Article XVI.—NOTES ON BIRDS AND MAMMALS OBSERVED NEAR TRINIDAD, CUBA, WITH REMARKS ON THE ORIGIN OF WEST INDIAN BIRD-LIFE.

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INTRODUCTORY.

Trinidad is situated on the southern coast of Cuba, about 400 miles from the eastern, and 350 from the western extremity of the island. The shore at this point is formed of recent coral limestone. Three miles inland this has been upheaved, and appears as a line of hills parallel to the coast, about thirty miles in length and reaching an altitude of 900 feet.

From the summits of this coast-range one looks north across the noble valley of Trinidad. This valley is three miles in width and about thirty in length. Its southern boundary is formed by the low range just mentioned, while its northern side is defined by the foot hills of the San Juan Mountains. It is celebrated for its fertility, and is, or has been, almost entirely devoted to sugar-cane plantations. The San Juan Mountains are largely formed of a palæozoic limestone. They are irregular and picturesque in outline and seamed by narrow valleys, down which dash clear mountain streams on their way to the sea. Their average height is from 2500 to 3000 feet, and one peak, Portrerillo, reaches an altitude of 4000 feet.

The region about Trinidad, then, may be divided into three quite different districts: first, the coast, including the southern slope of the coral limestone hills; second, the Trinidad Valley; third, the San Juan Mountains. During the month and a half (March 1–April 14, 1892) in which I collected in this region I visited localities in each of the districts mentioned, and a description of them will serve also for the districts in which they are included. They may be considered in natural, or what proved to be the reverse, order in which they were visited.

Casilda (April 10–14).—Casilda is the port of Trinidad. The harbor is formed by a crescentic-shaped sand-bar which reaches out from the shore and partly encloses a basin about two miles in diameter. On the sea side there is a hard, fine beach; on the bay side there are extensive mangrove swamps and large grassy marshes. The place seemed admirably adapted to support an aquatic avifauna, which nevertheless was largely wanting. Brown Pelicans and Cormorants were not uncommon, and Clapper Rails were apparently numerous in the mangroves. Beyond these I did not observe ten individuals of any species of water bird. The distance from the coast to the summit of the coast hills, near which is situated the city of Trinidad, is between three and four miles. The growth here is scattered, low and scrubby, the absence of royal palms being especially noticeable. Birds are comparatively rare.

Guanayara (April 5–9).—Guanayara is at the base of the mountains, eight miles west of Trinidad. There is no beach here, and the sea breaks on a solid wall of conglomerate coral limestone. At a distance of about one mile from the shore this formation meets the palæozoic rocks of the mountains. The line of connection is clearly marked by the royal palms which grow at the extreme edge of the older formation, but, as on the coast-range at Trinidad, this tree was not found in the recent coral limestone. My collecting here was largely limited to the newer land which flanks the mountains. On this tract the growth presents every gradation from the recently established running vines and hardy *Borricha*, growing within ten feet of the sea, to woods resembling second-growth with dense thickets underneath. Birds of certain species were abundant, but there were wanting a number of species found at both San Juan and San Pablo.

San Pablo (March 15–30).—San Pablo is in the Trinidad Valley, fifteen miles east of Trinidad. The valley is largely devoted to raising sugar and tobacco, but there are great tracts of fallow land given up to grazing and resembling northern pastures, and, where the cattle are not numerous, they are covered with a growth of guava bushes. At this point the valley is traversed by the Agabama River, in the winter a shallow stream

about fifty feet in width and with treeless banks. San Pablo is on the northern side of the valley, near the foothills of the San Juan chain. These low hills and their intervening valleys are generally well wooded, and in the latter are small streams bordered by a more or less dense tropical growth. Localities of this nature furnished the best collecting ground. Indeed the great diversity of ground at San Pablo gave rise to a richer avifauna than I found at any other place. In the 'old fields' of the valley were Meadowlarks and Yellow-winged Sparrows; on the Agabama were Jaçanas and Gallinules, and in the guavas and wooded hills and valleys were found all the species of woodland birds which I observed in Cuba.

San Juan de Letran (March 1–13).—The valley of San Juan is eight miles north of Trinidad at an altitude of 2000 feet in the San Juan Mountains. It is one of many small valleys, averaging a quarter of a mile in width, enclosed by the mountain tops, which at this point were about four hundred feet above the level of the valley. The summits and sides of the mountains were here covered by a dense growth of high, wiry grass, and numerous but scattered small palmettoes, and a species of agave bearing a yellow flower which was abundant at the time of my visit. As a rule each valley is watered by a clear mountain stream, and when the ground is not under cultivation by the mountaineers, it supports a fairly dense vegetation. Royal palms, averaging about sixty feet in height, are here, as elsewhere, the most abundant and characteristic trees.

San Juan was the realization of a naturalist's dream of the tropics. With the kindly hospitality, which I everywhere encountered, a resident mountaineer placed an unoccupied thatched cabin at my disposal, and having a young native to cook for me, I was thus most favorably situated for collecting. The nature of the country, too, was such as to focus the birds within comparatively narrow limits, and for this reason they were exceedingly abundant. In or near the clearing about my house grew royal and cocoa palms, mangoes, bananas, oranges, lemons, guavas and coffee, and from my door I saw, with few exceptions, all the species of birds I observed in the mountains. Altitude here has apparently no influence on the distribution of birds.

The absence at San Juan of certain species found at San Pablo was evidently due to purely local conditions; as for example, the lack of large fields suitable for Meadowlarks, or of a body of water suitable for the habitation of Jaçanas.

During my stay at or near Trinidad I was everywhere so hospitably received I have difficulty in fitly expressing my thanks. Mr. B. W. Morrill, Sres. Eduardo Caret and Manuel Fernandez, Sarjento Prats of the Guardia Civil, and Captain White of the American Schooner 'City of Philadelphia,' all rendered me invaluable assistance, which I desire to gratefully acknowledge; and I would especially thank Mr. Daniel Quayle, the American Consular Agent at Trinidad, whose home and services were always freely offered me.

I.—Notes on Cuban Birds.

General Impressions of Cuban Bird-life.—One familiar with the bird-life of only the middle Atlantic States of America would, I think, return from a morning in the woods of San Juan or San Pablo with three prominent impressions of Cuban birds; first, their abundance; second, their comparative tameness; third, their lack of song power. Probably the second characteristic contributes to the force of the first. Of some eighty species found at San Pablo it was customary to observe about two-thirds each day, while in the vicinity of New York City it is not usual to observe more than one-third of the summer-resident fauna during a day's outing.

The restrictions imposed by the government on the use of fire-arms, the high price charged for ammunition, and the absence of game, except Quail and Doves, are excellent reasons why there should be little shooting in Cuba, and during my stay I encountered but three gunners, all of whom were hunting Doves (*Zenaidura*, *Zenaida* and *Columba corensis*). Birds, therefore, are molested but little, and as a result many of them display an unusual confidence in their human neighbors. For this reason, and also because of their abundance and continuous presence, they are far better known to the natives of all classes than are

our common birds. The inhabitants of the country were particularly well informed, and seldom failed to recognize the permanent resident birds, either by their appearance or notes. Children of not more than eight years of age could generally name at sight most of the birds on my work table. A general knowledge of resident birds, however, was not confined to the inhabitants of the country, and on one occasion, in a restaurant in Trinidad, I was somewhat surprised to hear a discussion on the identity of the Flycatcher, known as Pitirre (*Tyrannus domincenus*), while the debate over the bird's time of arrival from the south became animated.

In saying that Cuban birds displayed a lack of song power I would not imply that they lack in vocal power; on the contrary, many of them are exceedingly noisy, and the woods and clearings resound with strange and sometimes not unmusical call-notes, cries and whistles. At San Juan the clearings, low growth and woods were in close proximity, and, as before stated, birds were more abundant here than elsewhere. The morning chorus was opened by the soft, plaintive cooing of the Zenaida and Zenaidura Doves and the more vigorous notes of the Torcaza. They were followed by the singular call-notes and whistles of the two Blackbirds (*Quiscalus* and *Ptiloxena*). Then the chattering notes of the Guatibero (*Pitangus*), the rolling call of the Carpintero (*Centurus*), the attempt at song of the Zorzal (*Mimocichla*) were added to the chorus; while at intervals one heard the *kr-r-row* of Trogons, the complaining note of the Anis, the mournful whistle of the diminutive Siju Owl, or the grating cries of a passing flock of Paroquets.

In the open valley at San Pablo birds were of course less abundant, and the characteristic species here were the Carolina Doves and Meadowlarks.

At the time of my visit woodland birds were feeding on the fruit of the cupey tree, and were always abundant in the vicinity of trees bearing ripe fruit.

On one occasion, while sitting beneath one of these trees, I heard or saw on or near it, within a period of ten minutes, eighteen species of birds, of which all but two, the Black-throated Blue Warbler and Black-whiskered Vireo, were peculiar to Cuba.

They included three species of Woodpeckers, three of Blackbirds, two Flycatchers (*Pitangus* and *Myiarchus*), Crows, Parrots, Paroquets, Trogons, Negritos, Zorzals and Todies.

Although I observed some twenty species of the North American land-birds which occur in Cuba during the winter only, the part played by these birds in the avifauna was, with five exceptions, an unimportant one.

These five birds mentioned, in the order of their abundance, were Black-throated Blue, Palm and Prairie Warblers, Redstarts, and Catbirds.

The nesting season among the Passeres in Cuba is apparently not fairly under way until after the middle of April. Some species commence to breed in March, but the real breeding season was evidently about to open at the time I left Guanayara. Early in March, however, I observed that birds which do not nest until late in April were in pairs. It seems not improbable that some of these sedentary insular species may be mated for life.

The Migration.—Beyond the arrival of three species, which are found in Cuba during the summer only, I observed no evidences of a migration. There were apparently no flights of transients *en route* to the North, and no marked fluctuation in the numbers of the winter visitants was noticed.

It is probable that by far the larger number of migrants which touch Cuba in going from the United States go to the westward and cross from Cape San Antonio to Yucatan in preference to following the Cuban coast to the eastward and thence continuing their journey through Jamaica, or San Domingo, Porto Rico and the Lesser Antilles. In returning in the spring it is natural to suppose they would retrace the course of the previous fall.

Birds Observed while Sailing from Batabanó to Trinidad.—Few birds were observed while sailing along the southern coast of Cuba. From Cienfuegos to the bar which makes the harbor of Trinidad, the shore is an almost continuous wall of coral limestone; there are no shoals or sandy beaches and no birds were seen. Between Cienfuegos and Batabanó the water is shallow, and there are innumerable mangrove islands varying in size from the

small sand-bar, on which a few mangrove shoots had but recently taken root, to the older islands having an area of thirty or forty acres. One would expect to find water-birds here in abundance, but seven Laughing Gulls, several hundred Cormorants, about fifty Frigate Birds, a few Brown Pelicans, and two great White Herons (*Ardea occidentalis*), were the only ones observed.

The Cuban Avifauna.—It is largely to that fine old naturalist, Dr. Juan Gundlach, that we owe our knowledge of Cuban birds. For fifty-four years he has pursued his studies of the Cuban fauna, and from his report on the birds[1] I make the following analysis:

Total number of species recorded	257
Land-birds	156
Water-birds	101
Permanent residents	130
Transient visitants	39
Winter residents	81
Summer residents	7

The number of species peculiar to the island, and a comparison of the extent of the avifauna with that of other West Indian Islands, will be found in a succeeding part of this paper.

In two genera, *Teretistris* and *Mimocichla* (see remarks under the latter) species ranging throughout Cuba seem to have became differentiated into two well-marked forms, an eastern and a western. Careful comparison of large series of birds will doubtless show that other wide ranging Cuban species are perhaps separable into eastern and western races.

Species Described as New or Added to the Cuban Fauna.—In the present paper the following species and subspecies are described as new or described under new names: *Rallus longirostris cubanus*, *Columbigallina passerina terrestris*, *Pitangus jamaicensis*, *Dendroica petechia flaviceps*, *Capromys columbianus*. "*Dives*" *atroviolaceus* is placed in a new genus *Ptiloxena*. *Colinus virginianus floridanus* is added to the Cuban fauna, and the Red-tailed Hawk is given as *Buteo borealis calurus*.

[1] Journ. für Orn., XIX, 1871, pp. 265–295, 353–378; XX, 1872, pp. 401–432; XXII, 1874, pp. 113–166, 286–308; XXIII, 1875, pp. 293–340, 353–407.

ANNOTATED LIST OF BIRDS OBSERVED.

In the following notes on birds observed near Trinidad the expressions abundant, common, etc., without mention of locality, refer to Guanayara, San Pablo and San Juan when applied to land-birds, and to Casilda when applied to water-birds.

When no doubt of identity existed I have given the local native name. In other cases I have given in quotation marks the native name from Gundlach's 'Beiträge zur Ornithologie Cubas' (l. c.). When practicable this is followed by the English equivalent.

1. **Colymbus dominicus** *Linn.* ZARAMAGULLON CHICO. ST. DOMINGO GREBE.—Two pairs of this little Grebe were found in the Trinidad River near its headwaters in the San Juan valley. The river at this point is a mere mountain stream, which in places widens into small pools. A female taken March 4 was molting and had lost all the quills of both wings.

2. **Podilymbus podiceps** (*Linn.*). ZARAMAGULLON GRANDE. PIED-BILLED GREBE.—Several observed at San Pablo.

3. **Sterna maxima** *Bodd.* "GAVIOTA." ROYAL TERN.—Not common.

4. **Anhinga anhinga** (*Linn.*). "MARBELLA." ANHINGA.—But two observed.

5. **Phalacrocorax dilophus floridanus** (*Aud.*). "CORUA." FLORIDA CORMORANT.—Common.

6. **Pelecanus fuscus** *Linn.* "ALCATRAZ." BROWN PELICAN.—Common.

7. **Fregata aquila** (*Linn.*). "RABIHORCADO." MAN-O'-WAR BIRD.—Not uncommon. During a severe storm on March 7 three of these birds were seen at San Juan. The wind was blowing the sea mist rapidly across the tops of the mountains, but high above these lower clouds the Man-o'-War Birds floated calmly, apparently undisturbed by the elements.

8. **Anas discors** *Linn.* BLUE-WINGED TEAL.—One seen at San Pablo.

9. Aix sponsa (*Linn.*). PATO DE LA FLORIDA.[1] WOOD DUCK.—Two pairs of these birds frequented a forest brook at San Pablo. A pair taken March 19 had the sexual organs but slightly enlarged. They were said by the natives not to remain during the summer.

10. Ardetta exilis (*Gmel.*). "GARZITA." LEAST BITTERN.—One specimen taken in the mangroves at Casilda.

11. Ardea occidentalis *Aud.* "GARCILOTE BLANCO." GREAT WHITE HERON.—One observed at Casilda.

12. Ardea wardi *Ridgw.* WARD'S HERON.—Observed on several occasions, but no specimens were secured. It is more than probable, however, that the Cuban bird should stand as *wardi* rather than *herodias*.

13. Ardea egretta *Gmel.* GARZA BLANCA. AMERICAN EGRET.—There was a flock of about twenty of these birds at San Pablo which came each night to roost in a tree at the border of the river. They appeared in a body with much regularity just after sunset, and after circling about the tree once or twice alighted on its branches. One now heard a low croaking chorus as the birds selected perches and settled themselves for the night. This rookery was but 200 yards from the houses and mill of the estate, and not more than sixty feet from a well-travelled road. The confidence thus displayed by the birds in their choice of a roost was in striking contrast with the habits of the shy, much-hunted Egret of Florida. During the day single birds were sometimes observed in cane-fields from which the cane had been cut. They were doubtless feeding on the lizards which abounded in ground of this nature.

14. Ardea cœrulea *Linn.* GARZA AZUL. LITTLE BLUE HERON.—Not uncommon.

15. Ardea tricolor ruficollis (*Gosse*). LOUISIANA HERON.—About twenty were observed at Casilda.

16. Ardea virescens *Linn.* "AGUAITA CAIMAN." GREEN HERON.—Common along mountain streams.

[1] Dr. Gundlach applies this name to the preceding species, calling the Wood Duck "Huyuyo."

17. Nycticorax nycticorax nævius (*Bodd.*). "GUANABÁ DE LA FLORIDA." BLACK-CROWNED NIGHT HERON.—Two observed at Casilda.

18. Aramus giganteus (*Bonap.*). GUARACAO. LIMPKIN.—A common bird at San Pablo, where they frequented the guava-grown uplands, probably to feed on land-shells. They were exceedingly wary. They were rarely, if ever, heard calling during the day, but soon after nightfall and throughout the night one could hear the weird cry from which they receive their native name.

19. Rallus longirostris cubanus, subsp. nov.

"GALLINUELA." CUBAN CLAPPER RAIL.

Char. Subsp.—Intermediate in coloration between *Rallus longirostris caribæus* Ridg. and *Rallus longirostris scotti* Senn. Of a darker and less reddish shade of brown, and with less white on the abdomen than *caribæus;* not so dark as *scotti.*

Description of Type (No. 57,391, Coll. Am. Mus. Nat. Hist., adult male, Casilda, coast of southern Cuba, April 14, 1892. Collected by Frank M. Chapman, Collector's No. 2707).—Upper parts dark sepia brown, the feathers of the back bordered laterally with olivaceous gray; wings and tail of a lighter brown than the back; tertials slightly darker than the back and with the lateral margins grayer; a buff superciliary stripe; lores and subocular region blackish; post-ocular region gray; chin and throat white bordered by deep buff, which on the neck has a grayish tinge and on the entire breast becomes cinnamon; flanks and under tail-coverts of nearly the same color as the wings, the feathers with narrow transverse white bands bordered by blackish areas; middle of the abdomen whitish, the feathers with indistinct, tranverse dusky bands. Wing, 5.98 in.; tarsus, 2.14; culmen, 2.44; depth of bill at posterior margin of nostril, .41 in.

Description of Female (No. 57,389, Coll. Am. Mus. Nat. Hist. Same date, locality, and collector. Collector's No. 2702).—Similar to the male but smaller, the sides of the throat, neck and breast paler. Wing, 5.20; tarsus, 1.90; culmen, 2.18; depth of bill at posterior margin of nostril, .38 in.

Six specimens of this new Rail were collected at Casilda. Two of these are fully-grown young of the year, which differ from the adults only in having the throat and chin buffy instead of white.

For comparison with these birds I have had, through the courtesy of Messrs. Brewster, Ridgway and Sennett, specimens of

carribæus, *scotti*, and also one example of *saturatus*. This included the type of *caribæus*, while in the American Museum Collection there are the types of *scotti* and one example of true *longirostris* from Bahia. Comparison of *cubanus* with this material shows that while it is more closely related to *scotti* than to any known form it evidently connects *scotti* with *caribæus*. Thus the darkest Cuban example is inseparable from a pale specimen of *scotti*, and on the other hand the palest Cuban birds are scarcely distinguishable from the darkest specimens of *caribæus*. From *saturatus*, *cubanus* is apparently separated by its browner color and gray instead of brown margins to the feathers.

I have provisionally adopted Mr. Sennett's nomenclature for *crepitans* and *saturatus*,[1] but, as previously stated by Mr. Brewster and myself,[2] I believe that a larger number of specimens than we at present possess will show a complete intergradation between all the forms of this group, with the probable exception of the Bahaman *Rallus coryi*.

The Cuban Clapper Rails were common in the mangroves at Casilda. The breeding season was evidently over before April 14, for on that date I secured the two fully-grown young birds before mentioned.

20. Gallinula galeata (*Licht.*). GALLINETA. FLORIDA GALLINULE.—Common in pairs at San Juan.

21. Tringa minutilla *Vieill.* "ZARAPICO." LEAST SANDPIPER.—One observed at Casilda.

22. Symphemia semipalmata (*Gmel.*). "ZARAPICO REAL." WILLET.—A flock of eight was observed at Casilda. None were secured, and it is possible they may have belonged to the western race *inornata*.

23. Actitis macularia (*Linn.*). "ZARAPICO." SPOTTED SANDPIPER.—Not uncommon at San Pablo.

24. Charadrius squatarola (*Linn.*). BLACK-BELLIED PLOVER.—One observed at Casilda.

[1] Auk, 1888, p. 161. [2] *Ibid.*, 1889, p. 136.

25. Ægialitis vocifera (*Linn.*). "FRAILECILLO." KILDEER.—Not common.

26. Ægialitis wilsonia (*Ord*). "FRAILECILLO." WILSON'S PLOVER.—A pair of breeding birds was taken at Guanayara. The male is in fully adult plumage, but lacks the cervical collar, which in most high-plumaged specimens of this species is nearly complete.

27. Jacana spinosa (*Linn.*). GALLITO. MEXICAN JACANA.—Found only at San Pablo, where they were not uncommon along the Agabama River. Here they feed among small lily-pads not more than two inches in diameter, growing in water several feet deep. If they paused the leaves sank beneath them, when they would take to the water, swimming easily and somewhat like a Coot (*Fulica*).

28. Colinus virginianus cubanensis (*Gld.*). CODORNIZ. CUBAN BOB-WHITE.—Two males and a female of this bird were taken from a small flock in the mountains.

29. Colinus virginianus floridanus (*Coues*). CODORNIZ. FLORIDA BOB-WHITE.—Six Quails were secured at San Pablo, where they were apparently not uncommon. They frequented the guavas, cane-fields and tobacco plantations. The familiar *bob-white* and 'scatter calls' were first heard on March 23, when the birds were still in flocks and evidently just beginning to mate.

Of four males one is typical of the very dark Quail from southern Florida, while the other three are intermediate between this form and true *cubanensis*. The two females apparently agree with the Florida bird, and are easily distinguishable from the females of true *cubanensis*.

I can account for the presence of these birds only on the supposition that Florida Quails have at some time been introduced in Cuba, and that they have interbred with the native birds. The explanation is not unreasonable, for we know that Quail have been introduced into other West Indian Islands.[1]

[1] *Cf.* Gundlach, J. f. O., 1874, p. 300. Dr. Gundlach, however, confused the two birds, for I have seen specimens of true *cubanensis*, and one equally typical of the Florida bird, which had been collected by him in Cuba and labeled *cubanensis*.

30. Columba corensis *Gmel.* TORCAZA.—Common, frequenting the royal palm trees, the berries of which seemed to constitute its sole food. One individual had no less than eighty of these berries, each measuring three-eighths by one-half of an inch in diameter, in its crop. The Torcaza is thus an active agent in distributing the seeds of palm trees. The call of the Torcaza is a vigorous *too-whòo, coo, too-whòo, coo,* with the accent strongly pronounced.

31. Columba leucocephala *Linn.* TORCAZA CABEZA BLANCA. WHITE-CROWNED PIGEON.—Single birds were observed on two occasions.

32. Zenaidura macroura (*Linn.*). PALOMA. MOURNING DOVE.—Everywhere a common species. At San Pablo they were exceedingly abundant, and there were few intervals during the day when their call could not be heard. In the afternoon in walking over the weed-grown bottom of a former course of the Agabama River, at nearly every step this species and the Ground Dove arose in small flocks from almost beneath my feet. They evidently came here to procure the fine gravel which had been brought by the river.

At the time of my visit the birds were breeding, placing their nests in the guava bushes, or even in the palm trees, where the leaves branch out from the trunk. I now frequently observed a peculiar aërial evolution which probably is confined to the breeding season. I have previously observed it only at Corpus Christi, Texas, where also the birds were breeding. This evolution consists of a short, unnatural flight, followed by a sail, which is sometimes over a circular course. This may be repeated two or three times, and the bird then sails to the ground or a near-by perch. The whole performance does not cover over two hundred feet, and is presumably confined to the vicinity of the nest. At least on several occasions I observed it directly above a nest. During this flight and sail the bird so exactly resembles an *Accipiter* that I never saw one engaged in it without involuntarily grasping my gun to shoot what I had mistaken for a Hawk. Indeed, so close is the resemblance, it is only after careful scrutiny that one recognizes the Dove.

Cuban specimens are smaller than examples of *Z. macroura* from the eastern United States, and in their slightly darker color and disproportionately shorter tail, they show an approach to *Zenaida zenaida*. Average measurements are as follows: five Cuban specimens, wing, 5.52; tail, 4.81 in. Five specimens from the vicinity of New York City, wing, 5.92; tail, 5.40 in.

33. Zenaida zenaida (*Bonap.*). GUANARO. ZENAIDA DOVE. —Common. It is more of a ground Dove than *Zenaidura*, and is therefore less frequently seen. Its notes resemble those of *Zenaidura*, but are deeper, louder and more solemn.

34. Columbigallina passerina, subsp. TOJOSITA. GROUND DOVE.—Common.

Throughout its range this small Dove presents much variation in the color of the bill, and to a less extent in the color of the plumage. It is not always possible to determine from dried specimens what was the color of the bill in life, and as few specimens are labeled with regard to this point much of the existing material is misleading. So far as I am aware, in eastern North America and the West Indies, the bill assumes three styles of coloration, as follows: In eastern North America it has the basal half or two-thirds coral red, the tip black or blackish. (In dried specimens the red becomes orange or yellow, and is then indistinguishable from the next.) In Jamaica (*cf.* Scott, Auk, IX, 1892, p. 124) it has the basal half or two-thirds yellow. Mr. Scott informs me that his remarks, as above referred to, are based on fresh specimens. In the Bahamas, according to Mr. Maynard, the bill is "constantly and wholly black." This is one of the characters on which he establishes his *Chamæpelia bahamensis* (*cf.* Am. Ex. and Mart., III, 1887, p. 33).

Cuban birds have the bill in life brownish black, darker at the tip, and with a faint reddish cast basally. The general appearance is that of a black bill, but as I have been unable to make an extended comparison of the Cuban and the Bahaman birds I cannot affirm their identity.

The bird from eastern North America, as before remarked, differs from true *passerina* of Jamaica in having the base of the bill red instead of yellow; there are also differences in coloration.

Mr. Scott has permitted me to examine his fine series of some forty Jamaican specimens, and comparison of these with some twenty examples from Florida shows that they may be separated into two well-marked races. Jamaican males are slightly paler and have whiter throats than Florida males. In the females the difference is more marked, Jamaican birds having the throat whiter, the breast more finely squamate, and the abdomen whiter, and they lack the pinkish tinge seen in Florida specimens. In size the sexes are alike, and, as might be expected, Jamaican birds are somewhat smaller. Five males and five females from Jamaica measure: wing, 3.25; tail, 2.06; bill, .44 in. An equal number of both sexes from Florida measure: wing, 3.50; tail, 2.30; bill, .44 in. It is evident then that the name *passerina* can no longer be accepted for the bird from eastern North America. In describing his *bahamensis* Mr. Maynard remarks (l. c.): "'Tis only after considerable hesitation that I name these species even provisionally; 'tis also possible that Limnaeus [*sic*] of *Columba passerina* was based on specimens of this species and not on birds of the continent of North America. In event of this proving the case, I propose the name of *Chamæpelia purpurea* for the larger continental Dove." It seems to me, however, that this name is unavailable from either logical or zoölogical grounds. The "event" which Mr. Maynard specifies has not 'proved to be the case,' nor does he designate which of the North American races of *Columbigallina* he proposes to call *purpurea*. Very probably he intended to name the race from eastern North America, but his remarks are so vaguely worded as to be capable of several interpretations. Furthermore, Mr. Maynard did not know the true *passerina*, and he thus fails to mention the differences which serve to distinguish the eastern North American bird from the bird which Linnæus named. In view of the unsatisfactory basis on which the name *purpurea* stands it seems unwise to recognize it, and I suggest, therefore, that the Ground Dove of eastern North America be known as *Columbigallina passerina terrestris*.

35. Geotrygon montana (*Linn.*). BOYERO. RUDDY QUAIL-DOVE.—A few were observed and several collected beneath the cupey trees at San Pablo. They were feeding on the fallen fruit

of this tree. Their flight is noiseless, and on being flushed they fly for but a short distance and then alight on the ground or in the low undergrowth. Their flesh is more delicate than that of any bird I have ever eaten.

Starnœnas cyanocephalus was reported to me, under the name Perdiz, as being a rare inhabitant of the mountains. I did not meet with it.

36. Cathartes aura (*Linn.*). AURA.\ TURKEY VULTURE.—Abundant.

37. Circus hudsonius (*Linn.*). GAVILAN. MARSH HAWK.—Four were observed near San Pablo.

On six occasions I observed individuals of an *Accipiter*, but secured no specimens.

38. Buteo borealis calurus (*Cass.*). GAVILAN. WESTERN RED-TAIL.—Red-tailed Hawks were not uncommon, but I secured only one specimen (No. 57,400), an adult male. Comparison with a large series of both *borealis* and *calurus* shows that the relationships of this specimen are with the latter rather than the former. The chin and upper throat are white, but the sides of the neck, breast, and abdomen are heavily marked with deep rufous or black, as in some specimens of *calurus*. The tail has a broad black subterminal band, and all the rectrices have traces, more or less distinct, of black bars. This Hawk, according to Gundlach, is resident in Cuba, and it is not improbable that further material will show it to be an insular race. The specimen just described measures: wing, 15.00; tail, 9.50; tarsus, 3.00 in.

39. Falco sparverioides *Vig.* CERNICALO. CUBAN SPARROW HAWK.—Common. With few exceptions all the Sparrow Hawks I saw were mated and preparing to breed, and at Guanayara one pair was nesting in a hole in a palm tree. Of fourteen specimens secured nine are of the light and five of the dark phase of plumage. Most of these specimens were taken in pairs, and in every case dark birds had dark mates and white birds white ones. In addition to these specimens a number of pairs were satisfactorily identified, but on no occasion were the two phases seen

together. The calls of both phases are alike, and resemble that of *Falco sparverius*.

In his forthcoming 'Catalogue of West Indian Birds,' advance sheets of which I have just (November 25) been permitted to see, Mr. Cory gives reasons for considering the San Domingo bird separable from the Cuban bird, basing his conclusion on the comparison of forty-six specimens from the former island and twenty-five from the latter. The name *dominicensis*, provided this determination proves correct, should therefore be restricted to the San Domingo bird, which apparently has but one, the light, color phase.

The Cuban bird should therefore stand as *sparverioides*, and the real point at issue is the identity or distinctness of the two very different color phases which the Sparrow Hawk assumes in Cuba.

It has been shown that the two phases intergrade; it is equally certain, I believe, that they breed together, and Mr. Cory states (l. c., p. 140) that he is informed that "birds of both colors have been taken from the same nest." The question is then whether this is an instance of dichromatism or hybridism. If the former it is certainly one of the most exceptional cases of which we have any knowledge. *Falco sparverius* and its several closely-allied forms range throughout the greater part of North and South America, and are found in nearly every island of the West Indies. At no point in this extended habitat does it give any indication of developing two color phases except in the island of Cuba. The differences which distinguish the two color phases are not such as occur in pure dichromatism, but involve also a change in the pattern of coloration. In the light phase the adult male has the underparts, including the lining of the wing, nearly pure white, while the back is cinnamon, as in *sparverius*. In the full development of the dark phase the underparts, except the throat, are deep cinnamon; *the lining of the wings is heavily barred with blackish;* the back is blue and of the same color as the head, but with traces of cinnamon on some of the feathers. In addition to these changes there is a deepening in the coloration of the other parts. Great as are the differences which exist between these phases they are not greater than those which we

know occur among Hawks; but the case becomes more remarkable when we consider that so radical a variation in coloration occurs in only one small part of the habitat of the species.

40. Polyborus cheriway (*Jacq.*). CARAIRA. AUDUBON'S CARACARA.—Three individuals were observed and one secured at San Pablo.

41. Pandion haliaëtus carolinensis (*Gmel.*). "GUINCHO." AMERICAN OSPREY.—One observed at Casilda.

42. Strix pratincola furcata (*Temm.*). LECHUZA. CUBAN BARN OWL.—Common. Their wild, startling cry was frequently heard at night, and would be followed by a high, rapidly repeated *cr-r-ree, cr-r-ree, cr-r-ree*, as they flew about in search of food. They live in the caves, evidently choosing such as are inhabited by bats, on which they feed. They also eat mice (*Mus musculus*) and rats (*Mus tectorum*). In the stomach of a specimen shot at noon in a bat-cave were the partially digested remains of three mice and two bats of a species (*Phyllonycteris poeyi*) which measured twelve inches in expanse of wing.

43. Glaucidium siju (*D'Orb.*). SIJU. CUBAN PIGMY OWL.—A common and apparently entirely diurnal species. Their usual note, a softly whistled *coo*, is one of the characteristic sounds of Cuban woods, and may be heard at all hours of the day. Their favorite perch when calling is near the top of a tall leafless tree, and I have seen them in this exposed position facing the sun. The short *coo* is uttered at intervals of about five seconds, and may be continued for more than an hour at a time. It is accompanied by a nervous, vertical twitching of the tail, which is sometimes raised to form an acute angle with the back. A second vocal performance, but a less common one, seemed to be the result of excitement and may be confined to the nesting season. It consists of a series of short whistles, rising in tone, uttered with increasing rapidity, and ending in a high piercing note. Their food seemed to consist of insects, small tree-toads and lizards.

On one occasion I heard a male of this species calling in a grove of cocoa-nuts. He was found without difficulty, and

on approaching I discovered also the female. The male was uttering the *coo*-note and occasionally varying it with the performance just described. To this the female responded with a thin, shrill squeak. As the male was secured the female flew into the top of a dead palm trunk about twenty-five feet in height. A rap at the base of the tree caused her to fly out and she also was secured. She contained an egg ready for deposition. The palm tree was badly decayed and was pushed to the ground. A depression in its top, of about six inches in depth, was evidently the Owl's nest. It was composed simply of the dead palm fibres. In these loose fibres, immediately below and for a distance of about eight feet down, I found twenty-five tree-toads of two species and a 'chameleon.' Some of the toads had bodies three inches long, while the lizard was twelve inches long. As it was more than probable that both had entered this retreat from above, it is natural to suppose they would leave in the same way. But their passage would so evidently interfere with the domestic arrangements of *Glaucidium*, I came to the conclusion that they were in winter quarters and that quite unsuspectingly the Owl had selected a nesting place above them.

A series of fifteen specimens shows that, irrespective of sex, there are two quite different color-phases, a gray and a red, between which there is a complete intergradation. In the red phase the spots or marks on the upperparts are reduced to the minimum, while in the gray phase they are longer and more clearly marked. Sexual variation is shown by the larger size of the females, as follows: six females average, wing, 3.81; tail, 2.43 in.; nine males average, wing, 3.61; tail, 2.30 in.

44. Amazona leucocephala (*Linn.*). COTICA. CUBAN PARROT.—Found only at San Pablo, where they were not uncommon in small flocks of not more than six individuals. They were frequently found feeding on the fruit of the guava, and were also attracted to the mango trees, the fruit of which was just ripening, and which, during its season, constitutes their favorite food. They are restless birds, spending little time in one place. They fly with a strong, rapid wing-beat, which suggests the flight of a cormorant.

45. Conurus euops (*Wagl.*). PERIQUITO. CUBAN PAROQUET.—Common, both at San Juan and San Pablo. They were generally seen in flocks of from ten to twenty, and, like the preceding species, they were restless and much on the wing. Their favorite food seemed to be the berries of the royal palm. They call in chorus while flying and the note is a grating squeak, quite different from the Woodpecker-like *kr-r-r* of *Conurus carolinensis*. Both these species and the Cotica defer their breeding season until late April and early May, when an abundance of ripe fruit assures them of a food-supply for the young.

In a series of sixteen specimens, thirteen have the plumage more or less mottled with red. There is some regularity, however, in the distribution of this color. On the upperparts it is confined to the head and nape. All but one of these specimens have red feathers also on the sides of the head and neck, and all but two have a few red feathers scattered through the plumage of the underparts.

46. Saurothera merlini (*D'Orb.*). ARRIERO. CUBAN CUCKOO.—A very common species, living in low growths of bushes more or less dense. Its notes are among the most striking of those of Cuban birds. There is apparently no limit to its vocal ability in certain directions, but its ordinary call commences like the rolling squawk uttered by an old, contented hen on a warm day, and increases in volume and rapidity until the notes are joined. This may be heard at a distance of half a mile. A second call is a *cluck*, followed by a gasping note, which would lead one to suppose the bird was being choked to death. This seems to be the result of revery, and when producing it the bird sits in a pensive attitude with the head drawn down between the shoulders, raising it, however, to call. Its other notes or squawks are varied, and on different occasions, after shooting one bird, a survivor has closely approached and scolded me with more weird and horrible sounds than one can well imagine issuing from the throat of a bird. Their food was found to consist of beetles and lizards. In the stomach of one specimen I found the partially-digested remains of an *Anolis* measuring one and a half inches across the angle of the jaws. The stomach was distended to the utmost and measured seven by five inches in circumference.

While it was not unusual to see this bird on the ground, it is by no means a Road-runner; still, in its habit of mounting a bush or tree by jumping from branch to branch, and then reaching the ground by sailing, it reminded me strongly of *Geococcyx*. It is not shy, and will permit one to approach to within a few yards before hopping or moving by short flights through the bushes, or mounting a tree in the manner described.

47. Crotophaga ani (*Linn.*). JUDIO. ANI.—Common in flocks of from five to twenty individuals. They pass much of their time on the ground and are generally found near herds of cows or hogs. On being alarmed they fly into the nearest bushes or low trees, uttering at the same time a kind of long-drawn complaining whistle, suggestive of the note of the Wood Duck. Perched there, with plumage hanging loose and bedraggled, calling their whining cry, they appear as dispirited and cringing as a whipped cur. Their infrequent long flights are accomplished by alternate flapping and sailing. They roost in the low bushes and crowd so closely together that a roosting flock resembles a bunch of black feathers.

48. Priotelus temnurus (*Temm.*). TOCORORO. CUBAN TROGON.—This beautiful Trogon haunts the more secluded parts of the woods, where it is common and generally found in pairs. It is, as a rule, exceedingly tame and will permit one to approach to within a few feet. Its flight is short, generally from tree to tree, and it passes much of its time resting quietly. The call of the male is a rather melancholy *kr-r-row*, *kr-r-row*, *kr-r-row*, and this note is sometimes muttered while on the wing. To this the female responds with a much lower but somewhat similar note. Perched on the branches of the same tree, or even when out of sight of each other, a pair will thus call for long periods, one answering the other with the greatest regularity.

Their food consists of insects and berries. I have seen them dart at flowers, probably to get the insects in or near the blossom. Berries were taken in the same way, that is, by darting and picking them from the stem on which they were growing. At the moment the fruit was secured the position of the bird was nearly upright, the wings of course were moving, the tail was

spread to the utmost, and with its brilliant plumage thus displayed *Priotelus* made a striking picture of tropical bird-life.

49. Ceryle alcyon (*Linn.*). "MARTIN PESCADOR." BELTED KINGFISHER.—Not uncommon.

50. Todus multicolor *Gould.* PODORERA. CUBAN TODY. —Among the most interesting of West Indian birds are the members of the family Todidæ, the only family of birds peculiar to these islands. Although so unlike them in color and general appearance, they still bear a laughable resemblance to their distant but nearest relatives the Kingfishers. Indeed, a Tody might be described as a green-backed, red-throated Kingfisher less than four inches in length, with a bill and habits resembling those of a Flycatcher.

Although a common species, the Podorera does not take a prominent place in the Cuban avifauna. Its haunts, habits and green color tend to make it an inconspicuous bird. As a rule I found them in pairs, frequenting low bushes in the woods or sometimes among the guavas. Their notes very closely resemble the sharp chittering of the Ruby-throated Hummingbird. When at rest their position is rather upright, the axis of the body being at an angle of about fifty degrees. At this time they frequently raise their head with a curious bobbing movement. All their food is apparently captured on the wing, after the manner of Flycatchers, but they differ from Flycatchers in that they generally seek a new perch after darting for their prey, and also that this perch is more likely to be in the centre of a bush than in the more exposed position a true Flycatcher would select. When they alight with their back to the observer its color harmonizes so well with that of the surrounding foliage that it is difficult to distinguish them. I did not observe, however, that the bird seemed aware of this protective resemblance. Perhaps the most peculiar characteristic of this little bird is the singular wooden whirring sound which sometimes accompanies its flight. After close observation I am convinced that this sound is produced by the attenuate primary found in the wing of both sexes. My reasons for this belief are: (1) that I heard the sound only when the bird flew with more than usual swiftness; (2) the sound corre-

sponded with the short undulations in the bird's flight from bush to bush. Furthermore, neither Gosse (Bds. Jamaica, p. 72), Scott (Auk, IX, 1892, p. 274), nor Taylor (*ibid.*, p. 373) mention this whirring sound in their accounts of the Jamaican species, and on examination I find that in that species the outer quill is shorter and not so attenuate, curved, or stiffened as in the Cuban bird.

51. Sphyrapicus varius (*Linn.*). YELLOW-BELLIED SAPSUCKER.—Observed on two occasions.

52. Xiphidiopicus percussus (*Temm.*). CARPINTERO REAL. GREEN WOODPECKER.—Common. Though not a 'Sapsucker,' this bird reminds me, in its habits and notes, of the preceding species.

53. Centurus superciliaris (*Temm.*). CARPINTERO JABADO. —A very common and noisy species. Its notes resemble those of the Red-bellied Woodpecker, but are louder, and I did not hear the Cuban bird utter the hoarse *chŭh, chŭh,* of *Centurus carolinus.*

54. Colaptes chrysocaulosus *Gundl.* CARPINTERO RIBERO. CUBAN GOLDEN-WINGED WOODPECKER.—Not uncommon. Resembles *Colaptes auratus* in its habits and notes.

55. Antrostomus carolinensis (*Gmel.*). GUABAIRO. CHUCK-WILL'S-WIDOW.—One was collected at San Pablo.

56. Chordeiles, sp?—Nighthawks were first observed on April 13, when they commenced to arrive from the South. I did not secure specimens, and cannot therefore say to which race they belong, though it is probable they were *Chordeiles virginianus minor.*

57. Cypseloides niger (*Gmel.*). GOLONDRINA. BLACK SWIFT.—Probably a common species. Flocks of large Swifts were seen almost every evening at San Juan, but at such an enormous height that on only one occasion did I observe an individual near enough to identify it with certainty.

58. Hemiprocne zonaris (*Shaw*). GOLONDRINA. COLLARED SWIFT.—A bird of this species flew low over my head near San Pablo. At no other time did I recognize it, though, as before stated, at San Juan large Swifts were frequently seen in the evening at an immense height.

59. Tachornis phœnicobia *Gosse.* GOLONDRINA.—This little Swift was common only at San Pablo, and was not seen at either Guanayara or in the mountains. They appeared late each afternoon, coursing rapidly for food, and in their manner of flight somewhat resembled a Bank Swallow.

60. Sporadinus ricordi (*Gerv.*). ZUMBADOR. RICORD'S HUMMINGBIRD.—Common. A nest containing two eggs, found March 11, was placed on the swaying branch of a coffee bush. It was composed of green moss, bound about with strips of bark, which hung in flowing streamers five inches below.

61. Tyrannus magnirostris *D'Orb.* "PITIRRE REAL." LARGE-BILLED KINGBIRD.—Four individuals, the only ones observed, were secured at San Pablo.

62. Tyrannus dominicensis (*Gmel.*). PITIRRE. GRAY KINGBIRD.—This is one of the few birds which are found in Cuba during the summer only. They were first seen on March 19, soon became common, and in April were abundant. At this time they commenced to mate and their noisy chattering cry of *pitirri, pitirri*, from which they receive their local name, was one of the commonest bird-notes.

63. Pitangus caudifasciatus (*D'Orb.*). GUATIBERO.—This Flycatcher very closely resembles the Kingbird (*Tyrannus tyrannus*) both in appearance and habits. Its notes, however, are quite different. When excited or in pursuit of another bird it has a cry like that of a nest full of hungry young birds, and when resting it gives utterance to a long rolling *chitter*. In April they commenced to mate and were then particularly noisy, calling long after nightfall. The Jamaican *Pitangus* has been referred by previous writers to the Cuban *P. caudifasciatus;* it is, however, apparently separable, and may stand as

Pitangus jamaicensis, sp. nov.

Char. Sp.—Differing from the Porto Rican *Pitangus taylori*, and the Haytian *P. gabbii*, in being slightly lighter and in having a broad basal and a narrow terminal whitish tail-band; differing from the Cuban *P. caudifasciatus* in being darker and in having the crest bright lemon yellow instead of orange.

Description of type. (No. 42,647, Coll. Am. Mus. Nat. Hist., adult male, Moneague, Jamaica, February, 1865. Collected by Henry Bryant. Collector's No. 2227.)—Head dark brownish black with a partly concealed crest of bright lemon yellow and not sharply defined from the hair-brown back; wings of the same color as the back, the outer margins of the coverts and tertials whitish, the axillaries and lining of the wing pale yellow; tail of same color as the head, the inner margins of the feathers whitish for their basal third; outer vanes of the lateral feathers whitish and a narrow terminal whitish band; underparts white. The female is similar to the male.

Comparison of five Jamaican specimens with nineteen specimens from Cuba show the characters assigned the new form to be constant so far as this material goes.[1]

64. Myiarchus sagræ (*Gundl.*). BOBITO.—Not uncommon. It resembles a *Contopus* in habits, and its call has the same plaintive quality as has the note of *Contopus virens.*

65. Blacicus caribæus (*D'Orb.*). BOBITO.—Very common. It resembles the Wood Pewee in habits but lives nearer the ground. Its notes also are suggestive of those of *Contopus virens.* A nearly completed nest, found April 9, was placed in a fork of an outer branch of a guasima tree about fifteen feet from the ground. It was constructed of grasses, small twigs and plant-down.

66. Corvus nasicus *Temm.* CAO.—Found only at San Pablo, where they were not uncommon in the woods and were feeding on the fruit of the cupey tree. Their call is a high, penny trumpet-like note, delivered after the manner of a Crow's *caw*, but frequently accompanied by a series of prolonged squawks, the whole performance sounding quite uncrow-like.

67. Agelaius humeralis (*Vig.*). MAYITO. — Abundant. It was found feeding among the blossoms of trees, and in its

[1] Since writing the above I have, through the kindness of Mr. W. E. D. Scott, been permitted to examine his fine series of sixty odd specimens of the Jamaican *Pitangus* and they confirm the validity of the species.

habits resembles an *Icterus* rather than an *Agelaius*. It has, however, a Blackbird-like *cack* and a single whistle not unlike that of *Agelaius phœniceus*. I have also seen it, with drooping wings and spread tail, utter the hissing note of *Molothrus ater*.

68. Sturnella hippocrepis *Wagl.* SABANERO. CUBAN MEADOWLARK.—Found only in the Trinidad Valley, where they were abundant in old fields. No bird I observed in Cuba proved more interesting than this Meadowlark. I first met with it on March 15, when during a ride through the Trinidad Valley I had an excellent opportunity to become familiar with its song and habits. My impression of the bird's song as given in my journal for that day is as follows:

"The vocal organs of *Sturnella* are apparently so modified by climatic influences that although some naturalists have pronounced its various races to be one species, no one, I am sure, would recognize in the song of the Cuban bird any resemblance to that of *Sturnella magna*."

Subsequent familiarity with this peculiar song led me to slightly alter this first opinion. It was subject to great variation, and occasionally I could distinguish some faint resemblance to the song of *S. magna*. I was more frequently reminded, however, of the song of the Dickcissel (*Spiza americana*). After several unsuccessful attempts to express in words the typical song of *Sturnella hippocrepis*, I found the syllables, *whēē-chēwēē, chŭckle-chŭr*, to be a not unsatisfactory description of it. The first two syllables have a whistled tone, the last two are guttural. The single *peek* note uttered by *magna* when its suspicions have been aroused and it is about to fly, was not heard from the Cuban bird.

A comparison of this humble vocal effort with the lauded melody of the Western Meadowlark (*S. m. neglecta*) presents a remarkable range of variation in song power between birds which are ranked as subspecifically related.

During the ride referred to I also observed in *Sturnella* what appears to be an instance of its appreciation of the value of protective coloration. Many birds were seen perching on the fences by the roadside. With one exception these birds did not permit me to see their breasts, but turned their backs as they

alighted near me or on my too close approach, and then watched me from over their shoulders. The exception may with truth be said to have proved the rule, for in this instance *Sturnella* chose the lesser of two evils, and presented his brilliant yellow breast to me, while the inconspicuous brownish back was turned toward a Marsh Hawk which was coursing over the field on the other side of the fence on which the Meadowlark was resting. Having my attention thus early attracted to this interesting trait I closely watched *Sturnella* during the following two weeks, but on no occasion did it fail to turn its back on me when I had approached to within what it considered an unsafe distance.

Fifteen specimens show both the winter and more worn breeding plumage; seven have the bluish-black bill of breeding birds. Comparison of this series with a large number of Meadowlarks shows unexpectedly that the Cuban birds are far more closely related to *Sturnella neglecta* than to any other form of the genus. Indeed, the differences which distinguish *hippocrepis* from *neglecta* consist largely in the smaller size and darker coloration of the former, but in pattern of coloration there is little difference between the Cuban and Western birds. When we consider that Floridan and Mexican birds very closely resemble each other, and represent the extreme of variation from *neglecta*, it is surprising that the Cuban bird should be more closely related to the latter than to either of the former. The relationship, too, brings into more marked contrast the differences which exist between the songs of the two birds.

69. Icterus hypomelas (*Bonap.*). SOLIBIO. CUBAN ORIOLE.—A common species, reminding me, in its flight and habits, of the Orchard Oriole (*Icterus spurius*). Their food seemed to consist largely of insects, which they obtained from the blossoms of flowering trees and plants, that of the banana being an especial favorite. As a result of this habit their heads and necks were frequently well-dusted with pollen, which showed conspicuously on their black plumage, and in some specimens persists as a permanent stain. Their song is weak but sweet and plaintive, and suggestive of that of a far-away Meadowlark (*Sturnella magna*). The single call-note was so like the metallic flight-note of the

English Sparrow that to one familiar with the haunts and character of the latter bird it was strikingly incongruous.

As in the case of several other Cuban species, these birds were almost always seen in pairs, or, on occasions, two pairs would be seen together. I was soon struck by the fact, to which I noted no exception, that these pairs were composed of birds of the same apparent age, that is adult black and yellow birds were mated with birds in the same plumage, while immature birds had immature mates.

One individual of this species, captured after being slightly winged, won my admiration by his fearless behavior. As I held him perched upon my finger, he divided his time between vigorously biting my hand and singing, thus giving a fine illustration of song as a result of excitement.

In a series of twenty-five specimens twelve are males and thirteen females. Sixteen are in the black and yellow plumage of the adult bird. Seven of these are males and eight females. Beyond a slight difference in size, the males being larger, the sexes are indistinguishable. The remaining nine birds have black throats, and the plumage is more or less mottled with black. They are evidently birds of the previous year, and would require one more year in which to complete their plumage.

70. Quiscalus gundlachi *Cass.* CHICHINGUACO. CUBAN GRACKLE.—An abundant and conspicuous species, giving character to the avifauna more than any other bird. It is not, however, found in the towns, as is the Great-tailed Grackle in Texas. It has an extended vocabulary of whistled notes and indescribable calls, and is very noisy. While these notes were unmistakably Quiscaline, I could detect no exact resemblance to the calls of either *Q. macrourus*, *major* or *quiscula*. In vocal ability I should rank the Cuban bird between *macrourus* and *major*.

In the males the tail is permanently keeled, that is, is wedge-shaped even when the bird is at rest. In flying it is expanded vertically, and measures from four to five inches in depth at the tip. This gives them a most ludicrous appearance, which is heightened by their fluttering, labored flight. Indeed, when on the wing they resemble miniature flying machines. These birds

were particularly abundant about my home in the San Juan Mountains, where they were attracted by the ripe corn in the clearing of a neighboring mountaineer. They passed the greater part of the day feeding on this dainty, but in the early afternoon, as the shadows came into the valley, they all flew, with much fluttering and calling, into the palms at the border of the clearing. Here they fed on the palm berries, passing from tree to tree up the slope of the mountain, following the fast waning light, until finally the sun set, and they roosted where darkness found them.

71. Ptiloxena (gen. nov.) **atroviolaceus** (*d'Orb.*). TOTI.—Abundant. Though frequently found with *Quiscalus gundlachi*, the birds were brought together through a fondness for the same kind of food, and were not in any other sense associated. Indeed, the bird does not resemble a Grackle in either flight or notes. It has a number of calls, the most common of which reminded me of the *peto, peto*, of the Tufted Titmouse. In April I saw them carrying nesting material into the palm trees.

Different authors have referred this bird to the genera *Quiscalus*, *Scolecophagus* and *Dives*. It is evidently more closely related to the last, in which recent authors place it. It differs from *Dives*, however, in several important structural details. In *Dives* the first primary is equal to the eighth, and the third to sixth are subequal; in *atroviolaceus* the first primary is longer than the sixth, and the second to fifth are subequal. *Dives* has a more rounded tail than the Cuban bird; in the latter the outer tail-feather is but a quarter of an inch shorter than the middle pair, while in the former the outer tail-feather is three-quarters of an inch the shorter. There is also a slight difference in the shape of the bill, which in *atroviolaceus* is shorter, stouter, and with a more convex culmen than in *Dives*. The most striking difference between the two, however, is in the structure of the contour feathers of the fore parts of the body, especially those of the breast.

In *atroviolaceus* the barbicels, while apparently of the normal number, are fasciculate, and, except at its basal third, adhere to the barb. For the terminal half of the feather, therefore, the barbs have no connection with one another, and this gives to the

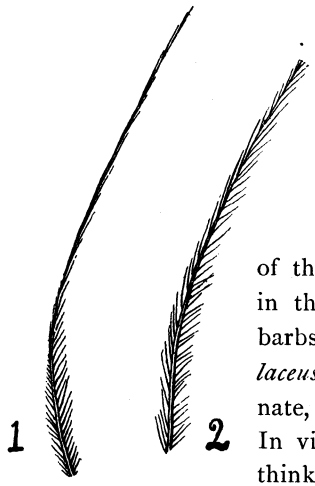

Fig. 1. Barb from a breast feather of *Ptiloxena*. Enlarged.
Fig. 2. Barb of *Dives sumichrasti*. Enlarged.

parts in which these feathers grow a finely streaked, hairy appearance. To some extent this peculiar structure is shown by the West Indian *Quiscali* of the Subgenus *Holoquiscalus*. In *Dives*, however, and the continental *Quiscali*, the structure of the feathers is normal, and, as shown in the accompanying cuts representing barbs from the feathers of both *atroviolaceus* and *Dives*, the barbicels are pennate, and branch out from the barb. In view of these structural differences I think *atroviolaceus* should be placed in a new genus, for which I propose the name *Ptiloxena*.

72. Ammodramus savannarum passerinus (*Wils.*). GRASSHOPPER SPARROW.—Common at San Pablo, and not uncommon at Guanayara.

Comparison of six specimens of true *savannarum* from Jamaica with a series of *passerinus* from the eastern United States fails to show any constant difference in color which would serve to distinguish these forms. The Jamaican birds average slightly darker, and are without the streakings on the breast found in many North American specimens. In size, however, the Jamaican birds are smaller than United States specimens. Of thirteen specimens from near Trinidad five are without streakings on the breast, but none are as small as the largest Jamaican specimen.

The appended measurements show that they belong to the northern rather than the southern form. Probably they were winter visitants, for Dr. Gundlach says the bird does not breed on the island.

	Wing.	*Tail.*
Jamaica, six specimens	2.24	1.54
Cuba, thirteen "	2.39	1.70
New York, six "	2.42	1.74

73. Euethia canora (*Gmel.*). TOMEGUIN DEL PINAR.—Not uncommon.

74. Euethia lepida (*Jacq.*). TOMEGUIN DE LA TIERRA.—Very common in small flocks, which pass much of their time on the ground. Their song is a not unmusical weak trill.

75. Passerina cyanea (*Linn.*). "AZULEJO." INDIGO BUNTING.—An adult male seen March 18.

76. Melopyrrha nigra (*Linn.*). NEGRITO.—A common species frequenting bushes and undergrowth. They commenced to nest about March 11. With *Euethia canora* this is one of the favorite cage-birds among the natives. Its song, however, is only a weak warble.

77. Spindalis pretrei (*Less.*). CABRERO. CUBAN TANAGER.—Not common. They were generally found in pairs in the woods, and frequented the tops of the trees. Their vocal effort is weak and squeaky and hardly deserves the name of song.

78. Petrochelidon fulva (*Vieill.*). GOLONDRINA. CUBAN CLIFF SWALLOW.—At San Juan a small flock of these birds occasionally came to the river in the morning to drink, and then disappeared. At San Pablo they were common. One morning a flock of about one hundred was seen to leave a large cave on the bank of a river, and after mounting high in the air scattered in various directions. The cave was inaccessible, and I was unable to determine whether it was used for nesting or roosting.

79. Vireo calidris barbatula (*Cab.*). "PREDICADOR." BLACK-WHISKERED VIREO.—A summer resident. First observed March 13, and soon became abundant. It is a very tame and unsuspecting bird, and resembles our Red-eyed Vireo both in song and habits. The song, however, is more emphatic and hesitating than that of *V. olivaceus*.

80. Vireo gundlachi *Lemb.* JUAN CHIVI.—Common. This bird has the habits of a White-eyed Vireo, and its song, while quite unlike that of *noveboracensis* is, nevertheless, of the same character. Its iris is light hazel, another character connecting it with the *noveboracensis-crassirostris* group, of which, in spite of its distinctness, it is probably the Cuban representative.

81. Arbelorhina cyanea (*Linn.*). "APARCEIDO DE SAN DIEGO."—An immature, molting male, taken at San Pablo while feeding on the fruit of the cupey tree, was the only one seen.

82. Mniotilta varia (*Linn.*). BLACK-AND-WHITE WARBLER. —Not uncommon.

North American Warblers which winter in or migrate through Cuba are not recognized by the natives under specific names, but are known by the general name 'Mariposa.'

83. Compsothlypis americana (*Linn.*). PARULA WARBLER. —Not uncommon.

84. Dendroica tigrina (*Gmel.*). CAPE MAY WARBLER.—Six were observed.

85. Dendroica petechia (*Linn.*). "CANARIO DE MANGLAR." CUBAN YELLOW WARBLER.—Observed only at Casilda, where a few were found in or near the mangroves. Their song is easily distinguished from that of *Dendroica æstiva.* Three specimens show that in the adult the crown has a cap of reddish chestnut.

Through the kindness of Mr. Ridgway I have been permitted to examine the National Museum specimens of this group, including Baird's types of *Dendroica petechia gundlachi.* These specimens, four in number, are all in immature plumage, and I think misled Prof. Baird to separate the Cuban from the Jamaican bird. I have seen only six specimens from the latter island, and so far as I am able to judge from this material there are no characters on which birds from the two islands may be separated.

The Bahaman bird, however, which has previously been considered the same as the Cuban species, is apparently a quite distinct race and may stand as

Dendroica petechia flaviceps, subsp. nov.

Chars. Subsp.—Smaller and more yellow than any bird in the group, and as a rule without a well-defined crown cap.

Description of Type (No. 39,848, Am. Mus. Nat. Hist. Adult male, Rum Cay, Bahamas, March 4, 1886. Collected by the naturalists of the Fish Commission Steamer 'Albatross.' U. S. Nat. Mus. No. 108,076).—Above greenish yellow, the crown yellower and with traces of concealed rufous; wings

externally brownish black, the quills margined with yellow externally and with their coverts heavily margined externally with the color of the back; tail dark greenish brown, the inner webs of the feathers, except the middle pair, entirely yellow except at the tip and a narrow strip along the vane; underparts rich yellow, the breast and sides streaked with rufous. Wing, 2.38; tail, 1.98; bill, .41 in.

Of this new race I have examined a series of twenty-one adult males from Rum Cay, New Providence, Conception, Wattling, Eleuthera and Cat Islands, taken by the same collectors in March, 1886. In nine of the twenty-one the rufous of the head, while not clearly defined, is at once evident; in the remaining twelve the head is apparently but slightly yellower than the back, but on closer examination the feathers are found to have small brownish centres or shaft streaks. The most highly-developed birds of the nine have the brownish centres larger and showing through the greenish yellow tips of the feathers. Doubtless in more worn plumage these yellowish tips would disappear, and in three birds from Conception and Wattling Islands there would remain sufficient brown to form a cap similar to that seen in Jamaican and Cuban specimens. The smaller size of the Bahaman bird is shown by the following average measurements: Nine males from Rum Cay: wing, 2.40; tail, 2.01; bill, .40 in. Three males from Cuba: wing, 2.56; tail, 2.07; bill, .40 in. Five males from Jamaica: wing, 2.59; tail, 2.12; bill, .40 in. Two males from Grand Cayman: wing, 2.54; tail, 2.05; bill, .40 in.

86. Dendroica cærulescens (*Gmel.*). BLACK-THROATED BLUE WARBLER.—Both sexes were very common.

87. Dendroica coronata (*Linn.*). MYRTLE WARBLER.—Two were observed.

88. Dendroica dominica (*Linn.*). YELLOW-THROATED WARBLER.—Two were seen, one of which was secured.

89. Dendroica palmarum (*Gmel.*). PALM WARBLER.—Exceedingly common. I saw no specimens of *hypochrysea*, which is easily distinguishable from *palmarum* in the field.

90. Dendroica discolor (*Vieill.*). PRAIRIE WARBLER.—Common.

91. Seiurus aurocapillus (*Linn.*). OVEN-BIRD.—Not uncommon.

92. Seiurus motacilla (*Vieill.*). LOUISIANA WATER-THRUSH.—Not uncommon.

93. Geothlypis trichas (*Linn.*). MARYLAND YELLOW-THROAT.—Not uncommon.

94. Setophaga ruticilla (*Linn.*). AMERICAN REDSTART.—Common.

95. Mimus polyglottos (*Linn.*). SINSONTE. MOCKING-BIRD.—Two birds, one of which was singing, were seen on the south slope of the coast range near Trinidad. They are not common anywhere, and are unknown away from the immediate vicinity of the coast.

96. Galeoscoptes carolinensis (*Linn.*). SINSONTE GATO. CATBIRD.—Common, but not in song.

97. Polioptila cærulea (*Linn.*). "RABUITA." BLUE-GRAY GNATCATCHER.—Five were seen, of which two were secured. I have not compared them with *P. c. cæsiogaster*, of which I have no specimens.

98. Polioptila lembeyi (*Gundl.*). "SINSONTILLO."—One specimen was secured at Casilda. It was singing a song which resembled that of *P. cærulea*, but it possessed greater volume and sweetness.

99. Mimocichla rubripes (*Temm.*). ZORZAL. CUBAN ROBIN.—An abundant species, reminding me strongly in some of its habits of our Robin (*Merula migratoria*). It was, however, an inhabitant of the lower growth, but still, like the Robin, it frequented the clearings, hopping a yard or so, then stopping, raising and lowering its tail in a pensive kind of way. At times it flew into the higher branches of the trees to sing. Its song is a weak, unmusical performance, curiously suggestive of a young Robin's first attempts, while the manner of singing is somewhat disconnected, as though the bird sang with an effort. A common and very singular call-note resembled the cry uttered by an

adult Robin when held captive and presumably greatly alarmed or in pain, but *Mimocichla* utters this call when alone and under no excitement whatever.

As a rule these birds were seen in pairs, and though evidently mated they showed no signs of breeding.

There is remarkably little sexual or individual variation among nineteen specimens collected in the mountains and in the valley, and all are typical of *rubripes*. *M. schistacea* is apparently confined to the eastern part of the island but the differences which distinguish it from *rubripes* are so slight that they doubtless intergrade as their habitats approach each other.

II.—Notes on Mammals Observed.

According to Dr. Gundlach (Cont. Mamalogia Cubana, Havana, 1877), there are found in Cuba three species of *Capromys*, one of *Solenodon*, and nineteen species of Bats.

The Solenodont is apparently unknown near Trinidad. Of Bats, one sees only the insect-feeding species coursing in the open, while the fruit-eating species are confined to the woods. Shortly before leaving San Juan I found that a long, narrow tract of woods at the base of the mountain was the nightly highway of immense numbers of Bats. They rushed through here in a continuous flight, flying from within a few feet of the ground to a height level with the tree tops. They were doubtless of several species, but I did not succeed in finding the cave or caves from which they proceeded.

1. Mus tectorum *Savi.* Rata. Roof Rat.—Abundant. I found this Rat inhabiting remote caves in the mountains where it was feeding on wild fruits, and was evidently quite independent of man. I saw neither *Mus rattus* nor *M. decumanus*.

2. Mus musculus *Linn.* "Ratoncito." House Mouse.—Abundant. In disintegrated Barn Owl pellets, secured in a cave, I found the remains of twenty-five House Mice and one Rat. The absence of the remains of other small Rodents is evidence pointing towards their absence from the island.

3. Capromys pilorides *Say.* HUTIA CONGA.—A common animal in the mountains and foot-hills where it lives among the rocks. It passes the day in concealment, generally in one of the innumerable holes among the rocks, and comes out at night to feed. At the time of my visit it was feeding on the 'guasima,' a small, round, green, nut-like fruit, which grew in abundance in trees about twenty feet in height. It is arboreal, and obtains this fruit by climbing the trees for it. It climbs slowly, but passes along limbs having a diameter of not more than one and a half inches with ease. It sometimes passes the day in a tree, choosing one with a rich growth of parasitic plants among which it conceals itself.

The largest of three specimens is an adult female, which contained four small embryos, and measured: total length, 31.88; tail, 8.07; hind foot, 3.93; fore foot, 2.44; greatest girth, 3.46 in.

The Hutia Mono (*Capromys prehensilis*) was reported to me by the natives, who said it was much rarer than Hutia Conga.

4. Capromys columbianus, sp. nov.

Based on a portion of a semi-fossil skull, showing the malar and alveolar portion of the maxillary of the right side, one upper molar, the anterior portion of the palate and anterior two-thirds of the inner border of the molar alveoli of the left side.

This fragment of the skull, of which a figure is presented,[1] belongs to a species of *Capromys*, slightly smaller than fully adult specimens of *Capromys pilorides*, but differing decidedly from any known species of the group.

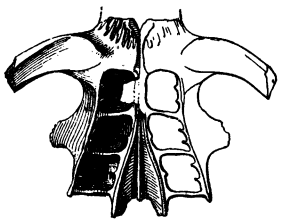

Fig. 3. Portion of the skull of *Capromys columbianus*. Nat. size.

In *pilorides* the space between the inner borders of the alveoli at the anterior margin of the upper premolar is .21 in.;[2] in *columbianus* the space between the same parts at the anterior margin of the first molar is but .04 in., and the alveoli would

[1] Compare with a figure of the inferior surface of the skull of *Capromys ingrahami*, this Bulletin, III, 1891, p. 335.

[2] *Cf.* also Dobson, P. Z. S., 1884, p. 235, where measurements of the skulls of four species are given.

apparently meet between the premolars. The malar portion of the maxillary is much expanded in *columbianus*, and at its base extends from a point opposite the first internal loop in the exterior margin of the premolar to the maxillo-premaxillary suture, and its inferior face is more deeply sulcate than in that of *pilorides*. The molar is either the first or second of the right upper series. The enamel pattern is somewhat different from that of *pilorides*, but the folds bear the same relationships to one another as do those in the molars of *pilorides*.

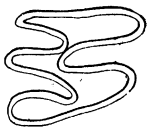

Fig. 4. Right upper molar of *Capromys columbianus*. About three times nat. size.

This portion of the skull was found in a cave near Trinidad, associated with remains of bats and birds, and also fragmentary pieces of the bones of *Capromys* of perhaps the same species as the one described.

The cave is situated in the southern slope of the coral limestone coast range at an altitude of about seven hundred feet, and within two hundred feet of the summit of this part of the range. Imbedded in the conglomerate walls of this cave were numerous shells, some of which I collected and have submitted to Prof. Whitfield, who has identified them with living species. This fact, in connection with its coralline structure, shows the cave to be of recent, doubtless Quaternary, formation.

The floor of the cave was covered to the depth of several feet with a red, ferruginous earth, and on this was a layer four or five inches in depth of a dark earth in which the bones mentioned were found.

The Hutia, as the native West Indians called the various species of *Capromys*, is the first animal mentioned from the New World by Columbus. Being almost the only edible quadruped, it formed an important part of the fare of the early colonists, and on the shores of South Cuba, in the then Province of Ornofai, perhaps within sight of the cave just described, Columbus landed with his crew and was feasted by the natives on the flesh of the Hutia. It seems eminently proper, therefore, to connect his name with the genus.

5. Vesperugo fuscus cubensis (*Gray*).

Scotophilus cubensis GRAY, Ann. Nat. Hist. IV, 1839, p. 7.
Vesperus dutertreus GUNDL. Cont. Mamalogia Cubana, Havana, 1877, p. 32.
Vesperugo serotinus Var. *β*. (Vesperus fuscus) DOBSON, Cat. Chiropt. 1878, p. 193 (Cuban references only).
Vesperugo fuscus J. A. ALLEN, Bull. Am. Mus. Nat. Hist. III, 1890, p. 169 (Bahamas).

The Brown Bat is a common species in Cuba, and with other purely insectivorous species was seen nightly coursing for food. Fourteen individuals found hanging together on the wall of a limestone cave proved to be all females.

These specimens are not smaller than examples of *fuscus* from North America, but, like the specimen described by Dr. Allen from the Bahamas, the ears and wing membranes are thinner than in North American specimens, and the former are slightly narrower and more pointed. These differences appear to be constant, and I think render the Cuban Brown Bat worthy of recognition as a race.

6. Atalapha noveboracensis pfeifferi (*Gundl.*).—Apparently not common. Two intensely colored specimens, both males, were secured. They are of the same size and show that, as has been claimed, the Cuban Red Bat is slightly larger than the North American *noveboracensis*. I do not observe, however, that the premolar is larger in the Cuban form, as has been claimed. The measurements of the two specimens are as follows: forearm, 1.71; third finger, 3.48; tibia, .90 in. North American specimens average: forearm, 1.60; third finger, 3.20; tibia, .87 in.

7. Nyctinomus brasiliensis *Is. Geoffroy.*—Common. Just after sunset, on March 17, thousands of these Bats were seen flying to the westward. On no other occasion were they seen in anything like the same numbers.

8. Phyllonicterus poeyi *Gundl.*—This species was not met with alive, and is included on the basis of two skulls found in the stomach of a Barn Owl.

9. Artibeus perspicillatus (*Linn.*).—Exceedingly abundant. This was found to be the common Cave-bat; indeed, was the only one which I succeeded in finding in numbers.

At San Pablo I visited a cave consisting of a series of chambers opening one into the other or to the surface, which were inhabited by these Bats in countless thousands. On arriving, a few were seen hanging in clusters from the rounded depressions which dotted the roofs of the chambers. It was light here, and on seeing us the Bats took wing, flitting about from cave to cave in search of new resting places. Finally we discovered a nearly dark chamber about seventy-five feet in diameter, and with walls twenty feet in height, with only two small openings. The moment we entered there was a rush of wings, sounding like the wind through trees; we could catch glimpses of many Bats, while a steady stream of them poured from the two openings. Bringing dead palm leaves we used them as torches, and their light revealed a wonderful sight. The white limestone roof of the cave was patched and streaked with hanging Bats, which in lines, bunches and large solid masses covered at least half its surface, while over our heads an incalculable swarm was circling to and fro. They were apparently all adults of one species. The floor of the cave was covered with the remains of fruit, which was mostly of the kind known as 'guasima.' Of fifty-six Bats taken at this cave twenty-four are males, and thirty-two females. Eighteen of the females contained one embryo each. All these Bats were infested by a small parsitic fly and spider.

Taken as a whole this series is quite constant in coloration, but comparison of the extremes shows, nevertheless, a wide range of variation in color. The underparts in the average specimen are light brown, with the hairs all tipped with white. In one extreme the color is much paler, almost grayish white, in the other the underparts are of a darker brown than the average, the hairs scarcely, if at all, tipped with white. There is less variation in the color of the back, which is usually of a light seal brown. The facial streaks are nearly obsolete, and in many specimens entirely wanting. There is apparently little sexual variation in either color or size.

This Bat is, of course, not true *perspicillata* but in the absence of material for comparison, I cannot determine to which of the numerous forms of this group it should be referred.

III.—Remarks on the Origin of West Indian Bird-Life.[1]

The marked peculiarities exhibited by the fauna of the West Indies have long claimed the attention of zoölogists. The proximity of the group to the mainland, the inter-relationships of the islands, the distinctness of some West Indian species, the evident relationships of others, combine to present problems of unusual interest to the student of island-life. At the same time the physical changes to which the islands have been subjected, their past probable connection with one another and with the mainland, render a study of the origin of their life far more complicated than in the case of purely oceanic islands.

In 1876, when Wallace wrote on the West Indian fauna (Distribution of Animals), he presented a table of 203 species of resident land-birds which had been recorded from this region. Since that date, largely through the efforts of Mr. C. B. Cory, Mr. Lawrence's reports on Ober's collections, and Mr. Ridgway's reports on material collected by the naturalists of the Fish Commission, our knowledge of the West Indian avifauna has been so augmented that the known number of resident land-birds is now considerably over 300. In addition to this increase in our knowledge of the avifauna we have, through the cruises made by vessels of the Fish Commission, more accurate and detailed information regarding the topography of the Caribbean basin. This has been well summarized by Prof. A. Agassiz in his 'Three Cruises of the Blake.' With the added assistance derived from these later works we may briefly review the bird and mammal life of the West Indies with particular reference to its bearing on a past connection of the islands with the Central American mainland.

Some 550 species and subspecies of birds have now been recorded from the West Indies. Of these no less than 303 are endemic, while the remaining 248 may be allotted according to

[1] Read before the American Ornithologists' Union, Tenth Congress, Washington D. C., Nov. 15–17, 1892.

the regions from which they apparently have been derived, as follows:

Continental	16
Tropical	56
South American	13
Central American	3
North American	160

The first, or Continental, includes species of more or less general distribution throughout both North and South America. Five are land-birds and eleven water-birds. The second, or Tropical, includes species of general distribution in the tropics. Many of these reach the southern border of the United States, and some are found throughout the Tropical Realm. Eighteen are land-birds and thirty-eight water-birds. Of the third, or South American group, ten, all of which are land-birds, are found in only the Windward Islands, while the three which occur in the Greater Antilles are water-birds. Of the three Central American or Mexican species, one is a Swift (*Cypseloides niger*), one a Duck (*Dendrocygna autumnalis*), and the third (*Icterus cucullatus*) has been recorded only from Cuba, where it has been found but once. The fifth, or North American group, consists of birds which pass the nesting season in North America and, with few exceptions, occur in the West Indies only during the winter or while on their migrations. Eighty-nine are land-birds and seventy water-birds. As Prof. Baird has shown,[1] they are all birds of eastern North America which enter the West Indies through Florida. Cuba, therefore, receives by far the larger share. While a study of this later and migratory life will, in some instances, show us the sources from which the more recent West Indian species have been derived, it will not aid in determining the origin of the more distinct species which may have become West Indian under physiographic conditions not now prevailing. It is only by a study of the endemic species that we may hope to gain some understanding of the past history of the islands. As already stated, 302 species are endemic. Some of these reach the neighboring mainlands, as, for example, southern

[1] Am. Journ. Sci. and Arts, XLI, 1866, p. 18.

Florida; but they are none the less truly West Indian. Of the number mentioned only nine are water-birds. This leaves 293 land-birds as peculiar, or about 90 per cent. of the resident land-bird life. Considering how near the islands are to the mainland this is certainly a remarkable degree of specialization.

The Relationships of the Greater to the Lesser Antilles.—The more distinct and characteristic West Indian species are found in the Greater Antilles. While in some instances, *e. g.*, *Myiadestes* and *Quiscalus*, certain West Indian forms are developed in both the Greater and Lesser Antilles, it is evident that the zoölogical relationships between the two regions are comparatively recent and, as Wallace has said, they may be divided into "two very different groups" (Distrib. Animals, Am. Ed., II., p. 62). Wallace, however, drew his dividing line "immediately south of St. Croix and St. Bartholomew," thus placing these islands, with St. Martin, Anguilla and Sombrero, in the Greater Antilles. But, as Prof. Agassiz has shown (Three Cruises of the Blake, II, p. 112), with the exception of St. Croix, these islands are enclosed by the 500-fathom line which, except for the more eastward Barbadoes and a narrow channel north and south of Martinique, unites the chain of Windward Islands with South America. To the westward the Anguilla group is separated from the Virgin Islands by the Anegada Channel, having a depth of from 1000 to 1600 fathoms. The position of St. Croix cannot perhaps be definitely determined. Its faunal affinities are with Porto Rico, to which it is connected by "a submarine ridge with a depth of about 900 fathoms" (Agassiz, l. c.), while to the eastward it is separated from the Saba Bank by a ridge having a not greater depth than 800 fathoms. Cleve (Annals N. Y. Lyceum, 1881, p. 189) states that St. Croix belongs geologically to the Virgin Islands, and remarks: "The large West Indian Islands contain, then, ridges of raised Cretaceous rocks and the Virgin Islands form their eastern outcrops. South of the Virgin Islands they are not met with except in Trinidad." Thus Anguilla, which, according to the same author, is entirely of Miocene formation, is placed with the Lesser Antilles. Its position is of importance, for from the bone caves of this island Cope has described the

only fossil mammalia which, so far as I am aware, have been found in the West Indies (excepting the *Capromys* described in the present paper). These remains, consisting of detached teeth and fragmentary bones, are considered as related to the South American Chinchillas.

It is evident then that, as Prof. Agassiz remarks (l. c., p. 113, footnote), "the Windward Islands were probably raised long after the range of the greater West Indian Islands existed...." In analyzing their avifauna, therefore, I shall treat of the two as separate regions. As might be expected, there has been an interchange of life between these two groups; certain Lesser Antillean genera, *e. g.*, *Margarops* and *Bellona*, extend northward into the more eastern Greater Antilles, and the larger islands have in some instances contributed to the life of the smaller, as in the case of a species of *Mimocichla* found in Dominica. Again, some genera have a continuous range from South America through the Antilles to Central America. But it is evident that the zoölogical influence of the Lesser on the Greater Antilles is of comparatively late date, and has no primary bearing on the origin of the older forms which characterize the last-named group.

Our inquiry lies more with the older islands, but before treating of them we may briefly review the avifauna of the Windward group.

The Lesser Antilles.—About 108 resident land-birds are known from the Lesser Antilles. Of these thirteen are South American, of which ten are West Indian only as they occur in the Lesser Antilles, and fourteen are West Indian species which have a continuous West Indian distribution. This leaves us with eighty-one land-birds as peculiar to the group. *Fulica caribæa*, the only peculiar water-bird, doubtless has a wider range than we are at present aware of. Eight genera are peculiar. Two of these, *Margarops* and *Bellona*, send each a species into the eastern Greater Antilles, but they are none the less distinctively Lesser Antillean. Excluding the two species just referred to, these eight genera contain seventeen species. Subtracting these from the eighty-one endemic land-birds we have left sixty-four

species. These may be divided, according to their relationships, as follows:

Tropical	22
South American	19
West Indian	23

The first includes localized forms of wide-ranging tropical species; the second is composed of species obviously derived from South American ancestors, *e. g.*, *Merula*, *Thryothorus*, *Calliste* and *Saltator*. The third contains species belonging to groups or genera which are now West Indian, though it is not improbable that some of them may originally have been derived from South America through the Lesser Antilles.

A comparison of the fauna of Trinidad, Tobago and Grenada, the most southern of the Antillean chain, will show more clearly the nature of the South American element in the Lesser Antilles. Omitting migrants and species of general distribution, some 150 land-birds are given from Trinidad by Léotaud. Of these about fifty-four are recorded by Jardine[1] from Tobago, which is distant twenty miles from Trinidad. With the exception of the very slightly differentiated *Troglodytes tobagensis* and the doubtfully distinct *Amazilia tobaci*, Tobago has no species not found in Trinidad, while the fifty-four species mentioned include representatives of such local and non-migratory families as Pipridæ, Momotidæ, Galbulidæ, Dendrocolaptidæ and Formicariidæ, thus strongly indicating a previous land connection with Trinidad.

From Wells's list of Grenada birds[2] we learn that of the 150 Trinidad species of which, as just stated, fifty-four reach Tobago, only fifteen appear or are represented by close allies in Grenada. None of the sedentary families mentioned as occurring in Trinidad and Tobago are found in Grenada, and with the exception of one species each of *Thryothorus*, *Calliste*, *Saltator* and *Spermophila*, the genera of Grenada have a more or less extended West Indian range. On the other hand Grenada has eight species not found in Trinadad. Grenada is seventy-five miles

[1] Ann. and Mag. Nat. Hist., XVIII, 1846, p. 114, et seq.
[2] Proc. U. S. Nat. Mus., 1886, p. 609.

from Trinidad, and the difference which we have seen to exist in their avifauna is such as might under the present conditions be expected. It would seem, therefore, that since the appearance of the present fauna no connection has existed between this island and the mainland. If we except the fossil remains found on Anguilla, and the possibly unassisted presence of a now apparently distinct Agouti (*Dasyprocta cristata*), this view is supported by the absence of terrestrial mammalia, excluding those whose introduction is due to man's agency.

The Greater Antilles.—In a previous paper (Am. Nat., 1891, pp. 528–539) I have given reasons for believing that the Bahamas are zoölogical dependencies of the surrounding mainland and islands, from which their avifauna has been derived.

Grand Cayman, with its fifteen peculiar forms, showing relationships largely to Cuban and also to Jamaican species, may perhaps be placed in the same category. This island is situated about 175 miles from Cuba, and 200 miles from Jamaica. It is enclosed by the 1000-fathom line, this depth being reached within a few miles of the shore, while to the north and west it is separated from Cuba and the mainland by 1500 to 2000 fathoms. On the south it is separated from Jamaica by the Bartlett Deep, which has a depth of over 3000 fathoms only twenty miles south of Cayman.

Dr. Sclater has said (Ibis, 1887, p. 125), "Probably the Caymans were mainly stocked with life not by immigration, but when still part of the old Continent out of which the Antilles were carved by the Gulf Stream;" but there is apparently little ground for this belief.

Little Cayman and Cayman Brac, smaller islands, sixty-five miles east of Grand Cayman, from which they are separated by a channel of 1000 fathoms, have, as Mr. Cory has shown (Auk, 1889, p. 30), an avifauna which "is apparently quite different from that of Grand Cayman." They have no peculiar species, and "only five of the resident species of Grand Cayman appear to be found on either of the smaller islands" (Cory, l. c.). Commander Bartlett has remarked of Little Cayman, Grand Cayman, and the Misteriosa Banks to the westward, that they are "the

summits, just appearing above tide-mark, of a submarine range of an average height of nearly 20,000 feet" (Three Cruises of the Blake, I, p. 100). We may then regard them as mountain peaks which at different periods have been elevated above the sea. Grand Cayman, with its remarkable number of peculiar forms, is doubtless the oldest, that is, was the first to appear. Little Cayman, with no endemic species, and the Misteriosa Banks probably followed in the order named.

Is it possible that Grand Cayman may once have been connected with Cuba in the direction of the shoal that makes out from Cape Cruz to the westward, but the difference which exists between its avifauna and that of the small Caymans does not confirm this supposition. When we consider also that the avifauna of Grand Cayman is composed of birds having the power of extended flight, and that such abundant but more sedentary Cuban species as *Todus*, *Saurothera* and *Priotelus* are wanting, we may, I think, with some assurance, class it as an oceanic island which has received its bird-life through migration from other islands.

This leaves us with the four islands of the greater Antilles, Jamaica, Cuba, Hayti (under which name I include San Domingo) and Porto Rico. As I have before remarked it is on these islands that the characteristic fauna of the West Indies is developed. There have been recorded from them 174 of the 300 birds peculiar to the West Indies. Of this number 169 are land-birds, and five are water-birds. They are distributed as follows:

Jamaica	66,	of which 42	are endemic.
Cuba	68,	" 45	"
Hayti	56,	" 34	"
Porto Rico	46,	" 25	"

Of the eighty-eight genera to which these birds belong, thirty, containing fifty-four species, are peculiar to the West Indies. They are distributed as follows:

With representatives in four islands	4
" " three "	3
" " two "	2
Peculiar to Jamaica	7
" Cuba	6
" Hayti	7
" Porto Rico	1

It will be observed that although Jamaica is but little larger than Porto Rico, and is more isolated from neighboring regions than any island of the group, it is nearly as rich in endemic species, and has one more peculiar genus than Cuba. The latter island is not only ten times as large as Jamaica, but its proximity to Florida has given it at least four forms which have evidently been derived from Florida species. They are *Colinus virginianus cubanensis*, *Campephilus bairdi*, *Colaptes chrysocaulosus*, and *Sturnella hippocrepis*. Hayti, although about seven times as large as Jamaica, has eight endemic species less, while Porto Rico, nearly as large as Jamaica, and favorably situated for the reception of Lesser Antillean species, has seventeen endemic species less than Jamaica, and but one genus is peculiar to the island.

It is evident that, as Wallace has said, the islands "were not peopled by immigration from surrounding countries while in the condition we now see them, for in that case the smaller and more remote islands would be very much poorer, while Cuba, which is not only the largest, but nearest to the mainland in two directions, would be immensely richer, just as it really is in migratory birds" (Distrib. Animals, Am. Ed., II, p. 66).

These facts in distribution, in connection with a study of hydrographic charts, give us the best clue to a past land connection between the West Indies and the mainland.

From the coast of Honduras and Nicaragua the Mosquito Bank extends northeastward for nearly two hundred miles, or over half the distance from the mainland to Jamaica. It is enclosed by the 100-fathom line, and is divided from the San Pedro Banks by a channel seventy-five miles in width, and having an average depth of 700 fathoms. The San Pedro Banks, some of which appear above the surface of the sea, while none are below twenty-five fathoms, reach to within thirty miles of the south shore of Jamaica, from which they are separated by a channel having a depth of 600 to 900 fathoms. An elevation therefore of 100 fathoms would leave only two channels, the wider seventy-five miles, between Jamaica and the mainland.

Wallace advances the theory of a complete land connection between Jamaica and Central America, and also between Cuba and Yucatan, and suggests the probability of an ancient land in

the area enclosed by these connections. This view, as we have seen, is supported by Dr. Sclater, who has proposed for this hypothetical region the name 'Præantillesia.' Recent soundings, however, tend to disprove this theory.

In this connection Prof. Agassiz remarks: "The deep soundings (over three thousand fathoms) developed by the 'Blake' south of Cuba, between that island and Yucatan and Jamaica, do not lend much support to the theory of an Antillean continent, as mapped out by Wallace, nor is it probable that this continent had a much greater extension in former times than now, judging from the depths found on both sides of the West Indian Islands" (l. c., p. 116).

While there is little ground, therefore, for the hypothesis of an Antillean continent, it is not impossible that the land connection I have just outlined between Central America and Jamaica may have existed. That there has been a closer connection between this island and the mainland both the disproportionately rich avifauna of Jamaica and the shallowness of the intervening sea give us good reason to believe, but that the island has ever been completely joined to the mainland there is abundant room for doubt; first, because of the scarcity of terrestrial mammalia in the West Indies; second, because of the restrictions of the avifauna.

The land mammals of the West Indies, exclusive of Bats, are included in the three genera *Solenodon*, *Plagiodontia* and *Capromys*. *Solenodon*, with a single species each in Hayti and Cuba, is remarkable as having its nearest relationships with *Centetes* of Madagascar. *Plagiodontia*, with one species in Hayti, is nearly allied to *Capromys*. *Capromys*, with five or six species, finds its nearest ally in *Dasysprocta*, which ranges from Mexico southward. Cuba has three species of *Capromys*, the Bahamas one, Jamaica one, and Swan Island one, Porto Rico being without a representative of the group. The recent discovery on Swan Island by Mr. C. H. Townsend of a species of *Capromys*, differing but slightly if at all from the Jamaican species, points strongly towards the former extension of land in this direction. Swan Island is about one hundred miles from the coast of Honduras, and sixty miles north of the Mosquito Bank, which reaches out towards Jamaica.

Our knowledge of West Indian Bats is as yet very incomplete. Comparison of Gundlach's lists of Cuban and Porto Rican species with Osborne's list of Jamaican species (using Dr. Dobson's determinations), results as follows: Of a total of nineteen species three are evidently of North American origin, and are recorded only from Cuba; seven are tropical, and nine are West Indian. Of fourteen genera four are West Indian. All the nine West Indian species have been found in Cuba, six have been recorded from Jamaica, and two from Porto Rico. This serves to emphasize the isolation of Porto Rico, and the richness of the Jamaican fauna as compared with the size of the island.

The discovery of the remains of extinct mammals on Anguilla is considered by Mr. Wallace as strong evidence in favor of a former Antillean continent, and he remarks that further exploration will undoubtedly result in the discovery of additional remains of extinct mammalia. We have seen that with little doubt Anguilla is a member of the Lesser Antilles, and has had no connection with the larger islands. The remains found there have, therefore, apparently no bearing on the present case.

The sixteen years which have elapsed since the publication of Mr. Wallace's work have not added to our recorded knowledge of the mammalian palæontology of the West Indies. While it is true there has been no direct search for fossil mammals, the fossil molluscan fauna has received the attention of eminent conchologists who have not reported the discovery of mammalian remains. That islands so well adapted to the support of a rich mammal fauna should be so poor in representatives of this class, is one of the strongest zoölogical arguments opposing a past continental connection. Comparison of the West Indian fauna, with the life of continental islands, presents a striking contrast. For example, Formosa, ninety miles from the mainland, and about one-fourth the size of Cuba, has, according to Wallace, no less than thirty-one species of terrestrial mammalia, including representatives of *Ursus*, *Felis*, *Sus*, *Cervus* and *Bos*.

Mr. Wallace accounts for the comparative absence of mammals in the West Indies by subsidence, which has greatly reduced the extent of the land. That there have been periods of subsidence in the West Indies is a geological fact. That the submergence

has been on so grand a scale as to result in the "almost complete annihilation of the mammalian fauna," does not, in view of the extensive development of older formations showing no traces of marine deposits, seem probable. Nor is it likely that in each island so defenseless an animal as *Capromys* would be almost the sole surviving species.

The absence from the West Indies of representatives of many families of birds found on the mainland is also evidence opposed to the theory of a past connection between these islands and the continent. With the exception of *Hadrostomus niger* on Jamaica, and *Colinus virginianus cubanensis* on Cuba, the following twelve families, all of which are found from Mexico southward, are without representatives in the larger West Indian Islands.

Troglodytidæ.	Formicariidæ.	Ramphastidæ.
Pipridæ.	Galbulidæ.	Cracidæ.
Cotingidæ.	Bucconidæ.	Tetraonidæ.
Dendrocolaptidæ.	Momotidæ.	Tinamidæ.

Examination of Zeledon's list of Costa Rican birds shows that in Costa Rica there are found no less than 140 species belonging to these families.

It is a significant fact that almost all these birds are either terrestrial or of sedentary habits. That is, they are birds which we should not expect to find occupying a prominent place in an insular avifauna. Their absence from the West Indies cannot with reason be attributed to subsidence, and is, therefore, a fact which must be explained before the theory of a continental connection can be accepted.

Summarizing this brief review of the more striking features of the West Indian fauna, we have, from the standpoint of birds and mammals, the following facts bearing on the question of a past connection between these islands and the mainland. In favor of this theory are, (1) the disproportionately rich fauna of Jamaica; (2) the shallow sea between this island and the mainland; (3) the West Indian affinities of Swan Island as shown by the presence of *Capromys*. Opposed to the theory of a land connection are, (1) the scarcity of land mammals; (2) the absence of representatives of many families of birds found on the mainland.

It seems to me, however, that these facts may be harmonized and made to support one another if we can show a reason for the belief, that if a connection existed between Jamaica and the Mosquito coast, it was at a time when the latter region was perhaps itself separated from the mainland by passages connecting the Pacific with the Caribbean Sea. Of such passages, Prof. Agassiz has said, "we find traces in the Tertiary and Cretaceous deposits of the Isthmus of Darien, of Panama, and of Nicaraugua" (Three Cruises of the Blake, I, p. 113).

The same author continues: "Central America and northern South America at that time must have been a series of large islands with passages leading between them from the Pacific into the Caribbean." If this supposition be correct, it is quite possible that the families of birds which we have seen are not represented in the West Indies were not at that time found in Central America, and that they have appeared there only since the land connection with South America has been formed. Previous to this time, however, the West Indies had become detached.

This view is supported by the fact that of the twelve families of birds named all but the *Troglodytidæ* and *Tetraonidæ* extend but little north of Southern Mexico. And further, with the two exceptions noted, the Central American and Mexican representatives of these families are in many instances co-specific with the South American forms, and but few peculiar genera have been developed north of the Isthmus. This would seem to indicate the recent appearance of these birds in this region. On the other hand the families to which the endemic West Indian birds belong are represented in Mexico and Central America by many peculiar genera.

In accordance with this hypothesis we may divide the West Indian fauna into two groups, the first of which was derived during the land connection just suggested, while the second owes its origin to migration, or the more or less fortuitous appearance of birds from surrounding regions. From the nature of the case the line between these two groups cannot be sharply drawn.

Capromys, *Solenodon*, *Mimocichla*, *Spindalis*, *Saurothera* and *Todus*, etc., are representatives of the former, while the slightly differentiated forms of *Mimus*, *Certhiola*, *Myiarchus*, and the

close allies of Florida birds found in Cuba, belong to the latter. The fact that many of the older genera have representatives on each of the islands would seem to indicate a past direct or indirect connection between the islands of the group. The generally close relationships which exist between the species of these genera points to the conclusion that they are derived from a common ancestor differing but slightly from the present type.

If we assume that the West Indies were separated sometime during the Middle Tertiary, we may then regard these older forms as survivors of the fauna of that period, which have been preserved to us through the isolation afforded by an insular life. This supposition is supported by the fact that they are quite as distinct from existing genera as are the genera of birds which have been described from the Miocene.

The isolation which has protected these old types has also resulted in the differentiation of the species derived through migration. Thus while the West Indies have preserved to us species which on the mainland have succumbed to the continental struggle for existence, they have given us many new forms which have been differentiated from their mainland ancestors under the influences of a new environment.