Ocean.

In dimensions, *C. k. kuhli* is intermediate between *edwardsi* and *borealis*, the average measurements of four males of *kuhli* in the American Museum and the Museum of Comparative Zoology being as follows: Wing, 337; tail, 125; exposed culmen, 47; tarsus, 51.5; middle toe with claw, 63.5. It is, nevertheless, the most distinctive of the three forms, having conspicuous whitish edgings on the feathers of the forehead, and a large white field on the inner vanes of the primaries, diagnostic markings which are lacking both in *edwardsi* and *borealis*. With regard to the latter races, *edwardsi* is darker on the head and back than *borealis*, but the outstanding difference is one of size.

The possession by the American Museum of large series of Azorean and Cape Verde Island shearwaters from the respective breeding grounds offers an exceptional opportunity for inquiry by statistical methods into the subjects of individual variation and subspecific relationship.

Variation within a species may be of at least five types, namely, (1) geographic, (2) age, (3) seasonal (including not only changes in color of plumage, but also variation in certain dimensions due to molt or other causes), (4) sexual, and (5) individual. Only variations of the first class properly affect classification, but variations due to one or more

¹See the following papers, in which the recent literature is cited: Murphy, R. C., 'Notes on Tubinares, including Records which Affect the A. O. U. Check-List,' *Auk*, 1922, pp. 58-65 (58-60); 'Notes on a Small Collection of Birds from the Azores,' *Ibis*, 1923, pp. 44-49 (45, 46).

of the other four causes have all too often been made the basis of untenable changes in the system. Among Tubinares the problems of true individual variation are doubtless the most fundamental of all, for not only have such been wrongly employed in the so-called splitting of species, but they have, with equal error, been put to quite the opposite purpose when results due in reality to geographic, sexual, or age variation have been attributed to individual variation. The fact that the bulk of Tubinares existing in the older collections were taken on the wide ocean, far from nesting grounds and often in localities where genetically and geographically distinct strains of one species mingle during the non-breeding season, has led numerous ornithologists to consider most species or races of these birds as extraordinarily erratic in their individual facies. As a matter of fact, study based upon adequate data has suggested repeatedly that, except for the phenomenon of dichromatism, individual variation is seldom notably great among at least the smaller and more rapidly maturing species of the group.¹ Loomis has, indeed, called attention to an indubitable example of marked individual variation in the form of the bill within a single breeding colony of Galapagos albatrosses (*Diomedea irroforata*).² When, however, he extends his deductions to cover "like discrepancies" among eighty-one specimens of another species "obtained on the high sea," his ground is far less sure. Slight structural differences in birds collected on the high sea usually offer no clue as to whether they should be regarded as individual or geographic, and in attacking this problem it is essential to compare like only with like.

With the object of ascertaining the range of true individual variation, as distinguished from variations of every other type, among the Cape Verde and Azorean shearwaters, the writer has selected at random 100 breeding specimens of *Calonectris kuhli edwardsi* (50 of each sex), and 100 breeding specimens of *C. k. borealis* (50 of each sex). These 200 birds were all collected by Mr. Correia. The specimens of *borealis* were obtained at the single island of Pico, Azores, within less than one month's time (July 11–August 7, 1921). The specimens of *edwardsi* were obtained at Razo and Brava, Cape Verde group, between May 16 and July 6, 1922. In both instances, therefore, the chosen specimens are all fully adult; they are in approximately the same physiological state with reference to the time of reproduction, i.e. in uniform condition of plum-

¹Cf. Murphy and Harper, 1921, Bull. Amer. Mus. Nat. Hist., XLIV, pp. 526–533. (Consideration of individual variation in *Pelecanoides georgicus* and other petrels.)

²Emu, 1920, p. 310.

TABLE III

100 Breeding Specimens of <i>Calonectris kuhli edwardsi</i>		Minimum	Maximum	Average, Including Probable Error
Wing	50 males	289	320	304.6±0.56 mm.
	50 females	284	316	297 ±0.71 mm.
Tail	50 males	113	131	120.7±0.34 mm.
	50 females	114	128	120 ±0.31 mm.
Exposed Culmen	50 males	41	49	44.7±0.10 mm.
	50 females	39	46	42.5±0.14 mm.
Tarsus	50 males	45	50	47.1±0.10 mm.
	50 females	43	48	46.1±0.12 mm.
Middle Toe with Claw	50 males	56	64	59.3±0.16 mm.
	50 females	55	63	57.9±0.18 mm.

age, etc. In short, they are seasonally and geographically comparable, and the sexes are equally represented. Since the skins were put up by one collector, the "make" is similar throughout. Finally, all measurements were made by the writer, and with the same instruments.

While 100 specimens of a form are but a small total from the point of view of a biometrician, the number is a relatively large one to a vertebrate taxonomist. Statistical data derived from such a series should at least indicate the range of true individual variation far more reliably than similar data obtained from specimens of indeterminate origin.

In preparing the necessary tables, five common measurements of ornithological usage were employed, namely, those of wing, tail, exposed culmen, tarsus, and middle toe with claw. Smaller dimensions, such as depth of bill, were omitted chiefly because of the increased probability of error in manipulation. Recent references to tables of measurements prepared by the writer¹ render it desirable to describe the methods.

WING.—The chord of the distal segment, from the carpal bend to the tip of the longest primary, taken with anthropometric calipers graduated in millimeter units. European ornithologists usually straighten the quills against a plane when taking this dimension, a method which yields figures appreciably greater than those for the chord.

¹For example, Mathews and Iredale, 'Manual Birds Australia,' Vol. 1, 1921, p. 49, write: "Nichols and Murphy contrasted Mathews's measurements [of albatrosses] with their own; but we would point out that their method of measuring is unknown to us and we cannot reconcile any of their figures with our own data."

TABLE IV

100 Breeding Specimens of <i>Calonectris kuhlt borealis</i>		Minimum	Maximum	Average, Including Probable Error
Wing	50 males	329	367	351.5±0.77 mm.
	50 females	329	362	344.3±0.68 mm.
Tail	50 males	122	140	130.2±0.41 mm.
	50 females	121	138	129.3±0.37 mm.
Exposed Culmen	50 males	51	59	55.5±0.16 mm.
	50 females	49	57	52.9±0.18 mm.
Tarsus	50 males	54	59	57 ±0.11 mm.
	50 females	51	57	54.6±0.12 mm.
Middle Toe with Claw	50 males	67	74	71.6±0.17 mm.
	50 females	65	73	69 ±0.18 mm.

The remaining measurements were all made with sharp-pointed steel calipers. The dimensions were first recorded and averaged in millimeters and tenths, but for purposes of subsequent tabulation the decimals were eliminated, those of 0.4 mm. or less being dropped, those of 0.6 mm. or more being considered as 1 mm. Fractions of exactly 0.5 mm. were assigned alternately to the next lower and the next higher unit.

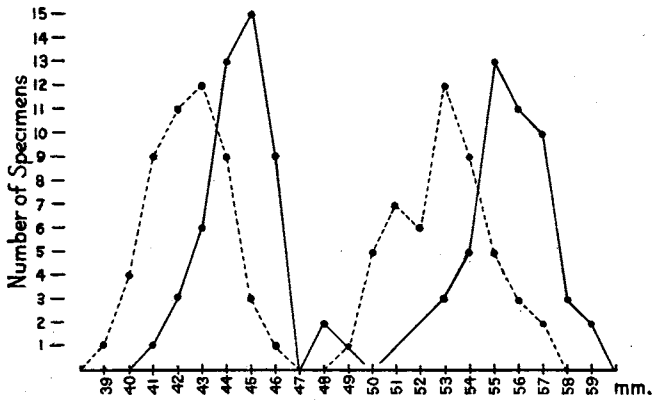
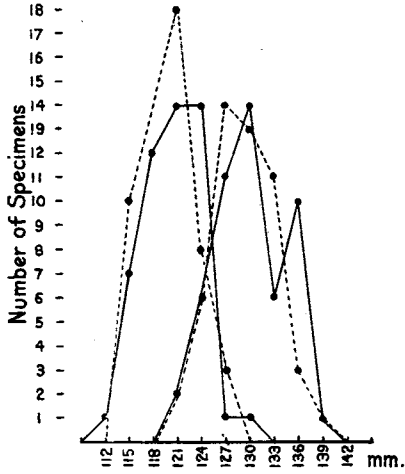
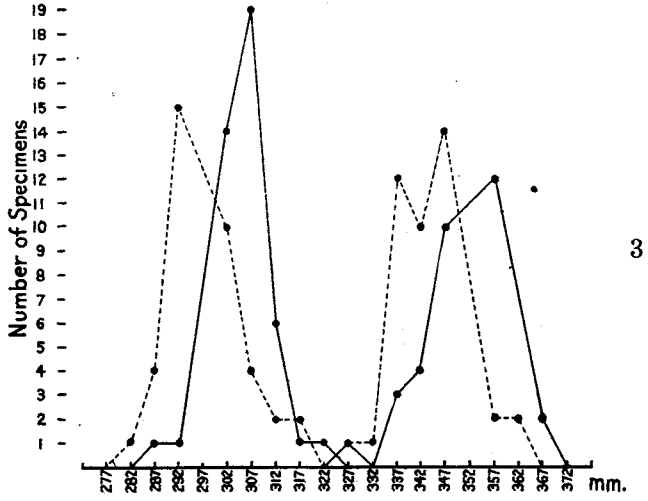
TAIL.—The distance from the base of the two central rectrices to the tip of the tail. In taking this measurement one of the points of the calipers was thrust between the two quills at the spot at which the skin enveloped their shafts.

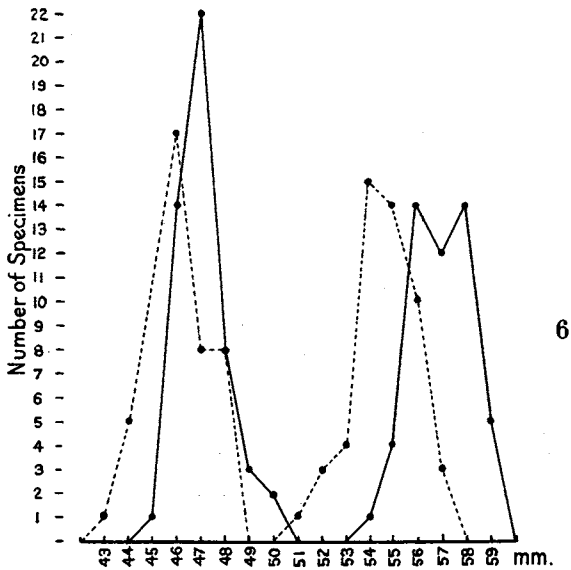
CULMEN.—The distance between the well-marked depression at the base of the culmicorn and the most distal point of the strongly hooked bill.

TARSUS.—The extreme length of the tarsometatarsal bone, obtained by thrusting the proximal point of the calipers through the skin, on the antero-external side of the heel joint, and the distal point into the joint between the middle condyle and the toe.

MIDDLE TOE WITH CLAW.—The distance between the base of the first phalanx and the tip of the nail, measured on the upper or anterior side. The toe was, of course, straightened before the calipers were applied.

The extreme and average dimensions of the fifty male and fifty female specimens of the Cape Verde and Azorean shearwaters, respec-





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Figs. 3-7. Frequency distribution graphs showing size of 50 males and 50 females of *Calonectris kuhli edwardsi* (left pair of curves in each figure), and *Calonectris kuhli borealis* (right pair of curves in each figure). Solid lines represent males; broken lines females.

- Fig. 3. Wing.
- Fig. 4. Tail.
- Fig. 5. Exposed Culmen.
- Fig. 6. Tarsus.
- Fig. 7. Middle toe with claw.

tively, are recorded in Tables III and IV. The decimal figure which is expressed as a plus-or-minus quantity after the mean for each dimension, represents the probable error of this mean as derived through the ordinary statistical methods. This quantity has a definite bearing upon problems of variation in that, according to the theory of statistics, differences in excess of three times the probable error of a given mean are considered to be significant.

Graphic expression of the entire series of measurements, as in figures 3-7, has a distinct advantage over the tables in that it reveals at a glance the relative frequency of each dimension, from minimum to maximum, as well as the relative proportions of the two sexes, and of the two geographic forms. In these graphs, the figures along the base line represent the total range in length of the respective structures, while the vertical figures indicate the number of specimens falling within each class. In the smaller structures, namely bill, tarsus, and toe, the class-range is of the smallest unit, i.e. one millimeter. The class-range of the tail is three millimeters and that of the wing five millimeters, the abscissas having been taken from the mid-point of each class. Solid lines represent the curve for males, dotted lines for females. The pair of curves at the lower or left end of each base-line represents, therefore, the range in size of 100 examples of the smaller form, *Calonectris kuhli edwardsi*, of the Cape Verde Islands; the right hand curves present similar data for *Calonectris kuhli borealis*, of the Azores.

As regards the variability and average differences of the sexes and of the geographic forms, respectively, the general conformity of the several curves is noteworthy. It will be observed also that *edwardsi* and *borealis* exhibit no intergradation in size, even between the largest males of the former and the smallest females of the latter, except in the case of the tail, in which structure the marked overlapping is coincident with practical lack of sexual difference.

Upon the evidence presented, many ornithologists would unhesitatingly consider the Cape Verde *Calonectris* specifically distinct from the bird of the Azores. So far as known, there is no intergradation between the two and the ranges appear to be widely separated. In default of specimens of *C. k. flavirostris*, however, as well as of an adequate series of Mediterranean topotypes, this question may here be left in abeyance. Hartert has suggested ('Vögel paläarkt. Fauna,' II, p. 1425) that *Calonectris creatopus*, of the west coast of America, is a member of the same assemblage. Whatever the precise interrelationships may be, it is apparent that the several representatives of *Calonectris*

tris kuhli, together with *C. creatopus*, comprise what the modern German ornithologists call, by a useful term which has no exact equivalent in English, a "Formenkreis."

Phalacrocorax carbo lucidus

Haliastur lucidus LICHTENSTEIN, 1823, Verzeichniss Doubl. Zool. Mus. Berlin, p. 86 (Cape of Good Hope).

Phalacrocorax lucidus ALEXANDER, p. 117, etc.

LOCAL NAME.—*Corvo marinho*.

A permanent resident, recorded from Razo, São Nicolau, and Boa-Vista.

Sula leucogaster leucogaster

Pelecanus leucogaster BODDAERT, 1783, 'Tabl. Planch. Enlum.,' p. 57 (Cayenne).

Sula fiber KEULEMANS, p. 372; ALEXANDER, p. 117, etc.

Dysporus sula DOHRN, p. 8.

Sula leucogastra SALVADORI, p. 308.

LOCAL NAME.—*Alcatraz*.

A permanent resident, recorded from Santo Antão, São Vicente, Razo, São Nicolau, Sal, Boa-Vista, São Thiago, Brava, and the Rombos Islets.

At the Cape Verde Islands, *Sula leucogaster* reaches its most northerly breeding station in the eastern Atlantic. The bird has never been reported from the Canary Islands, even as a wanderer.

With reference to the boobies of Brava, Alexander (1898, pp. 93, 94) writes:

"Owing to the proximity of their breeding-station on Rombos Islands, Gannets, singly or in pairs, were constantly to be seen hanging about the coast in search of food, while it was not uncommon to catch sight of flocks of from 15 to 20 beating over the smooth sea in a compact wedge-shaped body; sometimes skimming over the surface in graceful and steady flight, sometimes rising high in the air—mere specks in the sky—as they prepared to pass over the Brava hills in order to reach another part of the coast. The dexterity with which the species catches its prey must be seen to be appreciated. As soon as the fish is sighted, the bird, with closed wing, shoots into the water, the next moment to reappear floating on the surface busy tackling its prey and looking for an instant like a bird mortally wounded. Sometimes, however, a series of rapid twists and turns are indulged in prior to the dive, some 20 feet above the water. These movements may either result from the presence of a shoal of fish, the sight of which causes the bird to waver in its choice, or to a single fish having altered its course.

“Besides being much smaller than the female, the coloration of the soft parts in the male is altogether brighter, while the remarkable patch of bluish slate-colour visible in front of the eye in the female is continued round it in the male. The webs also in the feet of the latter are of a greenish yellow.”

Later, visiting the largest islet of the Rombos group, the same author (p. 96) found, on March 15, a rocky headland “where the steep sides had been here and there made hoary by the hundreds of Gannets that peopled them. On the long narrow ledges of rock facing the sea countless numbers of these birds were standing in serried ranks, bolt upright. Wherever a portion of this rock possessed a superficial covering of earth they nested in dozens, hardly 2 feet intervening between the nests. These consisted of a shallow depression made by the bird itself, and further bordered by a fringe of small pebbles and flakes of rock. Both sexes share in the incubation, and we nearly always found the male on the nest throughout the day. Incubation was well forward, nestlings being in every hollow, but only one in each; invariably the second egg of the clutches had turned out wrong. There were, nevertheless, many fresh eggs, but sad havoc is constantly made among them by the fishermen whenever they visit the island. The birds, too, do not escape molestation, often being stoned on their nests and killed for eating purposes.”

Correia collected an excellent series of thirty-five skins of this booby at Razo and Cima, between May 18 and July 1, 1922, together with numerous eggs from the Razo colony. All of the skins are of either fully adult, breeding birds or of nestlings; there are no intermediate examples in which the gray juvenal belly feathers are being replaced by white. One well-grown downy chick, which still shows no trace of quills, is dated Cima, June 29. All other young birds obtained in late June had molted the last of the white down.

The entire series of Cape Verde skins agrees in all respects with topotypical specimens from the Caribbean, as well as with birds from Fernando Noronha (the nearest breeding station on the western side of the Atlantic), the coast of Brazil, and the Bahama Islands. It is evident that but one race of *Sula leucogaster* inhabits the tropical Atlantic.

Measurements of twenty adult birds from the Cape Verde Islands are summarized below. It will be seen that females are larger than males, as reputed, but that the average difference is not great, amounting to perhaps five per cent in the length of the bill and middle toe, and to less than this in the other dimensions.

10 males.—Wing, 378–411 (392.2); tail, 173–208 (190); culmen, 90–100 (94.7); tarsus, 45–51 (47.9); middle toe with claw, 76–84 (79.8 mm.).

10 females.—Wing, 395–412 (404.3); tail, 177–200 (191.5); culmen, 97–102 (100.1); tarsus, 47–51 (48.8); middle toe with claw, 82–90 (86.1 mm.).

The eggs (Fig. 10) from Razo, all taken between May 18 and 25, are remarkably variable as to shape and size. Thirty of them fall within the following axial dimensions: breadth, 37–43.5; length, 53–64 mm.

Correia's field notes on the booby are as follows:

This bird lives in great flocks at the Cape Verde Islands, especially on uninhabited islets where there are no fresh water springs. Razo, which is visited only by fishermen, is both a summer and winter home for the *alcatraz*, and apparently the birds never go more than a few miles from their insular breeding ground in search of the fish upon which they subsist. Only the western portion of Razo, however, is occupied by the boobies.

What caused me most surprise was to see boobies of all ages at the same time—some laying eggs while others had downy youngsters or fledglings ready to leave for sea. But the fishermen assured me that this species lays eggs during every month of the year, and that there is no season when nestlings are not common.¹

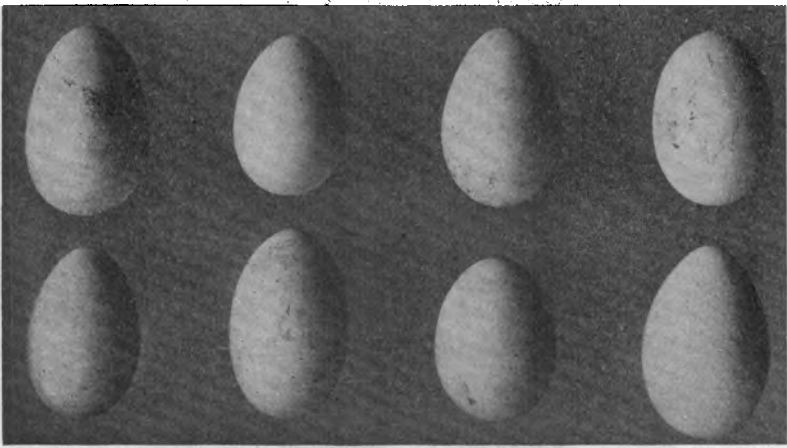
The fishermen are the boobies' greatest enemy, for large numbers of the birds are salted, sun-dried, and subsequently roasted on coals, precisely like fish. The Cape Verdians pay little attention to booby eggs, for they prefer the birds themselves as food, and it is safe to say that thousands are killed annually.

The booby seems to be absolutely indiscriminate in the choice of a nest; any haphazard site will serve, and no building materials are used. Three eggs are usually laid, with long intervals between each laying. In examining a set in one nest I observed that a chick was about ready to break the shell of one, while the second egg contained only a small embryo, and the third was so fresh that it might have been eaten. Again I saw three chicks in a nest, one so large as to be able to take care of itself, the second capable of lifting its head only with difficulty, and the last just emerging from the egg shell. Such incidents led me to believe that there is normally a period of many days between the deposition of the eggs.

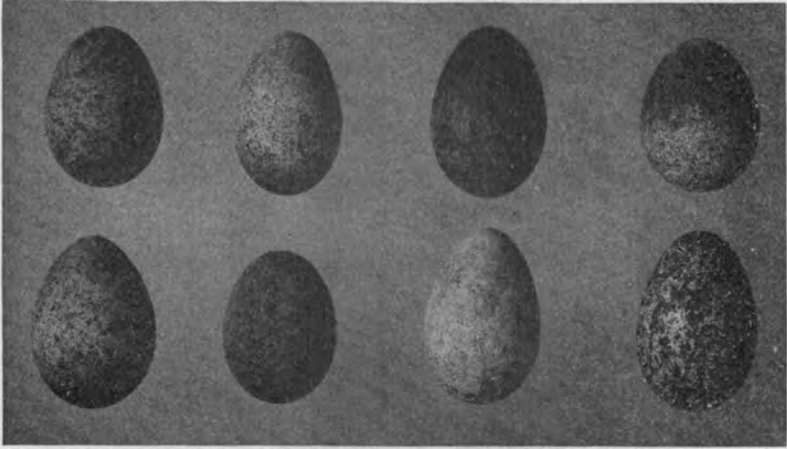
The booby is hatched naked, and two weeks pass before it is completely covered by the snow-white down. The dark wing plumes are the first feathers to appear, but eventually the nestling, after reaching full growth, exchanges the down for a coffee-tinted plumage. In young birds the bill and feet are dark, but they later turn successively to light gray, creamy flesh-color, bleached green, and yellow or orange-yellow which is the final hue.

The booby dives five or six feet into the water in order to obtain fish. I found various species in the stomachs of the birds, including the *chicharro*, *sardinha* (a herring), *voador* (flying-fish), *dobrada*, *agulha* (needle-fish), *bicuda* (barracuda), and others whose names I do not know. The birds hunt until dark, and then always come to land, sitting on the rocks until daybreak. They carry fish in their crops to the young, and the latter cause great confusion by their outcries and their efforts to introduce all their heads together into the mouth of the parent. The old birds, how-

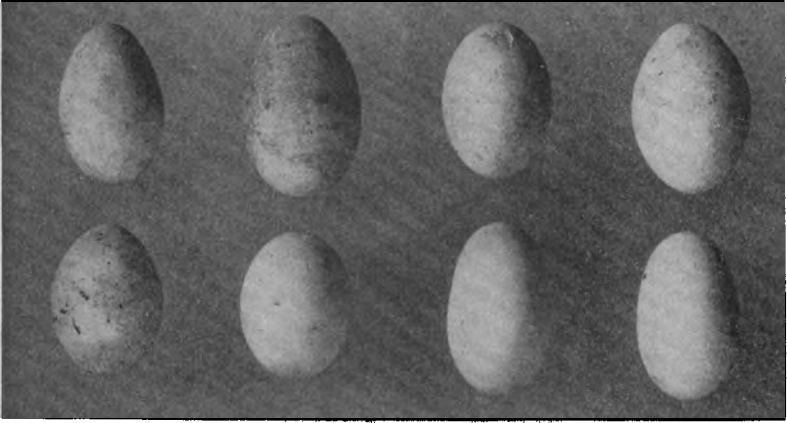
¹Bolle states that in his time (1856) a boat went from São Nicolau to Razo for fresh eggs during October.



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Figs. 8-10. Variation in the Eggs of Cape Verde Island Sea Birds.
Fig. 8. Eight eggs of *Calonectris leucomelas*. Fig. 9. Eight eggs of *Phaethon aethereus*. Fig. 10. Eight eggs of *Sula leucogaster*.

ever, calmly let the chicks tire themselves out before responding. The lazy fledglings continue to beg for food long after they seem capable of catching fish for themselves. When either old or young birds are startled, they usually vomit a few fish before flying or running away. The flocks of boobies are very sheeplike, for when one bird takes flight the others follow, and when the first returns it is a signal obeyed by all.

Some miles west of Brava, on September 19, 1912, the writer saw a flock of boobies following a school of albacores during a squall. The massed fishes in pursuit of their prey were breaking water continually, and the boobies, sailing in the high wind above, seemed to be struggling for the scraps. A few small, unidentified terns were among the larger birds.

Phaëthon æthereus

Phaëthon æthereus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 134 (Ascension Island); ALEXANDER, p. 117, etc.

Phaëton candidus KEULEMANS, p. 373.

Phaëton æthereus SALVADORI, p. 308.

LOCAL NAMES.—*Rabo de junco, rabi-junco, junco.*

A permanent resident, recorded from São Vicente, Razo, Sal, Boa-Vista, São Thiago, and the Rombos Islets.

The Cape Verde Islands, which are some 1400 geographic miles from Ascension, the type locality of *Phaëthon æthereus*, mark the northerly outpost of the breeding range of tropic birds in the eastern Atlantic. Toward the western sides of all the great oceans, where tropical oceanographic conditions obtain farther from the equator, the several species of Phaëthontidæ have more extensive latitudinal ranges. A form of *Phaëthon lepturus*, for example, is resident at Bermuda (lat. 32° N.).

According to Alexander and other observers, the tropic birds nest in fissures of the cliffs on many of the islands. The bulk of them, however, doubtless dwell at the Rombos Islets, where Alexander (1898, pp. 96, 97) on March 15 found "*Phaëthon æthereus* breeding in small numbers in suitable holes and clefts among different portions of the rocks. On that particular day, when the sea wore but a darker tone than the sky, it was a pretty sight to watch these birds taking wide graceful circuits from their nest-holes out across the sea, the glossy white of their plumage at once striking the eye, while their two long rectrices, like slender pennons, streamed out behind. Both sexes incubate, and while the female is sitting the male will often sit alongside to keep her company. Towards sundown these birds congregated over some favourite spot and indulged in nuptial flights, at times circling high in the air and uttering the whole while a series of harsh screeching notes that bore a striking resemblance to those of the Common Tern during the breeding-season."

Correia collected a beautiful series of tropic birds at Razo, between May 16 and 26, and at the Rombos Islets, between June 17 and July 3. He obtained also eggs and young at both localities. The chick of this species, as is well known, passes from the nestling down, which is white on the ventral surface and smoky gray above, to a plumage similar to that of the adult.

Most of the Cape Verde breeding specimens are in rather worn plumage, which gives them a relatively dark-backed appearance, abrasion of the white edgings of the dorsal plumage tending to expose the blackish bars of underlying feathers. The long middle rectrices, however, are in most instances well developed, both plumes often being intact. In one male bird the longer of the two has the exceptional length of 700 mm., or more than twenty-seven and one half inches.

Measurements of thirty adult tropic birds in Correia's series show that the sexes are approximately alike in size as in appearance, the males averaging a shade the larger.

15 males.—Wing, 288–310 (299.6); first lateral feathers of tail, 97–118 (108.9); longer of middle tail feathers, 414–700 (607); exposed culmen, 61–69 (64.5); tarsus, 27–30 (29); middle toe with claw, 44–48 (45.8 mm.).

15 females.—Wing, 283–310 (297.9); first lateral feathers of tail, 94–113 (104.6); longer of middle tail feathers, 437–598 (515.1); exposed culmen, 59–67 (62.9); tarsus, 27–30 (28.6); middle toe with claw, 45–48 (46.2 mm.).

Twenty-two eggs (Fig. 9) exhibit great variation in form as well as in the amount and distribution of the purplish or chocolate pigment. Some are very finely mottled, others coarsely blotched. One egg has the principal deposit of coloring matter in the form of a broad ring around the smaller end. A belt or patch of pigment at the larger end is, of course, more common. Six examples, selected for variety, measure as follows: 43×64, 45×62, 41×55, 43.5×56, 44×66, 40×59 mm.

Correia's field notes on *Phaëthon æthereus*, at the Cape Verde Islands, are as follows.

The tropic bird or marlin-spike is known to the Cape Verders as the *rabo de junco* (rush-tail), although the fishermen of Brava usually abbreviate this to *junco*. On the island of Sal is a small haven named after the species, and called Porto do Rabo de Junco.

About their breeding grounds the juncos nearly always travel in pairs or in greater numbers. After returning from a feeding trip at sea, they fly back and forth in front of their rocky homes for an hour or so, and finally alight to rest. The juncos usually go to sea very early in the morning, long before sunrise.

I found the larger of the Rombos Islets to be headquarters for the great majority of the juncos. At daybreak there is generally not a bird to be seen on or near the breeding grounds, but about eight o'clock they begin to return from the ocean. They

fly straight to their respective clefts or cavities in the cliff but, instead of alighting, they poise a while in air with the feet and tail trailing, and then wheel and describe short circles very rapidly, after which they return to the nest-site and poise once more. They seem to be suspicious one of another. A bird which has alighted makes loud outcries and attempts to peck any other bird which shows that it would like to descend near the same place. Should the approaching bird actually perch, the other flees from his post.

The male juncos also appear to be very jealous of their mates. If a strange male approaches a niche in which a female is brooding, the mate of the sitting bird promptly takes the invader to account, with ear-splitting calls.

The rabo de junco nests in any natural hole or cavity which affords shelter, never undertaking any construction nor bringing a nest-lining. Only one egg is laid, and, as I found young in all stages of growth along with the eggs, I came to the conclusion that the juncos breed at every season of the year. This supposition was confirmed by the local fishermen, who told me that junco eggs could be found on the island during every month. The fishermen know the breeding habits all too well, for they are the birds' worst enemies. At first I could not account for the hundreds of heads and wings of tropic birds scattered over the islands, but later I found that the fishermen come frequently to get these birds together with boobies. They pluck and draw the bodies, salt them inside and out and then hang them in the sun to cure. Hundreds of juncos are thus destroyed every year.

The juncos dive deep for the fish upon which they feed, and they remain several seconds under water, finally emerging with a fish crosswise in the beak or half swallowed.

The young of this species are hatched in light gray down, quite unlike the condition of the naked booby chicks, and this down gives place to plumage of the adult type. The feet and the bill change color with growth, the cream-colored bill of the young nestling becoming red, and the distal part of the feet turning black. The feet are small and weak, even in adults, and the juncos neither walk nor stand up. On the contrary they rest with their breasts on the ground, and when they progress over the short distances between the nest chamber and the jumping-off place, they push along on their bellies.

***Fregata magnificens* ? subspecies**

Tachypetes aquila KEULEMANS, p. 373.

Fregata aquila ALEXANDER, p. 117, etc.; SALVADORI, p. 309.

LOCAL NAMES.—*Rabo-forcado*, *rabil*, *quincho*.

A permanent resident, recorded from Santo Antão, São Vicente, São Nicolau, Boa-Vista, and São Thiago.

Keulemans states that at the time of his visit the man-o'-war birds were common in the harbor of Porto Grande, where they could be seen robbing the boobies and using the Bird Rock as a convenient resting place.

Alexander states that the only breeding station of this species among all the Cape Verde Islands is on a small islet opposite Sal Rei, Boa-Vista.

Unfortunately, Correia obtained no specimens. The status of the Cape Verde Island *Fregata* has never been fully determined. Rothschild (1915, Novit. Zool., XXII, pp. 145, 146) tentatively considered the bird as an endemic race of *F. magnificens*, but left the matter open for further investigation. Mathews' subsequent discussion (1915, 'Birds Austral.,' IV, p. 280) has shed no additional light upon its relationships with the various forms of *F. magnificens*, or with *F. aquila* of Ascension Island.

The man-o'-war bird, whatever its status may prove to be, finds at the Cape Verdès its most northerly breeding grounds in the eastern Atlantic. No member of the genus has been recorded from the Canary Islands.

Ardea cinerea cinerea

Ardea cinerea LINNÆUS, 1758, 'Syst. Nat.,' I, p. 143 (Sweden); ALEXANDER, p. 118, etc.

LOCAL NAME.—*Garça*.

A winter visitor, recorded from Santo Antão, São Vicente, São Nicolau, and São Thiago.

Pyrtherodia purpurea purpurea

Ardea purpurea LINNÆUS, 1766, 'Syst. Nat.,' I, p. 236 (France); ALEXANDER, p. 118, etc.

LOCAL NAME.—*Garça*.

A winter visitor, recorded from São Vicente and São Thiago.

Egretta garzetta garzetta

Ardea Garzetta LINNÆUS, 1766, 'Syst. Nat.,' I, p. 237 ("Habitat in Oriente").

Ardea garzetta ALEXANDER, p. 117, etc.

Herodias garzetta SALVADORI, p. 307.

LOCAL NAMES.—*Lavadeira, garça branca*.

A permanent resident, recorded from Santo Antão, São Vicente, Santa Luzia, Razo, São Nicolau, Boa-Vista, and São Thiago.

Alexander records a breeding station in Tarrafal Bay, São Nicolau, where he found the nests of nine pairs on April 24, 1897, and a colony of fifteen pairs on Boa-Vista. He also reports seeing a flock of five hundred of these egrets on Razo.

That this heron sometimes lives as a semidomesticated captive about the homes of the Cape Verdès is indicated by Lady Brassey's reference to a "washerwoman-bird" (*lavadeira*) at Tarrafal Bay, Santo Antão—"a kind of white crane, who appeared quite tame, playing about

just like a kitten, pecking at the clothes or the women's feet, and then running away and hiding behind a tree." ('Around the World in the Yacht 'Sunbeam,' 1883, p. 33).

Six adults in high plumage were collected by Correia at Razo and Santa Luzia between May 16 and 23, 1922. Their dimensions are rather small, but within the ranges given by Hartert ('Vögel paläarkt. Fauna').

Correia reports that the *lavadeiras* occur everywhere in the archipelago, but in greatest abundance upon Santa Luzia. They feed, he says, mostly on small fish trapped in pools by the receding tide, while at high tide the herons, which are rather wary, may usually be seen resting on rocks a short distance off shore. Similar situations are chosen for the nests, which are constructed of twigs and drift material, so that they look like jetsam.

Two eggs, according to Correia, ordinarily constitute the full set. A pair from Santa Luzia are pale greenish blue. One is considerably more pointed than its mate, but the measurements are nearly the same, viz., 32.2×44 and 32.6×43.5 mm.

Bubulcus ibis ibis

Ardea Ibis LINNÆUS, 1758, 'Syst. Nat.,' I, p. 144 (Egypt).

Bubulcus lucidus SALVADORI, p. 308.

A resident, recorded from Boa-Vista and São Thiago.

Comatibis eremita

Upupa Eremita LINNÆUS, 1758, 'Syst. Nat.,' I, p. 118 (Switzerland).

Comatibis comata SALVADORI, p. 307.

A rare or casual visitor, recorded from Boa-Vista.

Phœnicopterus antiquorum

Phœnicopterus antiquorum TEMMINCK, 1820, 'M. d'Orn.,' II, p. 587 (Europe); KEULEMANS, p. 372.

Phœnicopterus roseus ALEXANDER, p. 117, etc.; SALVADORI, p. 309.

LOCAL NAME.—*Flamingo*.

A permanent resident, recorded from Sal, Boa-Vista, and Maio.

Bolle states that the breeding grounds of the flamingo on the easterly islands were well known to early Dutch sailors, and that a raid upon one of them is described by Dampier. According to Keulemans, the young are still eaten by the Cape Verdiers, who also sometimes rear them in captivity.

The following quotation is taken from Alexander's account (1898, pp. 110, 111) of his visit to Boa-Vista:

"On May 13th [1897] we made our first attempt to approach the Flamingoes, which frequent a series of brackish pools close to the sea and not far from the village of Estenço Velho. The road thither being anything but good, we made use of our schooner, to get there. Towards the evening we landed and were met by a guide, who undertook to take us to the locality. On the way we happened to look seaward, and there, to our great satisfaction, caught sight of a party of Flamingoes coming towards the brackish pools; not in any wedge-shaped formation, but in a long, even line. They settled in open order, their backs towards the sea, preened their feathers, and then commenced to feed, without changing their position. Our guide mumbled a prayer in his hat; a minute later, however, they saw us, and then a slow march towards a common base, where their leader stood erect, was executed, a manoeuvre soon followed by a general uprising amid goose-like croaks. In the middle distance the white of their plumage disappeared, leaving visible only the rose-coloured bands on their wings, like a long streak of feathery cloud at sunset. Soon their white plumage showed out again as they steered once more towards the sandy coast, where a general settling took place some two miles ahead of us."

Nettion crecca crecca

Anas Crecca LINNÆUS, 1758, 'Syst. Nat.,' I, p. 125 (Sweden).

Nettion crecca SALVADORI, p. 310.

LOCAL NAME.—*Marreca*.

A winter visitor, recorded from Boa-Vista.

Marmaronetta angustirostris

Anas angustirostris MÉNÉTRIÉS, 1832, 'Cat. Rais. Caucase,' p. 58 (Lenkoran).

Marmaronetta angustirostris ALEXANDER, p. 117, etc.; SALVADORI, p. 310.

A resident species, recorded from Boa-Vista.

Nyroca ferina ferina

Anas ferina LINNÆUS, 1758, 'Syst. Nat.,' I, p. 126 (Sweden).

Nyroca ferina SALVADORI, p. 310.

A winter visitor, recorded from São Nicolau.

Nyroca nyroca nyroca

Anas nyroca GÜLDENSTÄDT, 1769, Nov. Comm. Sc. Petropol., XIV, part I, p. 403 (South Russia).

Nyroca africana SALVADORI, p. 310.

A winter visitor, recorded from Boa-Vista.

Neophron percnopterus percnopterus

*Vultur Perenopterus*¹ LINNÆUS, 1758, 'Syst. Nat.,' I, p. 87 (Egypt).

Neophron percnopterus ALEXANDER, p. 114, etc.; SALVADORI, p. 236.

LOCAL NAMES.—*Abutre, passaro branco* (São Vicente), *mignato* (São Thiago), *canhota, Manoel Lobo* (Brava).

A permanent resident, recorded from São Vicente, Santa Luzia, São Nicolau, Boa-Vista, São Thiago, Fogo, Brava, and the Rombos Islets.

At the Cape Verdes the "Pharaoh's chicken" reaches the western limit of its range. Bolle states that this vulture is found throughout the islands, in the valleys of the interior as well as on the coast. It is always in evidence about the settlements of fishermen, and among garbage dumps on the outskirts of towns.

Dohrn records that its numbers vary noticeably with the numbers of live-stock; after long periods of drought and famine the vultures, like the cattle and poultry, become relatively scarce.

An adult male, one of a dozen or more seen, was collected by the writer at Porto Grande, São Vicente, on September 17, 1912.

Alexander (1898, p. 77) writes of this species at São Thiago: "Around the outskirts of the town, numbers of Egyptian Vultures, all adult birds, sat hunched up on the boulders that strew the plain, choosing, however, stones as far apart as possible one from another—as if a quarrel had taken place between them, resulting in a mutual coolness. These birds find plenty of food in Praya. Every morning, as regularly as clockwork, they used to troop over the town on their way to the slaughter-house that lies a little back from the quay, in order to gorge themselves on the offal. Then they would return the same way, but a little slower this time, to their old place of meeting beyond the town, where they remained inert throughout the heat of the day."

Buteo buteo bannermani

Buteo buteo bannermani SWANN, 1919, 'Synopt. List. Accipitres,' p. 44. (Near Mindello Bay, São Vicente, Cape Verde Islands.)

Buteo vulgaris ALEXANDER, p. 115, etc.

LOCAL NAME.—*Milhafre*.

An endemic subspecies, recorded from São Vicente, Boa-Vista and São Thiago.

The type is a female in the British Museum. Swann's description of the race was based upon only a single skin. This buzzard is, however,

¹The original misspelling of the specific name has been generally accepted as a type-setter's error.

not uncommon and is one of the elements of the avifauna which has led Alexander and other observers to remark upon the extraordinary numbers of birds of prey to be found in the archipelago.

Cerchneis tinnuncula neglecta

Falco neglectus SCHLEGEL, 1873, 'Mus. Pays-Bas Rev. Ois. de Proie, Accipitres,' p. 43 (São Vicente, Cape Verde Islands); ALEXANDER, p. 115, etc.
Tinnunculus neglectus SALVADORI, p. 286.

LOCAL NAMES.—*Falcão, francelho, Zabelinha, peleli.*

An endemic subspecies, recorded from Santo Antão, São Vicente, Razo, São Nicolau, Boa-Vista, Maio, São Thiago, and Brava.

This native kestrel is so common and conspicuous that it figures in the island folklore. Dohrn records that the *Zabelinha* ("Little Isabella") was originally a pretty maiden, who was so inordinately fond of dancing that she was transformed into a hawk.

Keulemans states that the kestrel is particularly abundant in the mountains and near towns, that it breeds among rocks in January, and that it feeds upon grasshoppers, butterflies, beetles, mice, and small birds.

Two specimens were collected at Razo by Correia. The measurements are as follows:

	Wing	Tail	Tarsus
♂ ad., May 18, 1922	192	123	42.0 mm.
♀ ad., May 22, 1922	205	131	42.5

Alexander (1898a, p. 278) believed that the "southern islands of the archipelago, especially Santiago and Maio, possess a larger form of this Kestrel," and that typical *neglecta* is confined to the northerly islands.

The following is translated from Correia's field notes.

These small hawks spend most of their time seeking out lizards among the stones. They feed more upon lizards than anything else. They make a nest of dry grasses among crevices of the rocks, and lay three eggs. The natives of São Vicente and São Nicolau call this hawk *passarinho*, the same term of familiarity by which the inhabitants of the southern islands know the kingfisher. On São Thiago it is known as *falcãozinho*, and on Fogo and Brava as *peleli*.

Accipiter melanoleucus

Accipiter melanoleucus SMITH, 1830, South Afr. Quart. Journ., (1), p. 229 (Bavians River, Cape Province); WALLACE, p. 215.

An accidental visitor.

The black sparrow hawk, an Ethiopian form included in Wallace's list of the birds of the Cape Verdes, has not since been recorded from the

islands. The doubts have recently been cleared by Bannerman (1922, *Revue Zoologique Africaine*, X, fasc. 2, p. 173) who states that *Accipiter melanoleucus* is represented in the British Museum by a specimen taken at sea off the Cape Verde Islands. This hawk should, therefore, be considered as only a casual or accidental element of the fauna.

Circus pygargus

Circus Pygargus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 89 (England).

Montagu's Harrier, ALEXANDER, p. 284.

Circus cinerarius SALVADORI, p. 311.

A winter visitor, recorded from Branco.

Milvus migrans migrans

Falco migrans BODDAERT, 1783, 'Tabl. Planch. Entum.,' p. 28 (France).

Milvus regalis KEULEMANS, p. 364; DOHRN, p. 3.

Milvus iclinus WALLACE, p. 215.

Milvus migrans ALEXANDER, p. 115, etc.

Milvus korschum MOSELEY, 1879, 'Notes Nat. "Challenger,"' p. 55.

LOCAL NAME.—*Milhafre*.

A permanent resident, recorded from Santo Antão, São Vicente, Razo, São Nicolau, Boa-Vista, São Thiago, Brava, and the Rombos Islets.

Keulemans found this kite rather scarce in most of the islands, but common on São Nicolau, where it was an injurious bird, feeding largely upon young poultry. The same author states that the kites fly much along the coast, and that they not infrequently catch fish.

Moseley records the following notes, made in the harbor of Porto Praya, São Thiago, on August 7, 1873:

"As the ship came to anchor, a flock of kites (*Milvus korschum*) came wheeling round the stern, just as do gulls ordinarily, and keep swooping down after garbage from the ship. Instead of seizing the morsels with their beaks, like gulls, they did so with their claws, putting out one foot for the purpose as they swooped down, and seizing the food with it with wonderful precision. As they rose they bent down their heads and ate the food at once on the wing from their claws. Some large fish came round the ship, and amongst them some sharks, one of which was seen to seize one of the kites as it put its foot down to the water and carry it down after a short struggle."

Alexander (1898, p. 76) gives a vivid description of a similar scene.

Natives of São Vicente, São Nicolau, and Brava independently told the writer a weird tale about this bird, one which evidently finds con-

siderable credence in the islands. This was to the effect that the kite has a knife-like breastbone which projects beyond the feathers, and that with this weapon it decapitates poultry, leaving the heads on the ground while it carries off the body!

Pandion haliaëtus haliaëtus

Falco Haliaëtus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 91 (Sweden).

Pandion haliaëtus ALEXANDER, p. 115, etc.; SALVADORI, p. 287.

LOCAL NAMES.—*Guincho*, *Manoel Lobo* (São Thiago), *minhoto gaivota*.

A permanent resident recorded from Santo Antão, São Vicente, Branco, Razo, São Nicolau, Sal, Boa-Vista, São Thiago, and Brava.

The osprey reaches at the Cape Verdes the southeastern limit of its Old World breeding range. It apparently occurs on all of the islands, but is particularly common, according to Bolle, on the low, easterly islands of Sal and Boa-Vista, and upon the Desertas. Alexander reports that São Nicolau is also a favorite resort of this bird.

Keulemans states that the ospreys may often be seen soaring in groups of from three to six, that they feed upon mice (!) as well as fish, and that their breeding season extends from January to April. The same author says that many of the inhabitants call this hawk "gaivota," the Portuguese word for gull.

An adult male, with a white head, was collected by Correia at Brava on July 3, 1922. His field notes state:

The *guincho*, as it is called by the Cape Verders, rarely leaves the seashore. When it wishes to rest, it alights on any jutting rock, or on the ground, but never far from the beach. It is a difficult bird to approach. During its smooth, slow flight it seems to stop from time to time as though it were observing fish below. Unlike any sea bird, it picks the meat from the fish which it captures, never swallowing any of the bones. It spends the night on highlands near the coast, making its nest on the ground in similar inaccessible places. Some of the nests which I found during May contained but one egg. The *guincho's* iris is yellow and its feet are blue.

Numida galeata galeata

Numida galeata PALLAS, 1767, 'Epic. Zool.,' I, fasc. 4, pp. 13-15 (no locality).

Numida meleagris KEULEMANS, p. 371; DOHRN, p. 7; WALLACE, p. 215; ALEXANDER, p. 116, etc.; SALVADORI, p. 298.

LOCAL NAME.—*Gallinha do matto*.

An introduced bird, recorded from Santo Antão, São Vicente, São Nicolau, São Thiago, Brava, and Fogo.

Pallas applied the name *galeata* to the domesticated Guinea fowl of Europe. As the type locality of the wild form has apparently never been

fixed, I would suggest Bathurst, at the mouth of the River Gambia, where specimens have been collected by Moloney.

Bolle speaks of large numbers of Guinea fowls inhabiting the heights of Santo Antão. Keulemans found them common on the precipitous hillsides of all the inhabited islands, especially in inaccessible localities. In São Thiago, he states, they are more abundant than elsewhere, occurring in the lowlands as well as the hills. Keulemans further reports that these birds breed in October and later, and that they are extremely wary. They rarely fly, but when suspicious of danger they run rapidly to a place of concealment, from which they can be flushed with difficulty.

The following is quoted from Moseley ('Notes Nat. 'Challenger,' 1879, p. 57), and refers to the Guinea fowl of São Thiago.

"We met with several flocks of wild galinis, which are abundant on the island, but are very difficult to approach. The birds inhabit the slopes of the gorges which are covered with a thick growth of oil trees (*Jatropha curcas*) which have very much the habit and general appearance of castor-oil plants. The flocks of galinis station sentries to keep a look-out from some rocky eminence, and these, when once they have discovered an enemy, never lose sight of him, but carefully watch the stalking operations of a sportsman and give warning as soon as he gets too near to their comrades and is just expecting to get a shot."

Coturnix coturnix coturnix

Tetrao Coturnix LINNÆUS, 1758, 'Syst. Nat.,' I, p. 161 (Sweden).

Coturnix communis ALEXANDER, p. 88, etc.; CASSIN, 1858, 'U. S. Expl. Exp.,' VIII, p. 288.

LOCAL NAME.—*Codorniz*.

A migrant visitor, recorded from São Vicente, Boa-Vista, São Thiago, and Brava.

Although Hartert ('Vögel paläarkt. Fauna,' III, p. 1942) states that the endemic race of *Coturnix coturnix* is the only quail of the Cape Verde Islands, there can be little doubt that the numbers of the resident birds are swelled at certain seasons by bands of the European migratory quails on their autumn flight. Bolle reports that the islands are a favorite stopping place for migrant quails, and Moseley ('Notes Nat. 'Challenger,' 1879, p. 54) writes: "At the periods of migration, quails are extremely abundant on the island [São Vicente], as at St. Jago, and often afford good sport to naval officers; they are, however, mere birds of passage here, and there were none at the time of our visit." (August 5.)

Alexander (1898, p. 88) writes as follows:

"We rarely met with the red-throated resident form of Quail, *C. capensis*, and the only specimen of it obtained could not be preserved. We often found migrants of the Common Quail, and always in exactly the same spots. We killed more than a dozen of these, and all were females, from which we are inclined to think that the sexes of this species on migration keep apart. Quails are not so numerous as they used to be. The Governor-General, who is a keen sportsman, told me that four years ago it was not an unusual thing to go out and get thirty brace in a day. The present scarcity is no doubt due to the lack of food, consequent on there having been no rain for the last three years."

Coturnix coturnix inopinata

Coturnix coturnix inopinata HARTERT, 1917, 'Nov. Zool.,' p. 422 (Cape Verde Islands).

Coturnix communis KEULEMANS, p. 370; SALVADORI, p. 298.

Coturnix capensis ALEXANDER, p. 116, etc.

LOCAL NAME.—*Codorniz*.

An endemic subspecies, recorded from Santo Antão, São Vicente, São Nicolau, Boa-Vista, São Thiago, Fogo, and Brava.

Keulemans states that the native quail is particularly abundant upon São Nicolau, and that its breeding season commences in October.

In W. Winwood Reade's 'Savage Africa,' 1864, p. 303, is an account of a quail hunt on São Nicolau, included within a chapter of interesting information about the Cape Verde Islands.

Gallinula chloropus chloropus

Fulica Chloropus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 152 (England).

Gallinula chloropus SALVADORI, p. 301.

LOCAL NAME.—*Galeirão*.

A winter visitor, recorded from Boa-Vista.

Bolle found these birds in numbers during December, 1852, in lagoons of Boa-Vista, where Fea later collected specimens.

Arenaria interpres interpres

Tringa Interpres LINNÆUS, 1758, 'Syst. Nat.,' p. 148 (Gothland, Sweden).

Arenaria interpres SALVADORI, p. 299.

Streptilas interpres ALEXANDER, p. 118, etc.

LOCAL NAME.—*Maçarico*.

A winter visitor, recorded from Santa Luzia, São Nicolau, Razo, Boa-Vista, and the Rombos Islets.

A female was obtained by Correia at Santa Luzia on May 28, 1922.

Charadrius alexandrinus alexandrinus

Charadrius alexandrinus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 150 (Egypt).
Ægialitis cantiana ALEXANDER, p. 116, etc.; SALVADORI, p. 299.

LOCAL NAME.—*Tarambola*.

A permanent resident, recorded from São Vicente, Sal, Boa-Vista, and São Thiago.

Squatarola squatarola squatarola

Tringa Squatarola LINNÆUS, 1758, 'Syst. Nat.,' I, p. 149 (Sweden).
Squatarola helvetica ALEXANDER, p. 118, etc.

LOCAL NAME.—*Morinello*.

A migrant visitor, recorded from Boa-Vista.

Recurvirostra avosetta

Recurvirostra Avosetta LINNÆUS, 1758, 'Syst. Nat.,' I, p. 151 (Oeland).
Recurvirostra avocetta ALEXANDER, p. 285.

A migrant visitor, recorded from Maio.

Limosa limosa limosa

Scolopax Limosa LINNÆUS, 1758, 'Syst. Nat.,' I, p. 147 (Sweden).
Black-tailed Godwit, ALEXANDER, p. 285.
Limosa belgica SALVADORI, p. 311.

A migrant visitor, recorded from Boa-Vista.

Totanus totanus totanus

Scolopax Totanus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 145 (Sweden).
Totanus calidris SALVADORI, p. 300.

A migrant visitor, recorded from Boa-Vista.

Totanus nebularius

Scolopax nebularia GUNNERUS, 1767, in Leem, 'Beskr. Finm. Lapp.,' p. 251 (Norway).
Totanus glottis ALEXANDER, p. 118, etc.; SALVADORI, p. 300.

A migrant visitor, recorded from Boa-Vista and São Thiago.

Rhyacophilus glareola

Tringa Glareola LINNÆUS, 1758, 'Syst. Nat.,' I, p. 149 (Sweden).
Totanus glareola SALVADORI, p. 300.

A migrant visitor, recorded from Boa-Vista.

Actitis hypoleucos

Tringa Hypoleucos LINNÆUS, 1758, 'Syst. Nat.,' I, p. 149 (Sweden).
Tringoides hypoleucos ALEXANDER, p. 118, etc.; SALVADORI, p. 300.

A migrant visitor, recorded from São Thiago and Brava.

Canutus canutus canutus

Tringa Canutus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 149 (Sweden).

Tringa canutus ALEXANDER, p. 285.

A migrant visitor, recorded from Maio.

Pelidna alpina alpina

Tringa alpina LINNÆUS, 1758, 'Syst. Nat.,' I, p. 149 (Lapland).

Dunlin, ALEXANDER, p. 285.

Pelidna alpina SALVADORI, p. 311.

A migrant visitor, recorded from Boa-Vista.

Erolia ferruginea

Tringa Ferruginea BRÜNNICH, 1764, 'Orn. Bor.,' p. 53 (Iceland and Christiansoë).

Ancylocheilus subarquatus SALVADORI, p. 300.

A migrant visitor, recorded from Boa-Vista and Maio.

Crocethia alba

Tryngra alba PALLAS, 1766, 'Vroeg's Cat.' (Adumbratiuncula), p. 7 (Coast of North Sea).

Calidris arenaria ALEXANDER, p. 118, etc.; SALVADORI, p. 300.

A migrant visitor, recorded from São Vicente, Sal, and Boa-Vista.

Numenius arquatus arquatus

Scolopax Arquata LINNÆUS, 1758, 'Syst. Nat.,' I, p. 145 (Sweden).

Numenius arquatus ALEXANDER, p. 118, etc.

LOCAL NAME.—*Maçarico real*.

A migrant visitor, recorded from Sal, Boa-Vista, Maio, and São Thiago.

Numenius phæopus phæopus

Scolopax Phæopus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 146 (Sweden).

Numenius phæopus ALEXANDER, p. 118, etc.; SALVADORI, p. 299.

LOCAL NAME.—*Maçarico real*.

A migrant visitor, recorded from Santo Antão, São Vicente, Santa Luzia, Razo, São Nicolau, Sal, Boa-Vista, and São Thiago.

Adult females were collected by the writer at São Vicente on September 16, 1912, and by Correia at Razo on May 16, 1922.

Glareola pratincola pratincola

Hirundo Pratincola LINNÆUS, 1766, 'Syst. Nat.,' I, p. 345 (Austria).

Glareola pratincola SALVADORI, p. 299.

A migrant visitor, recorded from São Thiago.

Cursorius cursor exsul

Cursorius gallicus exsul HARTERT, 1920, 'Vög. paläarkt. Fauna,' II, p. 1526 (Cape Verde Islands).

Cursorius gallicus ALEXANDER, p. 115, etc.

LOCAL NAME.—*Corredeira*.

An endemic subspecies, recorded from São Vicente, Santa Luzia, Razo, Sal, Boa-Vista, and São Thiago.

Eight specimens were obtained by Correia at Razo and São Vicente during May 1922. The series, which includes nestlings, shows that as the down is molted the chicks acquire a plumage substantially like that of the adult, but lacking the gray pileum. The first plumage of the chest and the entire upper surface, moreover, is marked with dark, wavy, subterminal bars, which are subsequently lost through abrasion. The primary quills of the young are black like those of the adult.

The following is translated from Correia's field notes:

I saw these birds mostly on São Vicente, on the plain which lies south of the city and stretches toward São Pedro. This sandy region is more or less covered with leafless stalks of dead vegetation, and here small bands of *corredeiras* could be seen flying about or running very rapidly, though for only short distances. The native people say that they nest in sandy places where there is more or less grass, and that sometimes as many as ten eggs have been found in one nest.

Rissa tridactyla tridactyla

Larus tridactylus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 136 (Great Britain).

Rissa tridactyla ALEXANDER, p. 118, etc.

LOCAL NAME.—*Gaivota*.

A winter visitor, recorded from Brava.

Larus fuscus atlantis

Larus fuscus atlantis DWIGHT, 1922, Amer. Mus. Novit., No. 44, p. 1 (Fayal, Azores). Lesser black-backed Gull, ALEXANDER, p. 284.

LOCAL NAME.—*Gaivota*.

A winter visitor, recorded from Boa-Vista.

Dr. Jonathan Dwight has identified at the British Museum an adult specimen of this gull collected at the Cape Verdes in June 1901.

It is not likely that this Atlantic Island race breeds at the Cape Verde Islands, but it doubtless makes at least a partial migration from the more northerly groups.

***Columba livia* subsp. (?)**

Columba livia ALEXANDER, p. 116, etc.; SALVADORI, p. 297.

LOCAL NAMES.—*Pomba da rocha*, *pomba brava*.

An introduced species, recorded from São Nicolau and São Thiago.

Rock pigeons were living wild along the cliffs at São Thiago as early as the date of Bolle's paper (1856). Moseley also refers to their abundance in the cultivated fields of the main valley of this island.

Cuculus canorus subsp. (?)

Cuculus canorus SALVADORI, p. 297.

A winter visitor, recorded from Brava.

In default of specimens, it is impossible to determine whether the cuckoo recorded by Salvadori is of the typical north European race or the Spanish form, *C. c. bangsi* Oberholser (*C. c. minor* A. E. Brehm), which has been taken at Tenerife and Madeira.

Eurystomus afer afer

Coracias afra LATHAM, 1790, 'Ind. Orn.,' p. 172 (Africa).

Eurystomus afer ALEXANDER, p. 285.

A casual visitor, recorded from Maio.

Halcyon leucocephala acteon

Dacelo acteon LESSON, 1831, 'Traité d'Orn.,' p. 247 (Cape Verde Islands).

Dacelo rufiventris KEULEMANS, p. 366.

Halcyon rufiventris DOHRN, p. 4.

Halcyon erythrorhyncha WALLACE, p. 215.

Halcyon erythrogaster ALEXANDER, p. 116, etc.

LOCAL NAME.—*Passarinha*.

An endemic subspecies, recorded from São Thiago, Fogo, and Brava.

The kingfisher is confined to the southerly islands where, according to all observers, it is a great favorite with the inhabitants, notwithstanding a legend, recorded by Keulemans, that it "picks out the eyes of young chickens." Perhaps in consequence of the favor it has found, it is one of the tamest of Cape Verde species.

The breeding season, according to Keulemans and Dohrn, commences in December, the birds nesting in hollows among the exposed roots of trees. The kingfisher's food comprises grasshoppers, butterflies, lizards, and even mice. It has the habit of using the same perch for long periods, darting forth like a flycatcher in pursuit of its prey and then returning. This trait was noted also by Alexander, who has given a charming account of the species (1898, pp. 87, 88).

Keulemans writes that the young are slow to acquire their full growth, even after they fly, and that the adult birds are long distinguishable by their larger size and richly-colored bills. He states further that the flight note is a loud, laughing cry, similar to that of the native kestrel

(*Cerchneis*). Moseley describes its call as "a terribly harsh laughing cry, a feeble imitation of that of its congener of Australia, the laughing jackass."

Male and female adults were collected by Correia at Brava on June 14, 1922. The collector's field notes report:

This, the prettiest bird which I saw in the Cape Verdes, is protected by the sentiment of the inhabitants because of its beauty and inoffensiveness. The kingfishers are usually seen alone; in fact, I have no recollection of finding even two in the open together. They nest always in low places, such as holes in stone walls or the spaces among piles of earth and small stones. The nest itself is a ball of dry grass or similar material, completely filling the occupied cavity. They lay two eggs, but rarely hatch out more than one chick. The people of Brava believe that the kingfishers live only one year. They declare, moreover, that these birds are so weak and timid that the report of a gun close by is enough to cause them to fall to earth.

This kingfisher is a large-billed, island form of *Halcyon leucocephala*, which is found throughout the savanna regions of Africa and southern Arabia. Compared with specimens of the typical race collected by Dr. J. P. Chapin in the Uelle district of the northern Congo, the hue of the wings, rump and tail of the Cape Verde birds is of a distinctly deeper, less greenish blue. At the same time the color, particularly of the rump, is not nearly so dark and violaceous as in *H. l. swainsoni*, of which we have skins from the Kasai district of the southern Congo. The latter subspecies has, moreover, only cinnamon-rufous flanks and abdomen.

The ranges of these two mainland races, *leucocephala* and *swainsoni*, are separated by the equatorial forest. In East Africa, even the equatorial districts are occupied by the species, because of the lack of heavy forest, and the birds found there, which are referred to the races *hyacinthina* and *centralis*, combine the deep chestnut belly of *H. l. leucocephala* with a somewhat deeper blue on wings, rump, and tail.

Most recent authors have followed Claude Grant's revision of these kingfishers (Ibis, 1915, pp. 265-267), but Dr. Chapin considers the form *H. l. ogilviei* as synonymous with *hyacinthina*.

		LENGTH OF CULMEN	DEPTH OF BILL AT BASE	WIDTH OF MAXILLA AT BASE
<i>Halcyon leucocephala leucocephala</i>	♂	44.0	11.0	16.0 mm.
" "	♀	45.0	11.2	17.0
" "	♂	43.0	13.0	17.0
" "	♀	45.5	13.0	17.8
" "	♂	42.0	10.5	15.0
" "	♀	40.0	11.0	16.5

Tyto alba detorta

Tyto alba detorta HARTERT, 1912, Bull. Brit. Orn. Club, XXXI, p. 38 (São Thiago, Cape Verde Islands).

Strix insularis ALEXANDER, p. 115, etc.; SALVADORI, p. 288.

LOCAL NAME.—*Coruja*.

An endemic subspecies, recorded from São Vicente, Razo, São Nicolau, São Thiago, and Brava.

Hartert has shown that Pelzeln's name *insularis*, previously used for this form, is applicable to the barn owl of St. Vincent, West Indies, rather than São Vicente of the Cape Verdes.

According to Keulemans, the barn owl breeds in November among crevices of the rocks.

Correia collected an adult female at Brava on July 5, 1922. His notes state:

The *coruja* conceals itself in cavities of the rocks until sunset. As the bird feeds largely upon rats, it is a favorite with the people of the islands, notwithstanding certain bad omens connected with its calling from the housetops on moonless nights. The *coruja* lays three eggs, always in some more or less dimly lighted place of concealment.

• **Micropus apus apus**

Hirundo Apus LINNÆUS, 1758, 'Syst. Nat.,' I, p. 192 (Sweden).

Cypselus apus SALVADORI, p. 296.

A winter visitor, recorded from Fogo.

It is by no means impossible that *Micropus murinus brehmorum* also occurs at the Cape Verde Islands, or that specimens of this Madeiran form have been wrongly identified with *Micropus apus*.

Micropus unicolor unicolor

Cypselus unicolor JARDINE, 1830, Edinb. Journ. Nat. and Geogr. Sc., I, p. 242, Pl. VI (Madeira). ALEXANDER, p. 116, etc. (part).

A winter visitor, recorded from Brava and São Thiago.

This swift is the breeding form of Madeira and the Canary Islands, which winters in the Cape Verdes.

Micropus unicolor alexandri

Apus unicolor alexandri HARTERT, 1901, Nov. Zool., VIII, p. 328 (São Nicolau, Cape Verde Islands).

Cypselus unicolor ALEXANDER, p. 116, etc. (part).

An endemic subspecies, recorded from São Nicolau, São Thiago, and Brava.

Bolle, as long ago as 1856, noted the presence of *Cypselus unicolor* on São Nicolau. Alexander found this swift breeding in crevices of the rock on Brava.

Alæmon alaudipes alaudipes

Upupa alaudipes DESFONTAINES, 1787, Mém. de l'Acad., p. 504 (Gafsa and Tozer, Tunis).

Certhilauda desertorum WALLACE, p. 215.

Alæmon alaudipes ALEXANDER, p. 116, etc.; SALVADORI, p. 294.

Certhilauda alaudipes SHELLEY, 1902, 'Birds Africa,' III, p. 19.

LOCAL NAME.—*Cotovia*.

A permanent resident, recorded from Boa-Vista.

The possibility that the Cape Verde birds represent an endemic subspecies should be investigated.

Ammomanes phœnicura cinctura

Melanocorypha cinctura GOULD, 1841, 'Zool. Voy. 'Beagle,' III, Birds, p. 87 (São Thiago, Cape Verde Islands).

Alauda elegans, KEULEMANS, p. 369.

Alauda cinctura, DOHRN, p. 5.

Ammomanes cinctura, WALLACE, p. 215; ALEXANDER, p. 116, etc.; SALVADORI, p. 294.

LOCAL NAMES.—*Pastor*, *calhandra*.

An endemic subspecies, recorded from Sal, Boa-Vista, and São Thiago.

Keulemans and Dohrn report that this lark is common on São Thiago, where it forages for insects and seeds in little bands on the dry plains, often in company with *Pyrrhulauda nigriceps*. It is usually to be found in the neighborhood of grazing goats, which accounts for the name *pastor* (shepherd). It sings in flight, but does not rise as high as the European skylark. Its song, moreover, is shorter and feebler than that of its gifted relative.

Spizocorys razæ

Spizocorys razæ ALEXANDER, 1898, Ibis, p. 107, Pl. III (Razo, Cape Verde Islands).

Callandrella razæ SHELLEY, 1902, 'Birds Africa,' III, p. 137.

An endemic species, known only from Razo.

Pyrrhulauda nigriceps

Pyrrhulauda nigriceps GOULD, 1841, 'Voy. 'Beagle,' Birds,' p. 87 (Cape Verde Islands).

Pyrrhulauda crucigera KEULEMANS, p. 369.

Pyrrhulauda nigriceps ALEXANDER, p. 116, etc.; SALVADORI, p. 295; SHELLEY, 1902, Birds Africa, III, p. 81, Pl. xx.

LOCAL NAMES.—*Primo Philippe, pastor.*

A permanent resident, recorded from Santo Antão, Boa-Vista, and São Thiago.

Keulemans found these larks common on dry plains in São Thiago, usually in company with *Ammomanes*. He states that *Pyrrhulaua* does not fly high, but that it often covers long distances at a height of from ten to twenty feet, singing as it goes.

Alexander reports this lark to be more numerous on Boa-Vista than on any other island.

Sylvia atricapilla atricapilla

Motacilla Atricapilla LINNÆUS, 1758, 'Syst. Nat.,' I, p. 187 (Sweden).

Sylvia atricapilla gularis ALEXANDER, p. 81.

Sylvia atricapilla SALVADORI, p. 289.

LOCAL NAMES.—*Toutinegra, pardal rouxinol.*

A permanent resident, recorded from Santo Antão, São Vicente, São Nicolau, São Thiago, and Brava.

Bolle notes that the blackcaps are especially common on plantations, and wherever trees are cultivated. Keulemans found them most abundant on Santo Antão and São Nicolau. On the former island he discovered a nest with eggs in January, six feet from the ground in an orange tree and constructed of moss, wisps of grass, and banana fibers.

On São Nicolau, in February, Keulemans noted that all the blackcaps had their faces and throats stained yellow or orange with pollen from the aloes blossoms. The same phenomenon later misled Alexander into describing the resident Cape Verde Island blackcap as a new and highly colored subspecies!

Sylvia conspicillata bella

Sylvia conspicillata bella TSCHUSI, 1901, 'Orn. Monatsber.,' p. 130 (Madeira and the Canary Islands).

Sylvia conspicillata ALEXANDER, p. 115; SALVADORI, p. 289.

LOCAL NAME.—*Pardal d'algodoeiro.*

A permanent resident, recorded from Santo Antão, São Vicente, São Nicolau, Boa-Vista, São Thiago, Fogo, and Brava.

Keulemans reports that this species is especially common on Santo Antão and São Nicolau, and that it occurs from sea level to mountain top. He says that outside the breeding season the birds form small flocks which keep to the thickets of acacia or other vegetation. They breed in October and November, and Keulemans found a nest with five eggs in a low bush. The male sings much in flight.

A pair, apparently ready to breed, was taken by the writer in a tamarind grove near Porto Grande, São Vicente, on September 17, 1912.

Calamocichla brevipennis

Calamodyta brevipennis KEULEMANS, 1866, *Nederland. Tijdschr. Dierk.*, III, p. 368 (São Nicolau, Cape Verde Islands).

Calamorherpe brevipennis DOHRN, p. 4; WALLACE, p. 215.

Calamocichla brevipennis SALVADORI, p. 290.

LOCAL NAME.—*Pardal de Barbaria*.

An endemic species, recorded from São Nicolau, São Thiago, and Brava.

The description of this species has heretofore been credited to Dohrn, but Keulemans' designation has priority and satisfies all the technical requirements of nomenclature.

Keulemans and Dohrn found this reed warbler common on São Thiago and São Nicolau, but entirely lacking on Santo Antão and São Vicente. They state that the birds lived in the mountains, far from water, and also on sugar plantations, where they could be seen climbing the stalks of cane. They reminded the observers of the European reed warbler (*Acrocephalus arundinaceus*), except for their larger size and the fact that the song is entirely different. The voice of the male is so powerful that Keulemans, upon first hearing it, looked for a much larger bird.

An excellent account of this species is given by Alexander (1898, pp. 82, 83).

Saxicola oenanthe oenanthe

Motacilla Oenanthe LINNÆUS, 1758, 'Syst. Nat.,' I, p. 186 (Sweden).

Saxicola oenanthe ALEXANDER, p. 285.

A migrant visitor, recorded from Maio.

Hirundo rustica rustica

Hirundo rustica LINNÆUS, 1758, 'Syst. Nat.,' I, p. 191 (Sweden); ALEXANDER, p. 118.

LOCAL NAME.—*Andorinha*.

A migrant visitor, recorded from Santo Antão, São Vicente, Razo, and São Nicolau.

A young male came aboard the brig 'Daisy' on September 15, 1912, off Santo Antão. A second specimen, an adult male, was collected from a mixed flock of migrant swallows at São Vicente on September 17, and Correia obtained an adult female at Razo on May 18, 1922.

Delichon urbica urbica

Hirundo urbica LINNÆUS, 1758, 'Syst. Nat.,' I, p. 192 (Sweden).

Chelidon urbica ALEXANDER, p. 311.

LOCAL NAME.—*Andorinha*.

A migrant visitor, recorded from São Nicolau and Brava.

Riparia riparia riparia

Hirundo riparia LINNÆUS, 1758, 'Syst. Nat.,' I, p. 192 (Sweden).

A migrant visitor, here recorded from São Vicente, where an immature male was collected by the writer on September 17, 1912.

Corvus ruficollis ruficollis

Corvus ruficollis LESSON, 1831, 'Traité d'Orn.,' p. 329 (Cape Verde Islands).

Corvus corone KEULEMANS, p. 365; DOHRN, p. 5; WALLACE, p. 215.

Corvus umbrinus ALEXANDER, p. 115, etc.; SALVADORI, p. 288.

LOCAL NAME.—*Corvo*.

An endemic subspecies, recorded from Santo Antão, São Vicente, Razo, São Nicolau, Boa-Vista, São Thiago, Fogo, and Brava.

The raven may always be found about refuse dumps in company with the white vulture.

Keulemans states that those which he saw on Santo Antão had pronounced albinistic tendencies. Of three specimens obtained by Alexander on São Thiago, one was of "a pied variety." The same author found a nest ready for eggs on February 25.

Adults were collected at São Vicente by the writer and by Correia. The measurements follow:

	BILL	WING	TAIL	TARSUS	MIDDLE TOE AND CLAW
♂ September 17, 1912	63.0	352	181	66	53 mm.
♀ May 9, 1922	60.5	350	177	63	46

The September specimen is in fresh plumage, and the head is only slightly less black and glossy than the back. In the May bird, on the other hand, the head, neck, and upper breast are entirely cinnamon-brown, while the body is mottled with rich purplish and greenish feathers which are replacing the old and worn plumage.

The following is translated from Correia's field notes.

The raven is a repugnant and extravagant bird, seeking always places of filth where it may find something rotten to eat. Great numbers of them live in the archipelago, most of all in the island of São Vicente. The inhabitants regard them with disgust, and hold it to be bad luck when a raven crosses one's path. Because they are ignored rather than persecuted, the birds are altogether fearless, often con-

tinuing to sit in quiet melancholy while a traveler passes within three or four feet of them. Some of the inhabitants of São Vicente use them as food, especially during famine years, but only when the birds are nestlings. The ravens breed among the higher rocks, a few wisps of grass forming the nest. They lay either one or two bluish eggs.

Alexander (1898, p. 81) writes of the ravens of São Thiago:

"Locusts form the chief food of these birds, and they hunt for them in a most systematic manner. On several occasions I had the opportunity of watching them on the war-path. A party gets together and straightway sets about circumventing a portion of ground that is likely to hold locusts. Then a certain number spread themselves out like the cordon system of outposts, while the remainder, with quick strides, beat up the ground towards the locusts, which jump forward—the majority becoming the prey of the birds drawn up in line, who, carrying out the principle of "share and share alike," act in their turn as the skirmishers of the next beat."

***Estrilda astrild* subsp. (?)**

Estrilda cinerea DOHRN, p. 7; WALLACE, p. 215.

Estrilda jagoensis ALEXANDER, p. 85.

Estrilda astrild SALVADORI, p. 293.

LOCAL NAMES.—*Bocca vermelha*, *gingerotte*.

An introduced bird, recorded from São Vicente, São Thiago, and Brava.

This weaver has long been acclimated at the Cape Verdes, as at St. Helena. Dohrn relates the escape at São Vicente, in March, 1865, of hundreds of captive weavers from a French bird dealer.

Estrilda astrild is now a familiar bird on the sugar plantations. It nests in November and later among the stalks of reeds or in low shrubs.

Passer jagoensis

Pyrgita jagoensis GOULD, 1837, Proc. Zool. Soc., p. 77 (São Thiago, Cape Verde Islands).

Passer erythrophrys KEULEMANS, p. 370.

Passer brancoensis OUSTALET, 1883, Ann. Sci. Nat. Zool., (6) XVI, p. 2.

Passer jagoensis ALEXANDER, p. 115, etc.; SALVADORI, p. 292.

LOCAL NAMES.—*Pardal*, *pardal de terra*.

An endemic species, recorded from Santo Antão, São Vicente, Branco, Razo, São Nicolau, Boa-Vista, São Thiago, Brava, and the Rombos Islets.

Keulemans and Dohrn state that this abundant bird breeds between November and March, making its nest either in chinks of stone walls or

in low trees such as olives. In the latter case the nests are spherical, with a lateral opening. The eggs resemble those of the house sparrow (*Passer domesticus*).

Numerous specimens were collected by both the writer and Correia. Adults taken in a copse of tamarinds near Porto Grande, São Vicente, on September 17, 1912, had enlarged gonads and seemed ready to breed, although they were still molting.

Specimens from Brava, taken in June 1922, are larger than the São Vicente birds, with longer and heavier bills, a richer chestnut on the scapulars and coverts, and a more pronounced buffy wash on the breast. The color differences may be seasonal, but it is not at all unlikely that these sparrows show true geographical variation from island to island, and that Oustalet's name may be applicable to the birds of the windward members of the archipelago.

Correia's field notes state that the sparrows sometimes cause much damage by eating young leaves as well as grain. They record also that the birds nest on the ground when trees are not available, laying three or four eggs in a structure made of cotton, hair, and dry grass.

Passer hispaniolensis hispaniolensis

Fringilla hispaniolensis TEMMINCK, 1820, 'Man. d'Oÿn.', p. 353 (Gibraltar).

Passer salicarius KEULEMANS, p. 370; DOHRN, p. 6; WALLACE, p. 215.

Passer salicicola ALEXANDER, p. 115, etc.; SALVADORI, p. 291.

LOCAL NAMES.—*Pardal*, *pardal de Barbaria*.

A permanent resident, recorded from São Nicolau, Boa-Vista, São Thiago, Fogo, and Brava.

Dohrn states that the Spanish sparrow is absent from Santo Antão and São Vicente. On the southerly islands it is not rare. Keulemans writes that it begins to breed in September, making its nest usually in stone walls.