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# Mammals of Porto Rico, Living and Extinct

By H. E. Anthony

**Chiroptera and Insectivora**

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INTRODUCTION

Plans for a natural history survey of the Island of Porto Rico were drawn up in 1913 by the New York Academy of Sciences, with the active cooperation of the Insular Government of Porto Rico, The American Museum of Natural History, the New York Botanical Garden, and Columbia University. The plans covered work in all the different departments of Zoology, Botany and Geology. The first field work was begun in 1914 and the author was given the assignment to report upon the mammals of Porto Rico.

At the time this survey was planned, the known mammal life of Porto Rico was exclusively a bat fauna, no terrestrial land mammals other than introduced species being known from the island. The investigations of the anthropologists under Dr. Franz Boas, in 1915, gave promise of most interesting and unexpected additions to the list of mammals. In excavating shell-heaps, and caves formerly occupied by the aborigines, they discovered fossil remains of three undescribed rodents and a new ground-sloth. This evidence of a fossil mammal fauna greatly stimulated interest in what had promised to be a rather narrow field of research. Active field work for mammals was begun in May, 1916, and the author was able to further increase the list of terrestrial mammals and secured a great abundance of fossil material, as well as fairly extensive collections of the bat fauna.

The author was accompanied throughout the field work in Porto Rico by his wife, the late Edith I. Anthony, who was an active assistant during this time and found many of the specimens brought back by the expedition.

Itinerary

Text Fig. 1

We arrived at the port of San Juan May 31, 1916. The day was devoted to visiting the Government officials and arranging the various
Fig. 1.—Map of Porto Rico, with collecting sites indicated by black circles.
details of field work. Our first move took us to San German, near the west coast of the island, where we met Dr. Spinden, of the American Museum Department of Anthropology. Coöperative investigations were carried on for several days with the expectation of finding mammal remains in Indian shell-heaps and kitchen-middens. Although search was extended as far as Cabo Rojo, this immediate region did not yield very promising results and it was necessary to move on to Adjuntas. Both at San German and Adjuntas no opportunity was overlooked to collect specimens of the living mammals, namely, the bats. The third site selected was Utuado, in the interior of the island, and from this region we secured some of our most important material. Owing to the terrible condition of the trails and to a lack of understanding on the part of the natives, great difficulty was experienced at first in locating caves and favorable spots for excavation. Eventually an abundance of fossil mammal material was secured from caves which were worked from Utuado as a base. Several side trips were made while we were located at Utuado, one of these being to the Hacienda Jobo and another to Quebradillas. Dr. Spinden, finishing his archaeological investigations while we were at Utuado, returned to San Juan and to New York.

Upon completing the region about Utuado, it was necessary to return for a stay of several days at San Juan, and during this time, July 3 to July 8, several important caves in the San Juan vicinity were worked. One of these caves is the type locality for two species of bats. It is of interest to note that bats were more abundant and representatives of more species were collected about the San Juan sector than anywhere else on the island. Leaving San Juan, we returned to Utuado to pick up fossils which had been excavated on contract, and passed on west to Lares. Not very much was added by the visit to Lares, which seemed to be a region of rather limited possibilities, although there is an interesting deposit of fossil-bearing Tertiary limestones near San Sebastian. A delay in the receipt of funds expected from San Juan made necessary a return again to that site, and, as before, while waiting there, more of the caves of the region were visited.

We then motored to Manati, and a very promising field for fossil mammals was located near Morovis. It was possible to work out from Manati as a base, and several caves near Morovis, yielded a great abundance of mammal remains. On July 21 we returned to San Juan, and then went eastward to investigate the high mountainous area about El Yunque. Our headquarters were established at the Preston ranch, near Naguabo, where we were most hospitably received by the overseer. Unfortunately, no very extended work could be carried on here because of continuous, heavy rains. A long, all-day tramp back toward the summit of El
Yunque convinced me of the uselessness of any work in that region during the short time at our disposal and the probable negative results as far as mammals were concerned. From the Preston ranch our route took us to Coamo by the road which parallels the coast, and from Coamo we went inland as far as Cayey. The next move brought us to Ponce, where we left the automobile, took train and went around the coast, stopping off at Manati once more in order to run down several clues which we had been unable to investigate on the former visit. This completed the field work, the collecting at Manati being the last. On August 2 we left San Juan for New York.

So far as was possible in the limited time available for the work, special efforts were made to investigate each distinct type of country and each different ecological area. In a general way the entire island was covered, and although many regions were passed by, it was felt that work in these places would serve only to duplicate results obtained elsewhere.

Previous Work on the Mammals of Porto Rico

The first work on the mammals of Porto Rico was done by Dr. Juan Gundlach, who made three trips to the island from Cuba, in 1873, 1875 and 1881. The principal localities worked by Gundlach were Aguadilla, Guanica, Lares, Utuado, Arrecibo, Quebradillas, Vega Baja and Bayamón. The results of the first two trips appeared in the Anales de la Sociedad Española de Historia Natural for 1878. The part devoted to mammals is not very extensive and occupies only three pages; four species of bats comprised the known indigenous mammalia. Other collectors did work on the island at various times, but the total results have not greatly enlarged the knowledge of Porto Rican mammals, partly through non-publication. Mr. Alex. Wetmore, of the United States Biological Survey, worked in Porto Rico from December, 1911, to September, 1912, primarily on the birds of the island, but incidentally secured a fine collection of the bats, 235 specimens, among them a new form of Eptesicus. The Museum of Comparative Zoology sent an expedition under Dr. G. M. Allen to Porto Rico in the spring of 1917, a small collection of bats and fossil mammals being secured, none of which proved to be new.

Specimens Received from Porto Rico Subsequent to the New York Academy Expedition of 1916

Important collections of fossil mammal remains have been made by Señor R. Fernandez Maceira, of Rio Piedras, Porto Rico, who apparently found the bones while digging in caves for fertilizer. Señor Maceira has carefully saved all bones found in this manner and since 1920 has for-
warded three lots to the American Museum. The first collection, which was the largest, and the third collection were purchased by the American Museum and the second collection was acquired by the Museum of Comparative Zoology. The lots purchased by the American Museum are exclusively ground-sloth bones and it will be possible to mount a composite skeleton of this animal from the material.

Señor Maceira writes that these ground-sloth bones all came from the same cave, at Cabachelas, Barrio de las Torrecillas, near Morovis. The place goes under the local name of Cerro Iluco. It is a large cave, about sixty-five meters long by forty-eight wide. The bones were found at a depth of seven or eight meters.

Acknowledgments

It is a pleasure to acknowledge the wide-spread interest in the Porto Rican work and the great help and assistance which has been given me by different institutions and individuals. Dr. H. E. Crampton, of the Porto Rican committee of the New York Academy of Sciences, has done everything to make the work successful. The officials of the Insular Government, Governor Yager, the auditor, Judge Bonner, and the Chief of the Insular Police, Colonel Shanton, assured the success of the field work by their co-operation. The insular police were always eager to render very capable assistance wherever I found it necessary to call upon them. To the late Basil Hicks Dutcher, then a Major of the U. S. A. and surgeon for the insular troops, I owe a debt of gratitude, as does each one of the Academy field workers in Porto Rico, who found him a close friend. The residents of Porto Rico I found always interested and helpful, and I wish to acknowledge especially the co-operation in my work given by Mr. Leopoldo Strube, of Utuado. Mr. Gerrit S. Miller, Jr., of the United States National Museum, has been very generous in the matter of loans of West Indian bats and other material. Mr. Alex. Wetmoore, of the United States Biological Survey, kindly allowed me the use of his bat records from Porto Rico. Dr. G. M. Allen, of the Museum of Comparative Zoology, and Dr. Witmer Stone, of the Philadelphia Academy of Sciences, have also assisted by the loan of needed material.

The late Dr. J. A. Allen, Curator of the Department of Mammals in the American Museum, gave me the great benefit of his long experience in numerous consultations, both on the systematic work of the report and on editorial matters. Dr. W. D. Matthew, Curator of Vertebrate Palaeontology of the American Museum, and Mr. Walter Granger, of the same department, have assisted me in many ways, not only by contribution of departmental aid but by consultation as well. The Director of
the American Museum, Dr. F. A. Lucas, showed his sympathy and interest in the enterprise and did all that he could to further the work.

Finally, this list would not be complete without an expression of gratitude to my wife, the late Edith I. Anthony, who from the beginning took an active hand in the collection of material and its preparation, the writing of notes, the copying and arranging of the manuscript, the figures and the bibliography.

The text figures, with but few exceptions, were made by Mrs. Helen von Ziska, under my supervision. The bones figured were first outlined by means of the camera lucida and then the proportions checked by dividers. In connection with the text figures, I am greatly indebted to Mr. James P. Chapin, at that time a co-worker in the same department with me, for the benefit of much advice and help.

All of the typing and work of a secretarial nature has been done by Miss Ida Grobe, of the department staff, who has been exceedingly helpful to me in the preparation of this report, and whose name should not be omitted from this list of acknowledgments.

The color terms used in the descriptions are taken from Ridgway, Color Standards and Nomenclature, 1912.

I have constantly consulted The Families and Genera of Bats, by Gerrit S. Miller, Jr. (U. S. National Museum, Bull. 55, 1907), and helped myself liberally to the data therein when giving the characterizations of the bats, because I know of no more authoritative source than this invaluable report. In many cases it may be noted that my descriptions are but slightly altered transcriptions of Miller's wording.

**Physiography**

**Plates I-IX**

Porto Rico is a small island, 95 miles in length by 35 miles in breadth, with an area of 3,668 square miles. In shape it approximates a parallelogram, the sides of which run in the cardinal directions of the compass. The island is divided by physiographic features into several very distinct ecological areas. Mountain ranges of fair elevation extend east and west for the full length of the island, reaching in the western part an elevation of nearly 4000 feet and culminating at the eastern end in El Yunque, of 4985 feet elevation. These ranges form the backbone of the island and the greater part of its area as well. A large part of the northwestern end of the island is limestone, which occurs as a layer of considerable thickness. The southwestern part of the island also contains limestone, but it is here widely scattered. The eastern end of the island consists of conglomerates and metamorphic rock.
On parts of the island the annual rainfall is very heavy, notably in the high mountains at the eastern end and throughout the mountain district in general. On the southwestern end the rainfall is very scanty and desert conditions prevail. There are several good-sized rivers, the largest flowing through valleys of considerable extent. Throughout most of the island the virgin forest has been destroyed to make way for plantations, but in a few isolated localities remnants of the early forest remain. Such places may be found about Maricao, Utuado, and to the greatest extent in the Luquillo region. Close attention was paid to changes in the ecology of the country traversed, in the hope of finding changes in the bat fauna, but none were noted; although, because of the short time spent in the arid southwestern region, the most likely field for such observations was not by any means exhausted.

**List of Caves where Material was Collected**

Plates X-XII

San German— Cave of Monte Grande.
Two caves at Peños Lejos.
One unnamed cave.
Only bats and a very few scraps of *Isolobodon* secured at San German.

Cabo Rojo— Shell-mounds only; fragments of *Isolobodon*.

Utuado— Fourteen caves located at varying distances from the town. Many of these caves are unnamed, but a few have local designations.
Caves of Caguana.
Cueva de los Golondrinos.
Cueva de la Ceiba, on Hacienda Jobo.
Cave on property of Don Gervacio Torño—an important cave for fossils.
Cave on property of Don Sexto Lago.

San Juan Region—Cueva de Fari, near Pueblo Viejo—important for bats.
Cueva de Trujillo Alto—a good bat cave.
Piedra de la Cueva, Old Loiza, home of *Noctilio*.

Quebradillas— Two nameless caves.

Lares— Cueva de Pajita.

Corozal— Cueva de Corozal—a bat cave.

Morovis— Thirteen caves visited, eight of them nameless.
Cueva Lucera.
Cueva de Achatillo.
Cueva de San Miguel.
Cueva Clara—an important cave.
Cueva de Catedral—an important cave.

Cayey— An unnamed cave with many bats.
To summarize results, it might be stated that the Utuado and the Morovis regions were by all odds the richest in fossil-bearing caves. Bats were most abundant and varied in species in the San Juan region. In all, some 54 caves were explored.

List of Indigenous Land Mammals of Porto Rico

**Chiroptera**
- *Noctilio leporinus* mastivus
- *Chilonycteris parnelli* portoricensis
- *Chilonycteris fuliguisa* inflata
- *Mormoops blainvillii*
- *Monophyllus portoricensis*
- *Brachyphylla cavernarum*
- *Artibeus jamacensis* jamacensis
- *Erophylla bombyrons*
- *Eptesicus fuscus* vetmorei
- *Tadarida marina*
- *Molossus fortes*

**Fossil**
- *Monophyllus frater*
- *Stenoderma rufus*
- *Phyllochorycteris major*

**Insectivora**
- *Nexophontes edithae*

**Rodentia**
- *Isolobodon portoricensis*
- *Eiastomodonmys oblignus*
- *Heptaxodon bidens*
- *Heteropsomys insulans*
- *Ialomys antillensis*

**Edentata**
- *Acratocnus odontotigronus*
- *Acratocnus major*

Probable Age of the Fossils

A conservative estimate of the age of the fossil species of Porto Rico would place them in the Pleistocene and probably late Pleistocene. Indeed, it is more than probable that some of this fauna persisted into the Recent. *Isolobodon* we have found in the shell-heaps and know that it was an article of diet among the Arawaks. Many of the bones of the other species have every appearance of being fairly recent, geologically speaking. The evidence would indicate that the fossil species taken were all contemporaneous, since they occur in the same formation in nearly every instance. A possible exception is *Isolobodon*, which was doubtless the last mammal to become extinct on the island.

The fossil remains were encountered at depths of a few inches from the top down to as deep as nine feet. Often but little scraping was necessary to uncover bones, although in this connection it is well to state that the natives of the island are in the habit of digging out the bat guano from the caves and frequently take the earth from the floor of the caves as fertilizer. Thus the height of the earth in any cave may not always be considered with certainty as the maximum height of the deposit. However, the height of the original deposit is generally betrayed

*Also found fossil.*
by a discolored ring around the walls of the cave. The bones were very fresh in appearance when excavated and had not undergone any mineralization. In the case of the bats found fossil in the Cueva Catedral, a number of skulls were collected that prove indistinguishable from the living bats, and this formation contained the insectivore *Nesophontes* as well.

Fossils collected in Cuba and in Jamaica under similar conditions display unmistakable evidence of recent deposit.

As a general rule, the specimens were found in dry limestone caves in the mountainous part of the island. Caves on the sides of small hills yielded the most bones, and the size of the cave was immaterial. The cave that contained the greatest amount of ground-sloth material was a small one, with the entrance on a rather steep hillside and opening out of a sheer front of limestone. Inside, the cave did not open out very wide, but had a deep fissure at the left toward which the floor sloped abruptly. This fissure was richly packed with bones of the sloth and the large rodent *Ehusmodontonyx*, the bones beginning at near the surface and continuing down some nine feet, when excavations had to be given up because of the impossibility of reaching any deeper. This cave had the appearance of a trap for any animal that wandered into it and certainly would have proved so for any old or sick animal that had strength enough to crawl up through the cave entrance. The earth in this cave, which is the one on the property of Don Gervacio Toraño near Utuado, is reddish in color and composed completely of disintegrated limestone. It is rather coarse in texture and intermingled with it were good-sized fragments of the walls.

A much different type of cave is the Cueva Catedral, near Morovis. Also situated on a steep hillside, it occupies the top of a small hill, and the ceiling of the cave has fallen through, letting in considerable light. This cave has two large entrances and is a large, open chamber filled to a depth of several feet with earth and many fallen fragments of limestone. At one side there is a deep deposit of fine powdery soil, almost pure bat guano in spots, sloping rather steeply down from the back wall of the cave. The natives have removed from this part of the cave a great deal of the rich soil for fertilizer. Throughout a stratum of several inches to a foot or more in thickness, this deposit was literally packed with small bones of mammals, birds, reptiles and amphibians. In some spots the bones were interlaced almost in hundreds and a quart of earth required some minutes to pick over. In the crevices between the larger blocks of limestone and in the irregularities in the cave floor were especially rich pockets of these bones. Farther up the slope, above the fine
earth, a large number of skulls, some of them lime-encrusted, were found beneath a heavy, flat slab of limestone.

Subsequent cave explorations in Cuba and Jamaica have indicated that owls are to be considered responsible for these large aggregations of bones of the smaller creatures. The owls spend the day in the caves, where they cast up in pellets the bones of animals small enough to be swallowed, and may carry to their perch there the larger species which must be eaten piecemeal. A cave which is thus the home of owls may, over a period of hundreds or thousands of years, accumulate an almost unbelievable amount of bones, to be judged in hundredweights or even tons in some cases. While the large barn-owl known in Cuba and Jamaica today is absent from Porto Rico, Dr. Wetmore has discovered the fossil remains of a barn-owl among bird bones collected by me at Utuado, while the small bare-legged owl is common on the island today and probably should be considered as a factor in the creation of these cave deposits. (Wetmore, 1922, pp. 299 and 323.)

*Isolobodon* was found on the very surface of the floor, in nearly every case, in caves which had been occupied by the former Indian inhabitants of the island. Designs upon the walls of the cave, broken pottery and ashes attested to the occupancy, and amidst the ashes and fragments of pottery the scattered bones of this rodent could be found. Also throughout the great shell-heaps along the coast, especially at Cabo Rojo, an occasional bone of *Isolobodon* was encountered.

It is likely that the Arawaks or the Caribs carried *Isolobodon* with them in their canoes as food, since the remains of this rodent have been found on the eastern end of Santo Domingo and in the Virgin Islands associated with human artifacts. Wetmore (1922, p. 300) heard stories of the natives which hint at the persistence of *Isolobodon* into quite recent times.

Order CHIROPTERA

Suborder Microchiroptera

The first authentic list of the bats of Porto Rico was published in 1878, a paper by Gundlach in the Anales de la Sociedad Española de Historia Natural, 1878. He listed only four species, *Artibeus perspicillatus*, *Mormoops blainvillii*, *Chilonycteris macleayii*, and *Molossus obscurus*. Later lists have all accredited three of these species to Porto Rico, but for some reason have omitted his record for the genus *Mormoops*. Subsequent papers have added to the Porto Rican fauna, six species and subspecies being given by Dr. G. M. Allen in his *Mammals of the West Indies*, published in July, 1911, in addition to several other subspecies
given as doubtful records. The first mention of any native mammal from Porto Rico not a bat is the description of *Isolobodon portoricensis* by Dr. J. A. Allen (1916, p. 19). Fourteen species and subspecies of bats, four of them new to the island, were given in a paper published on the *Indigenous Land Mammals of Porto Rico* by Anthony (1918). No species have been added since this time.

Four families of bats are represented on the island: the *Noctilionidae* with one species, the *Phyllostomidae* with ten species, the *Vespertilionidae* with one species, and the *Molossidae* with two species. Porto Rico has several endemic species and several genera endemic to the West Indies. These endemic forms are found only in the family *Phyllostomidae*. The species of the other three families all have very near relatives on the continent or possibly occur there as the same species. No less than five genera of the *Phyllostomidae* of Porto Rico are endemic to the West Indies. The following list of the bats of Porto Rico will indicate this relationship:

**Family NOCTILIONIDAE**

*Noctilio leporinus mastirus*...... continental species

**Family PHYLLOSTOMIDAE**

*Chionycteris fuliginosa inflata*...... species endemic to the West Indies

*Chionycteris parnellii portoricensis*...... species endemic to the West Indies

*Mormoops blainvillii*...... species endemic to the West Indies

*Monophyllus portoricensis*...... genus endemic to the West Indies

*Monophyllus frater*...... genus endemic to the West Indies

*Brachyphylla cavernarum*...... genus endemic to the West Indies

*Stenoderma rufus*...... genus endemic to the West Indies

*Artibeus jamaicensis jamaicensis*...... continental species

*Phyllonycteris major*...... genus endemic to the West Indies

*Kryphylla bombifrons*...... genus endemic to the West Indies

**Family VESPERTILIONIDAE**

*Eptesicus fuscus wetmorei*...... continental species

**Family MOLOSSIDAE**

*Tadarida murina*...... species endemic to the West Indies

*Molossus foritis*...... species endemic to the West Indies

The endemic nature of the bat fauna is readily apparent and is good evidence of the long continued separation of Porto Rico from any mainland connection, since it is well known that bats are subject to practically the same laws of dispersal as are terrestrial mammals. (Dobson, 1878.

* Found fossil only.
Family NOCTILIONIDAE

See Miller, The Families and Genera of Bats, p. 95, 1907, for diagnosis of the family; p. 97 for diagnosis of the genus.

Fig. 2.—*Noctilio leporinus mastivus* × 2/1; Old Loiza, Porto Rico

**Noctilio leporinus mastivus** (Dahl)

Text Fig. 2


**Type locality.**—Island of St. Croix, West Indies.

**Distribution.**—Limits of range unknown, but probably the Greater Antilles, the Virgin Islands and St. Croix. Recorded in Porto Rico, Old Loiza, and on Mona Island (Elliot).

**Specimens collected.**—30 (20 skins and 10 alcoholics), from Old Loiza, near San Juan, on the northern coast.

**General characters.**—A very large bat with yellowish white dorsal stripe. Head large and rounded; ears high, narrow, pointed, tragus serrate along posterior border; muzzle simple, nostrils tubular; upper lip simple, lower lip and chin with a few dermal, wart-like growths; cheeks and chin sparsely haired; body robust and heavy; humerus very long and nearly straight; thumb large and strong; third phalanx of third digit very long; hind leg very large, with long tibia, long metatarsus and very large claws; calcar well developed and very long; tail short, enclosed, except for extreme tip, in very wide interdigital membrane; fur very short everywhere, almost woolly; fur restricted along lower back to a narrow median strip, practically no hair on any of the membranes except for a few scattered along lateral membranes; lateral membranes attached rather high on sides of body.

**Color.**—Adult: Above, snuff-brown, the hairs tipped with buff, with a narrow dorsal stripe of yellowish white running from hind neck almost to base of tail; below, whitish to yellowish or buffy, varying with individual; females yellower below than males. One specimen, No. 39563, adult, varies from normal in being cinnamon-buff below.

Young: When nearly full grown very similar to adults, but more strongly yellow on underparts.

**Skull.**—Large and strongly constructed; rostrum of normal length but rather broad; nasals slightly arched, premaxilla thin and inflated, nares opening outward, a pair of foramina at the posterior border of the nasal bones; braincase rounded, globose, with high sagittal and lambdoidal crests; sagittal crest dividing anteriorly and continuing as sharp ridges nearly to the maxillary root of zygoma; mastoid process large, shelf-like, subrectangular; zygomatic arch strong and heavy, flaring widely pos-
teriorly, jugal meeting posterior root of zygoma at a nearly right angle; basisoccipital region very short, slightly tilted upward from plane of palate; basisphenoid pits very faintly indicated; sphenoidal fissure very large and extensive; glenoid broad and shallow; bullae covering about half of cochlea; palate long and broad, deeply concave, more especially from side to side; interpterygoid fossa short and broadly U-shaped; mandible very heavy; horizontal ramus straight; ascending ramus low and rising in gradual curve from horizontal portion; coronoid higher than condyle, peg-like, condyle noticeably elevated above plane of molar crowns; angular process strong and abruptly reflected outward; dental toramen large and conspicuous, below sigmoid notch. Dentition heavy. Skulls of males heavier, with higher crests than those of females.

_Dentition._—1, 2-2; C, 1-1; Pm, 1-1; M, 3-3; (28.

Upper: Incisors unequal, inner much larger than outer pair, strongly in contact at mid-height of tooth, but divergent at root and tip; crowns of inner pair very high, with postero-external heel; outer incisors in contact with inner posteriorly, but separated by noticeable diastema from canines, small and low, with internal cusp; canine large and heavy, with well-developed internal cingulum, but no accessory cusps; inner face slightly concave; premolar very short in antero-posterior axis, with high anterior cusp and well-marked internal heel; first two molars similar, subequal, with W-shaped molar pattern of normal type, hypcone much lower than protocone; third molar reduced, lacking metastyle.

Lower: Incisors small, crowded into and completely filling intercanine space, crowns subrectangular, concave, anterior cutting edge faintly bifid; canine large, with strongly marked internal spiral groove, tooth curved forward at base, backward at tip; first premolar small, with low cusp, crowded by second premolar and by canine; second premolar with crown much wider than long, crowded in tooth-row, with well-developed external cingulum, high anterior cusp and low internal cusp; first and second molars with normal W-crown pattern, teeth projecting externally considerably beyond face of ramus; third molar slightly smaller than the other two, but similar in other respects.

_Measurements._—Average of 7 adult males: Total length, 132 mm. (127–135); tail vertebra, 28.3 (27–31); hind foot, 31.1 (31–35); forearm, 86.7 (85–88).

Average of 7 adult females: Total length, 124.3 (118–135); tail vertebra, 26.3 (25–28); hind foot, 31.1 (30–32); forearm, 83.9 (80–85.8).

_Skull._—Average of 5 adult males: Greatest length, 27.3 (26.6–28.5); zygomatic breadth, 20.26 (19.8–20.7); interorbital breadth, 7.2 (7.1–
17.3); breadth of braincase, 13.9 (13.7-14); mastoid breadth, 19.58 (18-20.1); length of palate, 12.64 (12.3-12.9); length of maxillary molar series, 8.72 (8.5-9.9); length of mandible, 19.06 (18.5-19.1); length of mandibular molar series, 9.88 (9.4-10).

Average of 5 adult females: Greatest length, 25.52 (24.9-26.3); zygomatic breadth, 18.86 (18.6-19.1); interorbital breadth, 6.96 (6.8-7.1); breadth of braincase, 13.1 (13.2-13.6); mastoid breadth, 17.2 (16.8-17.8); length of palate, 11.76 (11.5-12.2); length of maxillary molar series, 8.18 (8.3-8.6); length of mandible, 18 (17.7-18.4); length of mandibular molar series, 9.66 (9.5-9.8).

Remarks.—The species of the genus Noctilio are among the very largest of the New World bats. On the character of size alone, the Porto Rican Noctilio may be readily distinguished from all the other bats found on the island. There is only one other large bat found in the entire West Indies area which surpasses it or even equals it in size. This bat is Vampyrum spectrum and it has not been recorded from Porto Rico. The status of the two forms, leporinus and mastinus, has not been very satisfactorily worked out. Two specimens of leporinus from Trinidad are not very different from the series taken on Porto Rico, the Trinidad specimens being somewhat smaller and with the dorsal line less developed.

This large bat was found at but one locality, in a cave known locally as the Piedra de la Cueva, on the outskirts of the little town of Old Loiza, on the north coast. The fact that Noctilio had not been reported from Porto Rico before would indicate that its distribution is very local. Extracts from the field journal of the expedition will serve to describe the behavior of this interesting bat.

The first cave we came to, called “Piedra de la Cueva,” was a very large, high cave, more a shallow opening into the face of the small hill or huge rock in which it was situated than a cave, in the usual sense of the word. On account of its height the light came through into all parts, and so I did not expect to encounter anything except a few Artibeus. A large pile of droppings underneath a darkened crevice overhead led me to fire a shot on suspicion, and I was rewarded by several specimens of the large, hitherto unencountered Noctilio. At the report, others began to move about, and investigation showed that the cave had a number of these interesting large bats. They were sufficiently high up to be almost safe from my auxiliary, as the fine shot was not very deadly to such large bats at that distance. However, by pegging away at them I secured a fair number. These bats when disturbed flew out into the bright cave and moved about as surely as if the light were absolutely to their liking. Their flight was quite regular, and while not rapid, like that of most of the smaller species, it was a strong, well-sustained flight. The very large hind legs were stretched out behind, straight from the body and approximately parallel, keeping the interfemoral membrane and the posterior part of
the alar membrane in a flat horizontal plane, while the propulsion was furnished by the membrane on the forearm. They looked almost like large birds, as they circled about the cave overhead, the light shining down through their membranes and the red blood showing in the thin feet. When they alighted they seemed sure of their intention and swooped directly to a hanging position and did not make several vain preliminary trials, as does Ariliclus. Their large feet proved admirably suited to hanging, and they crawled about, upside down, with considerable agility, moving sometimes quite a distance before they found a spot that suited them well enough to remain. From below they seemed almost like big spiders crawling about on the rocky ceiling. Considerable of the crawling was done by means of the feet only and the thumbs were used only about half the time. A mother with an almost hairless young flew about the cave a few times, and then, as she had been wounded, flew against the side of the cave and was later secured. The call-note was distinctly different in tone from that of the other bats, being rather high pitched for such a large bat. These bats were very tenacious and, like all the other species, attempted to bite when picked up. They seemed to be crowded in several crevices that led back into the ceiling out of the direct light, but were rather easily alarmed, and a shot or two invariably brought individuals crowding out from such places. Ariliclus that were found in the same cave did not mingle with these bats and were dwarfed in comparison when flying beside their larger companions of the cave.

A minute, reddish parasite was found dotted over the interfemoral membranes of Xoctilia. It was a conspicuous feature in spite of its small size, and was seen on no other species of bat taken on Porto Rico. A small ectoparasite found in the fur has been identified by Dr. J. Bequaert as Paradyschiria fusca Speiser. This species was characterized by a very strong, disagreeable odor, rather musky in its nature.

Family PHYLLOSTOMIDAE

Subfamily CHILONYCTERINAE

See Miller, The Families and Genera of Bats, p. 116, 1903, for diagnosis of the family; p. 118 for diagnosis of the subfamily Chilonycterinae; p. 119 for diagnosis of the genus Chilonycteris.

Chilonycteris parnellii portoricensis (Miller)

Text Fig. 3


**Fig. 3.** *Chilonycteris parnellii portoricensis* × 3/4; adult ♂; Trujillo Alto, Porto Rico

**Type locality.**—Cueva de Fari, near Pueblo Viejo, Porto Rico.

**Distribution.**—Known only from the Island of Porto Rico. Recorded from Cueva de Fari, Cueva de Trujillo Alto and Cayey (U. S. Biol. Survey).

**Specimens collected.**—Two, from Cueva de Trujillo Alto.
General characters.—Size medium; ears tall, rather narrow and pointed, lower border extending outward in a broad shelf covered with long hairs, tragus blunt; nose simple, without leaf; under lip with a pair of transverse cutaneous lappets; forearm but moderately curved; tail short, free for the terminal half; feet of medium size; calcar long and slender; hair of sides not running onto membranes, but a few scattered hairs continuing along humerus and femur and onto the interfemoral membrane for about half its depth; hairs about nose directed forward.

Color.—Above, a uniform brown, about dusky drab, the hairs grayish at base; pelage rather thinner on neck and shoulders allowing more or less of light color at bases of hairs to show through; below, light drab; the hairs of abdomen blackish brown at base, those of the throat but little darker at base than tip; membranes blackish brown; hair everywhere rather long, soft and lax.

Skull.—Of moderate size with high, rounded braincase; rostrum long and somewhat inflated; a nasal concavity present; braincase tilted at an angle to axis of rostrum, globose; zygoma not flaring; interpterygoid fossa short; palate long and narrow, widening slightly anteriorly; cochlea large; mandibular rami long and curved upward posteriorly; coronoid low, about as high as condyle; angular process deflected outward.

Dentition.—$1, \frac{2-2}{2-2}; C, \frac{1-1}{1-1}; Pm, \frac{2-2}{3-3}; M, \frac{3-3}{3-3} = 34$.

Upper: Inner incisors about twice as large as outer, crowns with broad cutting edge; outer incisors low and crown almost flat; incisors all in contact and no diastema in the entire tooth-row; canines typical, with large internal cingulum and concave internal face; first premolar small, with high anterior cusp and prominent postero-internal basin; second premolar about twice as large as first, with a single, very high, sharp cusp and a wide internal basin; first and second molars with normal W-shaped molar pattern composed of five cusps and four commissures; third molar less than half as large and with only three commissures.

Lower: Incisors subequal, simple, cutting edges trifid; canines with internal cingulum and deep longitudinal grooves on internal and posterior faces; first and third premolars about equal in size, second much smaller; first premolar simple with single high conical cusp; second premolar minute and almost crowded out by first and third premolars; third premolar with high sharp cusp; three molars subequal, the third but little smaller than first two, molar pattern a widened W.

Measurements.—Two males: Total length, 78. 83 mm.; tail vertebrae, 20, 20; hind foot, 12. 13; forearm, 49.5, 51.
Skull.—Total length, 20, 20.4; zygomatic width, 10.8, —; interorbital width, 3.8, 3.9; breadth of braincase, 9.2, —; length of palate, 9.1, 9.1; length of molar series, 6.7, 6.7; length of mandible, 14.4, 14.7; length of mandibular molar series, 8.2, 8.3.

Remarks.—There are two species of the genus *Chilonycteris* occurring on Porto Rico. These two forms may be easily separated on the basis of size. *C. parnelli portoricensis* is much larger than *C. fuliginosa inflata*. It is also apparently a much rarer species and not found in such large numbers. The nearest relative of *portoricensis* is *C. parnelli boothi* of Cuba, from which it differs in smaller size and more inflated skull. In addition, the ear of *boothi* is more pointed and falcate than the ear of *portoricensis*.

Only two specimens of *portoricensis* were taken and it was found only at one place, the Cueva de Trujillo Alto. The type locality for the species is the Cueva de Fari, Pueblo Viejo, but although this cave was visited several times and carefully searched, no *portoricensis* were seen there. It is evidently not a common species anywhere, as the two specimens secured were the only ones seen, and the cave where they were found was visited no less than three times and hunted assiduously in the effort to secure more. The two specimens were found in an inner alcove of the cave, off to one side of the main chamber, from whence they issued with a swarm of the smaller species of *Chilonycteris*, *Monophyllus* and the rare *Mormoops*.

A fossil skull of this species was also found. Among a considerable collection of fossil bat skulls and limb bones picked up in the Cueva Catedral, there is one fairly complete skull of *C. p. portoricensis*. This skull shows no difference whatever from the skulls of the bats living on the island today.

*Chilonycteris fuliginosa inflata* (Rehn)

Text Fig. 4


Type locality.—Cueva de Fari, near Pueblo Viejo, Porto Rico.

Distribution.—Restricted to the Island of Porto Rico. Recorded as follows: Cueva de Fari; Mayaguez (U. S. Nat. Mus.); Cueva de Trujillo Alto.

Specimens collected.—79: Cueva de Fari, Pueblo Viejo, 19 (12 skins); Cueva de Trujillo Alto, 60 (8 skins).

General characters.—Size very small; ears quite high, narrow and pointed, widening abruptly into an ample conch at base, with two or three tooth-like projections on external border about midway; tragus of moderate length, with distinct notch-like infolding in anterior edge; nostrils simple, without nose-leaf, but having a very low transverse ridge just back of nares; nose-pad with a number of low, rounded excrescences along the margin; lower lip with lateral lobes or folds meeting anteriorly to form a lappet, median region of lappet papillose; body everywhere furred; membranes naked; tail about one-half the length of head and body, free for terminal one-fourth; interfemoral membrane nearly twice as deep as length of tail; calcar very long and slender; femur nearly as long as tibia, both bones slender; humerus strongly bowed; hair of moderate length, soft, denser on back and belly than on neck, stiffer about face and directed forward; a distinct longitudinal parting in the hair at anterior edges of ears, and hair on throat lax and radiating in all directions.

Color.—Two color phases are found in this species—a rich brown phase and a gray brown phase, the latter seemingly the commoner.

Cinnamon-brown phase: Above, color between cinnamon-brown and Prout's-brown, the hairs of the neck lighter at base, ochraceous buff, this color showing through, making the whole general tone lighter; below, hairs posterior to pectoral region between Saccardo's-umber and isabella
color, with hairs darker at base; throat and under side of neck cinnamon-buff, the hairs cinnamon-brown at base. The color is rich, not truly indicated by any single shade.

Bister-brown phase: Above, bister, varying in some individuals to Prout's-brown; hair on neck and shoulders drab-gray, crown like back; below, breast and abdomen like back, the hairs tipped with drab-gray, throat to breast light ochraceous buff, the hairs at base bister, a few hairs on throat drab at base.

Young: Individuals with the teeth sharp and showing little wear, but otherwise fully adult in every particular, have a pelage differing radically from either of the above and seem to be best accounted for by assuming an immature pelage that persists for some time. These individuals are a uniform slate-black above, with the neck pallid neutral gray, and color below nearly as dark as on back, except for throat and inguinal regions, which are lighter, like the neck above. One specimen, No. 39357, appears to be passing from the immature to the bister-brown phase.

These three different pelages, or color phases, while very distinct when selected specimens are compared, nevertheless gradually grade from one to the other in the series from Porto Rico.

Skull.—Small and delicate; elongate, with swollen rostrum and roundly inflated braincase; braincase raised up or tilted to axis of rostrum; zygoma narrowly expanded; nasals depressed; a sagittal crest, low but distinct from interorbital region to lambdoidal crest; auditory bullae inflated; palate normal; pterygoids divergent; mandible with a strong horizontal ramus of nearly uniform depth throughout; ascending ramus low; condyle small and higher than the weak coronoid; angular process subfalciform, strongly divergent externally.

\[
\text{Dentition.} - I, \frac{2-2}{2-2}; C, \frac{1-1}{1-1}; Pm, \frac{2-2}{3-3}; M, \frac{3-3}{3-3} = 14.
\]

Dentition almost identical, except for size, with that of *Chilonycteris p. portoricensis*, q. v.

Upper: Central pair of incisors bifid and larger than outer pair, which are appressed to sides of first; canine long, slender, sharp; first premolar much smaller than second; second premolar with highest cusp of molar series and well-developed internal cingulum; first two molars equal, with broad crowns and prominent W-shaped pattern; third molar about half as large.

Lower: Incisors subequal, with bifid cutting edges; canine normal; first and third premolars equal, with simple acute cusp, second small and nearly crowded inwardly from tooth-row; molars of nearly equal size, with normal cusps, high and sharp.
The skulls of females do not differ appreciably from those of the males, as they do in the case of the related *macleayii* of Cuba.

**Measurements.**—Average of 16 specimens, all adults: Total length, 66.25 mm. (62-70); tail vertebrae, 21 (19-26); hind foot, 9.37 (9-10); forearm, 38.41 (37.5-39.5); ear from meatus (average of 5 alcoholic specimens), 15.

**Skull.**—Average of 10 skulls, a series of 5 adult males and 5 adult females: Greatest length, ♂ 14.88 (14.6-15.1), ♀ 14.84 (14.5-15.1); zygomatic breadth, ♂ 7.56 (7.5-7.7), ♀ 7.54 (7.5-7.6); interorbital breadth, ♂ 2.91 (2.8-3.2), ♀ 3.04 (3-3.1); breadth of braincase, ♂ 6.78 (6.7-6.8), ♀ 6.58 (6.4-6.8); breadth of rostrum outside of m2, ♂ 6.14 (6-6.3), ♀ 6 (6-6); length of palate, ♂ 6.76 (6.6-7.1), ♀ 6.66 (6.5-6.8); length of maxillary molar series, ♂ 4.7 (4.6-4.8), ♀ 4.7 (4.6-4.8); length of mandible, ♂ 10.26 (10-10.4), ♀ 10.34 (10.2-10.5); length of mandibular series, ♂ 5.14 (5.3-5.6), ♀ 5.44 (5.3-5.5).

**Remarks.**—Dr. G. M. Allen discovered the presence of two small species of *Chilonycteris* in Cuba, describing the new one as *C. torrei*, which is distinguished from *C. macleayii* by the presence of two or three minute tooth-like projections on the ear, and lower nose-pad with less prominent protruberances, and slightly smaller size throughout. The Porto Rican subspecies, *inflata*, has the same assemblage of characters which mark *torrei*, and consequently the old designation of *inflata* as a subspecies of *macleayii* had to be revised. The next name available for the small species of West Indian *Chilonycteris* is *fuliginosa* Gray, 1843, occurring in Haiti. Gray's type is in the British Museum and Mr. Oldfield Thomas has examined it and pronounced it to be of the *torrei* style, while four specimens of *Chilonycteris* from Santo Domingo loaned by the Academy of Natural Sciences of Philadelphia, as well as specimens from Haiti in the American Museum, are also similar to *torrei* in the details of ear and nose structure. *Inflata* is thus made a subspecies of *fuliginosa*, and the name of the Porto Rican bat should stand as *Chilonycteris fuliginosa inflata* (Rehn).

*Chilonycteris fuliginosa inflata* is larger and has a longer calcare than true *fuliginosa* of Haiti, and also shows the extreme degree of rostral inflation for the entire group of small Antillean *Chilonycteris*. In addition to the characters mentioned, which separate it from *macleayii* of Cuba, *inflata* has a broader palate and shorter, broader ear. *C. macleayii grisea* of Jamaica is a larger bat than *C. f. inflata* and may be distinguished by this character.

I secured this bat only in the northern part of Porto Rico, in the San Juan district. A specimen taken at Mayaguez (Rehn, 1904, p. 191) is
in the United States National Museum, and Gundlach (1878, p. 140) records one which he caught in his house in Mayaguez. Although this species might be taken anywhere throughout the island, the field work done by this expedition inclines me to believe that normally it is restricted to a narrow belt along the north coast.

In the Cueva de Fari and Cueva de Trujillo Alto large numbers were found, more especially in the latter. This species prefers deep, narrow fissures or holes in the walls and ceiling and does not often cluster in the more open recesses. When disturbed, the inmates pour out in a rapid stream and disappear like shadows into some other part of the cave. The flight is very swift, but, owing to the small size of this bat, may appear to be more rapid than it actually is. When frightened from a resting place, as a rule they leave the spot with very little reluctance and do not hover about or make tentative returns. This species was not found in houses, as MacLeay found the small Chilonycteris in Cuba. A very small bat, possibly infleta, was seen at dusk flying over the streets of Lares. No small young were noted with the adults of this species, although young of the other species of bats were quite common at this time (July).

**Mormoops blainvillii** Leach

Text Figs. 5 and 6

See Miller: The Families and Genera of Bats, p. 121, 1907, for diagnosis of the genus.


1924. *Mormoops blainvillii cinnamomea* Miller, North American Recent Mammals, p. 44.

*Type locality.*—Casetal, San Antonio el Fundador, Cuba.

*Distribution.*—Cuba, Santo Domingo, Mona Island and Porto Rico.
Recorded in Porto Rico from Trujillo Alto and from "la parte meridional de la Isla" (Gundlach).

Specimens collected.—Six: Five skins and one alcoholic. Cueva de Trujillo Alto.

Fig. 5.—*Vormops blainvillii* X 3; adult ♀; Trujillo Alto, Porto Rico

General characters.—A small or medium size bat with grotesque head and face and wide interfemoral membrane; face very short; muzzle with small pad, but no nose-leaf; upper lip with two small fleshy processes on either side of nostril, and notch opposite first premolar; lower lip and chin with complex pad of fleshy leaflets, surface papillose; ears large, exceedingly broad, not joined across forehead, lower margin of ear conch broad and shelf-like; tragus large, complex, with subterminal process; eye small and located in enclosure made by ear, a small wart-like ridge at posterior border of eyelids; humerus of normal length, strongly bowed, pollex small and weak; femur and tibia long, hind foot small and delicate, calcar very long and well developed; tail long, enclosed, except for
tip, in very broad interfemoral membrane; membranes very thin and delicate, everywhere naked; fur long, lax, and exceedingly soft and silky.

Color.—Two types of coloration are represented. Four skins are as follows: above, uniform Saccardo’s-umber, the hairs distinctly lighter basally; below, about vinaceous buff. The fifth skin, No. 39558, is much darker than the others. Above, Prout’s-brown; below, between cinnamon-brown and ochraceous-tawny.

**Fig. 6.** *Mormops blainvilli* × 4.1: adult ♂: Trujillo Alto, Porto Rico

**Skull.**—Small and rather delicate; rostrum about as broad as long; with median nasal depression and inflated maxillaries; braincase globose, tilted to the axis of the rostrum so that frontal region makes an angle of almost 90° with rostrum; sagittal crest faintly indicated; mastoid process not expanded from braincase; zygomatic arches scarcely flaring; jugals nearly parallel; palate long, narrow, shallowly concave posteriorly; ptery-
goid processes depressed from palatal plane; glenoid large, rather flat; bulbae large, about equal to cochleæ; mandible long and narrow; horizontal ramus long, of good depth, ascending ramus broadly curving upward; coronoid very low, about midway between the condyle and molar plane; condyle high above molar crowns; angular processes flaring outward; dentition strong.

Dentition.—I, \frac{2-2}{2-2}; C, \frac{1-1}{1-1}; Pm, \frac{2-2}{3-3}; M, \frac{3-3}{3-3} = 34.

Upper: Inner incisors strongly in contact, with expanded crowns and looking somewhat as if they had been rotated slightly on the body of the tooth, cutting edge trenchant and bifid; outer incisors very minute, subterete, crowded against inner pair; noticeable diastema between canines and incisors; canine long, compressed, with keen cutting edges; first premolar very low-crowned, with very sharp median cusp and low posterior concavity; second premolar with highest cusp of molar series; first and second molars subequal, normal in detail, with W-shaped crown pattern, as in Chilonycteris; third molar reduced, lacking a cusp and a commissure of the W.

Lower: Incisors equal, small, cutting edges trifid, forming a close row, slightly convex between canines; canine simple, sharp; three premolars subequal, second smaller than first or third, with single trenchant cusps; three molars similar in detail, of nearly equal size, with normal cusps well developed.

Measurements.—Average of 5 adult females: Total length, 83.8 mm. (80-86); tail vertebrae, 29 (28-30); hind foot, 10.5 (10-11); forearm, 46.7 (46-48).

Skull.—Average of 5 skulls: Greatest length, 14.1 (13.8-14.4); zygomatic breadth, 8.55 (8.5-8.6); interorbital breadth, 4.4 (4.3-4.5); breadth of braincase, 7.38 (7.3-7.6); length of palate, 8.4 (8.1-8.8); length of maxillary molar series, 6.2 (6-6.4); length of mandible, 12.06 (11.9-12.2); length of mandibular molar series, 7.36 (7.2-7.5).

Remarks.—Mormoops blainvillii apparently remains unchanged over rather an extensive range, since specimens from Jamaica, Haiti, Cuba, Mona Island and Porto Rico are indistinguishable from one another. The question is complicated by the extreme variability in color shown by all the species of this genus, but the skull characters identify the Porto Rican specimens with the Cuban series. From M. b. blainvillii of Jamaica, M. b. cinnamomea has been differentiated by Rehn (1902, pp. 165-166), the reviser of the genus, on the character of the first upper premolar, "greatly expanded posteriorly." I have examined the same speci-
mens which Rehn had, with the advantage of additional specimens (the total number of West Indian Mormoops, 31, as follows: Jamaica, 15 skins and alcoholics with 12 skulls; Cuba, 4 skins and alcoholics with 4 skulls; Haiti, 1 alcoholic with 1 skull; Mona Island, 5 alcoholics with 5 skulls; Porto Rico, 6 skins and alcoholics with 5 skulls), and find that I am unable to distinguish more than one form in the lot. The shape of the first upper premolar varies somewhat with the individual and I can see nothing to indicate subspecific separation for the Porto Rican animal. The degree of rostral inflation varies as well.

None of the Porto Rican animals show the intense ochraceous coloration attained occasionally by this species elsewhere, but doubtless this is a condition due to the small size of the series, and more extended collecting would secure the bright individuals.

Mormoops appears to be a rare bat in Porto Rico, as it was seen in but one cave, Cueva de Trujillo Alto, and then only in very small numbers. One was secured July 4 after several shots had been fired into a chamber teeming with Monophyllus, and on later visits, July 14 and 20, a very few were found to be hanging in crevices in a small, elevated chamber, to which it was rather difficult to ascend from the main floor of the cave. Here it was consorting with the smaller Chilonycteris and Monophyllus, being found mingled with masses of these two genera. When in flight, which was generally only after all the other bats had departed, this species would alight on the first favorable spot, seemingly heedless of the light and confusion or else bewildered by such strange happenings, where it could be struck with a bit of brush. It is easily the most grotesque in appearance of any of the bats on Porto Rico, because of its very peculiar ears and complexly ornamented lower lip.

With the fossil remains of Neospathistes, Stenoderma, Phyllonycteris and other bats were found three skulls and two mandibles of Mormoops. The fossil skulls differ to no appreciable extent from recent skulls of Mormoops.

Subfamily GLOSSOPHAGINAE

See Miller: The Families and Genera of Bats, p. 136, 1907, for diagnosis of subfamily; p. 139 for diagnosis of genus.

Monophyllus portoricensis Miller

Text Fig. 7


**Fig. 7.** *Monophyllus portoricensis* × 3:1; adult ♂; Pueblo Viejo, Porto Rico

*Type locality.*—Cave near Bayamon, Porto Rico.

*Distribution.*—Known only from the Island of Porto Rico. Recorded from Bayamon, Cueva de Fari (near San Juan), Cueva de Trujillo Alto and Cayey (U. S. Biol. Survey).

*Specimens collected.*—125: Cueva de Fari, Pueblo Viejo, 3 skins; Cueva de Trujillo Alto, 122 (15 skins).

*General characters.*—Size small; nose and ears simple; tail very short, nose-leaf low, pointed; ears of medium height, about as broad as high, rounded at tip; tragus simple, straight; chin with median cleft; tail about 7 mm. long, free at tip; interfemoral membrane very narrow and
attached to a greatly reduced calcar; feet small; humerus haired on proximal third above and below, no hair on membranes elsewhere; hair everywhere soft and of moderate length.

Color.—Adults: Above, bone-brown, rather lighter on sides of neck; hair everywhere above practically unicolor except for minute grayish tipping of some hairs which suggests a frosted appearance: below, hairs bister at base, vinaceous buff at tips; membranes brownish black, ears-hair-brown.

Young: Everywhere darker than adults; color above, blackish brown; below, deep mouse-gray.

Skull.—Long, slender and delicately constructed; rostrum very long, slender and tubular; braincase large, rounded and smooth, not rising abruptly from plane of rostrum; zygomatic arches complete, but very light; bullae of moderate size, but smaller than cochlea; dentition very weak; palate long and narrow; basisphenoid pits distinct; mandible long, slender and nearly straight; coronoid low; condyle in plane of coronoid; angular process slightly deflected outward.

Dentition.—I, $\frac{2}{2}$; C, $\frac{1}{1}$; Pm, $\frac{2}{2}$; M, $\frac{3}{3}$ = 34.

Upper: Incisors about equal in size, very small, simple, outer pair inclined toward but not in contact with inner pair; diastema between incisors and canines; canine sharp and dagger-like, with internal anterior and posterior cutting edges and a poorly developed cingulum; first pre-molar with high, sharp, median cusp, the entire crown being sharp and narrow; second premolar like first, but rather larger; first two molars with sharp-cusped W-shaped crowns and extensive internal basins; last molar smaller and lacking the complete W.

Lower: Incisors often lacking in adult, but when present are very minute, simple, peg-like, not in contact with one another or with canine, crowns very low: canine sharp and with posterior cingulum; premolars like those of upper series, but the first one lacking the well-developed median cone: molars similar to upper molars, but very narrow and long, with a reduced external basin.

Measurements.—Average of 18 specimens from Cueva de Fari and Cueva de Trujillo Alto: Total length, 66.8 mm. (63-71); tail vertebrae. 8.8 (7-10); hind foot. 11.4 (11-12); forearm. 36.7 (36-38).

Skull.—Average of 5 adult skulls: Total length, 19.8 (19.1-20.3): zygomatic width, 8.5 (8.3-8.7); interorbital width, 3.86 (3.8-3.9); breadth of braincase, 8.32 (8.2-8.4); length of palate, 9.4 (9.3-9.5); length of molar series, 5.6 (5.6-5.6); length of mandible, 12.36 (12.1-12.8); length of mandibular molar series, 6.38 (6.2-6.8).
Remarks.—The genus Monophyllus is known only from the West Indies, where it occurs as different species on several islands. The genus is well characterized, and Monophyllus portoricensis is not liable to be confused with any other Porto Rican bat. M. portoricensis differs from the species of Monophyllus on neighboring islands by its smaller size, having a forearm less than 40 mm. The Monophyllus of Jamaica has a larger skull than that of the Porto Rican species, while the rostrum is proportionally much shorter and more tubular. M. cubanus of Cuba is quite similar to M. portoricensis, but the latter may be distinguished by a smaller skull, shorter rostrum and more rounded braincase.

This small bat was encountered in great numbers in the Cueva de Trujillo Alto, where it outnumbered all of the other bats. Here it was clustered in masses, hanging in deep crevices, or "chimneys," in the ceiling of the cave, and generally appeared to be segregated by sexes. Thus, out of 83 specimens collected on July 14, 80 were males. This species appeared to be rather loth to leave a locality, and even when disturbed flies about in fluttering circles several moments before leaving the spot for good. After several shots had been fired the bats would move on into an adjacent chamber. Some individuals which were knocked down into the stream that flowed through the cave lost little time swimming to the edge and crawling out. Others, which had been knocked down by means of a handful of slender branches and were not very seriously injured, crawled down into a deep fissure between the earth and the rocky wall of the cave and behaved very much like so many mice. When this species was flying about in a wild and disturbed condition, I often noted a metallic buzzing sound that seemed to be made by Monophyllus, and yet it was unlike any noise that I had hitherto heard made by bats. It was more suggestive of the droning flight of a huge beetle, and possibly may have been made by individuals with shot-pierced wings. The flight of this bat is strong, but not particularly erratic or angular.

Monophyllus was found only sparingly in the Cueva de Faro near Bayamón. These two localities, Cueva de Faro and Cueva de Trujillo Alto, were the only places where Monophyllus was taken by this expedition, but an additional record from the United States Biological Survey gives Cayey as a third locality.

This species was found as a fossil in the Cueva Catedral. A single fragmentary skull agrees well with skulls of the present-day animal. The fossil Monophyllus was found associated with Monophyllus frater, Phyllonycteris major and other species now extinct.
Monophyllus frater Anthony

Text Fig. 8


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**Fig. 8.** *Monophyllus frater* × 2 1; type: Morovis, Cueva Catedral, Porto Rico

*Type locality.*—Cave near Morovis, Porto Rico. The type is a broken skull with complete rostrum and palate, but with most of the braincase missing; the only teeth present are the last premolar and the three molars of the left side. Topotypes supply a few details indeterminable from the type.

*Distribution.*—Known only from the Island of Porto Rico.

*Specimens collected.*—Five fragmentary skulls, only one of which, the type, shows any great assemblage of characters, but all are unmistakably of the same species. They were collected in the Cueva Catedral, near Morovis.
General characters.—Very similar to *Monophyllus portoricensis*, but decidedly larger.

Skull.—Narrow and elongate; rostrum very long, tubular, with shallow nasal depression in region of terminal suture, external nares subelliptical, opening decidedly upwards; interorbital constriction scarcely noticeable; braincase incompletely known, but of rounded type; zygomatic arch doubtless complete; palate long, narrow, shallowly concave posteriorly, incisive foramina large; interpterygoid notch about midway between last molars and tips of pterygoid processes; dention normal for the genus. Mandible unknown.

Dentition.—Only upper dentition known from specimens, lower dentition assumed to be normal and so indicated in following formula:

\[
\begin{align*}
1, & \quad 3-2 \\
C, & \quad 1-1 \\
Pm, & \quad 2-2 \\
M, & \quad 3-3
\end{align*}
\]

The first tooth of the series present is the second premolar, but the alveoli of the incisors, canine and first premolar indicate a strictly normal *Monophyllus* dentition. Cusp of second premolar, the highest of the molar series, triangular in outline, with trenchant edges and conspicuous anterior and posterior accessory cusp on cingulum; molars with flattened-out and widened W-pattern, the cusps well developed, the commissures low; third molar with W incomplete, lacking the posterior stroke; outline of posterior border of first two molars with distinct indentation.

### Measurements of *Monophyllus*

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<tr>
<th></th>
<th>Interorbital breadth</th>
<th>Breadth of rostrum at m²</th>
<th>Length of palate</th>
<th>Breadth of palate inside m²</th>
<th>Alveolar length of maxillary molar series</th>
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<td>2.9</td>
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</table>

*Type.*

Remarks.—This large species of *Monophyllus*, while not found living today, was apparently contemporaneous with the smaller *M. portoricensis* at the time that the cave deposits were laid down. A typical skull of the smaller *portoricensis* found in the same deposit with the skull of *frater* would indicate that the two forms were living as distinct species. Had
this material not been discovered, associated, the natural assumption to make would account for portoricensis as a descendant of frater. The relationship of frater and portoricensis is quite close, however, and the differences appear to be in size rather than in detail. The two may be distinguished most readily by the greater length and breadth of rostrum and palate and by the much heavier dentition of frater.

M. frater appears to be the largest species of the genus Monophyllus. It is larger than M. lucine from the Island of St. Lucia, Lesser Antilles, having a longer rostrum and noticeably longer tooth-row.

It is quite possible that frater may yet be found living, and only a longer period of careful and extensive collecting can definitely prove this point.

Subfamily STENODERMINAE

See Miller: The Families and Genera of Bats, p. 149, 1907, for diagnosis of the subfamily; p. 152 for diagnosis of the genus Brachyphylla.

Brachyphylla cavernarum Gray

Text Fig. 9

1924. Brachyphylla cavernarum Miller, North American Recent Mammals, p. 54.

Type locality.—Island of St. Vincent, West Indies.


Specimens collected.—49: Pueblo Viejo, Cueva de Fari, 18 (8 skins); Cueva de Trujillo Alto, 10 (3 skins); Cayey, 1; Corozal, 20.

General characters.—A large, heavy-bodied bat with rudimentary nose-leaf, no external tail, and pale in color. Head large and rounded; pad

1 Through the kindness of Mr. Gerrit S. Miller, Jr., the author has been able to borrow specimens of Monophyllus lucine, clinodius and plethodon from the collection of the United States National Museum, and has thus, with the material in the American Museum, examined all the known specimens of the genus.
on muzzle, and nose-leaf represented by a low transverse ridge, faintly emarginate at middle and lacking any upright process; ears of moderate size, not reaching to tip of nose when laid forward, tips somewhat rounded; tragus tall, broad, with two wide notches on posterior border; humerus long, heavy, noticeably bowed; pollex long and strong; tibia and foot of normal length, calcar present but very small; no visible external tail; interfemoral membrane narrow; membranes very thick, heavily wrinkled between humerus and tibia; no hair on membranes except scattered hairs on interfemoral membrane; pelage of moderate length, with slight tendency to be woolly.

*Color.*—Adults: Above, tips of hairs warm sepia, greater length of the
hair ivory yellow, the exact tone varying with the individual; patches on
neck, shoulders at base of ears, and along sides having a much lighter
appearance than rest of upper parts because many of the hairs lack the
dark tips; underparts wood-brown, the hairs unicolor to the base except
on throat, where they are slightly paler at the base; membranes blackish-
brown.

Immature: Animals as large as the adults, but not yet in adult pelage,
are colored as follows: above, hairs tipped with deep mouse-gray, on the
rump and flanks the hairs practically unicolor to base, a patch along
either side of neck to shoulders white to gray basally; below, mouse-gray.
Considerable variation in the amount of dark tipping to the hairs is
shown.

Skull.—Large and strongly constructed; rostrum slightly longer than
broad, flattened across nasal suture, but not excessively so, nasals slightly
elevated above plane of upper border of maxillary, external nares opening
upward and outward; interorbital constriction slight; braincase long,
well rounded, greatest breadth posteriorly, well-developed sagittal crest.
mastoid process very poorly developed; zygomatic arches wide-spread,
evenly flaring; palate long. U-shaped, shallowly concave, interpterygoid
notch not reaching plane of zygomatic root of maxillary; basisphenoid
pits shallow, widely separate; bullae large and completely covering cochleae;
mandible strong and heavy; horizontal ramus deep, slightly concave
along lower border; ascending ramus broadly expanded; coronoid very
wide, much higher than condyle, subfalcate; condyle slightly above plane
of molar crowns; angular process very broad, posterior border a wide
curve ending above in an abrupt shoulder, deflected but slightly; den-
tition heavy.

Dentition.—I, \( \frac{2-2}{2-2} \); C, \( \frac{1-1}{1-1} \); Pm, \( \frac{2-2}{2-2} \); M, \( \frac{3-3}{3-3} \) = 32.

Upper: Inner incisors large, in contact at midpoint of tooth, cutting
dge a high triangle, posterior cingulum present; outer incisors minute,
in contact with crowns of inner pair, but not extending above their cin-
gula, peg-like in shape with slightly expanded crowns; canine large and
heavy, with antero-internal cutting edge, prominent posterior accessory
cusp, well-developed internal cingulum bearing two low cusps; first pre-
molar small, with crown almost same in cross-section as body of tooth,
cutting edge bilobed, crowded between canine and second premolar; sec-
ond premolar with very high cusp on cutting edge, the highest cusp in
molar series, with narrow internal cingulum and low cusp; first and
second molars similar, second slightly the larger, crowns wider than long.
greatest breadth externally, external cutting edge with two trenchant cusps, protoconule and metaconule present but small, internal cusp or protocone of good size, crushing surface concave with a few coarse wrinkles; third molars less than half size of first, with concave crushing surface and two external and two internal cusps, all low.

Lower: Incisors equal, crowded against canines and one another to form a slightly convex row, crowns flattened, and borders slightly rounded; canines strong and sharp, with well-marked posterior heel; first premolar smaller than second, more than half as high, with triangular, trenchant cusp and internal cingulum; second premolar with cusp much the highest of the molar row and even approximating the canine; first and second molars with broad, flattened crowns, with low cusps and wrinkled surfaces; third molar nearly as large as first, with crown similar in appearance but with rather high metaconid.

**Measurements.**—Average of 11 adult specimens. 2 males, 9 females: Total length, 107.3 mm. (100–118); hind foot, 22 (21–23); forearm, 64.5 (63–66.4).

Skull.—Average of 10 adult skulls, 3 males, 7 females: Greatest length, 31.5 (30.1–32.3); zygomatic breadth, 17.13 (16.3–11.8); interorbital breadth, 6.38 (6–6.8); breadth of braincase, 12.53 (11.8–12.9); length of palate, 12.86 (12.3–14); breadth of palate outside m², 11.48 (11.2–11.9); length of maxillary molar series, 8.73 (8.6–9); length of mandible, 20.73 (20.2–21.4); length of mandibular molar series, 10 (9.8–10.2).

**Remarks.**—This large, robust-bodied bat may be easily identified in the field by its peculiar light coloration, narrow interfemoral membrane, its muzzle with the low transverse ridge and no upright leaf or process, and lack of a tail. Next to *Noctilio leporinus masturus*, it is the largest of the Porto Rican bats, although it is closely approached in size by *Artibeus jamaicensis*. From *Artibeus*, *Brachyphylla* may be told by the lack of a nose-leaf and the much paler coloration.

*Brachyphylla cavernarum* ranges over a rather extensive area without any apparent differentiation. Specimens from Porto Rico agree quite well with specimens from St. Vincent, the type locality, as well as with specimens from other West Indian islands. Doubtless *Brachyphylla* ranges throughout most of Porto Rico, but it was found only along the north coast and the northwestern parts of the island. Usually it was found in large numbers if the cave was of any size. It appeared to be truly a cave-dwelling bat and was not found in any other situation.

It is often found associated with *Artibeus*, since the two are very similar in their habits. Both genera frequently use well-lighted caves and
even in extensive caves are found quite close to the entrance. *Brachyphylla* is decidedly quarrelsome in disposition, and bats which are at rest show their petulant nature when a new-comer attempts to crowd in, greeting the intruder with angry squeaks. The call-note is a strident, rasping squeak. Because of the aggressive disposition of this species, live specimens must be handled with care, for it is always ready to bite and capable of quite a severe nip.

Nursing females were collected on July 5, but no small young were noted.

Dr. Bequaert has identified as *Pterellipsis aranea* Coq, parasites which were taken from the fur of this bat.

Considerable fossil material of this species was collected in the Cueva Catedral. A careful comparison of some 25 skulls thus found with those of recent *cavernarum* shot on the island show no differences worthy of mention, and extensive measurements demonstrate the two series to be practically identical in detail.

**Stenoderma rufus** Oken

*Text Fig. 10*

See Miller: The Families and Genera of Bats, p. 165, 1907, for diagnosis of genus.


*Type locality.*—Unknown.

*Distribution.*—Unknown. Recorded from Porto Rico, from the Cueva Catedral, as fossil.

*Specimens collected.*—25 good-sized specimens of skulls, some nearly complete, 10 mandibles and smaller fragments too small to list in detail.

*General characters.*—“Nez simple. Oreilles petites, latérales et isolées, oreillon intérieur. Membrane interfémorale rudimentaire, bordant les jambes. Queue nulle.” (From description of Geoffroy.)

*Skull.*—Short and broad in general proportions; rostrum very broad, shortened; nasal region deeply depressed and bordered laterally by high supraorbital ridges coming off from the bifurcation of the sagittal crest.
Fig. 10.—Stenothermus carinatus. Skull figures × 3 1; dentition × 14 3; Morovis, Cueva Catedral, Porto Rico
A—crown view of maxillary tooth-row;
B—crown view of mandibular tooth-row.
external nares opening almost entirely upward, subcircular in outline; zygomatic arches heavy, widely flaring; braincase high and inflated, but compressed laterally rather than evenly rounded, low sagittal crest present, mastoid process poorly developed; palate very broadly horseshoe-shaped with deep posterior emargination reaching nearly to plane of first molar, large incisive foramina well separated from roots of incisors and from each other; pterygoid process short, low. triangular, interpterygoid fossa U-shaped, very long; glenoid well developed, post-glenoid process very heavy; basisphenoid pits large and prominent; bullae not present in Porto Rican material, figured by Peters (l. c.) as of good size; mandible wide and heavy; horizontal ramus very deep, rather short, ascending ramus wide with very high coronoid; low, wide condyle slightly elevated above molar plane and angular processes scarcely deflected.

*Dentition.*—I, $\frac{2-2}{2-2}$; C, $\frac{1-1}{1-1}$; Pm, $\frac{2-2}{2-2}$; M, $\frac{3-3}{3-3}$ = 32.

Incisors above and below missing in Porto Rican skulls and descriptions of these teeth taken from Peters' figures; all other teeth described from actual specimens.

Upper: Inner incisors very much larger than outer pair, with slender crowns; outer incisors about half as high as inner, with well-developed cingulum and low accessory cusp; all incisors in contact with each other and with canines; canine not very well developed, with good cingulum and very low internal accessory cusp; greatest transverse extent of canine almost at right angles to main axis of skull; entire molar tooth-row very much crowded, the teeth tightly pressed against each other; first premolar nearly as high as canine, which it roughly resembles, with a single trenchant cusp rising high on external border of tooth; second premolar fully as high or slightly higher than canine, with tall, subtriangular main cusp, lower posterior accessory cusp on external cutting edge and with concave internal basin; first molar with main cusp as high as that of second premolar, protocone well developed, hypocone present but small, metaconule as a low, rounded cusp, paracone the main cusp, very high, with trenchant edges, metacone similar but rather lower, with faintly bilobed edge, internal crushing basin concave; second molar slightly smaller than first, similar in general pattern but with metacone much lower and with an internal cingulum across entire flank of paracone, outline of crown subtriangular; third molar minute, closely appressed to second molar, crown flattened, subelliptical in outline, with two low cusps, probably protocone and paracone.
## Measurements of Stenoderma rubra

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<th>Greatest length exclusive of incisors</th>
<th>Length from anterior border foramen magnum to tip of premaxilla</th>
<th>Zygomatic breadth</th>
<th>Inter-orbital breadth</th>
<th>Breadth of braincase</th>
<th>Breadth of rostrum at m1</th>
<th>Length of palate from anterior border post-palatal notch to posterior border of incisive alveol</th>
<th>Breadth of palate inside m2</th>
<th>Length of maxillary molar series</th>
<th>Greatest length of mandible</th>
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* Alveolar length taken because of absence of some of the molar series.

† Crown length taken, all of the molar series present.
Lower: Incisors small, equal, forming convex row between canines; canine scarcely larger than premolars, with internal and external cutting edges and anterior face of tooth peculiarly flattened, a decided notch at external base of crown where it meets a poorly developed cingulum; premolars with very flat external aspects; first premolar with high triangular crown having very trenchant edges and an internal cingulum; second premolar larger than first, with a high, sharp cusp on the anterior border of the crown which is overlapped externally by the posterior border of the first premolar; first molar largest of series with main cusp, protoconid, as high as main cusp of premolars, metaconid and hypoconid present as much lower cusps upon a flattened posterior basin, and with antero-internal cingulum; second molar with much lower crown, the protoconid, metaconid and eutoconid as low but distinct cusps, the hypoconid scarcely discernible, a well-developed external cingulum; last molar very small, with low, flattened crown showing protoconid and metaconid with a posterior internal cusp, possibly the eutoconid.

Remarks.—Stenoderma rufus for over a century stood as a name only. The habitat of the species was unknown, although it was shrewdly surmised by Dr. G. M. Allen (1911, p. 238) that the homeland of the species was in the West Indies, and this conjecture accorded with the ideas of most workers on American Chiroptera. The animal was described by Etienne St. Hilaire Geoffroy in a work on Egypt dated 1813 (see Lyon, 1914, p. 217), but the type locality was not given. The natural assumption would be that the bat was African, but later workers felt that its New World origin was not to be doubted. For over fifty years nothing was added to the description of Geoffroy, and it stood as an animal of unknown habitat and poorly understood characters until Peters, in 1869, visited the Paris Museum and examined the type. He found the type represented by a damaged skin from which the skull had been removed and lost. Peters was deceived by the faulty figure of Geoffroy, and as a result he made Stenoderma out to be Vampyrops (Peters, 1869, p. 399). Later on Peters had occasion to examine the type of Artibens undatum Gervais in the anatomical collection of the Paris Museum (Peters, 1876, p. 432). The similarity between the skull of undatum (the type of undatum was a skull, the skin of which was supposed to be lost) and the skull figured by Geoffroy at once impressed Peters, who came to the conclusion that the skull of undatum was the long-lost skull of Stenoderma rufus. This interpretation was evidently accepted by Dobson (1878, p. 529), who wrote that the type of Stenoderma rufus was represented by a skin, in bad condition, and a skull in the Paris Museum. The work of Peters is important because he was able to demonstrate the existence of
such an animal as *Stenoderma rufus* and to define its well-marked characters, thus putting to an end a condition which had allowed *Stenoderma rufus* to be confused with *Molossus rufus* and *Desmodus rufus*.

Finally, in 1916, *Stenoderma rufus* was discovered as a fossil and its habitat, in part, at least, of this species was disclosed. Some of the obscurity of the previous 100 years was dispelled, but there still remains this interesting condition. In Porto Rico this bat is known only as a fossil, whereas Geoffroy had an animal in the flesh. The fossil material of this bat was found associated with *Nesophontes, Phyllonycteris major* and *Monophyllus frater*, all known only as fossils, and with skulls of *Brachyphyllum cavernarum* and other bats still living today. Geoffroy's type may very well have come from Porto Rico; on the other hand, *Stenoderma* may be extinct on Porto Rico and survive on some of the adjacent islands.

The relationships of *Stenoderma rufus* are well expressed by Miller's (1907, p. 165) treatment of the Stenoderminae. The affinities of the genus are with *Aridops* of the Lesser Antilles, *Phyllops* of Cuba and Santo Domingo, and more remotely with *Arileus* of Jamaica. Great diversity of development in the subfamily has taken place in the West Indies, specialization having run along different lines in separated localities. *Stenoderma*, in the character of its deeply excavated rostrum, is widely different from its most closely related neighbors, and in addition it possesses a well-developed metaconule in $m^1$ and $m^2$ which the other genera of the subfamily lack.

**Artibeus jamaicensis jamaicensis** Leach
Text Fig. 11


1924. **Artibeus jamaicensis jamaicensis** Miller, North American Recent Mammals, p. 58.
Type locality.—Jamaica.

Distribution.—"Central America and Southern Mexico, as far north as Morelos, and exclusive of Yucatan; St. Andrews and Old Providence Islands; Jamaica, Porto Rico, Santo Domingo, and Lesser Antilles as far east as St. Kitts."


Specimens collected.—47: Cayey, 1; Corozal, 5; Lares, 8; Old Loiza.

Footnotes:
1 Distribution from Miller (1924, p. 58).
1: Pueblo Viejo (Cueva de Fari), 1; San German, 14 (12 skins): Utuado, 17 skins.

**General characters.**—A large bat with robust body, narrow intermembranous membrane and conspicuous nose-leaf. Head rather large; muzzle with large prominent lanceolate nose-leaf, arising from an enlarged nasal pad; upper and lower lips normal, well haired; ears short, separate, when laid forward lacking considerable of reaching tip of muzzle, tips rounded, posterior border passing into the basal conch by an abrupt shoulder; tragus large, wide, notched basally, thickened internally, sharp externally; body thick set; humerus proportionally short and heavy, furred throughout basal half; tibia and hind foot short, calcare present but very short; tail vestigial and not externally visible; intermembranous membrane narrow; membranes heavy and tough.

**Color.**—Adults: Above, nearly uniform, varying with the individual from warm sepia to light seal-brown, but with color of basal portion of pelage, ranging from light buff to pale smoke-gray, showing through on neck and shoulders to give those parts a lighter tone; below, uniform in coloration with upper parts, but hairs unicolar to the base except for limited area on under side of neck, where the hairs are buffy or gray basally, as above; facial stripes absent in most cases, but appearing faintly in some specimens, of same color as bases of the hairs on the upper side of the neck, the stripes running from the nose-leaf over the eye to the anterior border of the ear; membranes blackish brown; pelage rather thick, of medium length and very soft.

Young: Dark mouse-gray above and below, the hairs of the upper neck and shoulders lighter basally.

**Skull.**—Size large, strongly built; rostrum very broad and flat across nasals, external nares opening outward and upward; braincase progressively expanded posteriorly, dorsal outline strongly curved downward from parietals, sagittal crest well developed; mastoid process poorly developed; zygomatric arches strong, wide-spread, jugals nearly parallel to one another; palate broad, horseshoe-shaped; interpterygoid fossa U-shaped, reaching about half the distance from tips of pterygoid processes to plane of last molars; basisphenoid pits well developed; bullae slightly smaller than cochlea, combined auditory mechanism rather small; mandible strong and heavy, horizontal ramus straight and thick; ascending ramus broad, its ventral border in same plane with horizontal ramus; coronoid wide, triangular, much higher than condyle; angular process short, wide, rounded; dentition above and below heavy.

**Dentition.**—I, \( \frac{2-2}{2-2} \); C, \( \frac{1-1}{1-1} \); Pm, \( \frac{3-2}{3-2} \); M, \( \frac{3-2}{3-3} = 30 \).
Upper: Incisors small, inner about twice size of outer pair, slightly separated from each other and from canines, inner pair with crowns slightly expanded laterally, cutting edge bifid, outer pair with cutting edge oblique, entire; canine straight, simple, with internal cingulum; first premolar rather small, with sharp, anterior cusp, chisel-like cutting edge and poorly developed style; second premolar about twice as large as first, its main cusp the highest in the molar tooth-row, with broad, flat internal heel and low internal cusp; first molar with crown about twice as wide as long, with external cusps, paracone and metacone, and two low internal cusps, protocone and hypocone, the crown sloping abruptly downward from the external cutting edge to form a broad, internal basin, surface of crown covered with fine wrinkles; last molar slightly more than half as large as first, subelliptical in shape, with broad, wrinkled, crushing surface and postero-external cutting edge.

Lower: Incisors small, peg-like, with flattened crowns, cutting edges very faintly bifid, teeth crowded into intercanine space; canine simple; first premolar about half as high as second, with triangular, trenchant cusp; second premolar with one very high cusp and resembling considerably the canine; first molar large, about twice as long as wide, narrowed anteriorly, crown low with finely wrinkled surface; second molar subrectangular, much smaller than the first, with trenchant internal border bearing three low cusps; third molar minute, peg-like, closely crowded against second molar.

Measurements.—Average of 24 adults, both sexes: Total length, 107.2 mm. (100–115); hind foot, 17.5 (17–19); forearm, 58.88 (56–61.9).

Skull.—Average of 5 males and 5 females, adults: Greatest length, 28.47 (27.8–29); zygomatic breadth, 17.02 (16.5–17.1); interorbital breadth, 7.16 (6.7–7.1); breadth of braincase, 12.46 (12.2–13); length of palate, 12.65 (12.1–12.9); breadth of palate outside m1, 12.36 (12.1–12.8); length of maxillary molar series, 8.41 (7.9–8.8); length of mandible, 18.43 (18–19); length of mandibular molar series, 9.1 (8.6–9.6).

Remarks.—The genus *Artibeus* has only one representative in Porto Rico and consequently there is little likelihood of confusion arising over the determination of this well-characterized species. The slight superficial resemblance which this species bears to *Brachyphylla cavernarum* is not misleading, for even a casual comparison of the two genera shows *Brachyphylla* to be larger, paler in color, and with a narrower rostrum, which lacks a well-developed nose-leaf. *Artibeus jamaicensis jamaicensis* has a very wide range and is found undifferentiated throughout the

\[5\] In this specimen m2 is lacking on both sides.
Greater Antilles, with the exception of Cuba. In Cuba, *Artibeneus* is represented by another subspecies, *j. parcipes*, which differs from *j. jamaicensis* in slightly smaller size, smaller skull and smaller teeth. This species is one of the most widely distributed of the Porto Rican bats. It was found in many localities widely separated and its range doubtless covers the whole island. It was always encountered in caves and, with one or two possible exceptions, when determination could not be made with certainty, was never seen flying at night. No especial preference for any particular type of cave was noticed, *Artibeneus* being found in deep, dark caves and in shallow, light ones. It was often found in caves so shallow that there was very little protection from direct daylight, and bats of other species would not be present. It does not appear to be highly social and was generally scattered throughout a cave rather than in a single large colony. Numbers of the fibrous cores of native fruits were found lying on the cave floors where this fruit-eating bat had brought them.

The flight of *Artibeneus* is rather heavy and steady in direction, when compared with some of the smaller species, although this bat is a strong, capable flyer. It is quarrelsome in disposition and vociferous when present in numbers. If given an opportunity, it is capable of making a painful wound, as its teeth are sharp and the jaw muscles powerful. It is not very easily alarmed and almost never left a cave when disturbed. Its call-note is a strong, strident squeak of harsh quality. Females with small young were taken June 3 and gravid females with a single, large embryo were collected on the same day. On June 26 half-grown young were taken, and June 29 and July 1 young nearly the size of the adults were noted. The females carry the young when the latter are almost as large as themselves, and fly about with the heavy burden without much loss of speed.

Subfamily PHYLLOXYCTERINAE

See Miller: The Families and Genera of Bats, p. 171, 1905, for diagnosis of the subfamily; p. 172, for diagnosis of the genus.

**Phyllonycteris major** Anthony

Text Fig. 12


Type locality.—Cave near Morovis, Porto Rico.
The type is a skull nearly complete, but lacking full dentition; \( m^3 \) and \( m^1 \) on left side, \( m^2 \) and \( m^3 \) on right side are the only teeth present.

Distribution.—Known only from the Island of Porto Rico.

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Fig. 12.—*Phyllonycteris major* × 2.1; type: Morovis, Cueva Catedral, Porto Rico

General characters.—Closely related to *Phyllonycteris poeyi*, but noticeably larger, with wider braincase and heavier dentition.

Skull.—Rostrum long, deep and rather tubular, external nares opening slightly upward, nasals marked as flattened ridge along rostrum; inter-
orbital constriction very slight; braincase high and rounded, not rising abruptly from rostral plane, broader than deep, expanded posteriorly, very low sagittal crest; mastoid process poorly developed; zygomatic arch incomplete; palate very long, shallowly concave, narrowed anteriorly, small, incisive foramina present, pterygoid region very long, processes flattened, concave for half their extent; V-shaped interpterygoid notch not reaching plane of last molars; very low median ridge along floor of interpterygoid fossa; poorly developed basisphenoid pits; paroccipital processes well developed; bulle unknown; mandible (not particularly associated with type skull) long and narrow; horizontal ramus very straight, of good depth; ascending ramus scarcely elevated above horizontal rami; coronoid high, wide, triangular; condyle much lower than coronoid, about level with molar crowns; dental foramen large and conspicuous.

\[\text{Dentition}^4 - \frac{2-2}{2-2}; \frac{1-1}{1-1}; \frac{2-2}{2-2}; \frac{M}{M} \frac{3-3}{3-3} = 3:2.\]

Dentition heavier than that of *P. poeyi*.

Upper: Incisors not present in any skull, but alveoli indicate incisors as in *poeyi*, a larger inner pair, a smaller outer pair, all in contact, but separated by diastema from canines; canine large, simple, with well-developed anterior and posterior cutting edges and narrow internal cingulum; first premolar small, subcircular; second premolar rather more than twice as large as first, with single triangular cusp, practically no cingulum; molars with low crowns, not reaching level of crown of second premolar; first molar with crown about as broad as long, paracone and metacone scarcely distinguishable on the external cutting edge, internal crushing surface broad, outline from above subelliptical; second molar wider than long, the greatest length along external cutting edge, crown pattern of raised cutting edge with two cusps and broad, internal crushing surface; third molar about half size of second, crown flattened, subtriangular, the tooth set inside of extreme border of molar series.

Lower: Incisors not present but indicated as minute, subequal; canine large, with prominent posterior notch on cingulum; first premolar not known, but alveolus as large as that of second; second premolar with well-developed triangular median cusp; first molar with crown longer than wide, flattened, outline of cusps lost; second molar subrectangular, slightly longer than wide, crown flattened, with trace of shallow concavity, cusps very faintly indicated; third molar smaller than either first or second molars.

\(^4\) Description taken from type and topotype material.
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* Type.
Specimens collected.—60 fragmentary skulls, only a few of which are nearly complete; 22 mandibles, mostly without any teeth, and small fragments not worth listing.

Remarks.—Phyllonycteris major is so obviously congeneric with poeyi that comparison elsewhere is unnecessary. From poeyi it may be told by its larger size, more widely expanded braincase and much larger second upper premolar.

This species was found only as a fossil and in but one cave. It was contemporaneous with Nesophontes as well as with Stenodermus rufus and other bats to be found living today. Possibly P. major may be found as a living bat, the chances for this being very favorable, since P. poeyi and the species of the related genus Erophylla occur only in isolated localities and escape notice for long periods, as witness the rarity, till recently, of P. poeyi and E. sezekorni in collections.

Heretofore, Phyllonycteris, with but a single species, has been known only from Cuba. The discovery of a closely related species of this peculiarly West Indian genus upon Porto Rico is an added bit of evidence in favor of an earlier, intimate connection between the now detached islands.

Erophylla bombifrons (Miller)

Text Fig. 13

See Miller: The Families and Genera of Bats, p. 175, 1907, for diagnosis of the genus.


Type locality.—Cave near Bayamon, Porto Rico.

Distribution.—Known only from the Island of Porto Rico. Recorded from Bayamon and from the Cueva de Fari, near San Juan.

Specimens collected.—14: Cueva de Fari, Pueblo Viejo, 14 (8 skins), July 5 and 6.

General characters.—Size medium, ears simple, about as high as broad; tragus with notched edges; nose-leaf rudimentary, represented by a low.
pointed, median projection upon a naked, tumid nasal-pad; lower lip with median split; tail very short, terminal half free; interfemoral membrane narrow; calcar present but vestigial; skull moderately narrow and elongate; zygomatic arch complete; lower molars with distinct cutting edge.

Fig. 13.—Erophylla bohniifrons $\times$ 3; adult $\sigma$; Pueblo Viejo, Porto Rico

Color.—Adults: Above, hairs distinctly bicolor, being white for rather more than half the basal half, then tipped with chestnut-brown; from shoulders posteriorly the color is darker than on foreparts, where white of the basal part shows through; rather lighter on head and face, the
hairs unicolor and shorter; below, uniform wood-brown, the bases of the hairs whitish.

Young: Above, hairs white at base, clove-brown at tips, and coloration uniform over whole upper surface, white not showing through on neck as in adults; below, coloration scarcely lighter than above.

Skull.—Elongate, with fairly well-rounded and expanded braincase; rostrum long and with a marked concavity in the region of the nasal termination, rim of external nares thin and distinctly flaring; braincase rising abruptly from rostral plane; zygomatic arch complete; interpterygoid fossa very long; basisphenoid pits present; palate long and sub-rectangular; ramus very long and straight, coronoid low, condyle in plane of tooth-row, angular process well developed.

Dentition.—I, 2-2; C, 1-1; Pm, 2-2; M, 3-3 = 32.

Upper: Inner incisors not meeting in midline, crowns expanded laterally, cutting edge broad, slightly bifid; outer incisors much smaller than inner, with oblique cutting edge in contact with neither canine nor incisors; canine large, dagger-like, with small internal cingulum; first premolar small and simple, with crown widened antero-posteriorly; second premolar much larger, with wide antero-posterior crown which has nearly smooth surface and outside border raised to form crescentic cutting edge; molars decreasing in size posteriorly; first molar nearly twice as long antero-posteriorly as wide transversely, outer border forming nearly flat cutting edge; second molar subtriangular across crown, cutting edge indented medially; third molar small, triangular, with straight cutting edge. All of the molar series very low crowned.

Lower: Incisors small, inner pair the smaller, not in contact, crowns expanded, cutting edges entire; canines large, with posterior cingulum; first premolar smaller than second, cutting edge on outer border, highest at middle; second premolar with a carnassial shearing edge; first molar with long, slightly concave cutting edge; second molar smaller than first, cutting edge more over central axis of tooth than on outside border and slightly depressed at middle; third molar smaller than second, cutting edge noticeably depressed at midpoint lying along central axis of tooth.

Measurements.—Average of 6 specimens: Total length, 81.6 mm. (80-85); tail vertebrae, 15.1 (13-17); hind foot, 16 (15-17); forearm, 48.6 (48-49).

Skull.—Average of 3 specimens: Total length 34.7 (34.3-34.9); zygomatic width, 11.83 (11.8-11.9); interorbital width, 4.5 (4.5-4.5); breadth of braincase, 10.1 (10-10.3); length of palate, 10.6 (10.4-10.7);
length of molar series, 6.27 (6.1–6.4); length of mandible, 16 (15.8–16.2); length of mandibular molar series, 1.8 (7.6–7.9).

Remarks.—There is no other Porto Rican bat liable to be confused with *Erophylla bombifrons*. In some characters this species has a superficial resemblance to *Monophyllus portoricensis*, but there are notable differences between the two in size, color and fundamental differences in tooth structure. From the other species of the genus to be found on other islands, *bombifrons* may be known by the combination of complete zygomata, high, rounded braincase rising abruptly above rostral plane, small teeth, notched tragus, and flaring rim of the external nares.

This brightly colored species was taken only in the Cueva de Fari, about two or three miles west of San Juan, and was noted in no other locality. It was found as a small colony, in a chamber to one side of the main cave, and there may have been about 35 or 40 animals altogether. After a few shots, the survivors flew out into other parts of the cave and were lost to observation. Their reddish appearance was apparent under the light of my acetylene lantern, and generally this species could be thus distinguished from the others found in the cave. *Erophylla* had segregated itself from the other species and was found in small potholes or concavities in the ceiling of the chamber, a few in each place. Young from two-thirds grown to nearly full grown were collected.

Family VESPERTILIONIDAE

See Miller: The Families and Genera of Bats. p. 195, 1907, for diagnosis of the family; p. 207, for diagnosis of the genus *Eptesicus*.

*Eptesicus fuscus wetmorei* (Jackson)

Text Fig. 14


Type locality.—Maricao, Porto Rico.

Distribution.—Known only from the Island of Porto Rico. Recorded from Maricao (U. S. Biol. Survey), Cueva de Fari (Pueblo Viejo) and San German.

Specimens collected.—51: Cueva de Fari (Pueblo Viejo), 26 (11 skins); San German, 25 (10 skins).

General characters.—From specimens taken at San German. A medium-sized bat with tail completely enclosed in interfemoral membrane,
muzzle simple and color of fur brown. Nostrils simple, no nose-leaf, upper lip sparsely haired; lower lip simple; ears of moderate size, bluntly pointed, about reaching tip of muzzle when laid forward; tragus tall, slender, with rounded tip; body of normal proportions; humerus long, slightly bowed; digits normal, tibia of normal length, hind foot short, calcir long and heavy; tail long, completely enclosed in wide inter-

Fig. 14.—Epiesicus fuscus veloxeri × 8/3; adult ♀: Pueblo Viejo, Porto Rico

femoral membrane; no fur anywhere on membranes; color above and below a warm brown, fur long and lax.

Color.—Adults: Above, everywhere a uniform mars-brown, the hairs blackish brown at the base; below, uniform clay-color; hairs blackish brown basally; membranes black. Individuals varying from the normal coloration as given were taken. The variants resemble very closely in color the immature pelage, although the animals are unquestionably adult.
Immature: Similar in color pattern to adults but differing in shade: above, bone-brown; below, tawny-olive.

Skull.—Moderate in size and normal in proportion of parts. Dorsal outline of skull nearly straight, a slight depression in nasal region; roof about as wide as long, very flat, external nares opening outward and upward; braincase moderately inflated through parietal region, flattened dorsally; noticeable sagittal crest; interorbital constriction somewhat pronounced; zygomatica flaring, greatest width posteriorly; mastoid reduced; palate long, moderately concave, cut away anteriorly between incisors to form a U-shaped indentation; bulk of medium size, about as large as cochlea: no basisphenoid pits; mandible normal; horizontal ramus straight; ascending ramus rising in gradual curve; coronoid very high and wide for a bat, much higher than condyle; angular process hook-like, very slightly deflected.

Dentition.—I, \( \frac{2-2}{3-3} \); C, \( \frac{1-1}{1-1} \); Pm, \( \frac{1-1}{2-2} \); M, \( \frac{3-3}{3-3} \) = 32.

Upper: Incisors unequal, inner much larger than outer pair; inner incisors separated widely by the emargination of the palate and inclined slightly toward each other, crowns high, pointed, with small accessory cusp and poorly developed cingulum; outer incisors closely in contact with inner, but separated by slight diastema from canines, with single, well-developed cusp and external posterior cingulum; canine normal, with well-developed posterior cutting edge; premolar with high, trigonal cusp; first and second molars subequal, with W-shaped crown pattern of five cusps and connecting commissures and single, low internal cusp; third molar about half the size of anterior molars, with two cusps and a commissure of the W-pattern well developed, two cusps poorly developed and the fifth lacking entirely.

Lower: Three pairs of incisors subequal and similar in detail, closely in contact with canines and with each other, crowns spatulate with anterior cutting edge trifid; canine simple, with sharp postero-internal cutting edge and well-developed cingulum; first premolar about half as large as second, both first and second with a single cusp and well-developed cingulum; molars subequal, the third the smallest, all with five well-developed cusps.

Measurements.—Average of 15 adult females: In all the series collected there were no adult males suitable to be included in the series for measurement. Total length, 119.9 mm. (114–125); tail vertebrae, 48.3 (43–52); hind foot, 13 (12–14); forearm, 50.46 (48.2–51.3).

Skull.—Average of 10 skulls of adult females: Greatest length, 19.55
(19.1–20.2); zygomatic breadth, 13.16 (12.8–13.4); interorbital breadth, 4.26 (4.1–4.4); breadth of braincase, 8.59 (8.3–8.8); length of palate, 8.59 (8.4–8.8); length of maxillary molar series, 5.59 (5.4–5.7); length of mandible, 13.73 (13.3–14.1); length of mandibular molar series, 6.81 (6.7–7).

Remarks.—The long, lax fur and rich brown color of Epitesicus fuscus wetmorei are sufficiently diagnostic to mark it off from all the other bats. Its closest relative, perhaps, is Epitesicus fuscus cubensis of Cuba, type locality, Trinidad, Cuba, from which it differs but slightly. In the original description by Jackson, the Porto Rican animal is given full, specific rank. On the basis of the improbability of the actual intermingling of the Porto Rican form with the mainland fuscus or the Cuban f. cubensis, this determination is satisfactory, but on the basis of development and actual relationship the trinominal is the best expression. Examination of typical fuscus, miradorensis, cubensis, and wetmorei has convinced me that the relationship is a very close one, and to carry the expression of this relationship only to the limits of the mainland and then call the island forms full species hardly seems consistent. Epitesicus f. wetmorei bears especial resemblance to f. miradorensis from the Chiriqui region of Panama, having the same, well-built skull, heavy dentition and long forearm.

This bat was not noted throughout the island, but appeared to be restricted rather to the western half. In the two regions where it was taken it was a conspicuous bat, and were it generally distributed over Porto Rico it seems fair to assume more specimens would have been taken. Both at San German and at Pueblo Viejo it was found in caves, using deep crevices and holes in the limestone in much the same fashion as did Tadarida, being crowded into its retreats in large numbers. The several colonies located were nearly all females, and practically every animal was nursing or heavy with a single large embryo. This condition was noted June 6 and July 6, and while considerable variation in the development of the young bats was noticed, the majority of them were at about the same stage of development. At San German, June 6, most of the young were short-haired and about one-half the size of the parent. One of those taken proved to be a partial albino, differing from the others in its almost white coloration.

A bat seen at dusk in Lares was thought to be of this species.

A series of 9 skulls, some of which are nearly perfect, and one mandibular ramus of E. f. wetmorei were secured as fossils in the Cueva Catedral. These skulls appear to be indistinguishable from those of the living form, although associated with the skulls were skulls of genera
and species now extinct, the inference being that the deposit is older than the very recent.

**Vespertilio maugui** Desmarest


This bat, said to have been brought from Porto Rico by Mauge, is described in sufficiently great detail to make its identification as one of the large-eared Vespertilionids certain. Very likely it is *Corynorhinus*, as the characters given by Desmarest fit this genus very closely, and Gray, in Cuvier’s Animal Kingdom, vol. 5, 1827, p. 97, places it under *Plecotus*. This state of affairs gives plausibility to the hypothesis that Desmarest’s specimen did not come from Porto Rico, since *Corynorhinus* has never been taken in the West Indies. Probably Mauge obtained his specimen from the mainland and, as was the case so often in the early days of systematic mammalogy, the describer confused the localities. For this reason I believe that *Vespertilio maugui* is not truly a Porto Rican record.

**Family MOLOSSIDAE**

See Miller: The Families and Genera of Bats, p. 241, 1907, for diagnosis of the family; p. 251, for diagnosis of the genus *Nyctinomus* = *Tadarida*.

**Tadarida murina** (Gray)

Text Fig. 15


*Type locality.*—Cuba.

*Distribution.*—Cuba, Jamaica, Santo Domingo and Porto Rico. Recorded in Porto Rico from Adjuntas, Cabo Rojo, Manati, San German and Utuado.
Specimens collected.—54: Adjuntas, 4 (3 skins); Cabo Rojo, 9 skins; San German, 35 (12 skins); Utuado, 6 skins.

General characters.—A small, free-tailed bat of dark-brown coloration. Head small; ears broad, not pointed, not united across forehead but arising from same point; tragus very small, subrectangular; antitragus low and rounded; muzzle well developed and without any excrescences except a few minute horny points on upper margin; scattered long hairs on face; upper lip with a number of transverse ridges; lower lip not peculiar; humerus long and nearly straight; wings very narrow; legs short; membranes fairly tough and leathery, not haired anywhere except for a few very short hairs on upper surface of interfemoral membrane and along median under surface of that membrane; long hairs on feet; tail free for about half of its length; color dark brown; fur soft and velvety.

Color.—Adults: Above, from warm Sepia to seal-brown, varying with the individual, the hairs light buff at the base and showing the lighter color more or less in the neck region; below, varying from cinnamon-brown to natal-brown, the hairs light colored at base as above; membranes blackish.
Skull.—Small, with dorsal outline nearly a straight line; rostrum fairly wide, rather flat and of normal length proportionally; interorbital constriction not excessive; braincase rounded but not globose, greatest inflation through parietal region, a constriction at region of supraoccipital and interparietal; no sagittal crest; zygomatic arch well developed, flaring but slightly; lachrymal and supraorbital ridges present; palate short and concave; interpterygoid fossa wide; basisphenoid pits hardly discernible; bulla and cochlea of moderate size; mandible normal with ramus curving slightly into ascending portion; coronoid sharp and deflected outward from plane of tooth-row; condyle slightly elevated above plane of tooth-row; angular process not conspicuously deflected from plane of lower border of ramus.

Dentition.—I, \( \frac{1-1}{3-3} \); C, \( \frac{1-1}{1-1} \); Pm, \( \frac{2-2}{3-3} \); M, \( \frac{3-3}{3-3} \) = 32.

Upper: Incisors inclined toward each other, but not meeting medially or filling up the intercanine space, crown surface long and oblique; canines sharp and simple, with practically no cingula; first premolar vestigial and visible only from outer side of tooth-row; second premolar large, with high anterior cusp and postero-internal basin; first and second molars equal, with W-shaped crown pattern of five cusps with connecting commissures and two additional cusps internally; third molar smaller, identical with second and third molars, but lacking the last ascending arm of the W and with only one internal cusp.

Lower: Incisors minute, subequal, crowns slightly expanded, bifid, the teeth completely filling space between canines; canine of moderate size with antero-internai accessory cusp and internal cingulum, first premolar about half size of second, simple in form, with single, sharp cusp; second premolar with high median cusp, the highest in molar tooth-row; second and third molars with normal pattern of five cusps; last molar slightly smaller but retaining the five cusps.

Measurements.—Average of 10 adults, 5 males and 5 females: Total length, 95.2 mm. (93–100); tail vertebrae, 33.8 (33–36); hind foot, 9.8 (9–10); forearm, 38.98 (38.2–40.1).

Skull.—Average of 10 adult skulls, 4 males and 6 females: Greatest length, 15.9 (15.6–16.2); zygomatic breadth, 9.25 (8.8–9.3); interorbital breadth, 3.78 (3.7–3.9); breadth of braincase, 7.5 (7.5–8.9); length of palate, 5.83 (5.6–6); length of maxillary molar series, 4.63 (4.5–4.8); length of mandible, 10.51 (10.2–10.7); length of mandibular molar series, 5.1 (5–5.3).

The name for the common *Tadarida* of the Greater Antilles has been
generally given by recent writers as *Nyctinomus musculus* Gundlach, 1861. This does not take into consideration the much earlier name of Gray. In The Animal Kingdom of Cuvier, published in 1827, Gray describes *Nyctinomus murinus* from a specimen in the British Museum, the habitat of which is Jamaica, queried, according to Redman. In the Magazine of Zoology and Botany, vol. 2, p. 501, 1838, Gray gives another description of this species and states its range as “South America. (Brasils): West Indies, (Jamaica).” Dobson, in his Catalogue (1878, p. 437), places *murinus* in synonymy with *N. brasiliensis* but lists among his specimens one from Jamaica as “Type of *Nyctinomus murinus* Gray.” As Dobson had other specimens from Jamaica and was familiar also with *Nyctinomus macrotis*, the only other species of *Nyctinomus* known to occur on Jamaica, it seems fair to assume the validity of *murinus* and of the type locality as well. This being the case, Gray’s name must stand for the small *Tadarida* generally distributed throughout the Greater Antilles, *musculus* being a synonym of it.

Lyon (1914, p. 217) has discussed the use of *Tadarida* for *Nyctinomus* and it seems best to make this change in generic terms.

**Remarks.**—*Tadarida murina* is not liable to confusion with any other Porto Rican bat with the exception of *Molossus fortis*. The distinguishing between these two forms are fundamental: the high sagittal crest, the robust upper incisors completely filling up the intercanine space, the number of lower canines reduced to 1–1, and the curving dorsal outline of the skull of *Molossus* serving to show a well-marked generic separation, if the skulls are compared. Superficially, however, the differences are not so apparent, and as a rule it is necessary to have the bat in hand in order to determine whether it be *Tadarida* or *Molossus*. The best external characters to distinguish between the two are the following: *Molossus* is appreciably the larger and has noticeable strips of fur along the humerus which *Tadarida* lacks; it has ears that are much lower and thicker than those of *Tadarida*, a much narrower tragus and more prominent antitragus; males of *Molossus* have a gular gland; the upper lip of *Tadarida* is more tumid and has transverse wrinklings not to be seen in *Molossus*; and the fur of *Molossus* is darker in color, more velvety to the touch and much richer in appearance.

From the species of *Tadarida* to be found on the other islands of the West Indies, *murina* is distinguished as follows: from *T. antillarum* of the Lesser Antilles by the slightly smaller size of the latter; from *T. bahamensis* of the Bahamas by the larger size and grayer coloration of that form, and from *T. macrotis* of Cuba and Jamaica by the fact that *macrotis* belongs to that section of the genus which has 2–2 lower incisors.
This small bat is easily the best flyer of the island species. Its flight is very rapid and under such perfect control at all times that on occasion very erratic maneuvers are executed. This bat occupies much the same position among its fellows that the swifts do among the birds. The long, narrow wings give rapid strokes, and the bat rows through the air, oscillating from one side to the other, looking at a distance very much like a small swift. The compact, cylindrical form of the body, the long tail generally held out straight behind, so that the contour of the animal diminishes from the thickness of the body at the hips to the point of the tail behind, and the wings vibrating so rapidly that they often present a semi-transparent zone along the sides, all combine to give such a characteristic picture that this animal may be readily recognized on the wing, the closely related Molossus being the only other bat on the island with similar flight.

Tadarida murina is a dweller in both caves and houses, seeming to be one of the most abundant bats on the island. Old buildings frequently had bats to the number of several hundred spending the day packed into dark crevices. In caves these bats chose deep fissures or holes in the limestone and were packed in very closely. When disturbed they poured forth literally in a stream. The large piles of droppings beneath such holes demonstrated the fact of the great concentration in numbers. In no case was Tadarida ever found in small, scattered groups, the social instinct seeming to bring all of the individuals of a region into large congregations. The habit of the sexes of keeping in separate colonies is very marked. This species has a sharp, high-pitched squeak and is rather noisy when in large numbers.

A very large colony was located in an old, deserted building in San German. It was a typical old Spanish structure of low, rambling construction, made of brick and wood and with an inner court. In places it was more or less fallen in. Early in the evening, about 6:15, we entered the building and were greeted by a great deal of squeaking from the many dark corners. The noise was made by so many individuals that it seemed as if we stood in a gigantic beehive, and this squeaking buzz could be heard even before the door was opened and the building entered, showing that the bats were beginning to stir about, preparatory to issuing forth for the night. By seven o’clock, bats were flying about the darkened corridors and rooms in small numbers. Very shortly they began to come forth in large numbers, and the interior was teeming with the noisy animals on the wing. Soon the bats left the interior and began to leave by way of the inner court, which took on the appearance of a whirlpool of bats. Issuing from the rooms, they circled the court, all
going in one direction and at a high rate of speed. A few passed up and over the enclosure at the completion of each lap, until finally none were left. The whole building had the pronounced musky odor seemingly characteristic of the Molossidae. Tadarida seen in other localities showed a tendency to circle for several moments about the spot where it had spent the day before straightening out the flight and taking a direct course for other feeding grounds.

Females taken June 7, 11 and 24 contained single, large embryos nearly ready for birth. No immature animals flying with the adults were taken. At San German, during early June, this bat was frequently seen to reenter the home crevice after having been awing about thirty minutes; possibly this was for the purpose of nursing the young.

**Molossus fortis** Miller

Text Fig. 16

See Miller: The Families and Genera of Bats, p. 260, 1907, for diagnosis of the genus.


*Type locality.*—Luquillo, Porto Rico.

*Distribution.*—Known only from the Island of Porto Rico. Recorded from Luquillo (U. S. Nat. Mus.), Adjuntas, San German, Utuado, Aibonito and Mameyes (last two records of U. S. Biol. Survey).

*Specimens collected.*—33: San German, 2 skins; Adjuntas, 21 (20 skins); Utuado, 4 skins.

*General characters.*—A small, free-tailed bat with dark pelage; head small; ears low, the joining membrane thick, meeting on forehead; tragus very, small, antitragus thick and rounded; nostrils slightly tubular; a few stiff hairs between ears and nostrils and on upper lip; lower lip not peculiar; humerus moderately curved; wings long and exceedingly narrow; tail free for about half its length; interfemoral membrane not extensive; feet with conspicuous long hairs on the tarsals and metatarsals; fur short, soft and velvety; gular gland on males; narrow strips of fur on humerus, above and below, and fur of body extending onto lateral membranes for short distance.

*Color.*—Adults: Above, varying with the individual from Vandyke-brown to clove-brown, the hairs white for the basal half; below, same.
color as above, but fur shorter and white basal portion showing more; membranes blackish.

Young: Pelage very short and thick; about chaetura-black; below, deep mouse-gray.

**Skull.**—Skull small, but not especially delicately constructed; rostrum very short, expanded anteriorly, external nares opening upward as well as outward; braincase expanded laterally, flattened on superior surface:

![Skull Diagram](image)

**Fig. 16.** *Molossus foris* × 3:1; adult ♂; Adjuntas, Porto Rico

high knife-like sagittal crest extending from just anterior to the greatest interorbital constriction back to the lambdoidal crest, and higher in males than in females; lambdoidal crest high and thin; zygomatic arches flaring very slightly; bullae nearly as large as cochleæ; jugal straight; palate short, concave, narrowing slightly anteriorly; interpterygoid fossa very wide; basisphenoid pits deep and prominent; mandibles of medium length, forming a triangle of approximately equal sides; ramus deepened
anteriorly, straight to last molar, then curved gently up into ascending ramus; coronoid a sharp, outwardly deflected process; angular process large and strongly curved outward.

Dentition.—$I, \frac{1-1}{1-1}; C, \frac{1-1}{1-1}; Pm, \frac{1-1}{2-2}; M, \frac{3-3}{3-3} = 26$.

Upper: Incisors large, strongly in contact medially and approximating contact with the cingula of the canines, crowns subtriangular, with high cone on the anterior internal angle; canine with anterior and posterior internal cutting edges and a cingulum; premolar wider than long, with a high, sharp cusp anteriorly and a deep, internal concavity posteriorly; first and second molars with the typical W-shaped pattern and the inner part of the crown filled up by a large protocone; third molar representing in most details half of an anterior molar.

Lower: Incisors minute with laterally expanded crowns, cutting edge bifid, in contact medially, but crowded forward from the normal position between canines; canines large, the cingula meeting in the midline, an internal anterior accessory cusp on the cingulum; first premolar small, very closely crowded by second premolar, very narrow antero-posteriorly; second premolar with high antero-median cusp and low postero-internal cusp; the three molars subequal, third the smallest, each with 5 cusps and connecting commissures to form a discontinuous W-pattern, the discontinuity due to the absence of the full number of commissures as found in the upper molars.

Measurements.—Average of 10 males: Total length, 111.3 mm. (104-118); tail vertebrae, 40.1 (35-46); hind foot, 10.9 (10-12); forearm, 39.45 (38.5-40.2). Average of 10 females: Total length, 108.3 (100-111); tail vertebrae, 37.8 (35-41); hind foot, 10.8 (10-11); forearm, 38.75 (37.5-40.2).

Skull.—Average of 10 skulls, 5 males and 5 females: Greatest length, 17.38 (16.9-18.2); zygomatic breadth, 10.1 (10.2-11.3); interorbital breadth, 3.61 (3.4-3.7); breadth of braincase, 8.72 (8.5-9.1); length of palate, 5.34 (5-5.5); length of molar series, 5.07 (5-5.2); length of mandible, 11.46 (11.2-12); length of mandibular molar series, 6.01 (5.9-6.2).

Remarks.—There is only one species of Molossus on Porto Rico, and consequently fortis needs no specific comparison with any of its immediate neighbors. A very close, superficial resemblance exists, however, between the small members of the related genera, Molossus and Tadarida, and as Tadarida murina is found on Porto Rico care must be taken in distinguishing the two. The characters of distinction have already been
given in the treatment of Tadarida murina. From the related species of Molossus, the Porto Rican fortis is distinguished by the combination of the following characters: moderate size (forearm, 40 mm.), rostrum not heavy, color dark and molars of normal size.

In addition to the localities recorded under the distribution, this bat was noted at Lares and at the Preston Ranch near Naguabo, but no specimens were taken. Because of the impossibility of distinguishing between Molossus and Tadarida when on the wing and in a poor light, definite records are given only when specimens were collected or the opportunities for observation were unusually good. Molossus fortis appears to be quite well distributed over the island, although I have no notes for it in the San Juan district. It was not found anywhere in caves and probably is almost strictly an inhabitant of old dwellings, which are sufficiently numerous in Porto Rico to afford ample quarters. For this reason it was not as easy to collect, as it was often impossible to shoot about the buildings, and in the case of old church buildings the high ceilings where the bats were in hiding were inaccessible.

The flight of this bat is exceedingly swift and erratic and possibly it is an even more skillful aviator than Tadarida murina. The flight of these two forms is so essentially identical and the size difference so slight that there is little to mark off the one from the other.

This bat comes forth while there is yet considerable daylight, and by early dusk, if there is any large colony of bats in a town, a multitude of the little animals will be seen pursuing their zigzag courses about the streets. In the month of June the first bats would begin to appear about 7 p.m. In 70 minutes an hour the number would greatly increase and probably the total bat population would be awing by 7:30. This bat was frequently seen leaving the coves of some house in the evening and one could not fail to be impressed by the intense activity of the small creature. The bat would drop out from the opening and take a downward course for five or six feet, then straightening out in the most rapid flight. Often one could see the head of the bat appear an instant before the animal precipitated itself headlong, but so quick were the movements that it was exceedingly difficult to shoot the bat, even when thus warned to expect its emergence. Not infrequently the animal was not observed until it appeared as if shot out from the opening in full flight.

A large colony was located in the attic of the lodge building at Adjuntas. It was possible to ascend into the attic and by poking into the crevices between the rafters dislodge the bats. This species is not very dormant, even in midday, and it was not an easy task to dislodge them. A nose and pair of bright eyes would peer out of a crack with a very
mouse-like aspect and the owner would dodge back so nimbly as to avoid all thrusts of the stick. Tobacco smoke blown into a long crevice demoralized the tenants and they attempted to move into adjacent nooks with much scuffling and scratching, accompanied by sharp squeaking. When animals were knocked down to the floor, if uninjured, they ran for dark corners with as much agility as a mouse. This bat always attempts to bite if given the opportunity. An intensely musky odor was always to be noted about the buildings where *Molossus* stayed.

Order INSECTIVORA

Family NESOPHONTIDAE


*Nesophontes* Anthony


Type.—*Nesophontes edithae* Anthony.

Insectivores of medium size with nearly the full primitive dentition; 3-3 1-1 3-3 3-3
I, —; C, —; Pm, —; M, — = 10. Incisors smaller than canines, simple, and with median diastema above; canines dagger-like, two-rooted, in normal position; upper molars triangular in cross-section, with V-shaped protocone, metacone and paracone;5 lower molars of primitive tuberculo-sectorial type; zygomatic arch incomplete, lacking malar; skull elongate and narrow, basicranial region moderately elongate antero-posteriorly.

Distribution.—Known only from Porto Rico, Cuba and the Isle of Pines.

5 The type specimen has worn molars and the paracone has been almost obliterated, a condition which led to an error in the diagnosis of the family, 1916, l. c., when it was stated that the *Nesophontes* molar had no paracone. The available material, however, demonstrated that the unworn molar possesses the full complement of primary cusps. Unfortunately, the diagnosis of the family, as given in the more detailed report of 1918, repeated the misstatement as to the paracone, through a lapsus, although the presence of the paracone was implied in other statements made in the same discussion (p. 378). The figure of No. 17096, palatal view, also indicated the presence of the paracone.
Fig. 17. *Nesophontes edithae* × 2½. Skulls of adult male and adult female from Cueva Catedral, Morovis, Porto Rico.
Nesophontes edithae Anthony
Text Figs. 17-28, Plates XIII-XV

Type.—No. 14174, Dept. Vert. Pal., Amer. Mus. Nat. Hist. The type is a skull in nearly perfect condition, being broken only at the extreme tip of the premaxillaries and lacking the auditory bullae; dentition well worn.

Type locality.—The type, as well as a large number of other skulls of this insectivore, was taken from a cave near Morovis, Porto Rico. This cave is more or less well known locally as the Cathedral Cave, "Cueva Cathedral."

Distribution.—Known only from Porto Rico. Recorded from Porto Rico from Hacienda Jobo (near Utuado), Utuado and Morovis (Cueva Clara and Cueva Cathedral).

Skull.—(Text Figs. 17, 18.) Males have skulls considerably larger than those of females, although proportionally the skulls of both sexes are practically identical.⁶

Skull elongate and narrow, tapering gradually in width from parietal to end of nasals, superior outline nearly straight, slightly elevated in fronto-parietal area; rostrum long, tubular, and strongly convex from side to side, only slightly narrower outside incisors than at base of zygomatic roots, much deeper than wide; nasal sutures not satisfactorily discernible because of fusion, but apparently nasals are very narrow; interorbital region with sides practically parallel, in males a very slight widening anteriorly, this whole region flatly convex from side to side; braincase only slightly inflated, parietals swollen, but interparietal and supraoccipital regions somewhat constricted, inflation generally more noticeable in females than males; very low sagittal crest, higher in males, ending anteriorly in noticeable supraorbital ridges; lambdoidal crest well developed, especially in males; noticeable fine wrinkling of bone surface over upper part of braincase (best shown in type, a female).

Zygomatic arch incomplete, lacking jugal, anterior root a peg-like process, posterior root a blunt process upon the expanded glenoid; infra-

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⁶The series of crania is divisible into two groups, on the basis of size only, and the most logical way to account for this is by assuming a sexual dimorphism. No such sex difference in size is known among living insectivores, but the occurrence of two similar groups in the series of Cuban *Nesophontes* strengthens the impression that the size difference is not inter- but intra-specific.
orbital foramen very large, lachrymal canal of good size; mastoid process well developed.

Palate long, laterally concave, almost parallel-sided, with a pair of small incisive foramina, and terminating just posterior to last molar in a square, postpalatal notch; palate completely ossified, but very thin and often with four distinct, transverse, areuate rows of minute pores or foramina; pterygoid processes well separated, low, terminating in small

![Image of skulls](attachment:skulls.png)
hook-like process at their highest points before they slope gradually to meet the floor of the alisphenoid; pterygoid fossa reduced to shallow concavity; basicranial region of good length, not compacted; basisphenoid with a pair of sharp ridges bounding basisphenoid pits; glenoid with concavity facing almost directly front instead of customary ventral position, due to extreme development of the postglenoid process; the petrosal is small, with a flattened anterior and rounded posterior face, and a short, thick posterior external wing that attaches to the tympanic; the tympanic is ring-shaped, nearly circular, and placed transversely, with only a slight posterior obliquity; it is closely appressed to the petrosal and is separated by a considerable interval from the postglenoid process; neither alisphenoid nor basisphenoid enter into the auditory structure; paroccipital process well developed; condyle large; foramen magnum very large.

Mandible very strong and heavy; horizontal ramus with lower border convex, deep and thick, deepest at m₁ and m₂; posterior mental foramen below the last premolar; ascending ramus with lower border continuing in the curve of horizontal ramus, angular process large, falciform; coronoid process large and high, with muscle insertion areas prominently marked; condyle with articulating surface facing obliquely backward.

**Dentition.** $I_{3-3}^{3-3}; C_{1-1}^{1-1}; Pm_{3-3}^{3-3}; M_{3-3}^{3-3} = 10.$

(Text Figs. 18, 19, 20.)

Upper: Incisors arranged in nearly parallel rows, the teeth of each row closely in contact with one another, but the anterior incisors of each row separated from each other by a diastema equal to about half the width of the palate from canine to canine; first incisor the largest of the three, about three-quarters as high as canine, with slightly convex anterior outline, and posterior outline with shallow notch or shoulder about half-way up; second and third incisors subequal, simple in structure, without any posterior notch, but a noticeable posterior cingulum; all three incisors have flattened internal faces giving anterior and posterior cutting edges; all are slightly procumbent, the greatest procumbency being found in the first incisor; a distinct diastema between incisors and canines; canine double-rooted, large, strong, piercing, much the highest tooth in the entire row except for first incisor, which approximates it; anterior face flat, with longitudinal groove, well-developed anterior and posterior cutting edges; internal face flat, with conspicuous median longitudinal groove; posterior face slightly convex, a noticeable posterior notch at base of tooth in the position of cingulum; first two premolars
subequal, with simple trigonal cusps and poorly developed postero-interna! cingula; third premolar submolariform, its single trigonal cusp the highest of molar series, with low internal heel and postero-externally shoulder; first two molars subequal, with crown roughly triangular in outline, well-developed protocone and metacone as trenchant V-shaped cusps; paracone much smaller than either protocone or metacone, low para- and metastyles; third molar slightly more than half as large as second, which it closely resembles except for loss of corner of tooth bearing metastyle; protocone well developed, metacone not as well developed as in $m^2$, parastyle present.
Lower: Incisors not all present in any mandibles found, but alveoli show that the three are small, closely in contact and the rows meeting at the mandibular symphysis; third incisor reaching about midway up canine, cutting edge broadly bilobed and entire face of tooth greatly expanded, a wide sulcus down inner face of incisor; canine strong and much higher than any other tooth of mandible, with an anterior cutting edge the outline of which is convex; the internal face, passing from apex to root, seems to rotate to the rear, so that canine appears as if twisted from right to left; this rotation further expressed by appearance of external and posterior faces of canine, a narrow shoulder developed at base of posterior face; three premolars subequal, with trenchant triangular cusps and narrow heel; three molars of approximately equal size, all with high tubercolu-sectorial trigonid and broad, flat talonid, the protoconid being the highest cusp.

In a mandible (No. 17115) showing evidences of early maturity what appears to be the permanent canine can be seen pushing up against its milk predecessor, which is subpremolariform in shape.

Skulls collected.—97, of which many are nearly complete, lacking only incisors and bule.

Mandibles collected.—70, the greatest number lacking only the incisors; also, a considerable number of fragmentary skulls and rami too badly broken to be worth listing separately.

Remarks.—Three species of the genus Nesophontes have been described—edithae of Porto Rico, micrus of Cuba and longirostris, also of Cuba. Edithae is very much larger than either of the two Cuban species. In addition to the size difference, there are cranial distinctions which have been set forth in detail by Anthony (1919, p. 633). N. micrus has the first anterior upper premolar noticeably larger than the second, whereas in edithae the anterior upper premolars are equal. N. longirostris has a distinct diastema between canine and first premolar above, between the two anterior premolars, and between the second and third premolars.
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*Type.
The Skeleton of *Nesophontes edithae*

The scapula (text Fig. 21) is long and has a breadth equal to about half its length. The spine is very high, the acromion and metacromion are well developed and the coracoid is very long and strongly curved. The axillary border is reflected outward to produce a ridge and a deep concavity paralleling the spine. The anterior superior border is smooth and regular.

*Scapula collected.*—Parts of seven scapulae, of which three are fairly well preserved and afford between them all the different structures.

![Fig. 21. *Nesophontes edithae.* Right scapula: A, external aspect; B, anterior aspect; C, ventral aspect. × 5/2](image)

**Measurements.**—Composite of scapula, all males. Length over all, 19.8 mm.; greatest width, 11.3; greatest depth, through acromion, 4; width of neck, 3.4; transverse width of glenoid, 2.4; glenoid + coracoid, 4.5.

If the *Centetes* scapula be taken as a primitive type, the *Nesophontes* scapula is seen to be rather more advanced in several details. The reflection of the axillary border and the extreme development of the acromial and coracoid processes are not found in the *Centetes* scapula, while the spine is much deeper in the case of *Nesophontes*. A close approxi-
tion to Nesophontes is noted in Solenodon. Proportionally, Nesophontes has carried the development of the spine further, and the constriction of the body of the bone at the neck is much more marked. Nesophontes does not have the posterior superior border drawn out into a sharp point, as in Solenodon. Probably as close agreement is shown by the Crocidura (Crocidura ymansae kiru) scapula, where the same deep, partially enclosed, infra-spinatus fossa is found. The same expansion of the spine in the acromial region does not occur in the Crocidura scapula. The Gymnura, and to a lesser degree the Erimurus, scapula resembles the Nesophontes scapula in most of the primitive details. Nesophontes

does not very closely parallel Tupaia in details of the scapula, although they have the reflected axillary border in common.

The humerus (text Fig. 22) of Nesophontes is nearly straight, rather robust, and with a conspicuous deltoid ridge. It is expanded distally and the shaft above the expansion is rather slender. The head is large and broadly elliptical in cross-section; the bicipital groove is well marked and the greater and lesser tuberosities are well developed. Moderate-sized entepicondylar and supratrochlear foramina are present. The supinator crest is an arcuate ridge which extends onto the unexpanded shaft. There is a conspicuous swelling on the internal aspect of the

Fig. 22.—Nesophontes edithae. Left humerus: A, anterior aspect; B, internal aspect; C, posterior aspect. × 5/2
deltoid ridge to mark the attachment area of the teres major and latissimus dorsi.

_Humeri collected._—135, most of them perfect.

### Measurements of Humerus of Nesophontes edithae

<table>
<thead>
<tr>
<th>Sex</th>
<th>Greatest length</th>
<th>Greatest width distally</th>
<th>Least width of shaft</th>
<th>Greatest depth through deltoid ridge</th>
<th>Transverse width of head from bicipital groove</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>26.1</td>
<td>6.9</td>
<td>1.9</td>
<td>3.1</td>
<td>4.2</td>
</tr>
<tr>
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<td>6.8</td>
<td>1.9</td>
<td>3.8</td>
<td>4.1</td>
</tr>
<tr>
<td>c</td>
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<td>1.9</td>
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<tr>
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<td>7.0</td>
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</tr>
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<tr>
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<td>22.7</td>
<td>5.7</td>
<td>1.6</td>
<td>3.3</td>
<td>3.7</td>
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<td>j</td>
<td>22.5</td>
<td>5.3</td>
<td>1.5</td>
<td>2.9</td>
<td>3.3</td>
</tr>
</tbody>
</table>

The humerus of _Nesophontes_ bears considerable resemblance to that of _Solenodon_, but is even more primitive than the latter, retaining an unspecialized form and showing little decided adaptation for a fossorial habit. The _Solenodon_ humerus is much heavier proportionally, and consequently is much more angular in the attachment areas. The Haitian animal lacks the supratrochlear foramen, the head of the humerus is much more elliptical and the deltoid ridge is more greatly expanded. The differences for the most part appear to be responsive specializations to a fossorial habit. Relationship in primitive characters is more clearly shown by a comparison with _Centetes_ and _Hemicentetes_, where modification by peculiar environment has not played a part. The _Erinaceus_ humerus only approximately resembles that of _Nesophontes_ and does not show as close a resemblance as the Zalambdodonts cited, but the _Gymnura_ humerus bears a very striking likeness to the _Nesophontes_ humerus. The arboreal type of humerus, as exemplified by _Tupaia_, shows such a parallelism with the humerus of _Nesophontes_ that the evidence should not be passed over lightly. The Talpids are too highly specialized in the fore limb to give any clues through comparison, except it should be noted that a primitive humerus, such as that of _Nesophontes_, has the possibilities for the Talpid specialization. The more primitive condition of the Soricid humerus, using _Crocidura_ as a type, bears significant likeness to the _Nesophontes_ humerus.
The ulna (text Fig. 23) is of the primitive placental type—long, slender and nearly straight. It is flat and thin for most of its length, with a large, strong olecranon process which is well ridged for tendon attachment. The sigmoid cavity is ample. There are well-defined surfaces for the articulation of the radius and for the pisiform and cuneiform.

Ulna collected.—33, most of them perfect.

**Measurements of Ulna of Nesophontes edithe**

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Greatest antero-posterior width</th>
<th>Length of olecranon from border of sigmoid cavity</th>
</tr>
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<td>2.3</td>
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<td>2.7</td>
<td>4.1</td>
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<td></td>
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<td>2.4</td>
<td>4.3</td>
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<td></td>
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<td>3.9</td>
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<td></td>
<td>23.4</td>
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<td>23.3</td>
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<tr>
<td></td>
<td>22.1</td>
<td>1.9</td>
<td>3.0</td>
</tr>
</tbody>
</table>
The *Nesophontes* ulna compares well with the shrew ulna, *Crocidura*, but there is rather more specialization to be seen in the olecranon region of the latter. The primitive zalambdodonts—*Centeles*, *Hemicenteles*, and less closely *Solenodont* and *Polamogale*—show remarkably close similarity to *Nesophontes* throughout. The *Erinaceus* ulna is also sufficiently generalized to be closely compared with *Nesophontes*. The ulna of *Gymnura* is very similar and the greatest difference seems to be merely in the curve of the bone. The ulna of *Tupaia* bears out the resemblance expressed by the humerus and agrees, in the main, quite well with *Nesophontes*.

![Fig. 24. *Nesophontes edithae*. Left radius: A, anterior aspect; B, external aspect; C, posterior aspect. × 5/2](image)

The radius (text Fig. 24) is moderately bowed, nearly uniform in cross-section throughout, and with a slight distal expansion. It has a conspicuous tubercle and well-marked insertion areas for the supinator and pronator muscles. There is a well-defined curve for the extensor tendon, and the articulating surfaces of the bone, both proximal and distal, are large. Considering the small size of the radius, the muscle insertion areas are unusually well marked.

*Radii collected.*—8, most of them perfect.
### Measurements of Radius of Nesophontes edithe

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Transverse width at mid-point</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
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<td>1.5</td>
</tr>
<tr>
<td>b</td>
<td>18.7</td>
<td>1.2</td>
</tr>
<tr>
<td>c</td>
<td>18.8</td>
<td>1.2</td>
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<tr>
<td>d</td>
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<tr>
<td>e</td>
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<td>1.1</td>
</tr>
<tr>
<td>f</td>
<td>17.1</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Centetes* and *Solenodon*, while rather closely agreeing with *Nesophontes* as to radii, are not proportionally as well equipped for pronation and supination. Although the bones of these two genera are much larger, and therefore should be more clearly marked off for muscle insertion, they are actually smoother than the small radius of *Nesophontes*. *Erimacrus* has a radius quite similar to that of *Nesophontes*, and the Shrew radius (*Crocidura and Blarina*) is also similar.

Although several ribs of *Nesophontes* were found, mostly from the anterior part of the series, it is not possible to draw very satisfactory deductions from the material. The ribs are not very strongly curved and the greatest degree of curving is at the proximal end. On some of the ribs the tubercle is fairly well developed, but on the longer ribs the tubercle facet is wanting or is undifferentiated from the surface of the rounded head. The shaft of the rib is strong, compressed, but expanded distally to form a thickened articulation surface for the costal cartilage. In most cases there is a well-marked groove along the shaft.

**Ribs collected.**—15, most of them perfect.

**Measurements.**—Sex indeterminable, ♀ (?). Greatest length, third (?) rib, 15.6 mm.; ninth (?) rib, 19.7; greatest breadth of shaft, third rib, 1.5.

Judging from the curvature of the few ribs collected, the body of *Nesophontes* must have been deep rather than broad. In the characters of the ribs themselves, considerable resemblance is shown to those of *Crocidura* and to *Gymnura*. *Centetes*, as well, should be included in this comparison, although in some details, such as the more rounded shaft and the better-developed tubercle, a decided difference is displayed. The *Solenodon* rib is compressed in a plane at right angles to the plane of compression in the *Nesophontes* rib, and this is confirmatory of the hypothesis that *Nesophontes* had a deep body and not a widened-out one like *Solenodon*. None of the other insectivores examined have such a
knob-like expansion for the costal attachments on the distal end of the ribs.

The sacrum (text Fig. 25) is composed of three vertebrae and is much wider at the cephalic than at the caudal extremity. The neural spines are not fused to form a continuous dorsal crest and they are not very high. The cephalic articular surfaces are of medium size, but the caudal articulations are rather small. The lateral borders curve gently from the ake to the third sacral vertebra. The dorsal foramina are very large and the ventral foramina are fair-sized. In one specimen, probably that of an old individual, advanced fusion with the first caudal vertebra is shown. The sacrum shows no characters of specialization.

*Sacra collected.—* 7.

*Measurements.—* Length through centra, ♂ 12.8, ♀ 11.9 mm., breadth across ake, ♂ 9.6, ♀ 8.2.

The *Nesophontes* sacrum finds its closest resemblance in the sacrum of *Crocidura* and others of the Soricidae, the proportions of the different elements being, in general, similar. The sacrum of the primitive zalambdodonts, *Centetes* and *Hemicentetes*, is decidedly different in the proportions of the first two sacral vertebrae. *Hemicentetes* resembling *Nesophontes* in this respect rather more than does *Centetes*. The *Solenodon* sacrum, of four vertebrae and with the neural spines fused to form a crest, is quite dissimilar to the *Nesophontes* sacrum. The Erinaceidae have quite a high sacrum of nearly uniform width and need no detailed comparison here. The sacrum of the arboreal *Tupaia* is much wider and of a structure widely different from that of the Porto Rican insectivore.

The innominate bone (text Fig. 26) is simple and unspecialized. The main axis of the element is nearly straight. The ilium is long, slender and trihedral, expanding anteriorly in the transverse plane, with the external border a symmetrical curve. The ilium probably does not enter into the acetabulum, judging from a specimen which has been broken and shows a sutural contact. The articulating surface of the ilium ex-
tends from about the middle of the bone to the terminal fourth. The ischium is laterally compressed, expanding where it articulates with the pubis, and seemingly does not have an osseous connection with the

Fig. 26.—Acrothorax editha. Right innominate of adult male: A, external aspect; B, dorsal aspect; C, internal aspect. Left innominate of adult female: D, external aspect. $\times 5/2$
sacrum. The ischial spine is present and there is a noticeable roughening for tendon attachment along the distal portion of the ischium. The pubis is flat, slender and straight for most of its length, with a slight inward curvature at the symphysis region. Apparently there is either very slight fusion of the pubis at the median symphysis or none at all, since the edge of the bone has such a small, roughened area in the symphysis region. The acetabulum is deep and cup-like, with a wide cotyloid notch. The obturator foramen is a large and roughly triangular opening. The contact of the innominate bone with the sacrum occurs only along the ilia.

*Innominate collected.*—59, a large part are perfect.

**Measurements of Innominata Bone of Nesophontes edithae**

<table>
<thead>
<tr>
<th></th>
<th>Greatest length of innominate bone</th>
<th>Anterior border of acetabulum to anterior end of ilium</th>
<th>Greatest width across ischium + pubes</th>
<th>Greatest diameter of acetabulum</th>
<th>Greatest diameter of obturator foramen</th>
</tr>
</thead>
<tbody>
<tr>
<td>♂</td>
<td>33.9</td>
<td>19.0</td>
<td>16.0</td>
<td>5.1</td>
<td>9.8</td>
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<tr>
<td>b</td>
<td>33.4</td>
<td>18.9</td>
<td>16.0</td>
<td>5.2</td>
<td>9.3</td>
</tr>
<tr>
<td>c</td>
<td>35.1</td>
<td>20.9</td>
<td></td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>32ż</td>
<td>18.9</td>
<td></td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>♀</td>
<td>27.1</td>
<td>16.1</td>
<td>11.2</td>
<td>4.1</td>
<td>7.4</td>
</tr>
<tr>
<td>f</td>
<td>27.2</td>
<td>16.3</td>
<td>12.0</td>
<td>4.0</td>
<td>7.7</td>
</tr>
<tr>
<td>g</td>
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<td>15.8</td>
<td>11.0</td>
<td>3.9</td>
<td>7.7</td>
</tr>
<tr>
<td>h</td>
<td>25.7</td>
<td>15.0</td>
<td>10.8</td>
<td>3.8</td>
<td>6.9</td>
</tr>
<tr>
<td>i</td>
<td>24.7</td>
<td>15.0</td>
<td></td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>j</td>
<td>24.7</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Young ♂ ?</td>
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<td>16.8</td>
<td>12.8</td>
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</tr>
</tbody>
</table>

The innominate bone of *Nesophontes* most nearly resembles that of the zalambodonts, *Solenodon, Centetes, Hemicentetes* and *Microgale*. Agreement with *Polamogale* is less intimate because this structure is more highly specialized in the latter genus. The simple characters of the different elements of the pelvic girdle, which lack any of the specialized variations in form found in the higher groups of insectivores, are sufficient to distinguish the *Nesophontes* innominate from most of the Insectivora outside of the Zalambdodontata. In this respect *Erinaceus* has progressed but little, if any, past the primitive condition found in *Nesophontes*, while in the case of *Blarina* and *Crocidura* a possible evolution from this condition is seen.
The femur (text Fig. 27) is of a very generalized type with a straight, smooth shaft of nearly uniform cross-section from trochanters to condyles. The well-rounded head represents fully half of a sphere. The deep constriction at the neck is continuous except at a point on the upper posterior surface, where the rounded surface of the head terminates abruptly at the edge of the trochanteric fossa in a V-shaped ridge. Both greater and lesser trochanters are well developed and almost equal in size. The posterior intertrochanteric line and the trochanteric fossa are conspicuous and well defined. The third trochanter is present as a prominent, rounded process on the compressed, external border of the shaft. The condylar region is normal. The femur of males is so much larger and heavier than that of females that some of the insertion areas, especially in the region above the intercondylar notch, are more clearly shown. However, there are some of the largest of the femora which are very smooth and with very little rugosity at any point.

_Femora collected._—144, most of them perfect.

In many details the femur of a male _Nesophontes_ resembles the _Solenodon_ femur; the disparity in size is great and the femur of the latter is proportionally heavier than that of _Nesophontes_, but the development of the different areas and processes in the two genera is almost identical. Both have the rounded surface of the head extended toward the greater trochanter in a V-shaped ridge, but the head of _Nesophontes_ is noticeably the better developed and more restricted at the neck. _Nesophontes_
differs from *Erinaceus* in having a femur with better-developed trochanters, the third trochanter of the former genus being very small, and a much deeper trochanteric fossa.

Compared with the femur of a large shrew, *Crocidura nyansae kiren*, from the Belgian Congo, close agreement in general structure is observed, but the shrew femur lacks the trochanteric fossa and the intertrochanteric line so well marked in *Nesophontes*.

The femur of *Scalopus* has the third trochanter greatly developed and high on the shaft, thereby differing from *Nesophontes*, but in the approximation of the convex surface of the head toward the greater trochanter there is similarity.

The femur of *Nesophontes*, because of its primitive character, needs no comparison with such genera as *Rhynchocyon*, *Macroselides*, *Chrysocloris* and *Tupaia*. In its generalized characters it agrees fairly well with any of the primitive insectivore types, the best agreement being with the genera discussed above.

**Measurements of Femur of Nesophontes cithae**

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Diameter of head</th>
<th>Greatest breadth across tips of trochanters</th>
<th>Least width of shaft</th>
<th>Greatest width across condyles</th>
<th>Width across articular surface</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td><strong>Average</strong></td>
<td>27.74</td>
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<td>p</td>
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<td>3.0</td>
<td>6.4</td>
<td>2.3</td>
<td>5.2</td>
<td>2.7</td>
</tr>
<tr>
<td>q</td>
<td>22.5</td>
<td>3.2</td>
<td>6.7</td>
<td>2.5</td>
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<td>2.7</td>
</tr>
<tr>
<td>r</td>
<td>22.7</td>
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<td>5.4</td>
<td>2.7</td>
</tr>
<tr>
<td>s</td>
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<td>6.3</td>
<td>2.3</td>
<td>5.4</td>
<td>2.7</td>
</tr>
<tr>
<td>t</td>
<td>22.6</td>
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<td>2.5</td>
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<tr>
<td><strong>Average</strong></td>
<td>23.05</td>
<td>3.10</td>
<td>6.52</td>
<td>2.39</td>
<td>5.33</td>
<td>2.64</td>
</tr>
</tbody>
</table>
The tibia (text Fig. 28) is quite long, being slender and nearly straight throughout most of its length, with a smooth shaft and no special insertion areas other than that for the tibialis anticus muscle. The crest of the anterior border is sharp and extensive and there is a well-marked concavity along the outer aspect where the tibialis anticus attaches. The tibia has a very flat proximal end with a low median ridge. The tuber-

![Fig. 28.—Nesophontes editha. Right tibia of adult male: A, external aspect. Left tibia and fibula of adult female: B, antero-external aspect; C, external aspect; D, posterior aspect. × 2 1/4.

osities are normal. The facet for the fibula is small, facing directly downward and not obliquely downward. The internal malleolus is long and the articulating surfaces indicate that the outside keel of the astragalus is much higher than that on the inside. The sexual dimorphism is very marked in the series of tibia.

Tibia collected.—123, most of them perfect.
Measurements of Tibia of Nesophontes edithae

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Greatest width across tuberosities</th>
<th>Least width across anterior aspect</th>
<th>Greatest length</th>
<th>Greatest width across tuberosities</th>
<th>Least width across anterior aspect</th>
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<tr>
<td>☞</td>
<td>36.0</td>
<td>7.3</td>
<td>1.7</td>
<td>☞</td>
<td>28.5</td>
<td>4.8</td>
</tr>
<tr>
<td>a</td>
<td>33.0</td>
<td>6.1</td>
<td>1.5</td>
<td>b</td>
<td>30.3</td>
<td>5.2</td>
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<tr>
<td>e</td>
<td>34.6</td>
<td>6.2</td>
<td>1.4</td>
<td>m</td>
<td>30.7</td>
<td>5.6</td>
</tr>
<tr>
<td>d</td>
<td>34.4</td>
<td>6.5</td>
<td>1.7</td>
<td>u</td>
<td>31.4</td>
<td>5.2</td>
</tr>
<tr>
<td>c</td>
<td>34.5</td>
<td>6.0</td>
<td>1.6</td>
<td>o</td>
<td>32.1</td>
<td>5.0</td>
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<tr>
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<td>33.5</td>
<td>5.9</td>
<td>1.4</td>
<td>p</td>
<td>31.2</td>
<td>5.5</td>
</tr>
<tr>
<td>g</td>
<td>36.2</td>
<td>6.3</td>
<td>1.6</td>
<td>q</td>
<td>30.7</td>
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<tr>
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<td>35.2</td>
<td>6.4</td>
<td>1.5</td>
<td>r</td>
<td>30.7</td>
<td>5.4</td>
</tr>
<tr>
<td>i</td>
<td>34.6</td>
<td>6.3</td>
<td>1.7</td>
<td>s</td>
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<tr>
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<td>t</td>
<td>31.4</td>
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<td>6.30</td>
<td>1.57</td>
<td>Ave</td>
<td>30.86</td>
<td>5.27</td>
</tr>
</tbody>
</table>

In the character of simple, smooth, and slightly curved shaft the tibia of *Nesophontes* displays its primitive nature. Among all the Insectivora, the retention of an equal degree of generalization is shown only by *Solenodon, Centetes, Hemicentetes* and *Tupaia*.

The fibula (text Fig. 28) is long, slender and of nearly uniform cross-section. The shaft is very straight, and fusion to the tibia is so imperfect that the two elements were seldom found attached, and close inspection is necessary to locate the area of fusion at the distal end. Expansion of the shaft at both proximal and distal ends is moderate. The grooves for tendon passage at the distal end are well developed.

*Fibulae collected.*—5, only one perfect.

*Measurements.*—6: total length, 29 mm.; cross-section at a midpoint, 1 by .9 mm.

The fibula of *Nesophontes*, being almost free from the tibia, needs little comparison with most of the insectivore genera. As in the case of the tibia, the closest agreement in this primitive condition is found in the members of the Centetoidea, *Solenodon, Centetes, Hemicentetes* and *Tupaia*.

The vertebral column is represented by comparatively few vertebrae, and hence cannot be described in detail, although a few vertebrae from each series are present. In most of its characters the column appears to be primitive. The atlas is of good size proportionally, with ample articulating surfaces and a well-developed tubercle for the longus colli muscle. The axis has a robust spine, higher than broad, large cephalic articulating surfaces, peg-like transverse processes, and a strong median ridge on
the ventral surface of the centrum, which gives the posterior aspect of the centrum a subtriangular appearance. The available material indicates that the anterior cervicals are normal. There is no trace of the dorsal spine on the few cervicals found. The sixth cervical has the three branches of the transverse process well developed, the costal element large and with an almost straight, ventral border. One of the first of the thoracic series is very short, with slender dorsal spine and well-marked articulation for the rib tubercle, but most of the thoracic vertebrae are too fragmentary to describe. The lumbar vertebrae are large, with well-formed processes and articulations. The dorsal spine is restricted to the anterior half of the vertebra because of the narrow, V-shaped indentation which runs forward between the two caudal articulations. The dorsal spine is low and forwardly inclined. The caudal vertebra, which is identified as that of Nesophontes, is a simple, rod-like element, with the length equal to about twice the diameter.

**Vertebrae collected.**—Atlases, 2; axes, 4; cervicals, 2; thoracics, 2; lumbars, 5; caudals, 1.

**Measurements of Vertebra of** Nesophontes edithae

<table>
<thead>
<tr>
<th></th>
<th>Atlas</th>
<th>Axis</th>
<th>Cervical (sixth)</th>
<th>Thoracic</th>
<th>Lumbar</th>
<th>Caudal</th>
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<tbody>
<tr>
<td>Length of centrum</td>
<td>♀ 7.3</td>
<td>♀ 6.5</td>
<td>♂ 3.2</td>
<td>♀ 2.4</td>
<td>♂ 5.2</td>
<td>6.0</td>
</tr>
<tr>
<td>Greater transverse breadth</td>
<td>♀ 11.5</td>
<td>♀ 8.8</td>
<td>♂ 10.5</td>
<td>♀ 8.6</td>
<td>♂ 7.0</td>
<td>2.8</td>
</tr>
</tbody>
</table>

The vertebral column of Nesophontes, as a whole, does not closely resemble that of any other of the Insectivora. In most details it comes closest to Crocidura and Centetes. The Crocidura column has the atlas very similar, except for a longer tubercle; the axis has a wider dorsal spine; the cervicals are very similar to those of Nesophontes and have but very low dorsal spines; the thoracics have a low spine, but otherwise vary somewhat from Nesophontes; the lumbar have the same indentation between the posterior articulating surfaces, but are rather more specialized on the ventral surface; the caudals are similar in nature. Centetes agrees with Nesophontes in the characters of the axis, the cervicals (except for the presence of a pronounced dorsal spine), and the thoracics, but only partially in the lumbar region and not at all in the caudal series. Erinaceus, Tympanuroid and Solenodon all have primitive vertebral characters resembling Nesophontes, the greatest resemblances
being found in the cervicals, where, however, the dorsal spine is found in every case. The specialized Tupaia has marked resemblances in the low-spined thoracics and the posteriorly forked lumbar.

Summary of the Principal Characters of *Nesophontes edithae*

1. The skull is primitive in character—elongate, tubular, slightly constricted interorbitally (hence with large olfactory chamber), lacking an ectopterygoid fossa, possessing large infraorbital foramen, large foramen magnum, incomplete zygomatic arch, prominent lambdoid crest and low sagittal crest.

2. The mandible has a curving ventral outline, a high coronoid, well-developed angular process and mandibular condyle with transverse expansion and backwardly directed articulation.

3. The dentition lacks only a premolar above and below of being the full, primitive, placental set of 44. The milk dentition is well developed, the milk incisors persisting into early maturity. The incisors are not highly specialized, the upper canine is two-rooted and large, the premolars are of the sectorial type, and the molars have the high V-shaped cusps above (protocone, metacone and paracone), the tuberculo-sectorial trigonid and talonid below.

4. The humerus is unspecialized, retaining its normal form and with large entepicondylar and supratrochlear foramina.

5. The ulna and radius are slender and unspecialized.

6. The innominate is normal in its development. The ilium is long, slender and trihedral, the ischia have well-developed spines and are well separated, and the public elements do not coalesce at the symphysis.

7. The femur has the third trochanter and a well-developed intertrochanteric line.

8. The tibia and fibula are separate, slight ossification taking place distally.

9. The vertebrae lack any specialization.

*Nesophontes* is widely separated from any of the existing families of insectivores, but because of its exceedingly primitive structure agreement in a few characters is found with each family. No living insectivore has such an assemblage of generalized characters and the gap between any of them and *Nesophontes* is apparently very great.

A number of characters link the Nesophontidae with the Centetoidae. The general form of the skull, with elongate rostrum, nearly full primitive dentition, tritubercular molars, absence of jugal, large infraorbital foramen, fused nasals, completely ossified palate and non-inflated brain-
For cone genera, zalambdodonts has to Solenodon. Nesophontes, however, is even more primitive than these genera, not only in details of the skull but in the skeleton. The protocone in the Nesophontes molar is a very important cusp of large size and has not begun to suffer from the reduction and subordination shown in living centetids; the incisors and canines bear the primitive relationship to each other and the skeleton in general is more primitive.

Nesophontes was undoubtedly of more primitive habit than those zalambdodonts to which it bears the closest resemblances—Solenodon and Centetes. The skeleton shows none of the fossorial adaptations of Solenodon, and the only developments aside from the purely terrestrial are arboreal. The forearm shows marked powers of pronation and supination, and, when taken in connection with the unthickened shafts of the bones, this faculty could have found expression, seemingly, only when the animal climbed. Perhaps it was both terrestrial and arboreal, or semi-arboreal, for only on this hypothesis can the fundamentally generalized skeleton be accounted for. The surprising parallelism with Tupaia in the characters of the humerus, ulna, tibia and vertebrae is significant in this connection as to an arboreal habit.

Nesophontes agrees with the tupaioid,7 erinaceoid and soricoid forms only in the very primitive characters. Gymnura has such a generalized skeleton that many resemblances are noted when the skeleton of Nesophontes is compared with it; this is true of Erinaceus to a lesser degree.

In its primitive type of skeleton with arboreal specialization, Tupaia shows unexpected similarities to Nesophontes. In skull characters the differences are profound.

Of the soricoid forms, the Talpidae are so highly specialized in many particulars that resemblance to Nesophontes is very remote. Of the different genera, the Old World Talpa presents the closest agreement in characters of dentition, the only part of the skeleton that may be consistently compared. The agreement consists in the relation of canine to incisors and the well-developed metacone. Differences equally important are the reduced protocone and well-developed paracune of Talpa, as contrasted with the reverse condition in Nesophontes.

The Soricidae, as far as their characters have been unchanged by specialization, have many skeletal characters in common with Nesophontes. Using large species of Crocidura as bases of comparison, agreement was

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7 For the sake of completeness, the Menotyphla were compared with Nesophontes, although there can be no doubt that Nesophontes is a true insectivore in the restricted sense.
found in the following characters: the shape of the scapula, the development of the spine-acromion complex and the deep infraspinous fossa; the ulna and radius; the humerus; the sacrum; the vertebrae; the ribs. The dentition, especially the incisor-canine series, is very highly developed in the shrews, but in the procumbent upper incisors and the bilobed lower incisors of Nesophontes a possible step in the direction of soricid specialization is seen, and there are marked resemblances in the molar crowns. Crocidura has a high metacone and reduced paracone very similar to Nesophontes. The shrew protocone, however, is greatly reduced and the molar has added a postero-internal spur not found in Nesophontes. The best agreement between Crocidura and Nesophontes is in the following skull characters: the wide separation of postglenoid process and petrioric, the lack of outgrowths from the alisphenoid and basisphenoid to form part of the bulla, the ring-shaped tympanic, the position of the foramen ovale between the postglenoid process and the pterygoid wing of the alisphenoid, the glenoid cavity opening forward instead of downward, the elongate basicranial region, the greatly reduced anterior and posterior zygomatic roots, the optic foramen opening into the sphen-orbital fissure in Nesophontes (confluent with it in Crocidura) and the posterior mental foramen situated below pm.

From the Leptictidae, Nesophontes differs radically, some of the main differences being the possession in this family of four premolars, as against three in Nesophontes; the presence of a well-developed zygomatic arch, the unfused nasals and the much broader, heavier skull, with prominent lateral longitudinal crests.

It will be seen from the foregoing paragraphs that the Nesophontidae is a very well circumscribed family and is not immediately related to the other insectivore families. Because of the undeveloped possibilities in its structure, the Porto Rican animal might be near the line of descent of several of the modern families. On the one hand, Solenodon or Centetes might have evolved from such a primitive ancestor as Nesophontes, while on the other hand the possibility that the Soricidae might have descended from an early nesophontid must not be overlooked. Nesophontes is such a type as might well be looked for in the Eocene and its persistence down into the late Pleistocene or early Recent may be explained by its insular isolation. If this interpretation of its relationships be placed upon Nesophontes, it implies a related ancestry for the Centetoidea and the Soricoidea—a condition already suggested by Leche (1907, p. 121).

8 These points are brought out in the description of the different skeletal elements of Nesophontes.
Skeletons of the following species have been available for comparison with Nesophontes:

- *Tupaia speciosa*
- *Macrosciellus rozeti*
- *Rhynchocyon claudi*
- *Gymnura rafflesii*
- *Erinaceus europaeus*
- *Sorex personatus*
- *Blarina brevicauda*
- *Crocidura nyansae kiru*
- *Crocidura rubicunda?*
- *Myogale moschata*
- *Talpa europaea*
- *Scalopus aquaticus*
- *Potamoget velox*
- *Solenodon paradoxus*
- *Centetes ecaudatus*
- *Hemiechinus semispinosus*
- *Eriurus telfairi pallescens*
- *Oryzomys teladae*
- *Microgale dobsoni*
- *Chrysocloris trevelyani*

**Status of the Family NESOPHONTIDAE**

The difficulty in determining the relationships of the Nesophontidae lies not so much in establishing the validity of the group as a family, but rather in finding other families of insectivores enough like it to claim affinity. The characters which set the Nesophontidae apart are obvious, but the resemblances with other insectivores are not so patent, except for the many primitive characters whereby similarity may be found, to some degree, with practically any of the insectivore groups.

The position in which I placed the Nesophontidae in my description of the family (1916), rather nearer to the soricoids than to the zalambdodonts, was not accepted by Dr. G. M. Allen (1918, p. 135), who believes that the true condition is the reverse.

Dr. Allen advances comparisons which give strong support to his contention, and I freely grant that there is a deep gulf between the primitive *Nesophontes* and the highly specialized Soricidae or Talpidae; so, also, is there a great gap between *Nesophontes* and *Solenodon*, to bridge which Dr. Allen presupposes special development of the generalized *Nesophontes* condition to evolve the present-day *Solenodon* condition. The profound changes which would develop a *Solenodon* from a nesophontid would also carry a nesophontid well into the soricid stage, if along slightly different lines. The main difference in the two comparisons is that the Soricidae are very highly developed as we find them today (with respect to some features of skull and dentition), whereas the zalambdodonts represent a more primitive stage. However, the zalambdodont dentition appears as early as the Basal Eocene in *Palaeoryctes* of Matthew (1913, p. 309). Gregory (1910, p. 268), writing of the evolution of the Centetoidae, says:

Since the common origin of the Centetoidae and Erinaceoidae seems well assured, from the evidence cited on page 266, we must believe that most of the
special Centetid characters above enumerated, except possibly the V-shaped protocone of the upper molars, the lack of a hypoconid, and the position of the posterior mental foramen, have been acquired by the Centetidae after they became separated from the forerunners of the Erinaceoidea.

The date of this separation can at present only be determined within very wide limits. It was certainly not later than the Lower Eocene, for in the Eocene and Oligocene the family Lepiictidae had already become Erinaceoid in many characters, while by the time of the Lower Oligocene the Zalambdodonts had differentiated into Chrysochlorids (p. 258) and Centetids (Apternodus, p. 259), the Solenodontidae also possibly being represented by Micropternodus (p. 259).

As to the lower limit for the date of separation, there is still less to guide us. If the *Palaeogale* upper molar be more primitive than the *Microgale* molar, then the morphological gap between the *Microgale* and presumably the *Apternodus* molar on the one hand and the *Ictops* molar on the other is very profound, and the separate phylogenetic lines representing the Lepiictidae and the Centetidae would have to be prolonged back very far before they would run together. If, on the contrary (as seems on the whole more probable), the *Microgale* molar is the primitive Centetid type, then the principal difference between it and the more primitive *Ictops* molar lies in the reduction of the paracone and sometimes its fusion with the parastyle. In that case the lower limit for the separation of the Erinaceoids and Centetoids might perhaps be the Basal Eocene or Upper Cretaceous.

Consequently, if the zalambdodont molar was derived from a nesophontid molar the development must have taken place at a very remote time. Dr. Matthew writes of the zalambdodont molar in his report on *Palaeorhynchos*: "that it has probably, although not certainly, passed through a normal tritubercular stage in its evolution" (l. c., p. 313). The same author, writing in 1909 on the Insectivora of the Bridger Basin, page 513, says:

Whatever theoretic views may be held as to the ultimate derivation of the dilambdodont from the zalambdodont type of molar, or *vice versa*, the fact remains that in Mesozoic as in modern times the two were entirely distinct, and that there is no direct evidence for the derivation of any dilambdodont families of insectivora from zalambdodont ancestors. The Oligocene zalambodonts may or may not be related to the Chrysochloridae, Centetidae or Solenodontidae, but they are not related to the Talpidae, Soricidae, Lepiictidae, etc., and should not be placed even provisionally in any of these families.

While this may be taken to show the antiquity of the distinction between the zalambdodont and the dilambdodont dentition, it has bearing on the affinities of *Nesophontes* only in so far as to point out the improbability of a transition from the nesophontid molar to the *Solenodon* molar in the period since the Eocene. I have conceded earlier in my discussion of *Nesophontes* the possibility of evolving a *Solenodon* from
a _Nesophasontes_, as far as structural data is concerned. Palaeontological data indicates that such structural changes, if they took place at all, transpired before the Eocene. Since _Nesophasontes_ is so well differentiated from the zalambdodonts on the one hand and the dilambdodonts on the other, it becomes more or less a question as to whether the hypothetical molar change of the unknown pre-Eocene should outweigh an apparent (although possibly unreal) affinity to the Soricoida molar.

While I have tried to show that the zalambdodonts, as far back as they have been discovered, are still far removed from nesophontids, it might be said with almost equal force that the same is true of the earliest known soricids and talpids. They, too, are well specialized families at their earliest appearance, although in their case the record does not go back to the Basal Eocene. In making the assumption that the line of descent of the Nesophontidae inclines toward the side of the Soricidae, I have pictured the primitive soricid as combining, to a greater or less degree, the primitive skeleton of the present-day shrew with the more generalized dentition (as compared with the Soricidae) of the moles. I would qualify my earlier use of the term Soricidae (Anthony, 1916, p. 728) and employ now Soricoida, in order to better include an ancestral form with generalized dentition and skeleton.

The Eocene talpoid forms are probably related to either moles or shrews, but probably they combined the more primitive dentition of the moles with the more primitive skeleton of the shrews, and may have lacked certain progressive features common to both families. (Matthew, 1909, p. 508.)

The Talpidae seem to be linked ancestrally with the Soricidae through the primitive genera, _Myogale_, _Urotrichus_ and _Uropsilus_, the first of which approaches the typical Talpidae, while the last is shrew-like in almost everything except its dentition. (Gregory, 1910, p. 265.)

The Talpidae and Soricidae have very probably diverged from a common stem, the typical Talpidae having acquired high fossorial specializations in the limbs, while the Soricidae have developed a very peculiarly, and highly modified antemolar dentition. (Gregory, 1910, p. 265.)

But the numerous resemblances cited above, as well as certain generalized centetoid features of _Xeeroleses_, seem only to warrant the inference that the stem form of the Soricoida (which was doubtless not yet mole-like in its limbs) is related to the stem of the Centetoida on the one hand and to the stem of the Erinaceoida on the other. (Gregory, 1910, p. 265.)

To sum up, the choice of affinity lies between the Zalambdodonta and the Dilambdodonta, and accordingly as the various characters of _Nesophasontes_ are given weight the hypothetical line of descent of the Nesophontidae may be diverted toward the one or the other. If the differences between _Nesophasontes_ and _Solenodon_—for example, such as the dif-
ference between the three-cusped W molar pattern of the former and the reduced two-cusped V pattern of the latter—do not outweigh the resemblances, such as “the shape of the skull, the incomplete zygomatic arch, the long, tubular rostrum, early fusion of the nasals (also in Soricidae), the slight inflation of the frontal region, large foramen magnum, prominent lambdoid and low sagittal crests, the tooth-formula, the double-rooted upper canine, and the transversely expanded mandibular condyle” (G. M. Allen, 1918, p. 135), which are, for the most part characters held in common by all primitive insectivores, then the Nesophontidae must have closer affinities with the Zalambdodonta than with the Soricoidae or any other superfamily of the Insectivora characterized as dilambdodont.

However, if the specialized features of the Soricoidae may be considered as a later development obscuring the true primitive condition, then serious consideration must be given to such agreement in characters between Nesophontes and Talpa as an identical fundamental arrangement of primitive cusps (modified to different degrees, but present in both cases), similarity in position of posterior mental foramen (under the last premolar in Nesophontes, approaching that condition in Talpa), and upper canines in the same stage of development, double-rooted and with normal relation to the tooth-row in both genera. Other genera of the Soricoidae—Crocidura, for example—are like Nesophontes in the following respects: high metacone and reduced paracone, wide separation of postglenoid process and periotic, no part of the alisphenoid or basiphenoid forming part of the bulla, ring-shaped tympanic, foramen ovale between postglenoid process and pterygoid wing of alisphenoid, glenoid cavity opening forward instead of downward, elongate basi-cranial region, reduced anterior and posterior zygomatic roots and optic foramen opening into the margin of the sphenoidal fissure. From the foregoing, it may be argued that the Nesophontidae have reasonable claims for inclusion in the Dilambdodonta rather than the Zalambdodonta. It may be overemphasizing these resemblances to include the Nesophontidae in the same superfamily with the Soricidae and the Talpidae. For that reason, and because of our present inadequate knowledge of Tertiary Insectivora, I feel that a definite statement as to the immediate status of the Nesophontidae partakes, more or less, of the nature of a guess. I believe, however, that we may expect to find the ancestors of the Nesophontidae in the dilambdodont rather than in the zalambdodont section of the Insectivora.
# Mammals of Porto Rico, Living and Extinct

*By H. E. Anthony*

**Rodentia and Edentata**

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*For Chiroptera, Insectivora and the Introduction see Part 1 of this volume.*

(97)
Order Edentata

Family Megalonychidae

Genus Elasmodontomys

Synopsis of genus

Elasmodontomys obliquus

Type.—*Elasmodontomys obliquus* Anthony.

A large hysticomorph rodent with extremely hypsodont rootless molars, composed of alternating enamel plates and bands of dentine: five, and often six, enamel plates in each molar; large infraorbital foramen; heavy zygomatic arch; and massive mandible.

Distribution.—Known only from Porto Rico; fossil.

Elasmodontomys obliquus Anthony

Text Figs. 29-47. Plates XVI-XXVI. XXX


Type.—No. 14171, Dept. Vert. Pal., Amer. Mus. Nat. Hist. A fairly well-preserved skull lacking complete zygoma, the nasals, and with almost half of the posterior skull broken away; only one tooth, m1 on the right, is missing.

Type locality.—Utuado, Porto Rico.

Distribution.—Known only from the Island of Porto Rico. Recorded in Porto Rico from Utuado, Morovis and Ciales (Ciales material in Mus. Comp. Zool.).

General characters.—A very large hystricomorph rodent with hypso-
dont, rootless molars, the crown patterns of which are made up of five to six enamel plates and connecting dentine.

**Skull.**—(Text Figs. 29-33.) Large and strongly constructed; superior outline nearly straight; rostrum short and heavy, much deeper than wide; nasals long, widening slightly anteriorly, well arched laterally above plane of maxillae; premaxillary suture with frontal in same plane as nasal suture; interorbital region very broad, with strong, wide, post-

orbital processes; an abrupt postorbital pinching-in of braincase, which is constricted and compressed throughout parietal region; a strongly developed sagittal crest with well-marked anterior bifurcation, which runs out, as a ridge, on either side into the postorbital process; high lambdoidal crest; infraorbital foramen large; zygomatic arch very strong and broad. Malar very broad, with low, rounded, postorbital eminence, and entering into glenoid as a deep, square shoulder; posterior zygomatic root massive; part of orbit reserved for eyeball exceptionally small; root

![Elasmodontonyx obliquus Morovis, Porto Rico. × 1/1](image-url)
of incisor producing a slight swelling across face of premaxilla and maxilla; palate of moderate length, closely constricted anteriorly by converging tooth-rows; diastema of good length; incisive foramina large and opening from side, postpalatal notch wide and deep, reaching nearly to line of anterior border of \( \text{m}^2 \), a median ridge along palate between molars, and six noticeable palatal foramina; pterygoid processes heavy and broad, with deep, extensive pterygoid fossa; bulke of medium size, somewhat compressed; paroccipital processes long and strong.

**Mandible.**—(Text Fig. 34.) Like the skull, the mandible is strong and massive; horizontal ramus deep and thick, its ventral border nearly
straight; ascending ramus narrower; coronoid well-formed but narrow and rather weak proportionally, condyle as high as coronoid with well-rounded and extensive head; angular process very broad and massive; a

very good attachment for the internal pterygoid muscle provided by expanded lower border of ramus and angular process.

*Dentition.*—I, \(\frac{1-1}{1-1}\); Pm, \(\frac{1-1}{1-1}\); M, \(\frac{3-3}{3-3}\) = 20  (Text Fig. 35.)

Upper: Incisors long, curving and of rather small size proportionally, deeper antero-posteriorly than wide, with faint, median, longitudinal
concavity on face of enamel, tips notched rather squarely; premolars and molars all hypsodont, deeply set into maxilla, rootless, and each tooth of nearly uniform cross-section from crown to base; molar series inclined to rear and each row divergent from the other at crown and base, but curving inward about middle: the individual tooth made up of five main enamel laminae with alternating layers of dentine, this number of laminae often increased to six by a small, posterior plate; laminae approximately parallel to one another in the tooth, but decidedly oblique to long axis of palate; premolar roughly trigonal in cross-section, molars subquadrate to subcircular.

Lower: Incisors not as strongly curved as above, with well-marked longitudinal groove and tips chisel-like; molar series as above, but enamel alternated with dentine in the reverse order, the teeth not curved from crown to base, but inclined forward to ramus; number of laminae four.
The *Elasmodontomys* molar is a highly specialized development from the more primitive, infolded crown pattern. Doubtless the early condition of the molar was something like that seen in typical Echimyidae—*Proechimys*, for example. With the progressive invasion of the enamel loops which eventually completely crossed the crown transversely, the mechanics of mastication, possibly, have produced the thickening of one wall of the loop and reduced the other. Regardless of what the cause may have been, the anterior enamel wall of each loop in the upper molars and the posterior wall in the lower molars is greatly thickened and the respective opposing walls of the loop are so reduced as to be visible only under a microscope. In slightly weathered specimens the molar laminae part readily from one another, the line of parting being between the thickened enamel wall of one plate and the reduced, semi-obsolescent enamel wall of its neighbor.

*Skulls collected.*—16, of which 3 are almost complete; 15 good-sized fragments, and a number of teeth and smaller broken portions.

*Mandibles collected.*—39 rami, of which a few present nearly all the characters; and a large number of fragments and teeth.
Measurements of Skull of Elasmotherium obliquus

| Catalog Number | Department of Palaeontology | Greatest length from lam- | Greatest breadth of maxillo- | Greatest length of maxillo- | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible | Greatest length of mandible |
|----------------|-----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 17126          | 123                         | 98.8                      | 71.5                      | 39.0                      | 43.5                      | 34.0                      | 19.5                      | 39.0                      | 33.0                      | 15.0                      | 14.2                      | 59.0                      | 4.5                       | 28.0                      | 33.0                      | 8.0                       | 7.2 x 7.8                   | 7.8 x 9.1                   | 7.4 x 8.6                   | 7.4 x 8.6                   | 7.4 x 8.6                   | 7.4 x 8.6                   | 7.4 x 8.6                   |
| 17127          | 122                         | 97.6                      | 70.7                      | 42.5                      | 47.0                      | 32.8                      | 19.2                      | 30.8                      | 33.5                      | 15.4                      | 57.2                      | 2.6                       | 20.0                      | 30.5                      | 33.4                      | 7.7 x 7.7                   | 6.8 x 8.4                   | 7.7 x 8.1                   | 7.5 x 8.9                   | 7.5 x 8.9                   | 7.5 x 8.9                   | 7.5 x 8.9                   |
| 17129†         | 121                         | 98.5                      | 70.0                      | 44.2                      | 47.0                      | 32.0                      | 24.0                      | 38.0                      | 43.5                      | 20.7                      | 72.0                      | 2.8                       | 19.5                      | 37.5                      | 36.0                      | 7.8 x 7.8                   | 7.2 x 8.3                   | 7.2 x 8.3                   | 7.2 x 8.3                   | 7.2 x 8.3                   | 7.2 x 8.3                   | 7.2 x 8.3                   |
| 17130          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17131          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17132†         |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17133          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17134          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17135          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| 17136          |                             |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |                           |

* Type.
† See special discussion under "Remarks."
‡ Tooth scarcely worn.
§ Parts slightly broken or distorted, but accurate measurement still possible.
Measurements of Mandible of Elasmodontoynys obliquus

<table>
<thead>
<tr>
<th></th>
<th>Total length from extreme posterior border of ascending ramus to tip of symphysis</th>
<th>Alveolar length of molar series</th>
<th>Length of diastema</th>
<th>Vertical depth of ramus at alveolus of m1</th>
<th>Vertical depth from tip of condyle</th>
<th>Breadth of ascending ramus</th>
<th>Dimensions of pm1</th>
<th>Dimensions of m1</th>
<th>Dimensions of m2</th>
<th>Dimensions of m3</th>
</tr>
</thead>
<tbody>
<tr>
<td>17137 a.</td>
<td>86.5</td>
<td>33.5</td>
<td>27.22</td>
<td>5.8 x 8.8</td>
<td>7.2 x 7.3</td>
<td>7.4 x 8.5</td>
<td>7.5 x 8.7</td>
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<tr>
<td>17137 b.</td>
<td>87.7</td>
<td>34.6</td>
<td>22.52</td>
<td>21.5 x 7.6</td>
<td>7.1 x 6.7</td>
<td>7.2 x 8.3</td>
<td>6.6 x 6.7</td>
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</tr>
<tr>
<td>17137 c.</td>
<td>93.5</td>
<td>33.5</td>
<td>27.28</td>
<td>22.5 x 6.7</td>
<td>6.5 x 8.8</td>
<td>7.1 x 8.7</td>
<td>6.5 x 7.9</td>
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<td>33.9</td>
<td>30.5</td>
<td>21.52</td>
<td>6.4 x 8</td>
<td>6.7 x 7</td>
<td>7 x 8.5</td>
<td>6.5 x 8</td>
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<tr>
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<td>31.0</td>
<td>31.0</td>
<td>23.22</td>
<td>5.7 x 9.8</td>
<td>6.4 x 6.8</td>
<td>7 x 8</td>
<td>6.4 x 7.2</td>
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<td>17137 g.</td>
<td>34.3</td>
<td>31.5</td>
<td>39.5</td>
<td>6.4 x 9.9</td>
<td>6.3 x 8.3</td>
<td>6.6 x 9.8</td>
<td>6.8 x 8.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17137 h*</td>
<td>34.2</td>
<td>32.5</td>
<td>31.5</td>
<td>5.9 x 8.4</td>
<td>6.7 x 7.2</td>
<td>7.2 x 8.4</td>
<td>6.8 x 8.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17137 j*</td>
<td>34.4</td>
<td>34.5</td>
<td>21.5</td>
<td>5.5 x 9.4</td>
<td>6.5 x 9.3</td>
<td>6.9 x 10.3</td>
<td>6.8 x 8.4</td>
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</tr>
<tr>
<td>17137 k.</td>
<td>32.5</td>
<td>34.5</td>
<td>22.3</td>
<td>5.7 x 8.6</td>
<td>6.8 x 7.1</td>
<td>7.3 x 8.6</td>
<td>6.8 x 8.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17137 l.</td>
<td>20.5</td>
<td>20.5</td>
<td>45.6</td>
<td>6.1 x 6.1</td>
<td>6.6 x 8.3</td>
<td>6.6 x 9</td>
<td>6.6 x 9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Last molar not above alveolus.
Remarks.—The molar (text Figs. 33, 34, 35) of *Elasmodontomys* appears to be on the peak of rodent specialization. The extreme length of the tooth and the perfection of its mechanical construction demonstrates the high plane of dental development reached by this hystericomorph.

The table of measurements reveals a great amount of individual variation. Variation in the form of the skull is slight throughout most of the series, except for two notable examples, Nos. 17129 and 17132. The first is a skull much larger in nearly every dimension and with a decidedly heavier rostrum than the others. The second has very unusual dentition, and the difference in form of the skull is the result of this. The dentition, however, is the most variable feature of the genus and scarcely any
two tooth-rows are just alike. The variation in the size of the teeth is
great and is well shown by the table of measurements. In addition, there
is a remarkable age variation that has been very puzzling until it became
possible, through the abundance of material available, to trace the dif-
ferent steps in the growth of the molars.

In the younger animals the molars are very long, from 31–36 mm. in
length for the longest maxillary molars, the second and third, and from
36–39 mm. for the longest mandibular molar, the third. In fact, $m^2$, in
two skulls, almost touches the under surface of the frontal, having pene-
trated the full depth of the skull. In this early stage the laminae extend
the full length of the tooth and the base is open, appearing as a cylin-
drical shell of enamel about a bundle of parallel plates. Later, as the
crown wears, the tooth pushes up from the base to keep a constant height
above the alveolar border, and cement is deposited about the base. At
the immediate base there is a slight constriction in the enveloping
enamel, and when cement is added the base is still further constricted.
The alveolus closes and shortens with the wear of the enamel, and in
advanced age the cement reaches the plane of wear. At this stage the
crown has a homogeneous structure, with perhaps a small hole down the
center, and the teeth are weak and brittle. Most of the teeth in this con-
dition are broken off at the border of the alveolus. At first, only 4
laminae show at the basal end of the maxillary molar, and as there are 6
laminae appearing in the crown, the extra two are developed from the
anterior and posterior walls of the basal enveloping cylinder of enamel.
The cross-section of the normal tooth is approximately constant at all
stages of wear except possibly in very young animals, where the crowns
are constricted when they break through the alveolar border. Several
specimens with the third molar only slightly worn show this tooth with
a crown smaller than the cross-section at a third of its length. In very
old animals the crown surface is much reduced when the cement enters
the wearing plane. The teeth shorten progressively, the premolar, as
might be expected, wearing out first, followed in rotation by the molars.
The greatest amount of wear in the upper series apparently must come
upon the second and third molars, as these teeth are so much the longest.
The third molar appears to be rather aberrant in its relation to the molar
series. Normally a tooth of large size and great length, it is also found in
different stages of apparent reduction to the point of disappearance. No.
17-132 lacks the last upper molar and, as on one side the bone is broken
away next to the second molar, it would be possible to see the third molar
even if it were greatly underdeveloped. In connection with the lack of
$\text{m }^2$, the other three molars are greatly enlarged, being the largest of the
entire series of specimens. The unusual size of the roots of these particular molars has expanded the side of the maxilla and restricted the infraorbital foramen so that it is considerably smaller than in the other specimens. Yet this specimen has a youthful appearance, and this fact, in conjunction with the reduction or lack of development of the third upper molar shown by other specimens, restrains me from describing as a new genus a specimen that undoubtedly would be so described should it be found unassociated in a series. This specimen is interesting as a possible example of the evolution of a new form through discontinuous variation.

The mandibular teeth vary in a similar manner. In some specimens the last molar is just breaking through the jaw, and doubtless in these cases the tooth would, with age, assume the full normal size. It is rather unusual with the hystricomorphs, more especially those with unrooted molars, for the last molar to be so long in reaching a functional stage. With animals like Hydrochoerus and Capromys, the last molar, both above and below, is functional at a much younger period.

Skeleton of Elasmodontomys

The skeleton of Elasmodontomys is similar, in some respects, to that of Dinomys.9 The length of each particular bone is greater in Dinomys, as may be noted in the tables of measurements, but in special instances the elements are more robust in Elasmodontomys, as, for example, the femur. The ratio of length of tibia to length of femur is of the same order; that is, the tibia is shorter than the femur in both cases, but more so in Elasmodontomys. The calcaneum is much shorter in Elasmodontomys and proportionally broader. The bones of the fore limb are shorter in the Porto Rican rodent.

The ilium of Dinomys is considerably heavier and stronger than in Elasmodontomys, but the ilium of the latter genus is wider distally.

No perfect scapulae (text Fig. 36) were collected, but the aggregation of fragmentary specimens show that the glenoid cavity is large and the coracoid process strong and well developed; the constriction at the neck is slight and the body of the scapula is of good thickness, especially along the borders. The spine is strong, but not very extensive; it reaches its greatest depth about midway and then passes into a long acromion. The

9 No skeletal material of Dinomys was available at the time that the skeleton of Elasmodontomys was described, in 1918; but since then the American Museum has received a complete specimen of Dinomys which died at the New York Zoological Park. Unfortunately, the effects of a long captivity are shown in the dentition, but the skeleton appears to be little affected.
Acromion is a strong process, rod-like in shape, without metacromion, terminal bifurcation or conspicuous expansion. The infraspinous fossa is deep, producing a marked convexity on the inner aspect of the blade and throwing it into relief as a concavity the superior half of the inner aspect. (See Plate XXX.)

Fig. 36.—Eulamantolophus obliquus. Porto Rico. A, external aspect of left scapula; B, internal aspect; C, posterior aspect; D, spine of scapula; E, glenoid surface of left scapula. × 1 1

Scapula collected.—30 fragmentary bones, mostly the articulating extremity, but a few acromion processes are included in the series; no part of the extreme distal border is present.
Measurements of Scapula of *Elasmodontomys obliquus*

<table>
<thead>
<tr>
<th></th>
<th>Breadth of head</th>
<th>Length of head + coracoid</th>
<th>Breadth of neck</th>
<th>Length of free acromion along under side</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Elasmodontomys obliquus</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17144 a</td>
<td>10.7</td>
<td>19.2</td>
<td>14.9</td>
<td></td>
</tr>
<tr>
<td>17144 b</td>
<td>10.2</td>
<td>18.2</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>17144 c</td>
<td>10.3</td>
<td>18.0</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>17144 d</td>
<td>10.6</td>
<td>18.0</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>17144 e</td>
<td>10.9</td>
<td>18.7</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td>17144 f</td>
<td>11.5</td>
<td>20.7</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>17144 g</td>
<td>11.0</td>
<td>20.7</td>
<td>15.6</td>
<td></td>
</tr>
<tr>
<td>17144 h</td>
<td></td>
<td></td>
<td></td>
<td>32.5</td>
</tr>
<tr>
<td>17144 i</td>
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</tr>
<tr>
<td>17144 j</td>
<td></td>
<td></td>
<td></td>
<td>36.3</td>
</tr>
</tbody>
</table>

*Diomys branickii*  
60734  
11.0  
27.8  
16.8  
32.0

*Myopotamus coyppu*  
1994, U.S.N.M.  
10.1  
16.7  
11.7  
35.0

*Erthizon dorsatus*  
15673  
9.9  
19.5  
17.6

The clavicle (text Fig. 37) is a strong, well-developed bone, curved at the proximal end and expanded distally into a trumpet-shaped termination. The shaft approximates a circle in cross-section. (See Plate XXX.)

**Clavicles collected.**—1, right, in perfect preservation.

Measurements of Clavicle of *Elasmodontomys obliquus*

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Transverse breadth proximally</th>
<th>Greatest breadth distally</th>
<th>Greatest breadth midway</th>
</tr>
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<td></td>
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</tr>
<tr>
<td>17145</td>
<td>41.6</td>
<td>5.4</td>
<td>7.1</td>
<td>4.4</td>
</tr>
<tr>
<td><em>Diomys branickii</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70354</td>
<td>50.0</td>
<td>9.0</td>
<td>8.6</td>
<td>5.4</td>
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<td><em>Myopotamus coyppu</em></td>
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<tr>
<td>1994, U.S.N.M.</td>
<td>44.8</td>
<td>6.6</td>
<td>7.3</td>
<td>4.1</td>
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<td><em>Erthizon dorsatus</em></td>
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<tr>
<td>15673</td>
<td>40.3</td>
<td>6.6</td>
<td>7.4</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Only one element of the sternal series has been found, the presternum or manubrium. Anteriorly it is somewhat expanded into a subrectangular plate with a low, median keel on the anterior half and shallow, lateral concavities for the insertion of the first costal cartilages. The
Fig. 37.—*Elasmobranchius obliquus*, Porto Rico. A, anterior aspect of left humerus; B, internal aspect; C, posterior aspect; D, anterior aspect; E, anterior aspect of left clavicle; F, posterior aspect. × 1.4
posterior half deepens into a roughly trihedral facet for the next sternebra.

*Sternum collected.*—1, a presternum.

*Measurements.*—Greatest length, 27.2 mm.; greatest breadth, 15.3; breadth at posterior facet, 9.8.

The humerus (text Fig. 37) is short and somewhat heavy. The head is well rounded and of good size, the deltoid crest well developed, the shaft practically straight, and the supratrochlear foramen may or may not be present. The expansion of the condylar termination is very moderate.

*Humeri collected.*—45, of which more than half are perfect or nearly so, and a number of fragments.

*Measurements of Humerus of Elasmodontomys obliquus*

<table>
<thead>
<tr>
<th>Elasmodontomys obliquus</th>
<th>Greatest length</th>
<th>Breadth across head from bicipital groove</th>
<th>Depth through deltoid ridge</th>
<th>Breadth across condyles</th>
</tr>
</thead>
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<td>88.6</td>
<td>16.1</td>
<td>18.5</td>
<td>21.0</td>
</tr>
<tr>
<td>17141 b</td>
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<td>15.4</td>
<td>17.0</td>
<td>20.5</td>
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<td>17141 j</td>
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</tr>
</tbody>
</table>

*Dimomys branickii*

| 70354                   | 109.0          | 19.0                                     | 19.0                        | 27.0                   |

*Myopotamus coypr*

| 1994, U. S. N. M.        | 75.3           | 14.5                                     | 18.4                        | 19.8                   |

*Erethizon dorsatus*

| 15673                   | 87.7           | 17.2                                     | 15.0                        | 25.0                   |

The ulna (text Fig. 38) is strong, robust and of good length in proportion to the humerus. The olecranon process is large and very strong; the sigmoid cavity is large and deep; the coronoid process is very high, and below it is a small, deep, longitudinal fossa for the extensor ossis metacarpi pollicis; the distal articulating surfaces are well developed and the shaft is slightly curved, the convexity facing outward.

*Ulna collected.*—About 30, in varying degrees of preservation, a few completely preserved, others lacking only the distal epiphysis; also a number of broken ends and fragments.
Fig. 38.—*Elasmotherium obliquus*. Porto Rico. A, anterior aspect of right ulna; B, external aspect; C, internal aspect; D, posterior aspect. × 1/1
Measurements of Ulna of Elasmodontomys obliquus

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Length of olecranon from border of sigmoid cavity</th>
<th>Cross-section of shaft midway</th>
</tr>
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<tbody>
<tr>
<td>Elasmodontomys obliquus</td>
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<td>109.7</td>
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<td>17142 b</td>
<td>99.4</td>
<td>17.7</td>
<td>4.7 x 6.9</td>
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<tr>
<td>17142 c</td>
<td>100.8*</td>
<td>19.9</td>
<td>5.3 x 8.6</td>
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<tr>
<td>17142 d</td>
<td>97.8*</td>
<td>19.5</td>
<td>5.5 x 9.1</td>
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<tr>
<td>17142 e</td>
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<td>20.0</td>
<td>5.2 x 8.3</td>
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<tr>
<td>17142 f</td>
<td>99.0*</td>
<td>18.3</td>
<td>4.7 x 8.4</td>
</tr>
<tr>
<td>17142 g</td>
<td></td>
<td>20.7</td>
<td>5.5 x 7.8</td>
</tr>
<tr>
<td>17142 h</td>
<td></td>
<td>21.0</td>
<td>5.4 x 8.7</td>
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<tr>
<td>Dinomys bradickii</td>
<td>123.0</td>
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<td>4.8 x 10.6</td>
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<td>Myopotamus coypu</td>
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<td>17.0</td>
<td>4.3 x 7.7</td>
</tr>
<tr>
<td>Erethizon dorsatus</td>
<td>106.7</td>
<td>9.3</td>
<td>4.7 x 6.6</td>
</tr>
</tbody>
</table>

* Lacking the distal epiphysis.

Fig. 39.—Elasmodontomys obliquus. Porto Rico. A, anterior aspect of right radius; B, external aspect; C, posterior aspect. × 1/1
The radius (text Fig. 39) is similar to the ulna in its proportions, being strong and well developed. The shaft is evenly curved throughout the proximal two-thirds of its length and each termination is expanded into a large, articulating surface, the distal termination being especially heavy and club-like. The tubercle is not present, but in the region it should occupy there is found a deep, tendon insertion fossa. The muscle insertion areas are exceptionally well defined. A large, median, longitudinal fossa in the proximal third of the concave face of the shaft is possibly for attachment of the supinator brevis and perhaps the flexor profundus digitorum; the pronator teres appears to be a strong muscle wrapping about the distal third of the convex face.

Radii collected.—About 30, of which three are complete and many others nearly so; in addition, many uncleaned and unlisted fragments.

**Measurements of Radius of Elasmodontomys obliquus**

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Dimensions of head</th>
<th>Greatest breadth of distal extremity</th>
<th>Dimensions of shaft midway</th>
</tr>
</thead>
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<tr>
<td>Elasmodontomys obliquus</td>
<td></td>
<td></td>
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<td></td>
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<td>17143 a</td>
<td>87.7</td>
<td>7.4 x 12.5</td>
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<td>5.2 x 6.2</td>
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<tr>
<td>17143 b</td>
<td>83.7</td>
<td>6.9 x 10.8</td>
<td>10.5</td>
<td>4.2 x 5.7</td>
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<tr>
<td>17143 c</td>
<td>88.0</td>
<td>8.2 x 12.2</td>
<td>11.8</td>
<td>4.3 x 6.8</td>
</tr>
<tr>
<td>17143 d</td>
<td>76.0*</td>
<td>7.1 x 11.4</td>
<td>10.0</td>
<td>5.1 x 7.3</td>
</tr>
<tr>
<td>17143 e</td>
<td></td>
<td>7.2 x 13.1</td>
<td>11.0</td>
<td>4.4 x 6.4</td>
</tr>
<tr>
<td>17143 f</td>
<td></td>
<td></td>
<td>5.2 x 5.9</td>
<td></td>
</tr>
<tr>
<td>17143 g</td>
<td></td>
<td></td>
<td>4.8 x 6.7</td>
<td></td>
</tr>
</tbody>
</table>

* Lacks distal epiphysis.

The ribs are normal in all respects. The head and tubercle are well developed and the shaft throughout most of the series is not strongly curved. The tubercle is the highest point on the curve, as the shaft does not curve upward beyond the tubercle. Judging from the way the ribs fit the vertebrae, the thorax of Elasmodontomys is large and broad and the strength of the ribs would support a thorax of this type. The first rib is especially heavy.

Ribs collected—60, a number of which are complete.

Measurements.—First rib: Total length, 34.3 mm.; breadth across head and tubercle, 12.9; greatest breadth midway of shaft, 5.2. Sixth
rib: Total length, 15.3 mm.; breadth across head and tubercle, 14.2; greatest breadth midway of shaft, 3.7.

The sacrum (text Fig. 40) is a strongly fused unit of four vertebrae. Ossification has not only united all the sutures, but has built up a con-

Fig. 40.—Elasmodontomys obliquus. Porto Rico. Sacrum. A, dorsal aspect; B, lateral aspect; C, ventral aspect. × 1.1
continuous dorsal ridge of great strength. The connection of the last vertebra to its fellow has the least advanced ossification. The alae are strong and heavy, and while well expanded are not much wider than the transverse processes of the posterior vertebra. The articulating surface for the ilium extends backward onto the second sacral vertebra. The dorsal outline of the sacrum curves evenly downward posteriorly and presents a condition that can be associated only with a very short tail. There is a marked reduction in the centra from the first to the last vertebra. The foramina are all large.

Sacro collected.—22, all rather fragmentary, among which are three that give practically all the characters of the complete sacrum.

Measurements of Sacrum of Elasmodontomys obliquus

<table>
<thead>
<tr>
<th></th>
<th>Length of the sacral vertebræ</th>
<th>Greatest breadth across anterior edge of articulation for ilium</th>
<th>Depth through dorsal crest and second vertebra</th>
</tr>
</thead>
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<tr>
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<td>17147 c</td>
<td></td>
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</tr>
<tr>
<td>17147 d</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dinomys brunickii*</td>
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<tr>
<td>Mecopolumus cupra</td>
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<td>25.0</td>
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<td>1994, U. S. N. M.</td>
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<tr>
<td>Eretrizon dorsatus</td>
<td>55.0</td>
<td>42.0</td>
<td>25.5</td>
</tr>
<tr>
<td>15673</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*This part of the Dinomys skeleton is articulated and measurements of the innominate are only approximate.

The innominate (text Fig. 41) bone is very long in Elasmodontomys. The ilium constitutes about two-thirds of the total length of the innominate and is widely expanded distally. The articulating surface of the ilium is oblique, between the vertical and horizontal planes, and the greater part of the expanded portion forms a broad, shallowly concave shelf adjoining the sacrum. The unexpanded ilium is trihedral in cross-section. The ischium is broad, heavy and curves evenly downward to the pubis. The tuberosity of the ischium is large and the posterior border thickened noticeably in some specimens for tendon attachment. The pubis is not completely represented in any specimen, but appears to be a rather slender element. The pubic symphysis is short and possibly the connection is only ligamentary, to judge from the parts of the pubis preserved. The acetabulum is deep and the cotyloid notch narrow; the obturator foramen is of medium size and oval in shape.
### Measurements of Inominate Bone of Elasmodontomys obliquis

<table>
<thead>
<tr>
<th></th>
<th>Length of ilium + ischium</th>
<th>Length of ilium from acetabulum</th>
<th>Greatest breadth of ilium</th>
<th>Least breadth of ilium</th>
<th>Length of obturator foramen</th>
<th>Breadth of ischium about midway</th>
<th>Diameter of acetabulum at superior border of cotyloid notch</th>
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</tr>
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</tr>
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</tr>
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</tr>
<tr>
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<td>11.4</td>
<td>32.5</td>
<td>8.3</td>
<td>17.0</td>
</tr>
</tbody>
</table>

* Slightly broken but possible to take measurement approximately correct.
*Innominate bones collected.*—About 60 good-sized pieces, a very few of which present nearly all the characters, and many additional fragments.

The femur (text Fig. 42) is proportionally robust, the breadth being about one-seventh of the length. The head represents a hemisphere and

![Diagram of femur](image_url)
is sharply marked off by the neck. The greater trochanter is very well
developed; the digital fossa is capacious and deep; the lesser trochanter is
large and the condylar region normal, with deep trochlear groove. There
is a well-developed fossa immediately anterior and distal to the lesser
trochanter, evidently for attachment of the pectineus and perhaps one
of the adductor muscles. This bone is of the type that forms a power-
ful, well-muscled hind limb.

_Femora collected._—About 60, in good to fair condition; very many are
perfectly complete, and there are many broken pieces and much uncleansed
material.

**Measurements of the Femur of Elasmodontomys obliquus**

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Breadth across head to trochanter</th>
<th>Breadth across condyles</th>
<th>Breadth midway of shaft</th>
</tr>
</thead>
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<td>17138 a</td>
<td>105.4</td>
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<td>25.7</td>
<td>14.5</td>
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<td>26.5</td>
<td>14.6</td>
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<td>25.2</td>
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<td>32.1</td>
<td>26.7</td>
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<td>15673</td>
<td>104.7</td>
<td>29.1</td>
<td>23.4</td>
<td>10.7</td>
</tr>
</tbody>
</table>

The tibia (text Fig. 43), in proportion to the femur, is very short.
It is in actual length shorter than the femur—a rather unusual con-
dition. It is somewhat straighter than most rodent tibiae, the external
border being only slightly curved, the crest of the anterior border with a
prominent tuberosity about midway. The proximal end is widely ex-
panded into the two tuberosities and the distal expansion is normal.
The internal malleolus is rather long.

_Tibiae collected._—10, of which the greater part are well preserved, and
a number of unlisted fragments.
# Measurements of Tibia of Elasmodontomys obliquus

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Breadth across tuberosities</th>
<th>Depth through tuberosity on anterior border</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
</tr>
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<td><em>Erythizon dorsatus</em></td>
<td>96.0</td>
<td>24.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

![Fig. 53. *Elasmodontomys obliquus*. Porto Rico. A, anterior aspect of left tibia; B, external aspect; C, internal aspect. × 1/1](attachment:image.png)
In the mature animal the fibula (text Fig. 44) is firmly fused with the tibia proximally, but is apparently always free distally. In young individuals the proximal articulating surface on the tibia for the fibula is well shown. The fibula is a strong, slender element with a broad and fairly thick proximal termination and a heavy, thickened distal end. The shaft is nearly straight, and in young specimens is laterally concave along the internal face, especially proximally; in mature adults the shaft is roughly circular in cross-section.

Fibulae collected.—2 complete, and proximal ends of several others.

Measurements of Fibula of Elasmodontomys obliquus

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Greatest proximal breadth</th>
<th>Greatest transverse breadth midway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elasmodontomys obliquus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17140 a</td>
<td>87.5</td>
<td>17.0</td>
<td>3.7</td>
</tr>
<tr>
<td>17140 b</td>
<td>71.8</td>
<td>13.9</td>
<td>5.3</td>
</tr>
<tr>
<td>17140 c</td>
<td>18.0</td>
<td></td>
<td>4.5</td>
</tr>
<tr>
<td>Dinomys braničkii</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>70354</td>
<td>98.0</td>
<td>14.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Myopotamus coypu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994, U. S. N. M.</td>
<td>99.5</td>
<td>14.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Erethizon dorsatus</td>
<td>83.8</td>
<td>12.7</td>
<td>3.8</td>
</tr>
</tbody>
</table>

The vertebral series is quite well represented.

Atlas.—The atlas (text Fig. 45) is large and strongly built, with wide, transverse processes, a well-developed tubercle for the longus colli and no pronounced dorsal spine.

Atlases collected.—11, of which 3 are complete.

Axis.—(Text Fig. 45.) This vertebra is conspicuous for the high dorsal spine, only slightly directed backward. The odontoid process is of good size and moderate height.

Axes collected.—14, of which 6 are complete.

Cervicals.—The cervical series is normal in every respect, containing five vertebrae, exclusive of the atlas and axis. The most noteworthy features are the thick, transverse processes and the poorly developed dorsal spines. The third cervical has a fairly well-developed dorsal spine and the sixth has the customary two branches of the transverse processes. The posterior ventral surface of the centrum of the fourth cervical, and to a lesser degree of the third, is built out to form a faintly indented platform quite different from the median ridge along the centra of the other cervicals. The transverse processes of the third, fourth, fifth and
Fig. 44.—*Elasmotheromyys obliquis*, Porto Rico. A, external aspect of right tibia; B, posterior aspect; C, internal aspect. × 1/1

Fig. 45.—*Elasmotheromyys obliquis*, Porto Rico. A, dorsal aspect of atlas; B, anterior aspect; C, lateral aspect of axis; D, anterior aspect. × 1/1
sixth cervicals bear a groove along the anterior face running from the vertebral canal to the tip of the process.

Cervicals collected.—37, most of which are complete. A complete set of five cervicals was found still connected with one another.

Thoracies.—The first thoracic (text Fig. 46) has a very well-developed dorsal spine, which is, however, somewhat slender. The transverse process has an unusually deep concavity for the tubercle of the rib. The second thoracic has a tall, thick dorsal spine expanded at the tip and slightly bifid. A wide range of individual variation is expressed by the series of second thoracic vertebrae. This vertebra has the highest spine of the series, and it is also the thickest from side to side, although surpassed in antero-posterior breadth by some of the vertebrae caudad in the series.

The remaining thoracies gradually reduce the height of the dorsal spine, decrease the angle between it and the vertebral axis (so that the
actual length appears even less) and widen the spine antero-posteriorly. The concavity for the rib tubercle appears to be deeper at the anterior end of the series. The transverse processes, from about the second vertebra caudad, are curved conspicuously forward, in some vertebra forming a decided hook. The inter-centra facets for the heads of the ribs are about evenly divided between each pair of adjacent centra.

Thoracics collected.—88, the most of which are complete or nearly so.

Lumbars.—(Text Fig. 46.) The lumbar vertebrae are rather large in proportion to the other vertebrae. The centrum is heavy and the processes short and thick rather than long. The dorsal spine is not very high, but is of good breadth; the mammillary process or metapophysis is short and thick; the transverse process on none of the series is very long, on some it is almost vestigial. There are two sets of accessory processes; the first, in the normal position on the posterior walls of the pedicle, are long and slender; the second, above the posterior articulations and appearing as bifurcations from the dorsal spine, are shorter and thicker.

Measurements of Vertebrae of Elasmodontomys obliquus (from the Vertebrae of Numerous Individuals, Mostly Adults, as far as may be determined)

<table>
<thead>
<tr>
<th></th>
<th>Length of centrum</th>
<th>Vertical depth through dorsal spine and centrum</th>
<th>Breadth across transverse processes</th>
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<tr>
<td>Atlas</td>
<td>17148 a</td>
<td>6.7</td>
<td>21.4</td>
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<td>Atlas</td>
<td>17148 b</td>
<td>5.1</td>
<td>18.8</td>
</tr>
<tr>
<td>Atlas</td>
<td>17148 c</td>
<td>7.2</td>
<td>23.2</td>
</tr>
<tr>
<td>Axis</td>
<td>17148 d</td>
<td>20.7*</td>
<td>35.1</td>
</tr>
<tr>
<td>Axis</td>
<td>17148 e</td>
<td>20.4*</td>
<td>37.0</td>
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<tr>
<td>Axis</td>
<td>17148 f</td>
<td>22.6*</td>
<td>35.3</td>
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<tr>
<td>Third cervical</td>
<td>17148 g</td>
<td>8.8</td>
<td>22.0</td>
</tr>
<tr>
<td>Third cervical</td>
<td>17148 h</td>
<td>8.8</td>
<td>22.5</td>
</tr>
<tr>
<td>Fifth cervical</td>
<td>17148 i</td>
<td>7.0</td>
<td>18.0</td>
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<tr>
<td>Fifth cervical</td>
<td>17148 j</td>
<td>8.1</td>
<td>18.8</td>
</tr>
<tr>
<td>Sixth cervical</td>
<td>17148 k</td>
<td>7.6</td>
<td>20.0</td>
</tr>
<tr>
<td>Sixth cervical</td>
<td>17148 l</td>
<td>7.5</td>
<td>18.7</td>
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<td>First thoracic</td>
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<tr>
<td>Sixth (?) thoracic</td>
<td>17148 q</td>
<td>8.6</td>
<td>33.0</td>
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<td>Twelfth (?) thoracic</td>
<td>17148 r</td>
<td>10.3</td>
<td>27.5</td>
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<tr>
<td>First (?) lumbar.</td>
<td>17148 s</td>
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<td>31.5</td>
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<tr>
<td>Fifth (?) lumbar.</td>
<td>17148 t</td>
<td>15.3</td>
<td>35.3</td>
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<tr>
<td>First or second Caudal</td>
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<tr>
<td>&quot;</td>
<td>17148 v</td>
<td>12.4</td>
<td>14.0</td>
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</tbody>
</table>

* Includes odontoid process.
† Breadth taken across accessory processes, instead of transverse processes.
Lumbars collected.—90, a few of which are perfect and others lack only tips of the processes.

Sacral.—Described under sacrum.

Caudals.—(Text Fig. 46.) The caudals are reduced in structure and are probably few in number. The transverse processes are broad but short, the dorsal spine is a low, thickened crest; the centrum is not elongate and the anterior zygapophyses are very thick, extending forward from the centrum as a broad V.

Caudals collected.—6.

The tarsus is represented by specimens of the astragulus and calcaneum. The astragulus (text Fig. 47) has a long neck and the articulating surfaces are all normal and well developed. The calcaneum (text Fig. 47) is large and heavy and evidently of the plantigrade type. The external portion has considerable depth and the plantar surface is exceedingly broad, because of the wide expansion of the surface that articulates with the head of the astragulus.

Other bones of the tarsal series have not been found.

Astragali collected.—6.

Calcanea collected.—12.

Measurements.—Astragali: Greatest length through head, 16.4 mm.; greatest breadth across trochlear surface, 11.3; greatest depth through trochlear region, 9.3.

Calcaneum.—Greatest length, 29.1 mm.; greatest breadth, 10; depth of free portion, 18; extreme depth through articular region, 20.9.

Apparently there is very little difference between the metacarpals and metatarsals (text Fig. 47) of *Elasmodontomys*. The bones considered as metacarpals are slightly shorter and wider than those judged to be metatarsals. This animal seemingly had a generalized manus and pes of five toes each. In proportion to the size of *Elasmodontomys*, these bones are very short. They are not straight, but curve slightly, and the distal articulating surfaces bear a well-developed median keel.
Metacarpals and metatarsals collected.—15.

Measurements.—Metatarsal: Greatest length, 25 mm.; breadth of shaft midway, 1.1; breadth of distal termination, 6.5.

The phalanges (text Fig. 47) are very short and proportionally broad. The articulating surfaces are perfectly smooth, without any median keel; they are concave proximally, convex distally. The ungual phalanx is short, broad and deep, with the termination entire, not bifid.

Phalanges collected.—16, most of them perfect.

Measurements.—Dimensions of a subterminal phalanx, 5.4 mm. broad by 8.2 long; of an ungual phalanx, 4.7 broad by 5.8 deep by 10.8 long.

Relationships of Elasmodontomys

Miller and Gidley (1918, p. 446) in their Synopsis have placed Elasmodontomys in the family Dinomyidae, a small group which includes the fossil genera Amblyrhiza, Megamys and Tetrastylus, among others. This classification is a sound one, and undoubtedly the closest relatives of Elasmodontomys are to be found with the Dinomyidae as constituted by these authors.10

Dinomys and Elasmodontomys are alike in the hypsodont development of the molars and quite similar in the lamellar structure of their cheek teeth. The laminated, hypsodont molar has been independently derived in many groups, and for that reason this type of tooth may or may not be diagnostic of relationship. This highly developed type of molar is seen in Megamys, Amblyrhiza and Tetrastylus, while in slightly modified form it is found in the Jamaican genera, Clidomys, Spirodontomys and Speocerus, in Drytomomys and in Castoroides. In the last named we have an obvious case of parallelism, but all the other genera, with the possible exception of Drytomomys, are probably within the same family.

It may be noted, from a comparison of the measurements of Dinomys and Elasmodontomys given in the various tables, that the two are quite dissimilar in most characters, notably in the much greater breadth and massiveness of the former.

Measurements of Myocastor and Erethizon have been included in the tables given throughout the treatment of the Elasmodontomys skeleton. These two genera were selected not to imply relationship, but to serve as

10 The Synopsis appeared after my previous report (Memoirs, American Museum of Natural History) had gone to press. In that report I followed the general classification as given by Palmer, North American Fauna, No. 23, p. 844, 1904, placing Elasmodontomys in the Chinchillidae, but reserving for it a separate subfamily. The older grouping of genera under the Chinchillidae is well shown by Miller and Gidley to be unnatural. Furthermore, the American Museum has acquired material of Dinomys, so that an opportunity is afforded for a direct comparison between it and Elasmodontomys.
types for comparison—*Myocastor* as a normal-bodied, semi-aquatic rodent, *Erzthizon* as a heavy-bodied terrestrial and semi-arboreal rodent. The agreement in most cases is with *Erzthizon* rather than with *Myocastor*, showing that *Elasmodontomys* must have been a heavy-bodied rodent. As to whether it was semi-arboreal, little may be said except that the short phalanges and short, non-curved claws would be poor climbing devices. The indication of a short tail can not be taken as evidence of any particular habitat. Nowhere in the skeleton do there appear to be any pronounced aquatic adaptations.

Family HEPTAXODONTIDAE


**Heptaxodon** Anthony


*Type.—Heptaxodon bidens* Anthony.

A hystricomorph rodent of medium size with highly specialized dentication; molar series reduced to two teeth in each jaw; molars with lamellar, reduplicated structure, seven enamel plates present (at least in anterior molar).

*Distribution.*—Known only from Porto Rico; fossil.

**Heptaxodon bidens** Anthony

Text Fig. 48, Plate XXXVI


*Type locality.*—Utuado, Porto Rico.

*Specimens collected.*—The type skull and two broken mandibles, one of which came from the Cueva Clara.
**Distribution.**—Known only from the Island of Porto Rico. Recorded from Utuado (cave on property of Don Gervacio Toraño), from near Morovis (Cueva Clara), and from Ciales (record of Mus. Comp. Zool.).

**General characters.**—A good-sized rodent with two molars in each jaw, the molar crowns composed of seven laminae.

![Fig. 48.—Heptaxodon bidens. Utuado, Porto Rico. A, B. two views of skull; C, D. two views of mandible. × 1/1. E, crown view of maxillary molar; F, crown view of mandibular molar. × 8/3](image)

**Skull.**—(Text Fig. 48). Upper part of skull unknown. Palate short, V-shaped, with deep postpalatal notch reaching nearly to plane of posterior borders of first molar teeth; deep median furrow in floor of maxilla leading down into incisive foramina; maxillary roots of zygoma rather weak; infraorbital foramen probably not very large.

Mandible large and heavy; horizontal ramus deep, posterior ventral border expanded internally and externally.
Dentition.—I: 1/1; Pm, 1/1; M, 1/1 = 12. (Text Fig. 48.)

Upper: Incisors unknown; premolar with crown greatly elongated antero-posteriorly and composed of seven parallel plates of enamel separated by dentine, the teeth being inclined outward slightly from each other and toward the rear of the skull; molar not yet functional, but evidently similar to premolar.

Lower: Incisor very weak; premolar similar to upper, but with six main enamel laminae; these laminae are so oblique to the tooth-row as to lie almost parallel to its main axis; molar not sufficiently up to be worn, but indicated as similar to premolar.

Measurements.—Breadth of palate at point immediately anterior to zygomatic roots, 13 mm.; length of palate from postpalatal notch to anterior alveolar border, 14 mm.; length of premolar crown, 11.5 mm.; transverse breadth of same tooth, 5.5 mm.; length of mandible from posterior border of incisive alveolus to anterior face of condyle, 38 mm.; depth of ramus + premolar, 16.1 mm., 15.3, and 17; greatest length of premolar (at alveolar plane), 12.5 mm., 11.6 and 12.2; transverse breadth of same tooth, 5 mm., 4.8, and 5.3.

Remarks.—Heptaxodon is a very highly specialized type, presenting in the character of its dentition a condition that is found in no other hystricomorph. The reduced dentition, only two molar teeth in each jaw, and the highly developed molar in which the number of laminae has been increased and the crown elongated, so that in actual space occupied the two molars are equivalent to four, are characters of very considerable importance. The available material is scanty and it is possible that some of the conclusions based upon this material go too far.

In the type skull, the anterior tooth has a well-worn crown surface and the fragment of the skull has the appearance of maturity. However, the second molar tooth lies with its crown below the alveolar border, the assumption being that the tooth was not yet functional, although we must consider as a possibility that its present position in the jaw may be displacement after the death of the animal. The inference that the molar series is comprised of only two teeth seems sound enough when one makes allowance for the size of the individual teeth and the space they occupy in the jaw. The position of the interpterygoid fossa or the postpalatal notch indicates with reasonable certainty about how much of a tooth-row we could expect to find in a perfect skull. The condition of the specimens of mandible leads to a similar line of reasoning, namely, that the second tooth of the molar series, although not up through the mandible,
is to be the last one of the row. Studying the mechanical features demanded of a rodent dentition, we find that the two molars in each jaw will give ample grinding surface and more would be superfluous. In fact, the late appearance of the second molar tooth, to judge from the specimens, may follow as a result of the mechanical perfection of the first molar tooth, with its seven complete transverse enamel plates, which alone would seem to give sufficient grinding surface for the animal. In some ways this multitubercular molar recalls features seen in the dentition of the capybara and in the elephant, where one tooth by reason of its larger size takes over the major part of the work to be done by the molar dentition.

The upper premolar contains seven distinct and separate parallel laminae of strong enamel. The evolution of the tooth from a primary pattern of external and internal reëntants would leave enamel on both the anterior and posterior faces of each transverse loop. This condition is still discernible under a strong magnifying glass, but the anterior enamel plate has greatly thickened, while the posterior has dwindled away to the merest sheet. The dentine that fills in the inter-enamel space, being softer, wears away to form a concavity, and the upstanding transverse plates of enamel act as keen shearing edges. The direction of these plates, oblique to the main axis of the tooth-row, is matched by an obliquity in the lower molars which brings the plates above and below parallel with each other. The lower premolar is constructed on the same scheme as the upper, with the usual reversal that is called for by the lower jaw. The enamel is thickened posteriorly instead of anteriorly, and there are six instead of seven plates. The anterior two plates of the lower premolar, like the posterior two of the upper, are connected by a continuous, partially encircling band of enamel, indicative of the earlier stage through which the other plates passed.

Skeleton of *Heptaxodon bidens*

The only part of the skeleton of this species collected is a tibia, found in the cave where the skull was found. This bone does not agree with tibia of the other rodents and is consequently assumed to belong to *Heptaxodon*.

The tibia is robust and rather short. In most details it resembles the tibia of *Elasmodontomys*, but it is much smaller, the shaft is straighter, the enamel crest is very poorly developed, and the articulation for the fibula is proportionally narrower. The bone has every appearance of maturity, the epiphyses being firmly fused to the shaft, and its size is such as to match well with the skull of *Heptaxodon*. 
Measurements.—Greatest length, 68.5 mm.; dimensions of proximal termination, 12.8 x 16.8; dimensions of distal termination, 7.3 x 10.2; dimensions of shaft at a mid-point, 5 x 5.5.

Relationships of *Heptaxodon*

Miller and Gidley in the Synopsis (1918, p. 445) erected a full family for *Heptaxodon*, the Heptaxodontidae, which stands as a monotypic group, unless *Morenia* from the Miocene of South America should prove to be a member. The available material of *Morenia*, isolated teeth only, is too inadequate to serve as a basis of comparison.

The Heptaxodontidae is founded upon the mechanical dominance of the first tooth of the maxillary series, the reduction in the number of cheek teeth and multilaminar enamel structure, with reduplication in the anterior tooth. In relationships this family approaches the Dinomyidae and Cuniculidae in some characters and is placed next to these groups by Miller and Gidley.

Family ECHIMYIDAE


Subfamily ECHIMYINAE


**Isolobodon** J. A. Allen


Type.—*Isolobodon portoricensis* J. A. Allen.

Most like *Plagiodontia* and somewhat like *Capromys*; characterized by molar pattern in which external and internal reentrants are simple and only slightly oblique to the long axis of crown; molars finely ridged transversely.

Distribution.—Known only from Porto Rico, Santo Domingo, St. Thomas, and St. Croix; fossil.

**Isolobodon portoricensis** Allen

Text Figs. 49–52, Plates XXVII–XXXIII


![Image of skull](image)

**FIG. 49.—*Isolobodon portoricensis*. Utuado, Porto Rico. A, B, C, three views of skull.**


*Type.*—No. 38109a, Dept. of Mammals, Amer. Mus. Nat. Hist. Represented by a skull in comparatively good condition, lacking the nasals and basioccipital region and with only two teeth (molars) present.

*Type locality.*—Cueva de la Ceiba, near Utuado, Porto Rico.

*Distribution.*—Porto Rico, Santo Domingo, St. Thomas, and St. Croix.

Recorded in Porto Rico from Utuado, Cabo Rojo (American Museum); specimens in the Museum of Comparative Zoology from Ciales, Salinas, San German and Manati.

*General characters.*—A large rodent about the size of *Capromys melanura*, closely related to *Plagiodontia adiam* F. Cuvier and also to *Capromys*.

*Skull.*—(Text Figs. 49, 50.) Typically hystricomorph in character; rostrum of moderate length, deeper than broad, nasals arched from side to side, only slightly curved downward from frontal plane, ascending portion of premaxillae and nasals terminating in about the same plane; frontals wide and almost flat, making a broad, interorbital region with scarcely any constriction, well-developed postorbital processes on frontals;
small, narrow lachrymal projecting above orbit as a rounded process; parietals at first a gently convex continuation of frontal surface, then abruptly compressed and depressed, so that the higher portion of parietal surface is a broad V in shape; interparietals indistinguishable; a low lambdoidal crest and thin median vertical crest on supraoccipital.

Superior outline of skull a gently curving line; depth of skull proportionally very shallow; zygomatic arch heavy; horizontal portion of maxillary root strong, with flattened ventral face, ascending portion wide; jugal wide, with broad ventral angle and terminating above in square-cut shoulder on ventral face of posterior zygomatic root to form part of glenoid; a low, rounded, postorbital process on zygomatic arch; infraorbital foramen large and insertion area of the muscle that passes through it (branch of masseter) well marked on maxillary; root of incisor producing a large swelling on lateral face of maxillary.

Palate of moderate length, greatly constricted between premolars, widening posteriorly; incisive foramina large, with palatal groove entering from between tooth-rows; interpterygoid notch U-shaped with small
median spine and extending almost to anterior border of m²; interpterygoid processes low; pterygoid fossae deep; basioccipital region missing in specimens and consequently unknown; bulla medium-sized, rounded, nearly as broad as long.

Mandible (text Fig. 51) large and strong; rami, diverging broadly from symphysis; horizontal ramus deep, with well-developed ventral margin and greatly prolonged angular process; symphysis long; ascending ramus narrow, rising at an angle of about 45° with molar plane; coronoid very slender and proportionally high, almost reaching plane of condyle; condyle with well-rounded and expanded surface; attachment areas for masseter, temporal and pterygoid muscles well developed.

_Dentition._—I, 1-1 1-1; Pm, 1-1 1-1; M, 3-3 3-3 = 20. (Text Figs. 50, 51, 52.)

Teeth unrooted, with persistent pulp.

Upper: Incisors simple, ungrooved, rather weak; premolar with simple crown pattern, an internal réentrant angle, which meets an external réentrant, the inner somewhat deeper than the outer, and an additional smaller external réentrant, the enamel covered by cement with numerous fine, parallel ridges transverse to the long axis of the tooth: molars similar to premolar, but with only one réentrant from either side dividing tooth into halves, the plane of these divisions inclined forward from right angles to axis of tooth-row.

Lower: Similar to upper; incisors weak; premolar with one main réentrant from external and internal sides, small anterior external réentrant and small anterior internal projecting spur; molars with one deep external and two shallower internal réentrants; cement on enamel of lower molar series finely ridged, as on upper molars.

_Skulls collected._—17 more or less complete skulls, of which 10 are in fair condition, and many fragments of broken skulls.

_Mandibles collected._—200, the greater number of which are nearly complete, and unlisted fragments.
**Measurements of Skull and Mandible of *Isolobodon portoricensis***

<table>
<thead>
<tr>
<th>Skull Catalogue number, Department of Mammals</th>
<th>Greatest length of palate, including maxillae</th>
<th>Greatest length of palate, excluding maxillae</th>
<th>Breadth of palate at posterior border</th>
<th>Length of nasals</th>
<th>Depth of median suture</th>
<th>Length of palate, #18 posterior to incisive alveoli</th>
<th>Length of diastema</th>
<th>Alveolar length of maxillary</th>
<th>Greatest length of mandible, ex. crest</th>
<th>Alveolar length of mandible, maxillary series</th>
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<tr>
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</tr>
<tr>
<td><em>Plagiodonta aedium</em></td>
<td></td>
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<tr>
<td>217,112, U. S. N. M.</td>
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</tr>
</tbody>
</table>

* Type.
1 Nasals lacking.
Remarks.—Isolobodon finds its closest relative in F. Cuvier's Plagiodontia, type locality Santo Domingo, from which it differs as follows: Plagiodontia has noticeably heavier dentition and the molar crowns above, while containing the same elements as those of Isolobodon, have them arranged differently, the reentrants of Plagiodontia being much more oblique to the tooth-row axis and the external reentrant passing by the internal instead of meeting it squarely, as in Isolobodon; the molars of Plagiodontia show none of the peculiar transverse ridging of cement on their enamel. Plagiodontia lacks the conspicuous swelling on the maxillary caused by the root of the incisor; the incisive foramina are more pinched together posteriorly than in Isolobodon; the mandible of Plagiodontia is decidedly the heavier and stronger; the lower teeth are larger, but the crown patterns are very similar, except that the lingual reentrants are deeper in Plagiodontia; the root of the incisor produces a rounded swelling on the inside of the mandible near the first molar, and the angular process is shorter and much broader than in Isolobodon. Probably Plagiodontia was a rather larger animal throughout than Isolobodon. (See Plate XXIX.)

The teeth of Isolobodon, like those of Capromys and some other hystricocomorphs, undergo very considerable growth from the time they first appear. The full set of molars is present in very young animals and the teeth are exact duplicates of the adult molars except for size. They show wear very early in life, and consequently an immature specimen may very easily pass for a full-grown adult. This is especially so in the case of the mandibula. As the animal grows older the teeth not only maintain their height above the ramus, but increase in cross-section as well. The open base of the tooth, with its persistent pulp, permits this growth to occur.

Skeleton of Isolobodon portoricensis

(See Plates XXX-XXXIII)

The scapula is similar to that of Capromys pilorides, except that the latter is about 50 per cent larger and proportionally heavier. The body is very wide, the spine is nearly median in position, the acromion process is very long and the coracoid is well developed. The acromion is free from attachment to the blade for a distance equal to about half the length of the scapula.

Measurements.—Greatest length, 44 mm.; greatest breadth, midline of spine to inferior angle, 18; greatest breadth, midline of spine to anterior superior border, 13; length of acromion and free portion of spine, 25.
Material collected.—8 nearly complete scapulae, 16 fragmentary.
Two bones, incomplete, suspected of being clavicles, proves too inadequate to be described with certitude.

The humerus has a practically straight shaft, a full, nearly spherical head, deep bicipital groove, greatly developed deltoid crest, slightly expanded condylar region, and small, supra-trochlear foramen. The humerus is proportionally stout, but it is surprisingly short for an animal with such a large skull. The deltoid ridge shows a marked posterior deflection of the border.

Humeri collected.—22, of which 5 are nearly complete.

Measurements of Humerus of Isolobodon portoricensis

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Breadth of head from bicipital groove</th>
<th>Breadth across deltoid ridge</th>
<th>Breadth across condylar region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolobodon portoricensis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38109 a</td>
<td>45.7</td>
<td>8.4</td>
<td>9.8</td>
<td>12.0</td>
</tr>
<tr>
<td>40062 a</td>
<td>46.7</td>
<td>9.7</td>
<td></td>
<td>12.3</td>
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<tr>
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<td>43.8</td>
<td>9.0</td>
<td>8.5</td>
<td>11.0</td>
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<tr>
<td>40062 c</td>
<td>50.1</td>
<td>9.2</td>
<td>9.0</td>
<td>14.4</td>
</tr>
<tr>
<td>40062 d</td>
<td></td>
<td></td>
<td>9.7</td>
<td>12.9</td>
</tr>
<tr>
<td>Plagiodontia acadiana*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>217127</td>
<td>59.3</td>
<td>10.9</td>
<td>11.4</td>
<td>15.2</td>
</tr>
<tr>
<td>Capromys pilorides</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41054</td>
<td>63.1</td>
<td>12.8</td>
<td>13.3</td>
<td>18.4</td>
</tr>
<tr>
<td>Capromys thorocatus†</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>12816</td>
<td>41.7</td>
<td>8.2</td>
<td>8.6</td>
<td>11.4</td>
</tr>
</tbody>
</table>

* Collection of U. S. Nat. Mus.
† Collection of Mus. Comp. Zool.

The Isolobodon humerus carries out the impression of the size given by the femur, although it is quite short for an animal with a skull the size of Capromys melanurus. The measurements will show the greatest difference between the humeri of Isolobodon, Plagiodontia and Capromys, namely, that of size; the details of structure are identical, with the exception of the marked deflection of the deltoid ridge in Isolobodon, not to be found in the other genera.

The ulna has a long, gently curving shaft, a heavy olecranon process and a well-developed styloid process. There is a well-defined fossa just below the coronoid process.

Ulnae collected.—43, most of which are in a fair state of preservation, three of them practically complete.
The ulna varies considerably in length with the individual in the series collected. It resembles the ulna of *Capromys pilorides* down to minute details.

The radius is proportionally rather robust, with a well-curved shaft, moderately expanded at either end for the articulating surfaces.

_Radii collected._—21, of which one is perfect and several lack only the distal epiphysis.

<table>
<thead>
<tr>
<th>Measurements of Radius of Isolobodon portoricensis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><em>Isolobodon portoricensis</em></td>
</tr>
<tr>
<td>38409 m</td>
</tr>
<tr>
<td>40963 a</td>
</tr>
<tr>
<td>40963 b</td>
</tr>
<tr>
<td><em>Capromys pilorides</em></td>
</tr>
<tr>
<td>41054</td>
</tr>
</tbody>
</table>

The radius of *Isolobodon* is practically a diminutive of the *Capromys* radius, resembling it in every way.

The ribs indicate a compressed and deepened thorax and are perfectly normal. They have well-developed heads and tubercles and the greatest amount of curve is situated proximally. The shafts are of good strength, with a cross-section widely oval rather than flattened.

_Ribs collected._—75, a great many of which are complete.

_Measurements._—A rib from about the middle of the series is 47.3 mm. long by 2.5 wide at a mid-point; a similar rib of *Capromys pilorides* measures 54.3 by 2.7.
The ribs, while not showing as many characters as the other bones of the skeleton, appear to agree well with the ribs of *Capromyys*.

The sacrum presents no peculiarities of specialization and is composed of four vertebrae, the anterior three very firmly ankylosed, the posterior one not completely fused with its neighbor. The alae are wide, the expanded transverse processes form a continuous lateral sheet, the neural spines are rather low, and the main axis of the sacrum is but slightly curved.

*Sacra collected.*—Only one; this one, however, in nearly perfect condition, No. 38409 h.

*Measurements.*—Breadth across alae, 31.3 mm.; length through centrum, 39; greatest transverse extent at third sacral, 16.7; greatest depth at third sacral, 11.

The sacrum of *Isolobodon* resembles that of *Capromyys pilorides* very closely, the greatest differences being the higher neural spines and the slightly larger size of the latter. No sacrum of *Plagiodontia* is available for comparison.

The innominate shows no characters of unusual import. This bone in *Isolobodon* is practically identical with that of *Plagiodontia* and is very closely approximated in living rodents by *Capromyys pilorides*. The ilium is widely expanded at the surface for attachment to the sacrum; this surface is bounded externally by a high, sharp crest along the ventral border of the ilium; there is a noticeable tuberosity for the rectus femoris. The ischium is broad and well developed and bears a prominent spine. The pubis apparently is quite variable in breadth, but in most of the specimens is rather more than half as wide as the ischium; it also bears a spine. Ossification at the symphysis apparently does not take place. The acetabulum is large and well cupped; the obturator foramen is roughly oval in outline.

The resemblance, except for the matter of size, between the innominate bones of *Isolobodon* and a small adult *Capromyys pilorides* is very close. The proportions are nearly the same, *Isolobodon* having somewhat the longer, more slender bone.

*Innominate bones collected.*—66, in varying states of completeness, a few in very good shape, and many fragments.
Measurements of Innominate Bone of Isolobodon portoricensis

<table>
<thead>
<tr>
<th></th>
<th>Greatest length of ilium from border of acetabulum</th>
<th>Greatest breadth of ilium</th>
<th>Least transverse breadth of ilium</th>
<th>Breadth of ischium + pubis</th>
<th>Dimensions of obturator foramen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolobodon portoricensis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38409 j</td>
<td>46.5?</td>
<td></td>
<td>7.5</td>
<td>25.5?</td>
<td>10 x 17.3</td>
</tr>
<tr>
<td>40958 a</td>
<td>48.8</td>
<td>19.0</td>
<td>7.5</td>
<td>11 x 19.5</td>
<td></td>
</tr>
<tr>
<td>40958 b</td>
<td>49.2?</td>
<td></td>
<td>8.0</td>
<td>28.0</td>
<td>11 x 18.0?</td>
</tr>
<tr>
<td>40958 c</td>
<td>49.0?</td>
<td></td>
<td>6.9</td>
<td>27.8</td>
<td>10.3 x 19.2</td>
</tr>
<tr>
<td>40958 d</td>
<td></td>
<td></td>
<td>8.0</td>
<td>24.5</td>
<td></td>
</tr>
<tr>
<td>Plagiodontia aedium*</td>
<td>200414</td>
<td></td>
<td>7.6</td>
<td>26.2?</td>
<td>11.8 x—</td>
</tr>
<tr>
<td>217127</td>
<td></td>
<td></td>
<td>8.3</td>
<td>29.3</td>
<td>11.8 x—</td>
</tr>
<tr>
<td>Capromys pilorides</td>
<td>41054</td>
<td>54.8</td>
<td>20.4</td>
<td>34.8</td>
<td>13.2 x 24.0</td>
</tr>
</tbody>
</table>

* Collection of U. S. Nat. Mus.

? Bones somewhat broken, but measurement can be taken with considerable degree of accuracy.

The femur of Isolobodon is like that of Capromys in its short, thick shaft and wide, greater trochanter. The head is almost a hemisphere, the digital fossa is deep and extensive, the greater trochanter is very well developed and rugose, the lesser trochanter is a low tubercle, the posterior and interior aspects are well marked for muscle attachment, the condyles are heavy and the trochlear surface is long and narrow.

Femora collected.—10, a few of which are practically complete, besides unlisted fragments.

Measurements of Femur of Isolobodon portoricensis

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Transverse breadth across greater trochanter and head</th>
<th>Transverse breadth of shaft midway</th>
<th>Transverse breadth across condyles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolobodon portoricensis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38409 l</td>
<td>65.3</td>
<td>20.0</td>
<td>8.8</td>
<td>15.2</td>
</tr>
<tr>
<td>40959 a</td>
<td>60.3</td>
<td>16.2</td>
<td>6.8</td>
<td>14.1</td>
</tr>
<tr>
<td>40959 b</td>
<td></td>
<td>18.8</td>
<td>8.8</td>
<td>14.5</td>
</tr>
<tr>
<td>40959 c</td>
<td></td>
<td></td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Plagiodontia aedium*</td>
<td>217113</td>
<td>74.1</td>
<td>18.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Capromys pilorides</td>
<td>41054 young adult</td>
<td>78.0</td>
<td>23.7</td>
<td>10.0</td>
</tr>
</tbody>
</table>

* Collection of U. S. Nat. Mus.
It will be noted from the measurements that the femur of *Plagiodontia* is much longer and proportionally more slender than in *Isolobodon*. In this respect the latter genus much more closely resembles *Capromys*, and in view of the close resemblance in other characters between *Isolobodon* and *Plagiodontia*, it is rather surprising to find such a difference in the femora. The range of variation shown by the series of *Isolobodon* femora is quite extensive, the points of greatest variation being the length and thickness of the shaft, doubtless age characters. The smaller bones are apt to be fully as rugose and showing muscle attachment areas as distinctly as the larger, but the adult characters seem to appear at such an early stage that size and incompletely ossified epiphyses are considered to be the only criteria of age.

The tibia is long, slender and with a noticeably bent shaft. The head is well expanded and the different grooves for tendons and areas for muscle attachment are well marked.

*Tibia collected.*—51, in a fair state of preservation, some complete, and many broken fragments.

**Measurements of Tibia of *Isolobodon portoriccensis***

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Breadth across tuberosities</th>
<th>Greatest depth from crest through to posterior face</th>
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</thead>
<tbody>
<tr>
<td><em>Isolobodon portoriccensis</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38409 k</td>
<td>68.2</td>
<td>15.4</td>
<td>6.5</td>
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<tr>
<td>40960 a</td>
<td>70.8</td>
<td>15.0</td>
<td>6.9</td>
</tr>
<tr>
<td>40960 b</td>
<td></td>
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<td>7.7</td>
</tr>
<tr>
<td>40960 c</td>
<td></td>
<td></td>
<td>8.0</td>
</tr>
<tr>
<td><em>Plagiodontia acidum</em></td>
<td></td>
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<tr>
<td>217113</td>
<td>72.3</td>
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<tr>
<td>217127</td>
<td>74.4</td>
<td>16.0</td>
<td>9.0</td>
</tr>
<tr>
<td><em>Capromys pilorides</em></td>
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<td></td>
</tr>
<tr>
<td>41054</td>
<td>78.5</td>
<td>19.0</td>
<td>8.8</td>
</tr>
</tbody>
</table>

* Collection of U. S. Nat. Mus.

The *Isolobodon* tibia is very similar to that of *Plagiodontia*, bearing out, however, somewhat the same difference expressed in the femur, the longer hind leg of *Plagiodontia*. *Capromys pilorides* has a tibia of the same type, but proportionally more robust.

The fibula is a long, very slender bone, terminating proximally in a widely expanded, fan-shaped sheet, and distally in a thickened and grooved knob. A thin, sharp crest extends along the greater part of the internal surface.
Fibulae collected.—15, of which 4 are nearly complete, lacking only a portion of either termination.

*Measurements of Fibula of *Isolobodon portoricensis*

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Breadth of proximal termination</th>
<th>Greatest breadth of distal termination</th>
</tr>
</thead>
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<td><em>Isolobodon portoricensis</em></td>
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<td></td>
<td></td>
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<tr>
<td>40961 a</td>
<td>58.0</td>
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<td>5.8</td>
</tr>
<tr>
<td>40961 b</td>
<td></td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>40961 c</td>
<td></td>
<td></td>
<td>6.0</td>
</tr>
<tr>
<td><em>Capromys pilorides</em></td>
<td>68.7</td>
<td>15.7</td>
<td>8.4</td>
</tr>
</tbody>
</table>

No fibula of *Plagiodontia* is available but a comparison of the *Isolobodon* fibula with the fibula of *Capromys pilorides* shows agreement in all the essentials, the latter animal, however, having a thicker and stronger fibula.

Relationships of *Isolobodon*

*Isolobodon* is unquestionably one of the *Capromys* group, close resemblances being obvious throughout the skeleton. The relationship seems to be more with the larger species, such as *Capromys pilorides* and *C. melanurus*, than with the smaller, such as *Geocapromys thoracatus*. In point of size *Isolobodon* is intermediate between the two groups coming the closest, in size of the skull, to *C. melanurus*. The Porto Rican animal is also related to *Plagiodontia*. The latter is somewhat larger than *Isolobodon* and appears to be more slenderly proportioned but the two genera have a number of characters in common.

*Isolobodon portoricensis* gives evidence of being the last mammal to become extinct on Porto Rico. Its bones are found on the surface in many undisturbed caves and are a common find in the shell-heaps along the coast and inland where the Indians were wont to congregate. That it was a common article of diet among them, there is no doubt, as in the shell-heaps and in caves where the bones are mingled with broken pottery and ashes the association is unquestionable. Some of the bones show signs of having been burned. Probably the fact that the Indians fed on *Isolobodon portoricensis* explains its rather wide range, since it may easily have been carried from one island to the other by them, and for this reason it may be difficult to assign to it its true original habitat. If more extended search proves it to have been common on Santo Domingo, this island may be shown to have been the original center of dis-
persal. It is unlikely that its primitive range included both Santo Domingo and Porto Rico, because no differentiation between specimens from the two places is seen.

Family ECHIMYIDAE


Heteropsomys Anthony


Type.—Heteropsomys insulans Anthony.
A fair-sized hystricomorph rodent, with rather full, rounded brain-case, postorbital process on frontal, proportionally small infraorbital foramen, rooted molars with simple crown pattern of reentrant angles and enclosed enamel lakes, incisive foramina small and opening laterally into a specialized area surrounded by a thin wall of bone, and large foramen magnum.

Distribution.—Known only from Porto Rico; fossil.

Heteropsomys insulans Anthony

Text Figs. 53, 54. Plates XXXIV—XXXVI


Type.—No. 14172, Dept. of Vert. Pal., Amer. Mus. Nat. Hist. The type is a skull in a good state of preservation, lacking one incisor and four molars, the nasals, one zygomatic arch and a bulla. A mandible is associated with the cranium and several other bones of the skeleton, as follows: 3 vertebrae, an ulna and a femur.

Type locality.—Near Utuado, Cueva de la Ceiba, Hacienda Jobo, Porto Rico.

Distribution.—Known only from the Island of Porto Rico; found at Utuado and at Morovis.

General characters.—Skull roughly resembling that of Capromys brownii in size and appearance.
Skull.—(Text Fig. 53.) Dorsal outline gently curving from tip of nasals to parietal region, then abruptly curving downward; nasals unknown; ascending portion of premaxilla not reaching to nasal termination; lachrymal indicated as large, frontal with well-developed postorbital process, interorbital constriction slight; parietals strongly convex; supra-occipitals with low, sharp, sagittal crest. Zygomatic arch strong.
and heavy; jugal with a prominent posterior process and a low superior postorbital process; zygomatic root of squamosal heavy; mastoid process not developed; infraorbital foramen of medium size. Palate short, parallel-sided, posterior emargination V-shaped, reaching almost to posterior plane of first molar; incisive foramina set in a large median excavation into which they open obliquely from the sides; pterygoid processes fairly strong; bulle of medium size, slightly compressed; paroccipital processes large; foramen magnum very large.

Mandible of fair size, with well-developed muscle-insertion areas; coronoid low and weak, about as high as condyle; angular process long and slender.

*Dentition.*—I, \(\frac{1-1}{1-1}\) : Pm, \(\frac{1-1}{1-1}\) : M, \(\frac{3-3}{3-3}\) = 20. (Text Fig. 53.)

Upper: Incisors rather weak but very long, the roots being seated at base of anterior zygomatic root, the course of the tooth discernible as a swelling on face of premaxillae and maxillae; premolar and molars similar, with a single internal median reëntrant and three enclosed lakes; crowns short, roots short and blunt.

Lower: Similar to upper, with weak incisor and four molar teeth of identical pattern; molar crowns with a shallow, median, external reëntrant and two lakes.

*Skulls collected.*—2, the type and the palatal portion of an immature skull.

*Mandibles collected.*—1, complete except for \(m_3\) and tip of angular process.

**Homopsomys** Anthony


*Type.*—*Homopsomys antillensis* Anthony.

Similar to *Heteropsomys*, but differing in the characters of longer palate, flatter interorbital region and heavier incisors.

*Distribution.*—Known only from Porto Rico; fossil.

**Homopsomys antillensis** Anthony

*Text Fig. 53, Plates XXXV–XXXVI*


### Measurements of Skull of *Heteropsomus insulans*

<table>
<thead>
<tr>
<th>Type</th>
<th>Length from tip of premaxillary crest</th>
<th>Length from anterior border to incisive alveolus</th>
<th>Interorbital breadth</th>
<th>Zygomatic breadth</th>
<th>Breadth of braincase</th>
<th>Breadth of rostrum at maxillary suture</th>
<th>Length of palate, postpalatal notch to incisive alveolus</th>
<th>Breadth of palate inside m²</th>
<th>Length of diastema</th>
<th>Alveolar length of molar series</th>
<th>Transverse breadth of bulla</th>
<th>Length of mandible from incisive alveolus to anterior border of condyle</th>
<th>Alveolar length of mandibular molar series</th>
</tr>
</thead>
<tbody>
<tr>
<td>14172 Type</td>
<td>68.8</td>
<td>53.5</td>
<td>18.4</td>
<td>40</td>
<td>26.4</td>
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<td>5.2</td>
<td>17.4</td>
<td>14.2</td>
<td>7.2</td>
<td>37.3</td>
<td>15</td>
</tr>
</tbody>
</table>

### Measurements of Skull of *Homopsomus antillensis*

<table>
<thead>
<tr>
<th></th>
<th>Zygomatic breadth</th>
<th>Breadth of braincase</th>
<th>Interorbital breadth</th>
<th>Length of palate from postpalatal notch to incisive alveolus</th>
<th>Alveolar length of maxillary molar series</th>
<th>Breadth of palate inside m²</th>
<th>Transverse breadth of bulla</th>
<th>Greatest length of mandible</th>
<th>Length of mandible from incisive alveolus to anterior border of condyle</th>
<th>Alveolar length of mandibular molar series</th>
</tr>
</thead>
<tbody>
<tr>
<td>17102</td>
<td>47.4</td>
<td>27.0</td>
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<td></td>
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<tr>
<td>10129</td>
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</table>

*Collection of Mus. Comp. Zoöl.*

Type locality.—Utuado, Porto Rico.

Distribution.—Known only from the Island of Porto Rico. Recorded from the type locality, cave on the property of Don Gervacio Torano, and from Ciales (record of Mus. Comp. Zool.).

General characters.—A good-sized rodent with short-rooted molars, closely related to *Heteropsomys insulans*.

Skull.—(Text Fig. 53.) Very much as in the genus *Heteropsomys*. Nasals unknown; interorbital region flat, postorbital processes well developed; parietals convex; jugal heavy, with posterior ventral process and a short posterior process where jugal meets squamosal; palate parallel-sided, posterior emargination V-shaped, reaching posterior plane of m²; palate at diastema but slightly concave; zygomatic root of maxilla broad and strong; bulla small; foramen magnum large.

Mandible slightly larger than that of *Heteropsomys*; root of incisor producing a large rounded swelling on external face of ascending ramus.

Dentition.—As far as known, identical with that of *Heteropsomys* except for slightly heavier incisors.

Skulls collected.—1, the type. In addition I have been loaned a skull with a mandible of this species found near Ciales by Dr. G. M. Allen, of the Museum of Comparative Zoology.

Mandibles collected.—5, more or less fragmentary; one is perfect except for the loss of three molars.

Remarks.—*Homopsomys* is very closely related to *Heteropsomys*. Indeed, it may be that the two forms should be considered congeneric, and I would make them so but for the fact that the material at hand is rather inadequate. Additional collecting may bring to light more specimens and disclose characters now unknown. To avoid confusion and an unnecessary shifting of names, the status of *Homopsomys* is left unchanged.

The differences between the two genera, such as the length of the palate, the noticeable size difference, the incisors heavier in *Homopsomys* than in *Heteropsomys*, and the more convex frontals in the latter genus, are borne out by the skull collected at Ciales and loaned to me by Dr. G. M. Allen, of the Museum of Comparative Zoology. These differences are such, however, as may well be included within the limits of a single genus. The amount of variation due to age being unknown for this restricted group, due allowance must be made for such changes, although the differences noted appear to be beyond the ordinary range of age variation. The few parts of the skeletons of these two forms are described without any attempt at distinction, as it is very doubtful if distinction is possible.
A few of the bones were definitely associated with the type skull and are so indicated in the following descriptions.

Skeletons of *Heteropsomys* and *Homopsomys*

Text Fig. 54

On account of the scarcity of material of these two genera, it is not possible at present to go into great detail. The few limb bones collected—femora, innominate, ulna and radius—unfortunately do not give any great insight into the true nature of the animals' skeletons. They do not show any highly specialized characters and agree as well with *Capromys* as with *Dasyprocta* or any other hystricomorph having generalized upper limb bones. The vertebrae, however, agree significantly with those of the Dasyproctidae. Because of a suspected relationship between

---

![Fig. 54.—*Heteropsomys insulans*. Utuado, Porto Rico. Two views of atlas and two views of lumbar vertebra. ×1/1](image-url)

---

these two genera and the Dasyproctidae, on the basis of skull characters, additional clues were sought in the skeleton, but the material is too inadequate to permit of conclusive statements. A further difficulty lies in the impossibility of establishing definite associations in a cave fauna, making the identification of unspecialized bones a problem.

The ulna is about equal in length to the femur. The olecranon process is very strong and widely expanded distally; the sigmoid cavity is exceptionally large; the styloid process is well developed; and the shaft is slightly curved. Muscle attachment areas are conspicuous.

*Ulnae collected.*—3, two of which are perfect and appear to be associated with the type skull of *Heteropsomys*.

*Measurements.*—Greatest length, 67.3 mm.; length of olecranon from sigmoid cavity, 10.3; dimensions of shaft at a mid-point, 3.6 by 5.6.

The radius is well proportioned, with well-developed articulating sur-
faces. The shaft is but slightly curved and its surface is strongly marked by tendons and muscles.

**Radii collected.**—1, in perfect condition.

**Measurements.**—Greatest length, 48 mm.; dimensions of articulating surfaces, proximal, 4.2 by 6.8; distal, 5.7 by 6.6; dimensions of shaft at a mid-point, 2.5 by 3.2.

Two innominate bones provisionally referred to this group are normal in character. The ilium is abruptly expanded along the internal margin and the articulating surface is deeply marked. The ischium and pubis are incomplete, but apparently are unspecialized in any way. The acetabulum is deep.

**Innominata collected.**—2, both fragmentary.

**Measurements.**—Transverse breadth of ilium near acetabulum, respectively, 8.5 mm., 9.7; transverse breadth of ilium at expanded portion, 14.2, 13; greatest diameter of acetabulum, 11.3, 10.1.

The femur is a strong bone, rather more slender than in *Capromys pilorides*. The head is full and symmetrical, the trochanters are very well developed, the lesser projecting as a noticeable process from the intertrochanteric ridge, the digital fossa is deep, the condyles are heavy and the third trochanter is faintly indicated on the shaft. The muscle insertion areas on the posterior face of the femur are well marked.

**Femora collected.**—5, one of which is perfect and is associated with the type skull of *Heteropsomys*. Two femora loaned by the Museum of Comparative Zoölogy are referred to this group; they were collected near Ciales.

**Measurements of Femora of Heteropsomys insulans and Homopsomys antillensis**

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<tr>
<th></th>
<th>Length, head to condyles</th>
<th>Diameter of head</th>
<th>Transverse breadth of shaft at mid-point</th>
<th>Breadth across condyles</th>
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<td></td>
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</table>

*Collection of Mus. Comp. Zoöl.*

Three vertebrae from the cave where the type skull of *Heteropsomys* was taken are provisionally associated with the type. They are an atlas, a thoracic and a lumbar vertebra.
The atlas (text Fig. 51) is of ample proportions, with broad, strong transverse processes and a well-developed tubercle. The foramina are all large and the two ventral foramina on each side open outward in a common foramen, as in Dasyprocta.

**Measurements.**—Breadth across transverse processes, 27.8 mm.; vertical depth through tubercle, 14.6.

The vertebral series is represented by scanty material.

**Thoracic vertebra.**—The thoracic is rather small, with a well-developed dorsal spine, strong transverse processes and the posterior zygapophyses high up on the expanded base of the dorsal spine.

**Measurements.**—Breadth across transverse processes, 11; length of centrum, 5.4.

**Lumbar vertebra.**—(Text Fig. 54.) The lumbar is of good size with well-developed processes. The mammillary processes are long, but somewhat narrow, the dorsal process is low, the zygapophyses are robust and the accessory processes are short. Agreement with the lumbars of Dasyprocta is readily apparent.

**Measurements.**—Length of centrum, 11.8; vertical depth through dorsal spine, 14.6.

**Relationships of Heteropsomys and Homopsomys**

In discussing the relationships of *Heteropsomys* and *Homopsomys* in a previous paper (Anthony, 1917) I pointed out the strong resemblances between these genera and the Dasyproctidae, creating the Heteropsomyinae as a subfamily of Dasyproctidae. Since then, Miller and Gidley's able paper on the Supergeneric Groups of Rodents (1918) has appeared and offers a general classification more in keeping with available material than the looser grouping of earlier workers. Accepting their bases of classification, I have reconsidered the relationships of the Heteropsomyinae and can no longer believe that these two genera are Dasyproctidae.

Miller and Gidley have used in their key for the Hystricidae the development and importance of the lacrymal bone. In *Heteropsomys* the lacrymal appears to be quite typically of the Echimyidae pattern and so much unlike the lacrymal of the Dasyproctidae as to more than offset the converging characters.

However, while I have included these two genera of Porto Rican fossils in the Echimyidae, I still think that they are rather widely distinct from many of the genera included in Miller and Gidley's Echimyidae, the subfamily where these authors have included *Heteropsomys* and *Homopsomys*. Aside from a general similarity in the structure of the molars,
the lachrymal, the bulbe, etc., there are very striking differences between these two genera and any of the spiny rats, such as the large foramen magnum, the well-developed postorbital process on the frontal, the incisive foramina opening into a specialized area and the rounded brain-case—characters not seen in Proechimys, Loncheres and their allies. A hint of the specialized incisive foramina is seen in the skull of Loncheres grandis.

The many resemblances between Heteropsomys and Homopsomys and the Dasyproctidae are probably best treated as parallelisms.

**Order Edentata**

**Family Megalonychidae**


*Acratocnus* Anthony


*Type.*—*Acratocnus odontotrigonous* Anthony.

A small ground-sloth related to *Hapalops* of the Santa Cruz and *Megalocnus* of Cuba, and characterized by trigonal canines, large preorbital fossae, sagittal crest, symphysial tongue on mandible, small size and light limb bones.

*Distribution.*—Known only from Porto Rico; fossil.

*Acratocnus odontotrigonous* Anthony

Text Figs. 55, 57, 59, 60, 62, 64–70, 72, 74, 77–84, Plates XXXVII–XLII, XLVI–LIV


*Type.*—No. 14170, Dept. Vert. Pal., Amer. Mus. Nat. Hist. The type is the anterior portion of a skull extending to the interorbital region above and to the first alveolus of the molar series below. The right canine is the only tooth present. Three fragments of the mandibular rami are associated with the skull.

*Type locality.*—Cueva de la Ceiba, Hacienda Jobo, near Utuado, Porto Rico.

*Distribution.*—Known only from the Island of Porto Rico. Recorded
from Utuado, Morovis and Ciales (Ciales is the record of the Museum of Comparative Zoology).

_Skulls collected._—14, five of which are nearly complete, the other specimens being broken, rostral portions. A number of loose teeth and smaller pieces of skull collected undoubtedly are to be associated with these.

_Mandibles collected._—15 specimens, of which none are perfect, but several have both rami preserved in part and the assemblage gives most of the characters.
General description.—A small ground-sloth related to *Megalocnus* of Cuba, but a much lighter-limbed, smaller animal.

Skull.\(^n\) (Text Figs. 55, 57, 59, 60, 62, 64.) Rostrum short and very wide, strongly convex from side to side, broader than deep, greatest

\(^n\) The acquisition of additional material has enabled me to add to the original description and to correct impressions which were based upon inadequate specimens.
breadth across canines, nasals completely fused with each other and with the maxillae; frontals broad and slightly convex, with thickened, subterete, postorbital processes; parietales much depressed below frontal plane and with a marked postorbital constriction; a high, strong, sagittal crest from frontals to the high lambdoidal crest.

Superior outline (text Fig. 59) a well curved line with highest point over parietal region; lacrimal duct with a large, external opening walled about by bone; maxillary with a well-marked articulation for malar; malar (text Fig. 61) a large element with long, high, postorbital process and lacking a posterior articulation with skull; posterior zygomatic root a strong, thick process; ventral outline with palate sloping downward from canines.

Palate parallel sided throughout region of cheek-teeth, but widening out abruptly to meet the canines in front; a deep, subelliptical constriction from each side in the palate, the preorbital fossa, between the first of the cheek-teeth and the canine; postpalatal notch reaching about to the fourth cheek-teeth; pterygoid region apparently similar to that of Brachypus; glenoid broad and open; occipital condyles large and protruding.

Mandible (text Figs. 57, 62) strong and heavy; horizontal ramus deep and nearly straight, with rounded swelling on ventral surface due to root of last tooth of molar series; a small, but well developed, symphyseal tongue present: ascending ramus broad, with a strong, high condyle greatly expanded transversely and a low, wide coronoid process; angular process broad and rounded.

\[ \text{Dentition} = \frac{1}{3-3} \text{ cheek-teeth, } \frac{4-1}{4} = 18. \]  \hfill \text{(Text Figs. 59, 62, 65.)}

Upper: Canine heavy and trigonal, strongly curved, with face worn to give sharp, triangular cutting edge; cheek-teeth all similar, with long crowns, open roots and elliptical cross-section, the enamel forming transverse anterior and posterior cutting edges with a concavity between them.

Lower: Canine strong and straight, with flat, internal face, rest of the periphery convex, the cutting edge worn flat and producing a sharp pointed tooth; molars similar to those of upper series.

Measurements. — See tables, pages 162, 167.

\[^{13}\text{At the time Acratoceras valentinum was described (1916) the fragmentary mandibular material available led me to suppose this genus lacked a symphyseal tongue on the mandible — an erroneous conclusion, as disclosed by material acquired later.}\]
ANTHONY, MAMMALS OF PORTO RICO

Acratocnus major Anthony

Text Figs. 56, 58, 61, 63, 71, 73, 75, 76, 79, 82, Plates XLIV-XLVII, XLIX-L, LII-LIV


Type.—No. 17169. Dept. Vert. Pal., Amer. Mus. Nat. Hist.; represented by a broken skull and mandible, part of a scapula, fragments of both humeri, both ulnae in perfect condition, part of a radius, a badly broken pelvic girdle, a broken femur, one tibia nearly perfect and part of the other, end of a fibula, both calcanea, one of them perfect, an astragulus, a number of phalanges from manus and pes, and a number of vertebrae.

The skull represents the posterior parts of the braincase and bascranial region nearly to the posterior nares; a fragment of the frontals and maxillary is present; and the mandible comprises both horizontal rami with all the teeth present, but badly fractured. One upper canine, loose, was collected.

Type locality.—Cave on the property of Don Gervacio Toroño, near Utuado, Porto Rico.

Distribution.—Found only at the type locality.

Specimens collected.—Only the type.

General characters.—Very similar to Acratocnus odontrigonus but larger and heavier and with different skull characters.

Skull.—(Text Figs. 56, 58, 61, 63.) Large and very massive; frontals broad, with peg-like postorbital processes; lachrymal and maxillary fused with root of malar;\(^{12}\) zygomatic root of squamosal very thick and strong and sending back a prominent ridge to the lambdoidal crest; sagittal crest high and thick; glenoid with a broad, longitudinal concavity; basioccipital elevated noticeably above plane of basisphenoid.

Mandible very heavy and strong, with a short but thick symphysal tongue; very similar in general structure to mandible of odontrigonus.

Dentition.—Similar to that of odontrigonus, but considerably heavier; upper dentition represented by canine only.

Measurements.—See table of measurements given for Acratocnus.

page 162.

\(^{12}\) Possibly due to advanced age.
Fig. 57. *Lamiaecus erinaceiformis*. Skull and mandibles found near Humaco, Porto Rico. × 1.1
Fig. 78. *Cebus major*. Skull and left mandible found near Utuado, Porto Rico. × 1.1
### Measurements of the Skull of Acrocanthus

| Catalogue number of cranium | Length from midfrontal to occipital condyle | Breadth of braincase at post-orbital constriction | Breadth of braincase above post-orbital processes | Breadth of braincase at post-orbital constriction | Length of palate, post-palatal notch to anterior notch | Breadth of palate, posterior to labial frenula | Breadth of palate, outside second cheek-tooth | Length of distance | Least breadth of palate anterior to first cheek-tooth | Depth of skull through foramen magnum and mental shelf | Length of mandible, from condyle to tip of symphysis | Length of horizontal ramus at second tooth of molar series | Breadth of malar processes | Length of symphyseal | Alveolar length of mandible, to last tooth of molar series | Alveolar length of mandible
| A. major | 14779 | 17158 | 17159 | 17160 | 17161 | 17162 | 17163 | 17715 | 17720 | 17721 | 17722 | 17164 | 37.5 | 12.4 | 29.2 |
| 17164 | 37.5 | 12.4 | 29.2 |

* Type.
† Juvenile ?
‡ This mandible probably belongs with cranium No. 17720.
§ This measurement was obtained from a fragment representing the frontal region from postorbital process to a point beyond the mid-line.
Fig. 60. *Terraromyx oblongigus*. Elizado, Porto Rico.
FIG. 61.—Acratochus major. Utuado, Porto Rico. × 1/1

FIG. 62.—Acratochus adontirigonus. Utuado, Porto Rico. × 1/1
Measurements of the Dentition of Acrotoerus odontrigonus

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<th>Catalogue number of cranium</th>
<th>Dimensions of canine in cross-section</th>
<th>Dimensions of first molar tooth</th>
<th>Dimensions of second molar tooth</th>
<th>Dimensions of third molar tooth</th>
<th>Dimensions of fourth molar tooth</th>
<th>Catalogue number of mandible</th>
<th>Dimensions of canine in cross-section</th>
<th>Dimensions of first molar tooth</th>
<th>Dimensions of second molar tooth</th>
<th>Dimensions of third molar tooth</th>
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</table>

* In each case the first measurement is taken in an antero-posterior plane, and the second measurement at right angles to the first.
Skeleton of *Acratocnus*

Both species, *odontrigonus* and *major*, are treated in the following description.

The scapula (text Fig. 66, Plate XL1) is large and strong, the blade divided into two nearly equal parts by the well-developed spine. The pre-scapular fossa is about equal in extent to the post-scapular fossa. A large coraco-scapular foramen is present. The coracoid is strong and heavy. The glenoid cavity is spacious and well cupped; the articulating surface for the clavicle is extensive. The large sub-scapular fossa, the well-developed ridges and muscle insertion areas, all indicate a very powerful fore limb. *Acratocnus odontrigonus* has the scapula considerably smaller than in *major*, but the structures appear to be identical.

*Scapula collected.*—*A. odontrigonus*. 15, of which one is perfect: *A. major*, the proximal ends of both scapulae.
### Measurements of Scapula of Acratocnus

<table>
<thead>
<tr>
<th></th>
<th>Dimensions of glenoid</th>
<th>Breadth of neck from coraco-scapular foramen</th>
<th>Greatest breadth of coracoid process</th>
<th>Greatest length, coracoid to edge of blade</th>
<th>Greatest breadth of blade at right angles to spine</th>
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The humerus (text Figs. 67, 68, Plates XLIX, L) is a strong, heavy bone, very highly developed throughout. The head is moderately full and spherical, the tuberosities are strong and the position of the bicipital groove is occupied by twin grooves. The deltoid ridge is greatly developed and is expanded to form conspicuous internal and external crests, the former ending distally in a strong tubercle. The distal termination of the bone is broadly expanded and a wide flange for the supinator extends proximally almost half way up the shaft. The entepicondylar foramen is large and there is a small supratrochlear fossa. The internal condyle is very large and prominent. The entire bone is deeply marked by attachment areas.

The humerus of major is much the larger of the two species, but preserves practically the same details of structure.

*Humeri collected.*—1. *odontotrigonus*, 25, of which several are perfect and others nearly so; 1. *major*, the proximal end of one, the distal end of another.
Fig. 67.—Acratopus odostrigos. Utuado, Porto Rico. A, anterior aspect of right humerus; B, external aspect. × 1/1
Fig. 68.—Acratocnus' odontogonius. Utuado, Porto Rico. Posterior aspect of right humerus. × 1/1
**Measurements of Humerus of Acratoenus**

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<tr>
<th></th>
<th>Greatest length</th>
<th>Diameter of head through bicipital groove</th>
<th>Breadth across tuberosities</th>
<th>Greatest breadth of deltid ridge</th>
<th>Greatest breadth of expanded distal extremity</th>
<th>Least breadth of shaft, taken posteriorly</th>
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</table>
The clavicle (text Fig. 69) is short and thick, with a curved, twisted shaft and large sternal articulation.

*Clavicles collected.*—2, one of them perfect.

*Measurements.*—Greatest length, 56 mm.; dimensions of shaft midway, 4 x 7.7.

The ulna (text Figs. 70, 71, Plate L) is a strong, heavy bone, regularly curved from tip to tip, with the convexity directed posteriorly. The olecranon is short and thick, the sigmoid cavity large but shallow, and the distal articulation nearly flat, with scarcely any concavity. The posterior border is broad throughout its extreme length and slightly convex from side to side. There is a deep, longitudinal fossa along the proximal three-quarters of the internal aspect, and, in some individuals, a strong longitudinal ridge along the middle portion of the external aspect. The ulna of *major* is much more massive than that of *odontrigonus* and is more rugose throughout the attachment areas. The shaft is decidedly concave along both the external and internal faces.

*Ulna collected.*—*A. odontrigonus*, 23 and a number of smaller fragments; seven ulnae are perfect and others are nearly so; *A. major*, two ulnae in a perfect state of preservation.

*Measurements of Ulna of Acratocinus*

<table>
<thead>
<tr>
<th>A. <em>odontrigonus</em></th>
<th>Greatest length</th>
<th>Length of olecranon from sigmoid cavity</th>
<th>Dimensions of shaft at a mid point</th>
<th>Diameter of sigmoid cavity</th>
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<td></td>
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</tr>
<tr>
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<td>20.0</td>
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<td><em>A. major</em></td>
<td>171.0</td>
<td>26.0</td>
<td>13.4 x 21.6</td>
<td>25.0</td>
</tr>
</tbody>
</table>

* Lacking distal epiphysis.
Fig. 70. *Acutoncus odontirogus*. Utuado, Porto Rico. Internal aspect of right ulna.

\[ \times 1/1 \]
Fig. 71. Acratocnus major. Utuado, Porto Rico. A, anterior aspect of right ulna.
B, internal aspect; C, posterior aspect. × 1 1
The radius (text Fig. 72, Plate XLVIII) is a broad, flat bone with a strongly bowed shaft. The proximal termination is nearly circular and evenly concave, the tubercle is large and the distal extremity ends in a long, suboval concavity. The shaft is broader than deep throughout the proximal third; at this point it expands rather abruptly to a considerable breadth and this breadth is maintained to the distal extremity; posteriorly this expanded portion is concave. This bone is well marked by muscle areas and tendon grooves.

The radius of *A. major* differs only in its much greater strength.

*Radii collected.*—*A. odontrignonus*, 37, of which 12 are practically perfect; *A. major*, a proximal and a distal portion.
The ribs (text Fig. 73) are very strong and heavy, with broadly expanded shaft. The shaft curves evenly throughout most of its length and there is no apparent angle. The head and tubercle are both well developed.

**Fig. 73.** _Acratoctus_. Porto Rico. Ribs. × 1 1

**Ribs collected.**—392, many of them badly broken.

**Measurements.**—1st rib: length, 65 mm.; dimensions of shaft midway, 5 x 11.

A portion of the sternum (text Fig. 74), with parts of 4 sternebrae and costal attachments, shows that this part of the skeleton was heavy and well proportioned.
A prescternum, fused with one of the first ribs, is large and heavy, with a broad anterior lip, prolonged beyond the attachment of the first rib, and with a strong tubercle on the ventral surface posteriorly.

Fig. 71. Acratocnus adontiquama. Morovis, Porto Rico. External aspect of sternum. × 1.1

Fig. 75. Acratocnus major. Utuado, Porto Rico. Lateral aspect of left innominate. × 1.1

Several fragments of the sacrum show that it is very thick and heavy, with a low dorsal ridge and not very widely expanded alæ.

Sacra collected. — 7 fragments.

Measurements.—Length of two centra, 36 mm.; breadth across alæ, 71; depth through dorsal ridge, 31.5.
The innominate bone (text Figs. 75, 76) is large and massive. Only broken fragments of this element were collected, but they are sufficient to show that *Acratocnus* has a heavy, widely expanded ilium, a short, massive ischium with expanded posterior border and long pubes which fuse firmly at the symphysis. The acetabulum is deep and the cotyloid notch well developed.

*Innominate bones collected.*—45 pieces, representing probably 4 individuals at least, one of which is *A. major*.

*Measurements.*—All of *A. major*. Least breadth of ilium near acetabulum, 35.7 mm.; approximate breadth of expanded portion of ilium, 110; length of ischium from acetabulum, 51; greatest diameter of acetabulum, 31; length of pubic symphysis, 17.4.

The femur (text Figs. 77–78, Plates L, LII), although very strong and robust, has not acquired the extremely expanded shaft characteristic of most of the members of this family. The head is very well rounded, symmetrical, and represents a hemisphere; the constriction at the neck
Fig. 77.—Acrauchenia odontrigonus. Morovis, Porto Rico. A, anterior aspect of right femur; B, internal aspect. × 1/1
Fig. 78.—Acotoenops odontivorus. Morovis, Porto Rico. Posterior aspect of right femur. × 1/4
is slight and the fossa for the ligamentum teres is large and well defined. The greater trochanter is thick, rugose and rather low, not reaching to the top of the head; and the lesser trochanter is a well-developed tubercle. There is no digital fossa, but a well-marked intertrochanteric ridge is present. The third trochanter is a long, low, thickened ridge on the external border of the shaft. The condyles are large and heavy and the trochlea is broad. The shaft narrows from either extremity toward the middle and nowhere throughout the mid-portion is nearly as wide as at either extremity. Attachment areas are very well indicated.

The variation in size shown by the series of femora is considerable. The femur of the type, as chance had it, is one of the smallest and consequently gave the early impression that the Porto Rican sloth was a much lighter-limbed animal than it now appears to be. Several of the series of femora are smaller and slender, like the type femur, but most of them are noticeably more robust. None of them approach in this respect the femur of *Megalocnus*. The femur of *A. major* is decidedly heavier than that of *Adontirigonus*, as will be seen by the table of measurements, but in the few characters to be obtained from the broken specimens does not appear to differ otherwise.

_Femora collected._—*A. adontirigonus*, 37, of which 20 are perfect or nearly so; *A. major*, a head and distal extremity.
## Measurements of Femur of Acrotocnus

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Diameter of head</th>
<th>Distance from greater to lesser trochanter</th>
<th>Breadth of shaft through third trochanter</th>
<th>Least breadth of shaft distal to third trochanter</th>
<th>Depth of shaft, antero-posteriorly, at same point</th>
<th>Breadth across condyles</th>
<th>Depth through condyles</th>
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<tbody>
<tr>
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<td></td>
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</tbody>
</table>
The tibia (text Figs. 79, 80, Plate XLVII) has an expanded, knob-like proximal termination and a broad, flattened distal end. The shaft, viewed from in front, is nearly straight, with a gentle concavity externally; from the rear this concavity is much more pronounced. The articulating surfaces at each extremity are large and nearly flat. The articulation for the fibula faces obliquely downward and slightly forward. The shaft is rather smooth and not roughened by muscle attachments, but the tendon grooves on the distal extremity are deep and well defined.
The tibia of *A. major* is much the heavier and more rugose of the two species.

_Tibiae collected._—*A. odontrigonus*, 36, a number of which are perfect; *A. major*, 1 complete and the proximal extremity of the other.

---

**Fig. 80.**—*Lecatosus odontrigonus*, Morovis, Porto Rico. A, external aspect of right tibia; B, posterior aspect. × 1/4
<table>
<thead>
<tr>
<th>Measurements of Tibia of Acrotaeniops</th>
<th>A. ohnoi</th>
<th>A. tonkei</th>
<th>A. major</th>
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<td>135.0</td>
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<td>37.0</td>
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<tr>
<td>Depth across proximal extremity</td>
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<td>31.0</td>
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<tr>
<td>Breadth of shaft at mid-point</td>
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<td>13.3</td>
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<tr>
<td>Depth of shaft at same point</td>
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<td>8.5</td>
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<tr>
<td>Depth across distal extremity</td>
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<td>20.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Breadth of shaft at distal extremity</td>
<td>18.0</td>
<td>17.5</td>
<td>17.5</td>
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</table>
The fibula (text Fig. 81, Plate XLVIII) is not fused to the tibia at either extremity and is a strong, well-developed bone. Proximally it terminates in a flat, expanded sheet and distally in a thickened club-like knob. The shaft is slightly curved, with the convexity directed outward.

The fibula of _A. major_ differs, as far as may be determined from the available material, only in its much greater size and massiveness.

_Fibula collected._ — _A. odontagonus_, 21, of which 14 are complete: _A. major_, 2 proximal and 1 distal termination.
The calcaneum (text Fig. 82, Plate LII) is very well developed. Distally it extends as a broad, expanded body, reaching its greatest breadth near the extremity. Rotation inward of the lower border of the distal portion produces a shallow concavity on the internal face. The extreme

Fig. 82. Acratocnus major. Utuado, Porto Rico. A, right calcaneum. Acratocnus odontriginus. Utuado, Porto Rico. B, C, left calcaneum. × 1/1

border of this extremity is thickened and roughened for tendon attachment. The articulating facets are all well developed and large, the posterior astragalar facet facing obliquely upward and forward, the anterior facets for the astragulus and cuboid facing respectively obliquely upward
and forward. There is a slight expansion of the calcaneum proximally.

The calcaneum of *A. major* is very much more massive than that of *odontrigonus*, but has retained the same disposition and proportion of the facets.

_Calcanea collected._—*A. odontrigonus*, 23, most of them complete; *A. major*, 2.

**Measurements of Calcaneum of Acratocnus**

<table>
<thead>
<tr>
<th></th>
<th>Greatest length</th>
<th>Greatest transverse breadth of proximal extremity</th>
<th>Greatest transverse breadth of distal extremity</th>
<th>Least breadth between posterior astragular-facet and tip of distal superior border</th>
</tr>
</thead>
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<tr>
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</tr>
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<td>58.0</td>
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<td>39.5</td>
<td>15.0</td>
</tr>
</tbody>
</table>

The astragulus (text Fig. 83, Plate I.II) is of the long-necked type. Anteriorly it terminates in a well-cupped facet for the scaphoid, and continues posteriorly with but very little constriction at the neck. Posteriorly it rises in a well-developed but somewhat low, convex articulation for the tibia. The facets for the calcaneum and fibula are very large and well developed.

The astragulus of *A. major* is much wider and heavier than that of *odontrigonus*, but it is only slightly longer, resulting in a slight change of proportions, the most noticeable being the shorter neck of *major*.

_Astraguli collected._—*A. odontrigonus*, 9, in perfect condition; *A. major*, 1, perfect.
The carpus and tarsus are only poorly represented and no attempt has been made to fit the scattered elements together since so many are lacking that the determination is difficult.

The scaphoid is rather thin in the antero-posterior plane and has a large, full articulation with the astragulus.

**Measurements.**—Greatest thickness in antero-posterior plane, 1.4 mm.; greatest depth dorso-ventrally, 6.2.

The metacarpals and metatarsals (text Fig. S3) are short and thick, with angular articulating surfaces proximally and strongly keeled termi-
nations distally. The phalanges have very well-developed articulations, with sharp, median keels and deep, pulley-like surfaces. The terminal or ungual phalanges are strong, heavy claws and well bent.

*Metacarpals and metatarsals collected.*—65.

**Phalanges collected.**—31.

*Terminal phalanges collected.*—124. (See Plate LIIV.)

**Vertebrae.**—(Text Fig. 81, Plate LIII.) The atlas is large and strong, with rather short transverse processes and a very low tubercle. This element appears to be exceedingly variable. One specimen has a well-developed tubercle and narrow transverse processes, and differs so in appearance from the other atlases that it requires an elastic conception of the species to reconcile the two types. However, the circumstances preclude the possibility of this particular atlas belonging to anything other than *Acratocnus*, and I am unable to correlate the difference in the atlas with specific differences in the other material from the same cave, so prefer to consider the difference as individual variation.

*Atlases collected.*—*A. odontrigonus*, 4; *A. major*, 1.

The axis is well developed, having a very stent odontoid, a deep, median ventral ridge, a strong dorsal spine and weak transverse processes.

*Axes collected.*—*A. odontrigonus*, 3; *A. major*, 1.

The cervicals (text Fig. 81) have short centra of ovate cross-section, low dorsal spines on the anterior vertebrae of the series, well-developed anterior and posterior zygopophyses, broad but short transverse processes and large vertebral canals.

*Cervicals collected.*—*A. odontrigonus*, 16; *A. major*, 1.

The thoracic vertebrae (text Fig. 84) have centra with cross-section varying from ovate cephalad to round or subtriangular caudal; the dorsal spines are strong and of normal height, the transverse processes are well developed cephalad in the series, shorter and higher up on the pedicle caudal. Anteriorly in the series, the head of the rib articulates with two centra, but posteriorly the articulation is entirely on the same vertebra that receives the rib tubercle.

*Thoracics collected.*—*A. odontrigonus*, 143; *A. major*, 11.

The lumbars (text Fig. 84) are large, with deep centra, strong transverse processes, deeply interlocking articulations and very low dorsal spines.

*Lumbars collected.*—*A. odontrigonus*, 20; *A. major*, 1 of the type series and 1 of an odd individual.

The caudal vertebrae (text Fig. 84) are very characteristic and the common feature of the entire series is the widely expanded and flaring transverse process. The size of the vertebrae decreases rather abruptly
from the very large members of the series, with subquadrate or subcircular centra, to the small ones, with flattened, depressed centra. The large ones have a low, flattened neural arch with well-developed zygapophyses, but toward the end of the series the neural arch is lost and the zygapophyses become vestigial and finally disappear completely. The tail of *Acratocnus* is indicated by the rather complete set of caudals as being quite short. Although in some instances the caudals of *odontrigonus* and *major* may be distinguished, it is very difficult to draw a dividing line, and the material is consequently listed in the aggregate.

_Caudals collected._—100. (See Plate LIIL.)

The vertebrae of *A. major* in most cases differ from those of *odontrigonus* only in point of size. The range of variation in the size of individuals of *odontrigonus* is large, but the largest of this species lacks considerable of attaining the size of *major*. The most noteworthy feature of the column in general is the lowness of the dorsal spines. Throughout most of the series the dorsal spines are very low, and even when they reach their greatest height in the thoracic series the spines are directed obliquely backward and the actual height above the pedicle is slight.

**Measurements of Vertebra of Acratocnus**

<table>
<thead>
<tr>
<th><em>A. major</em></th>
<th>Length of ventral wall or length of centrum</th>
<th>Breadth across transverse processes</th>
<th>Greatest depth or depth through dorsal spine to ventral border of centrum</th>
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</thead>
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<td>9.7</td>
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* *A. major,*

**Relationships of Acratocnus**

The two species of *Acratocnus* appear to be very closely related. *Acratocnus major* is merely a larger relative of *odontrigonus*, and the character of size is the best one for determining the material. The larger
sloth has proportionally a much broader muzzle and an elevated basioccipital region.

Apparently there is considerable individual variation within the species _odonirigonus_. The type is one of the smallest individuals of the series, and because of its small size the name _Acratocnus_ was taken. Later material proves that the average size is well above that of the type, and the differences between the extremes suggest that there may be a sexual differentiation in size.

_Acratocnus_ is well marked off as generically distinct from _Megalocnus_ of Cuba. Aside from the great size difference, with its changes of proportion, there are numerous differences in the skull and dentition, the more important of which are the shape of the canines, trigonal in _Acratocnus_, subquadrate or roughly sublunar in _Megalocnus_, and in _Megalocnus_ the lack of a sagittal crest, large preorbital fossae and symphysyal tongue.

The relationship of _Acratocnus_ with the more primitive of the Santa Cruz _Megalocnichidae_ is well shown by a comparison with _Eucholoeops_ and _Hapalops_. _Eucholoeops_ agrees with _Acratocnus_ in the possession of a developed sagittal crest (not as well developed, however), large preorbital fossae, subtrigonal and differentiated upper canines and well-developed symphysyal tongue. _Hapalops_ resembles _Acratocnus_ in its light-limbed skeleton and particularly in the structure of the pes.

_Acratocnus_ in some characters shows a tendency toward semi-arboREALISM, such as the long-necked astragalus, and this genus and the modern tree-sloths have a number of characters in common.

THE ORIGIN OF THE MAMMALIA OF PORTO RICO

The problem of the origin of the mammalia of Porto Rico is but a part of a larger problem which concerns the origin of the mammalia of the Antilles as a whole. Most of the facts and arguments connected with the various attempts at solution of this problem are well enough known to students of the West Indian faunas, and it seems almost trite to repeat what has been said so often before; but, in order to make this report complete, it is necessary to go over the salient features of this question. In this discussion my use of the term fauna carries especial reference to the mammalian fauna.

It should occasion no surprise if we found the Antilles today without any mammals other than a few waifs from the continental mainland differing from mainland forms in varying degrees. Should this be the case, and disregarding for the moment all other evidence, we would be
well justified in considering the islands to be of oceanic origin. If, on
the other hand, we should find the Antilles with a large and varied fauna,
comparable in most respects to that of either North, Central or South
America, we would be equally well justified in assuming that the islands
were of continental origin, and there would be scant ground for argu-
ment. However, the true condition of affairs lies between these two
hypothetical conditions, and the problem is far from a simple one.

A great deal has been written upon the geological history of the West
Indies.11 While there is a division of opinion among the geologists as
to the origin of the Antilles, I think it is safe to assert that today the
majority are inclined to favor a continental connection during some part
of the Tertiary. The major features of the Caribbean and North Atlantic
submarine topography are sufficiently well known through the cruises
of the Blake, the Albatross, and other hydrographic researches to furnish
the basis for a hypothetical restoration of Tertiary conditions (see map
on page 240).

In general, it may be said that the Antilles are surrounded by great
ocean depths, with numerous banks or submarine plateaus covered by
much shallower waters. Here and there throughout the area occur deep
canyons or chasms in the ocean bottom, which are considered by some
writers to be lying along geologic fault-planes. The presence of active
volcanoes in some of the Antilles today and the evidence of extensive
volcanic activity in the past; together with the existence of these great
rifts in the submarine topography, show that the Antillean area is one of
seismic activity, with potentiality for major displacements of this part of
the surface of the earth.

From inspection of the map on page 240, based on data from the
U. S. Hydrographic Office, it will be readily noted that an elevation of
the ocean floor of 600 feet would produce considerable change in the
dry-land area of the Antilles. It will be observed that one of the most
extensive of the shallow-water areas extends eastward and northeast-
ward from Honduras, with a similar shallow bank from Yucatan north-
ward and eastward toward Cuba. The presence of these two sections
of elevated ocean floor bears a significant relationship to a hypothetical
former mainland connection with the Greater Antilles. Two other areas
of elevated ocean floor will be found on the map, one bearing southward
from the Bahamas toward Cuba and Haiti, the other extending north-
ward from Trinidad more or less the entire length of the Lesser Antilles.
Whether or not these latter two areas point to a Tertiary fusion of the
Greater Antilles with the continents of North or South America, which

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11 See bibliography for references on origin of West Indies.
seems to me to be unlikely, has little or no bearing upon the origin of the mammalia of the Antilles, since it will be shown later that such mammals as are found in this region today can scarcely have migrated through these two assemblages of small islands. The two important potential points of contact with continental America are Honduras and Yucatan.

The stratigraphy of the Greater Antilles shows that these islands have not maintained a consistent level above the seas. Marine limestones, in many places found today at an elevation of several thousand feet above sea-level, show us that there has been a considerable fluctuation in the area above water. hill (1899, p. 165), writing on Jamaica, states:

The first or great primary oscillation was that embraced in the cycle of the Cambridge-Montpelier descending, and the early Oligocene ascending movement. This subsidence was certainly 3,000 feet, as can still be measured by the height to which the bases of the old pre-existing mountain summits are plastered with its deposits. When we remember that the present land surface of Jamaica is only the crest of a larger Jamaica still submerged, it would be no stretch of the imagination to believe that the movement was from twice to thrice the amount given. In fact, there is very direct evidence which leads us to the latter conclusion.

The purity of the Montpelier chalks and their dominant composition of Globigerinaceae would indicate that they were deposited like the deep sea ooze of to-day at depths of 1,200 and 2,300 fathoms. The fact that in the eastern end of the adjacent island of Cuba the stratigraphic and time position of these beds is occupied by Radiolarian earths which are now known to abound from 2,000 to 4,000 fathoms (12,000 to 24,000 feet) justifies us in premising that the Globigerina beds of Jamaica were laid down in very deep waters. It would not be at all unfair to assume the average between the minimum and maximum of the Globigerina and Radiolarian depths as 1,750 fathoms, or over 10,000 feet, as the mean of this subsidence at Jamaica. The assumption of a minimum depth has additional support in the fact that the Jamaican Globigerina deposits were close to the slope of the nuclear islands which persisted as tips of land during this epoch.

The succeeding Post-Montpelier upward movement brought up the bottom not only to sea level (+ 10,000 feet), but raised it at least 3,000 feet above it, which would equal an elevation of 13,000 feet. As the highest mountain peaks of Jamaica now stand 4,525 feet above the material deposited in the Montpelier subsidence, they must have reached at the culmination of this elevation attitudes of over 17,000 feet above the sea. As great as these heights may seem, they do not greatly exceed that of the summit of the Sierra de Santa Marta, which now stands beside the Caribbean shore of Colombia, and of other known high peaks like Orizaba and St. Elias adjacent to the Pacific shore lines of our own continent.

So grand a subsidence and elevation as this must surely have left some record in the present submarine topography of the whole region, and we cannot contemplate maps of such phenomena without coming to some very definite opinions which will be elucidated in Part V. Neither could the maxi-
mum of elevation have failed to expand the areas of the Antillean lands, and to unite many of the islands or even the mainland together, especially had their geographic areas been greater than they now, which hypothesis seems tenable.

The main direction of the principal mountain masses in the large islands—Porto Rico, Santo Domingo, Cuba (and Jamaica?)—is such that it places no great strain upon the imagination to conceive of them all having formerly been one continuous system. The ocean straits between these three islands are all narrow, and they are not of such a nature that their permanence throughout the Tertiary is indisputable. Vaughn (1919) discusses the submarine topography as follows:

Depths of about 1,000 fathoms or somewhat more are found between Cuba and Haiti in the Windward Passage, and between Anegada and Anguilla in the Anegada Passage, but they are usually less than 500 fathoms (p. 598).

As the maximum depth between Haiti and Porto Rico is about 318 fathoms, they rise from a common, not greatly submerged bank (p. 602).

A submarine bank extending from the east end of Porto Rico to Anegada Passage is known as Virgin Bank. The depth of water between the islands rising above this bank is less than 20 fathoms, which is a minimum for the amount of submergence they have recently (geologically speaking) undergone. These islands are detached outliers of Porto Rico.

8h. Saint Croix.—Although St. Croix is separated from the Virgin Islands by a depth as great as 2,400 fathoms and is joined to the St. Christopher chain by a ridge less than 1,000 fathoms deep, it possesses great similarity to members of the Virgin group. The west end is truncate and the submarine slope precipitous; the submarine slope to the north is also steep. There is clear evidence of faulting on the west and north sides. A ridge, largely of igneous rock, stands against the north shore from the west end of the island for some distance to the east. South of the ridge is a sloping, rolling, calcareous plain. The east end has a submarine continuation in a bank less than 50 fathoms deep. The tectonic axis is east and west, the rocks resemble those of the Virgins, and the zoogeography indicates former connection with them. For these reasons it seems probable that this island was formerly a part of the Porto Rican-Virgin Island land-mass and has been separated from it by diastrophic processes. However, Saint Croix might be accorded separate status as a province, or referred to the St. Christopher axis; but it appears to me preferable to classify it with the Virgin Islands (p. 603).

Willis (1910, p. 225) states:

In the West Indian region the close of the Oligocene period was marked by a notable disturbance, which raised a folded mountain chain from Puerto Rico to Cuba and probably continuously to Yucatan. It may also have closed the Isthmus of Tehuantepec and possibly have temporarily connected Honduras with South America. Another possible line of connection is around the eastern end of the Caribbean through the Windward Islands. If, however, such a land link united North and South America it was but temporary.
Many such statements by eminent geologists and geographers could be quoted here to the same effect as the above. The geological evidence, therefore, interposes no great obstacle in the way of a land connection between Central America and the Greater Antilles.

An elevation of the land of about 1,000 fathoms would unite the Greater Antilles into one continuous land-mass. There is a correlation between the faunas as we find them today on the respective islands and between the various marine formations, which strongly indicates that these islands actually were connected with one another in mid-Tertiary time. The presence of the fossil genera *Nesophontes* on Porto Rico and Cuba, of related genera of fossil ground-sloths on Porto Rico and Cuba, of *Brokomys* on Santo Domingo, and the closely related *Boromys* on Cuba, as well as a number of significant relationships between the living bats found on these islands, denote a distribution which can scarcely be accounted for on any other hypothesis. The mammalia of Jamaica is sufficiently aberrant in many details to warrant the assumption that it was probably split off from the main Antillean continent, if such existed, before the other three islands were broken apart.

The mammal fauna of the entire Antillean area may be classified under three distinct categories. The first group includes the Chiroptera, which are more or less widely distributed throughout the Greater and Lesser Antilles. As factors bearing upon the origin of the Antilles, the distribution of bats must be interpreted with the same reservations as apply to that of birds or of other winged forms of life. The second category comprises land mammals whose affinities are so obviously with present-day mainland forms that they may be classified as waifs or strays from the mainland within comparatively recent times, possibly through the agency of man. The third group is made up of forms, largely fossil, whose relationships are not so immediate, pointing to a remote separation from mainland stock. This third group includes such mammals as *Solenodon* *Nesophontes* and the large fossil rodents *Amblyrhiza*, *Elastomodontomys*, *Elidomys*, etc. It is this third group which has the most profound bearing upon the problem we are discussing.

It is well known that native peoples may transport, either as pets or as food, various forms of smaller mammal life. The presence of *Isolodon* in kitchen-middens in the Virgin Islands, in Porto Rico and in Santo Domingo indicates that the Arawaks probably carried this animal from place to place in their canoes. The presence of the opossum, the armadillo, the aguti, the rice-rat and the raccoon in the Lesser Antilles, and the deer and rice-rat in the Greater Antilles, is of unquestionably recent introduction, since they differ but slightly from mainland species.
or may even, as in the case of deer on Cuba, have been introduced within historical time. Instances such as these are of no especial significance in their bearing upon the origin of the Antilles, unless it may be argued that as a waif fauna they represent the incipient stages through which the more distinct island forms may have passed.

There are only two ways in which it seems at all practicable to account for the presence of terrestrial mammals on the Antilles. The first, and to my mind the only, way to account for their presence is to assume that they passed over to the islands on a dry-land connection. The other hypothesis would involve the transportation of these mammals to the islands on life-rafts, which are floating masses of tangled vegetation, such as have been found at a considerable distance at sea off the mouth of the Amazon, Orinoco and other large rivers. Living animals have been noted on these life-rafts after the rafts have been many days at sea, and it is a well-established fact that life may be transported, to some extent at least, in this way. But obstacles in the way of transporting the Antillean fauna on life-rafts seem to be insurmountable. After a fairly extensive experience with conditions as they exist today in the Greater Antilles, it is difficult for me to believe that the terrestrial life which we have found on these islands can have all been brought from some part of the continental mainland by such hazardous methods of transportation.

Dr. Matthew (1915, p. 296) has given the best exposition of the life-raft theory in its relation to the West Indian fauna, and in later papers (1916, p. 11; 1919, p. 161) discusses the arguments for fortuitous distribution. Dr. Barbour (1916) has pointed out some of the obstacles which prevent him from accepting the hypothesis. To any one who has experienced the heat and vigor of the tropical sun and has seen the inhospitable nature of most of the Antillean coast-line, the odds appear overwhelmingly against the successful transportation of such highly organized forms as mammals from some point at the mouth of a great South American river to a safe landing, hundreds of miles from that point, upon an alien shore, and the consequent final establishment of the species.

On the other hand, the occupation of the islands over a mainland connection should have given a much more varied and extensive mammalian fauna than we know today. The known fauna comprises only insectivores, edentates, rodents and bats, leaving out of consideration the obviously recent arrivals. Groups of major importance upon the mainland, such as ungulates, carnivores, lagomorphs and the primates, are entirely wanting in the Antilles and their non-appearance in the An-
tillian fauna, if it is continental in origin, seems most strange. It might be suggested in partial explanation of this apparent absence, first, that exploration of the Antilles may yet disclose the presence of some of these groups, since the field for research is very extensive and has been by no means exhausted; second, that the Antilles as they exist today not only may, but probably do, represent the elevated portions of a now submerged, greater land-mass. Plains types, which include many of the ungulates, lowland forms such as primates, and the larger carnivores preying upon these two groups may never have ranged at sufficiently high elevations to have been brought into the area now above water. Had they existed on a former Antillean continent they might be preserved today in formations under the sea. This admittedly weak argument might explain the absence of certain larger mammals, but will hardly suffice for the non-appearance of the smaller representatives, which would be expected to range wherever the rodents and edentates could go.

The absence of dominant mainland types in the Antilles and the restricted variety of the fauna is summarized by Matthew (1918, p. 665).

As to the former connection of the Antilles with each other and with the mainland, my conclusions with the proviso just stated are as follows:

1. That the Greater Antilles have probably been united with each other, as far east as the Anguilla bank, in the late Tertiary or Pleistocene. This I conclude from the near affinity of representative species of the same or closely allied genera and the general similarity of the fauna, so far as known, in the different islands.

2. That they have not at any time during the Tertiary been united with North America. If they had been we should find North American ungulates, rodents, carnivores, etcetera, differentiated in accord with the length of subsequent isolation, but of clearly recognizable affinities, and it would be a balanced or representative fauna. We might object that such a fauna had perhaps existed, but been wiped out by subsequent submergence. But the presence of Solenodon and Nesophontes negatives that, for they represent a very ancient survival, and if there had been a representative fauna it is hardly credible that submergence would have spared just two insectivores and destroyed all the rest of the fauna.

3. That they probably have not been connected with South America, either via the Lesser Antilles or via Central America, during the Tertiary; for if they had the fauna should be of continental South American type, with South American ungulate groups, marsupial carnivores, and a full representation of the rodents, edentates, etcetera.

4. The mammalian fauna appears to me to be reducible to perhaps three primary rodent stocks, one or more primary ground-sloth stocks, and two insectivores. These I conceive to have arrived at various times during the Tertiary, the rodents and ground-sloths from South or Central America, the insectivores from North America, by accidents of transportation, of which the most probable for the mammals would perhaps be the so-called "natural rafts"
or masses of vegetation dislodged from the banks of great rivers during floods and drifted out to sea. The probabilities of this method I have elsewhere discussed. For birds and bats, for the smaller reptiles, amphibians, fishes and invertebrates, the problem of oversea transportation is a much simpler one. That successful colonization in this way can occur is shown by their presence on nearly all oceanic islands; for it will hardly be maintained by reasonable men that every oceanic island has been joined to the mainland and has been continuously above water since its separation. Obviously, the larger the island and the nearer to continental land, the more often such colonization will occur.

With few exceptions, the affinities of the Antillean mammals appear to be South American. Among the bats, only a few forms are of genera or species essentially North American. Most of the groups are related to forms found in Central and South America, the present-day Central American distribution of these particular forms seeming to have been derived by migration from the South. G. M. Allen (1911, p. 179) has discussed at some length the affinities and origin of the Chiroptera of the West Indies.

The insectivores, Solenodon and Nesophontes, are probably of North American origin. The only insectivore known from South America, apart from the very recent invasion of the shrews into northern South America, is the fossil Necrolestes from the Santa Cruz formation of Patagonia, with which the Antillean insectivores have nothing in common. The zalambdodont Palaeoryctes has been found in the Basal Eocene of North America and may possibly have had affinities with an ancestral Solenodon. Nothing has been found in North American formations to which Nesophontes may be said to be closely related; but, due to absence of Insectivora in South American formations, it is to the North American fields that one would most logically turn for an ancestral nesophontid.

That these two insectivores typify two separate and distinct families endemic to the Greater Antilles can not be taken as an ipso facto argument for extreme antiquity of arrival from the mainland. While it is true that the forms most like Solenodon and Nesophontes are not found later than Eocene and Oligocene in North America, it does not necessarily follow that the island insectivores invaded the Antilles at that time or prior to it. These primitive creatures may have arrived during the Miocene, or whenever it was that the hystricomorph rodents took possession, and I think it unlikely that distinctive family characters have been acquired by insular isolation; these characters the animals had when they left the mainland. The fossil records of Insectivora are so scanty and the Central American field has been so little explored for any fossil mammals that such negative evidence as the absence of related fossil in-
sectivores on the mainland after Eocene and Oligocene times should be discounted in estimating the time of arrival of the Antillean mammals.

The rodents of the Antilles are all hystricomorph (dismissing again from the discussion the recently transported Oryzomys and the cricetine Megalomyys), and here the affinities are all with South American forms. The genera displaying the best evidence of a long separation from the mainland stock are Amblyrhiza, Elasmodontomys, Heptodon, Clidomys, Spiradontomys, Speoconeus and Alterodon. Amblyrhiza and Elasmodontomys find their closest counterparts in Megamys and Tetraustylus of the Eocene of South America and in Didomys, a living South American representative of the family. The relationships of the other genera are not so clear; but, inasmuch as the hystricomorphs were a flourishing group in South America during the Tertiary, it seems most likely to assume that they came from there. Another assemblage of the rodents includes Heteropsomys, Homopsomys, Plagiodontia, Isolobodon, Aphaenops, Thylodontia, Boromys, Brotops, Capromys (including the sub-genus Geocapromys), and these are all of undoubted South American affinities, although not very immediately related to any of the Echimyidae known on the continent today.

The distribution of Geocapromys presents an interesting problem because of its discontinuity. There are three living species known—one from the Plana Keys in the Bahamas, one from Jamaica, and the third from Little Swan Island just off Honduras. A fourth species is known from Cuba as a fossil.

A presumably ancestral capromid, Procapromys geayi, has been described from the mountains of northern Venezuela by Pousargues (1899, p. 150). So far as I am aware, no additional specimens of this animal have been taken since its description, and I am loath to use its supposed nativity on the mainland and its affinity to the Antillean Capromys as evidence until we have more data. The type and only specimen of Procapromys geayi may have been carried to the mainland from the Antilles. Indeed, Pousargues himself considered this to be a possibility until he became convinced that the animal was mature and distinct from known island species. The small size of the type of Procapromys and the slightly worn molars strongly indicate juvenility, because in this group the full adult dentition comes early in life. There is nothing in Pousargues' description, apparently, which would not fit an immature Capromys pilorides, for example. In fact, a specimen of this species, No. 41052, collected by me in eastern Cuba, seems to be indistinguishable when compared with the figures given by Pousargues. The assumption that the Antillean genus Capromys has a close relative on the Venezuelan
mainland has been used as one of the arguments for a continental connection through the Lesser Antilles.

I am disposed to believe that the Antillean land-mass was not connected to South America through the Lesser Antilles, and that it is unnecessary to use such a hypothesis to account for the Antillean mammal fauna. The absence of truly Antillean mammalia throughout most of the Lesser Antilles, the volcanic nature of many of these islands, and the better agreement of the facts in general with the hypothesis of a Central American connection are all arguments against a functional land-bridge through the Lesser Antilles. In just how far a land-bridge may have functioned, the present distribution of mainland types on the Lesser Antilles is taken as evidence.

No one will dispute the continental origin of Trinidad, with its comparatively rich continental fauna. The submarine topography from the Windward Islands south to Venezuela would seem to favor equally well a mainland connection anywhere from Trinidad to Guiana.

Agassiz (1888, Vol. I, p. 99) states:

The eastern boundary of the Eastern Caribbean is formed by the dumbbell shaped plateau, from which rise the Windward Islands (Fig. 58). These extend in a gigantic arc from Sombrero and Santa Cruz to Grenada, Tobago, and Trinidad, leaving broad, shallow passages between the islands to the north of Dominica, with the three comparatively deeper straits separating Dominica, Martinique, St. Lucia, and St. Vincent. We next come to the still shallower passages over the Grenadines Bank, and the deeper passage between that bank and Tobago. This island, as well as Trinidad, and all the Leeward Islands to the north of Venezuela, lie within the hundred-fathom line. They are all only outposts of the South American continent. From the Gulf of Venezuela to the mouth of the Orinoco the hundred-fathom line is about ninety to one hundred and twenty miles from the South American coast.

A fissure 12,000 feet deep which cuts in from the Caribbean to the Gulf of Paria may indicate that the Antillean contact with the mainland was east of this cleft. However, the exact point of contact is immaterial, and once we have started northward along the Windward Islands the course of the hypothetical bridge is apparent. Tobago has a fauna akin to that of Trinidad, continental in its affinities, but not so extensive by far. The mainland invasion then loses most of its force and only a few scattered representatives go north of Tobago. Such mammals as Dasyprocta, Didelphys, Marmosar, Procyon and Megalomya appear here and there. But this distribution is so desultory and the mainland affinities are so apparent that many of these records must be suspected as the results of fortuitous transportation.

It is interesting to note the character of this fauna which has been
distributed by “flotsam and jetsam” methods. The advocates of fortuitous distribution throughout the Antilles have pointed to the scarcity of types represented as evidence of waif distribution. In the Lesser Antilles we note that, in this case at least, a waif fauna is rather inclusive, since it takes in a wide variety of types and two large groups, the marsupials and carnivores, which are not found in the Greater Antilles. The apparent selection of the types known in the Greater Antilles seems to imply something more than blind chance, which, we can observe in the Lesser Antilles, distributes without partiality, physical size alone proving to be a factor.

No mammals (exclusive of bats) properly to be considered as endemic to the Antilles are encountered until we pass out of the Windward Islands, through most of the Leeward Islands, and enter an area which is apparently to be associated with the Greater Antillean area. Here Amblycercus occurs fossil on St. Martins and on Anguilla, the northernmost of the Leewards. Therefore, it seems reasonable to assume, from the distribution of the mammals throughout the Lesser Antilles, that these islands had no continuous land connection to South America north of Tobago since the time that the present continental fauna has developed, and, furthermore, that there has been no such connection in mid-Tertiary time.

The facies of the mammalian distribution in the Greater Antilles shows that the problem here is quite distinct from that in the island chain to the south. In the assemblage of forms which are found in the region from Anguilla to Little Swan, all of the terrestrial mammals (except Oryzomys and Odocoileus) and many of the bats are so distinct in affinity from continental species, genera, and even families, in some cases, one can not escape the conclusion that we have to deal with the remnants of a subcontinental fauna derived from the mainland at some Tertiary period.

The presence of Capromys (Geocapromys) thoracatus on Little Swan Island close to Honduras has been frequently used by writers as an argument for a continental connection between Jamaica and Honduras. No species of Capromys is known to occur in Central America today, and hence thoracatus can be no modern waif from Honduras. On the other hand, Jamaica is the home of a closely related species, brownii, of the same subgenus. Other terrestrial mammals on Jamaica, fossil hystrixcomorph rodents, are quite distinct from the fossil hystricomorphs of Cuba, Haiti, Porto Rico and Anguilla. If the only mainland connection to the Antilles was by way of Jamaica, one could expect to find the larger islands having some of these peculiar hystricomorphs in common with
Jamaica, at least as closely related genera. The explanation here, as pointed out earlier in this discussion, is to assume an early separation of Jamaica from the other large islands and a subsequent divergence in the evolution of the respective faunas.

It is not unlikely that the Antillean fauna arrived over two continental contacts, established possibly simultaneously, but more probably at different times. This hypothesis would explain the edentates and insectivores on Cuba, Haiti and Porto Rico and their absence on Jamaica, and the difference between the hystricomorph rodents on Jamaica and the other large islands. If the evidence seems sufficient to postulate two land-bridges to Central America, it would be unnecessary to argue for fusion of Jamaica with the Antillean subcontinent, since the distribution of the island mammalia can be explained without such fusion. If the mammals were rafted to the Greater Antilles and no land connections existed, it seems strange that the rafts distributed the various forms, restricted in variety though they be to the three orders, in proper geographical regions to conform to a subcontinental distribution. If the exponents of the raft theory concede a former fusion of the Greater Antilles into a subcontinent, their case can claim little geological support, since the same elevation which united the islands raises the bridges to the mainland. After such an admission, the strongest evidence against a land connection from Central America to the united island mass is the restricted nature of the fauna.

The fundamental relationships between the Antillean and the continental mammal faunas may be shown best, perhaps, by a table listing the entire mammalia of the Antillean region, but omitting the unquestioned introductions (Odocoileus, Mungos, etc.). In this list Haiti is used collectively as the name for the entire island which comprises the Republic of Haiti and the Republic of Santo Domingo. The Bahamas are not all included in the geographical region covered by the list, since they are, for the most part, of recent formations. Some of them may have been associated with the Antilles in a former land-mass; but, since their fauna is so scanty and the question of continental connections stands or falls upon the evidence secured in the Antilles, it simplifies matters somewhat to omit the Bahamas.
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<th>Location</th>
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<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Megalocenus rodens</td>
<td>Cuba</td>
<td>fossil</td>
<td>Genera endemic to Cuba, monotypic—affinities with forms which predominated in the Miocene of South America and some of which reached North America in Pleistocene.</td>
</tr>
<tr>
<td>2</td>
<td>Microcenus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mesocenus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Miocenus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Acrocanthosaurusodontrigonus</td>
<td>Porto Rico</td>
<td>fossil</td>
<td>Genera endemic to Porto Rico—affinities with <em>Megalocenus</em> and Miocene of South America.</td>
</tr>
<tr>
<td>6</td>
<td>* Acriocera odontigerous</td>
<td>major</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Amblyrhiza inundata</td>
<td>Anguilla, St. Martin's</td>
<td>fossil</td>
<td>Genera endemic to West Indies, monotypic—affinities with Dinomyidae of South America—Miocene to Recent.</td>
</tr>
<tr>
<td>8</td>
<td>Elasmomys obliquus</td>
<td>Porto Rico</td>
<td>fossil</td>
<td>Genera endemic to Porto Rico, monotypic—affinities with Dinomyidae.</td>
</tr>
<tr>
<td>9</td>
<td>Clidonyx osborni</td>
<td>Jamaica</td>
<td>fossil</td>
<td>Genera endemic to Jamaica—affinities with Dinomyidae—latter two genera monotypic.</td>
</tr>
<tr>
<td>10</td>
<td>&quot; parvulus</td>
<td>Jamaica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Spiorodontomys jamaicensis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Speoxenus cundallii</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Alterodon major</td>
<td>Jamaica</td>
<td>fossil</td>
<td>Genera endemic to Jamaica, monotypic—affinities to Octodontinae? of South America—Oligocene to Recent.</td>
</tr>
<tr>
<td>14</td>
<td>Capromys pilorides</td>
<td>Cuba</td>
<td></td>
<td>Genera endemic to West Indies—affinities with Echimyinae of Tropical America—Miocene to Recent.</td>
</tr>
<tr>
<td>15</td>
<td>&quot; pilorides &quot;</td>
<td>relictus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>&quot; prehensilis</td>
<td>prehensilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>&quot; gundlachi</td>
<td>prehensilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>&quot; melanurus</td>
<td>prehensilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>&quot; nana</td>
<td>prehensilis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>&quot; (Geoeapromys) brownii</td>
<td>Jamaica</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>&quot; thoracatus</td>
<td>Little Swan Island</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>&quot; ingrahami</td>
<td>Plan A Key, Bahamas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>&quot; columbianus</td>
<td>Cuba</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Location</td>
<td>Status</td>
<td>Notes</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------</td>
<td>---------------------------------------</td>
<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>25</td>
<td>Isolobodon portoricensis</td>
<td>Porto Rico, Haiti, St. Thomas, St. Croix</td>
<td>fossil</td>
<td>Genus endemic to West Indies, monotypic—affinities with Echimyinae.</td>
</tr>
<tr>
<td>26</td>
<td>Aphaedreus montanus</td>
<td>Haiti</td>
<td>fossil</td>
<td>Genera endemic to Haiti, monotypic—affinities with Echimyinae.</td>
</tr>
<tr>
<td>27</td>
<td>Ithydontia levir</td>
<td>Haiti</td>
<td>fossil</td>
<td>Genera endemic to Haiti, monotypic—affinities with Echimyinae.</td>
</tr>
<tr>
<td>28</td>
<td>Brotomys voratus</td>
<td>Haiti</td>
<td>fossil</td>
<td>Genus endemic to Haiti, monotypic—affinities with Echimyinae.</td>
</tr>
<tr>
<td>29</td>
<td>Boromys offella</td>
<td>Cuba</td>
<td>fossil</td>
<td>Genus endemic to Greater Antilles—affinities with Echimyinae.</td>
</tr>
<tr>
<td>30</td>
<td>&quot; torrei</td>
<td>Cuba</td>
<td>fossil</td>
<td>Genera endemic to Greater Antilles—affinities with Echimyinae.</td>
</tr>
<tr>
<td>33</td>
<td>Oryzomys* antillarum</td>
<td>Jamaica</td>
<td>—exterminated</td>
<td>Species apparently endemic to Jamaica, but a recent arrival from Central America nevertheless.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>in last century</td>
<td></td>
</tr>
</tbody>
</table>

**INSECTIVORA**

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>Nesophontes edithae</td>
<td>Porto Rico</td>
<td>fossil</td>
<td>Genus endemic to Greater Antilles—affinities with North America, but very ancient.</td>
</tr>
<tr>
<td>35</td>
<td>&quot; micrus</td>
<td>Cuba</td>
<td>fossil</td>
<td>Genus endemic to Greater Antilles—affinities with North America, but very ancient.</td>
</tr>
<tr>
<td></td>
<td>&quot; longirostris</td>
<td>Cuba</td>
<td>fossil</td>
<td>Genus endemic to Greater Antilles—affinities with North America, but very ancient.</td>
</tr>
<tr>
<td>37</td>
<td>Solenodon paradoxus</td>
<td>Haiti</td>
<td>—living</td>
<td>Genus endemic to Greater Antilles—affinities with North America, but very ancient.</td>
</tr>
<tr>
<td>38</td>
<td>&quot; cubanus</td>
<td>Cuba</td>
<td>—living</td>
<td>Genus endemic to Greater Antilles—affinities with North America, but very ancient.</td>
</tr>
</tbody>
</table>

**Notes:**

13. It seems logical, upon the evidence, to assume that the Greater Antillean area reached as far east as Anguilla and St. Martins. However, the presence of the deep Anegada Passage between the Virginis and Anguilla and St. Martins may well call for comment on the soundness of such a grouping. The biological data is given precedence over this geological obstacle, and if the Anegada Passage is the result of block-faulting its existence throughout mid-Tertiary times may well be questioned.

16. Dr. W. D. Matthew (1918, p. 660, and 1919, p. 108) has given a short, provisional description of these three genera related to Megaloceras.
### CHIROPTERA

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>39.</td>
<td>Noctilio leporinus mastivus</td>
<td>St. Croix, Porto Rico, Mona, Jamaica, Cuba.</td>
<td>living</td>
<td>Subspecifically distinct from continental forms—a recent arrival from Tropical America.</td>
</tr>
<tr>
<td>40.</td>
<td>Chilonycteris macleayii</td>
<td>Cuba.</td>
<td>living</td>
<td>Species endemic to Greater Antilles—affinities with species in Tropical America.</td>
</tr>
<tr>
<td>41.</td>
<td>&quot; fuliginosa fuliginosa</td>
<td>Haiti.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>42.</td>
<td>&quot; inflata</td>
<td>Porto Rico.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>43.</td>
<td>&quot; grisca</td>
<td>Jamaica.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>44.</td>
<td>&quot; torrei</td>
<td>Cuba.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>45.</td>
<td>&quot; parnellii parnellii</td>
<td>Jamaica.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>46.</td>
<td>&quot; boothi</td>
<td>Cuba.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>47.</td>
<td>&quot; portoricensis</td>
<td>Porto Rico.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>48.</td>
<td>&quot; pusillus</td>
<td>Haiti.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>49.</td>
<td>Mormoops blainvillii</td>
<td>Jamaica, Cuba, Haiti, Mona, Porto Rico.</td>
<td>living</td>
<td>Species endemic to Greater Antilles—related specifically to forms ranging from southern Texas to northern South America.</td>
</tr>
<tr>
<td>50.</td>
<td>Macrotus waterhousii</td>
<td>Haiti.</td>
<td>living</td>
<td>Species endemic to Greater Antilles—related specifically to forms ranging from southern United States through Central America.</td>
</tr>
<tr>
<td>51.</td>
<td>&quot; jamaicensis</td>
<td>Jamaica.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>52.</td>
<td>&quot; minor</td>
<td>Cuba, Isle of Pines.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>54.</td>
<td>Glossophaga soricina antillarum</td>
<td>Jamaica.</td>
<td>living</td>
<td>Subspecifically related to widely ranging continental species of tropical distribution.</td>
</tr>
<tr>
<td>55.</td>
<td>Monophyllus* redmani</td>
<td>Jamaica.</td>
<td>living</td>
<td>Genus endemic to West Indies—affinities with genera on the mainland of Tropical America.</td>
</tr>
<tr>
<td>56.</td>
<td>&quot; cubanus cubanus</td>
<td>Cuba.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>57.</td>
<td>&quot; ferreus</td>
<td>Haiti.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>58.</td>
<td>&quot; portoricensis</td>
<td>Porto Rico.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>59.</td>
<td>&quot; frater</td>
<td>Porto Rico.</td>
<td>fossil</td>
<td></td>
</tr>
<tr>
<td>60.</td>
<td>&quot; clinedaphus</td>
<td>Unknown but undoubtedly West Indian.</td>
<td>living</td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>Species</td>
<td>Notes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>---------------------------------------------</td>
<td>--------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Carolia perspicillata</td>
<td>Jamaica — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Sturnina lilium</td>
<td>Jamaica — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Brachyphylia cavernarum†</td>
<td>Porto Rico — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>&quot; nana</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>&quot; pumila</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Artibeus jamaicensis jamaicensis‡</td>
<td>Jamaica, Porto Rico, Haiti, Virgin Islands, Anegada, Anguilla, St. Martins — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Artibeus jamaicensis parvipes</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Phyllips falcatus</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>&quot; haitiensis</td>
<td>Haiti — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>&quot; vetus</td>
<td>Cuba — fossil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Ariteus flavescens</td>
<td>Jamaica — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Stenoderma rufus</td>
<td>Porto Rico — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Phyllonycteris major</td>
<td>Porto Rico — fossil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>&quot; poeyi</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>Erophylla bombifrons</td>
<td>Porto Rico — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>&quot; santacristobalensis</td>
<td>Haiti — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>&quot; sezekorni</td>
<td>Cuba — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>&quot; syops</td>
<td>Jamaica — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>Reithronycteris aphylla</td>
<td>Jamaica — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Natalus* major</td>
<td>Haiti — living</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>&quot; primus</td>
<td>Cuba — fossil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identical with widely ranging continental species of Tropical America.

Genus endemic to West Indies—affinities with continental genera ranging throughout Tropical America.

Subspecifically identical with continental form ranging from northern South America into Central America—see map of distribution of *Artibeus*, page 241.

Subspecies endemic to Cuba.

Genus endemic to Greater Antilles, species endemic to respective islands—tropical American affinities.

Genus endemic to Jamaica, monotypic—tropical American affinities.

Genus endemic to Porto Rico, monotypic—tropical American affinities.

Genus endemic to Greater Antilles—tropical American affinities.

Genus endemic to Greater Antilles and to Bahamas—tropical American affinities.

Genus endemic to Jamaica, monotypic—tropical American affinities.

Related specifically to forms of Neotropical mainland.
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Location</th>
<th>Status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>Chilonatalus macer</td>
<td>Cuba</td>
<td>-living</td>
<td>Genus endemic to West Indies and Bahamas—two other species known from Old Providence and Watling Island—tropical American affinities.</td>
</tr>
<tr>
<td>83</td>
<td>&quot; micropus</td>
<td>Jamaica</td>
<td>-living</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>Nyctiellus lepidus</td>
<td>Cuba</td>
<td>-living</td>
<td>Genus endemic to Cuba, monotypic—tropical American affinities.</td>
</tr>
<tr>
<td>85</td>
<td>Eptesicus fuseus cubensis</td>
<td>Cuba</td>
<td>-living</td>
<td>Related subspecifically to species with range from North to South America. Genus cosmopolitan in distribution.</td>
</tr>
<tr>
<td>86</td>
<td>&quot; &quot; wetmorei</td>
<td>Porto Rico</td>
<td>-living</td>
<td>Related subspecifically to widely ranging form of North and Tropical Americas.</td>
</tr>
<tr>
<td>87</td>
<td>Nycteris borealis pfeifferi</td>
<td>Cuba, Jamaica</td>
<td>-living</td>
<td>Closely related to species ranging throughout southeastern United States.</td>
</tr>
<tr>
<td>88</td>
<td>Nycticeius cubanus</td>
<td>Cuba</td>
<td>-living</td>
<td>Closely related to species found widely distributed throughout Tropical America.</td>
</tr>
<tr>
<td>89</td>
<td>Tadarida murinus</td>
<td>Porto Rico, Cuba, Haiti, Jamaica</td>
<td>-living</td>
<td>Related to continental species, found in Tropical America—genus distributed throughout warmer regions of the world.</td>
</tr>
<tr>
<td>90</td>
<td>Tadarida macrotis</td>
<td>Jamaica, Cuba</td>
<td>-living</td>
<td>Species endemic to Cuba, only other species of genus known in the Western Hemisphere is found in Peru. Genus occurs in southeastern Africa, Madagascar, Bourbon and Mauritius.</td>
</tr>
<tr>
<td>91</td>
<td>Mormopterus minutus</td>
<td>Cuba</td>
<td>-living</td>
<td>Specifically identical with a continental form which ranges from Brazil to Central America.</td>
</tr>
<tr>
<td>92</td>
<td>Eumops glaucinus</td>
<td>Cuba</td>
<td>-living</td>
<td>Closely related to, if not identical with, glaucinus.</td>
</tr>
<tr>
<td>93</td>
<td>Eumops orthotis</td>
<td>Jamaica</td>
<td>-living</td>
<td></td>
</tr>
</tbody>
</table>
94. Molossus* fortis............................. Porto Rico..............—living...... Closely related inter se and to mainland forms ranging throughout Tropical America.
95. " fuliginosus............................. Jamaica..................—living......
96. " verrillii................................. Haiti......................—living......
97. Molossus* tropidorrhynchus............. Cuba......................—living...... Related to species of Central and South America.

* Genus found also in Lesser Antilles.
† Species found also in Lesser Antilles.
‡ Subspecies found also in Lesser Antilles.

Forms Found in Lesser Antilles

MARSUPIALIA
1. Didelphys marsupialis insularis........... Dominica, St. Vincent, —living...... Recent arrival from South America.
                      Grenada.
2. Marmosa chapmani......................... Grenada..................—living...... Recent arrival from South America.

EDENTATA
3. Dasypus novemcinctus hoplites........... Grenada..................—living...... Recent arrival from South America.

RODENTIA
4. Dasyprocta albida.......................... St. Vincent..............—living...... Recent arrival from South America.
5. Dasyprocta antillensis..................... St. Lucia..................—living...... Recent arrival from South America.
6. Dasyprocta noblei.......................... Guadeloupe.............—living...... Recent arrival from South America.
7. Echimys armatus............................. Martinique..............—living...... Recent arrival from South America.
8. Oryzomys* victus............................ St. Vincent..............—living?...... Recent arrival from South America.
9. Megalomys desmarestii..................... Martinique..............—extinct?..... Megalomys considered by Major to be indistinguishable from Oryzomys.
10. Megalomys luciae........................... St. Lucia..................—extinct?.....
CARNIVORA

11. Procyon minor ........................................ Guadeloupe —living .................................. Recent arrival from Tropical America.

CHIROPTERA

12. Peropteryx canina phaea ............................ Grenada —living .................................. Recent arrival from South America.

13. Noctilio leporinus mastivus† ...................... Grenada, St. Lucia, St. Vincent, Guadeloupe, Antigua. —living .................................. Recent arrival from South America.


15. Glossophaga longirostris rostrata .............. Grenada, the Grenadines —living ........................ Subspecifically related to continental species of South American distribution.


17. "  luciae ............................................. St. Lucia —living ..................................

18. Sturnira lilium ....................................... Dominica —living .................................. Identical with widely ranging continental species of Tropical America.


20. " minor ............................................. Barbados —living ..................................

21. Artibeus jamaicensis jamaicensis‡ ............ St. Kitts, Antigua —living .................................. Identical with subspecies ranging through Central America and northern South America.

22. Artibeus jamaicensis palmarum .................. St. Vincent —living .................................. Identical with subspecies ranging through Central America and northern South America.

23. Artibeus jamaicensis praeceps ................... Guadeloupe, Dominica —living ........................ Subspecies endemic to Guadeloupe and Dominica.
| 24. Artibeus planirostris grenadensis | Grenada | —living | Subspecies endemic to Guadeloupe and Dominica. |
| 25. Arlops annectens | Guadeloupe | —living | Genus endemic to Lesser Antilles, species endemic to respective islands—affinities with several endemic genera of the Greater Antilles and less closely with genera of tropical mainland. |
| 26. " luciae | St. Lucia | —living | |
| 27. " montserratensis | Montserrat | —living | |
| 28. " nichollsi | Dominica | —living | |
| 29. Natalus* stramineus | Dominica | —living | This same species ranges through northern South America and Central America. |
| 30. Myotis dominicensis | Dominica | —living | Related specifically to widely ranging species of North and South America. Genus cosmopolitan in distribution. |
| 31. Tadarida* antillularum | Dominica, St. Kitts, St. Bartholomew, Montserrat, St. Lucia | —living | Closely related specifically, if not sub-specifically, to widely ranging forms found from southern North America through Central America into South America. |
| 32. Molossus* major | Martinique, Dominica | —living | Closely related to fortis, fuliginosa and verrilli of Greater Antilles. |
| 33. " debilis | St. Kitts, Nevis, Antigua, Montserrat. | —living | |
| 34. " obscurus | Barbados, St. Lucia | —living | |

* Same genus found in Greater Antilles.
† Same species found in Greater Antilles.
‡ Same subspecies found in Greater Antilles.
Ninety-seven species and subspecies of mammals are known from the Greater Antillean area. These forms are comprised in four orders, some fifteen families and fifty genera. Of the ninety-seven species and subspecies, only fourteen are identical with or immediately related to species found on the continents of North and South America. Eighty-three forms are endemic to the Antilles, either specifically or generically. Thirty genera are autochthonous in the Greater Antilles, exclusive of two genera autochthonous in the West Indies (used in the large sense). Both families of the Insectivora are endemic to the Greater Antilles, and all of the edentates and hystricomorph rodents of the Greater Antilles are so distinct from mainland genera that calling attention to them as autochthonous genera scarcely suffices; doubtless some of the distinctions should warrant subfamily separations. The outstanding feature of the mammalia of the Greater Antilles is its endemic nature.

Thirty-four species and subspecies of indigenous mammals are known to occur in the Lesser Antilles, representing twenty-one genera, sixteen families and subfamilies and five orders. Of these thirty-four species and subspecies, twenty-four species and subspecies are either identical with or very closely related to species and subspecies living in Central and South America. Of the remaining ten forms, two (the species of Megalomys) are of undoubted recent arrival from the mainland (I have not seen this genus, but feel certain that it is closely related to Oryzomys, as stated by Major, 1901, p. 205) and eight are members of genera endemic to the Antilles. There is one autochthonous genus in the Lesser Antilles (with the possible exception of Megalomys), Ardops; no species of Ardops has been found, either on the mainland or in the Greater Antilles. The evolution of four distinct species of Ardops on as many islands of the Lesser Antilles points toward an early arrival of the ancestral form and also is a bit of evidence to show that some species of bats do not pass back and forth freely between islands separated by a few miles of sea-water.

It might be urged that a given form does or does not typify an endemic genus, accordingly as the worker restricts or enlarges his concept of a genus. The classification of the Antillean mammalia followed in this discussion is that of the majority of mammalogists and grants extensive limits to the genus concept. Furthermore, the same classification holds for the Lesser as for the Greater Antilles, and it is impossible to avoid the conclusion that the mammals of the Greater Antilles have been longer separated from mainland stock than have those of the Lesser Antilles, and also that there has been comparatively little migration of forms from the one group of the Antilles to the other.
No less than twenty of the thirty autochthonous genera of the Greater Antilles are monotypic, and this fact has bearing on the apparently restricted dispersal of types in recent times and hints at either a polyphyletic origin of the mammalia in earlier times, a very ancient separation of the respective islands, or a very rapid rate of differentiation. In each case, the individuals of the monotypic genus have been restricted to one island. Whenever one of the endemic genera is found indigenous on two or more islands specific differentiation is seen.

Thus far in this discussion the zoological comment has been based solely upon the nature and distribution of the mammalia in the Antilles and any hypothesis advanced has been postulated upon zoological evidence entirely mammalian. The distributions of other forms of life, while giving support, in some respects, to other hypotheses, such as a mainland connection to South America through the Lesser Antilles, also corroborate the theories of a former Antillean continent, the connection of this continent to Central America, and the distinction between the faunas of the Greater and Lesser Antillean associations. Chapman (1892 and 1898) points out the high percentage of endemic forms in the avifauna, 90 per cent of the resident land birds being endemic and one family (Todidae) and 38 genera peculiar to the West Indies. He goes on to say (1898, p. 245):

So far as their avifauna is concerned, therefore, there has apparently been no connection between the Lesser Antilles and the mainland, and we may regard these islands as zoological dependencies of both South America and the Greater Antilles, from which, through more or less fortuitous circumstances, their avifauna has been derived.

Turning now to the Greater Antilles, we may at once dispose of the Bahamas as oceanic islands of more recent formation than any of the larger islands or mainland adjacent to them, from which they have evidently received their life. Only one genus is peculiar, and with the exception of its single species, the ancestry of the twenty-five forms peculiar to the Bahamas can be traced with more or less certainty, Cuba furnishing the greater number of parent forms. The Caymans, about 175 miles south of Cuba and 200 miles west of Jamaica, present an apparently similar case, most of the fifteen forms peculiar to them being closely related to Cuban or Jamaican species.

We have left now the four larger islands of the Greater Antilles, from which 174 of the 303 peculiar West Indian birds have been recorded. They are distributed as follows:

Jamaica, 66, of which 42 are endemic; Cuba, 68, of which 45 are endemic; Haiti and San Domingo, 56, of which 34 are endemic; Porto Rico, 46, of which 25 are endemic.

And again (1892, p. 325):

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 Colius virginianus cubancensis, Campephilus bairdi, Colopites chrysocautusus, 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 (1876, p. 66) 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."

Chapman concludes (1892, p. 326):

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.

Since the above was written, there have been notable additions to the mammalia known from the West Indies, and consequently Chapman’s first argument against a mainland connection to Jamaica loses some of its force. A not inconsiderable addition to the avifauna has been made as well, and such discoveries as a resident White-winged Crossbill in Haiti has opened new lines of speculation.

Chapman writes (1917, p. 332):

Dr. Abbott’s discovery that a race of the White-winged Crossbill inhabits the pine forests of the higher mountains of Santo Domingo is one of the ornithological sensations of recent years.

If the bird were a Red Crossbill, its presence, even in a West Indian island, would not be so surprising. This latter species nests as far south as the Alleghanies of northern Georgia, and its accidental occurrence in the Bermudas proves its ability to reach an island well removed from the nearest mainland.

The White-winged Crossbill is not known to nest south of northern New York, and, even in winter, it has not been recorded from south of Virginia. Its fortuitous occurrence in the West Indies is, therefore, not now to be expected. Nor does it seem probable that, under existing climatic conditions,
a bird of the Canadian Zone would thrive in the tropics, even at an altitude of 4,000 feet, if introduced there.

If this be true, it follows that *Loria* has adapted itself to life in the Subtropical Zone through, not a sudden, but a gradual climatic change. Such a change we know to have accompanied the wane of the last Glacial Period. Perhaps, therefore, we are warranted in assuming that the climatic conditions which brought the Musk Ox to Kentucky, the Walrus to the vicinity of Charleston, South Carolina, and the Great Auk as far south as Ormond, Florida, are also responsible for the original occurrence of the White-winged Crossbill in Santo Domingo.

The pines which had preceded it, and which may also be considered as boreal invaders, forced southward by the Ice Age, offered the food supply the bird's habits require, and in its insular home it has been stranded after the causes to which its presence is due have disappeared.

It is not implied that the existence of *Loria* in the greater Antilles indicates a land connection between these islands and the southeastern United States. We have seen that the Red Crossbill is of recent occurrence in Bermuda, and it is therefore well within the bounds of probability to believe that during the time when the Glacial Period forced the White-winged Crossbill far below its present range in North America, it might have occurred fortuitously in Santo Domingo.

This assumption by Chapman, that the southern advance of the ice sheet in North America may have produced such profound climatic changes in the Antilles that boreal visitors found an acceptable home there, suggests as a corollary the extinction or driving southward of tropical forms in the Antilles which could not withstand boreal conditions. The poverty of the present-day non-volant mammalia may be, in part, explained by such an assumption and the extinction of the greater part of the fossil mammalia may have been contemporaneous with the Glacial Period. While there is nothing in this assumption to conflict with the distribution of the mammalia in the Antilles, I leave to the students of the other classes of zoology the determination as to whether or not this idea is compatible with their facts.17

The distribution of the reptiles and amphibians best conforms to the hypothesis of a mainland connection. According to Barbour (1919, p. 79),

The connection, at some time in the past, of Cuba with both Yucatan and Haiti is very strongly indicated by the fauna, not only among the reptiles and amphibians but in very many other groups.

And (1914, p. 236):

The fauna of the West Indian region as a whole is homogeneous: that is to say, certain genera, as, for instance, *Ameiva*, probably derived from north-

17 See Daly, 1915, p. 167, for an account of the far-reaching influence of the great ice-caps.
eastern South America, have penetrated through the chain with a local species upon practically every island, and reached as far as Cuba and Jamaica. Naturally, the types derived from South America are most abundant in the islands which were last in connection with South America, as in Grenada; and disappear gradually, dropping out one by one, until but comparatively few reach the Greater Antilles. Conversely, types of Central American origin predominate in Cuba and Jamaica; Central American types, derived through both of these islands, occur on Haiti and Porto Rico. Other genera which may be called purely Antillean are found throughout the entire group of islands; and the most characteristic of these are *Aisophis* and *Leimadophis*, whose distributions parallel one another in a most remarkable manner, as does also the distribution of *Eleutherodactylus*. There is no use in expanding upon the limits of extent of the other genera, as these may easily be seen by referring to the tables. The point, however, which is most worthy of emphasis is that this homogeneous fauna is characteristic not only of reptiles and amphibians, but of birds and mammals, as well as of groups of terrestrial invertebrates, *Peripatus* affording an excellent example. When this fact is taken into consideration with the regularity with which the important genera occur on practically every island that has been scientifically explored, with a species peculiar to each, it becomes evident at once that these groups of individuals on each island have been isolated for a long time, and that evolution by isolation would be impossible if individuals were being carried from one island to another by flotsam and jetsam dispersal. The inherent tendency of any isolated group of individuals to vary in some definite direction and to fix peculiar characters within the group would be impossible if a constant exchange of individuals from one island to another were taking place. If this has taken place in the past, it should be occurring still; and the fact that it does not occur now is good proof that this method of dispersal has never played a part of any importance in the past. A very few species have been carried about fortuitously,—whether by human agency or otherwise, it is impossible to know,—but this has been the exception and not the rule. The West Indian fauna is obviously one which has descended from species which formerly ranged over great areas of land which, in connection with each other at various times, as well as with the mainland of Central and South America, have gone to make up the area we may call Antillean.

Barbour (1910, p. 277) also finds that the reptiles and amphibians of Jamaica call for an early separation of Jamaica from Antillean:

Hydrographically, then, Jamaica is intimately related with both Central America and Haiti, and it seems probable that Lesser Antillean species and Central American species have come through a land connection which had nothing to do with Cuba. This would account, for instance, for the presence of *Aristelliger* in Haiti and Jamaica. The early separation of Jamaica from the mainland and from Haiti would account for the absence of types having such a distribution as *Rufio* and *Amphisbaena*, which may easily have reached Haiti from the mainland of Central America by way of Cuba. For another connection must have existed between Cuba and the upper peninsula of Haiti after the separation of Jamaica from Haiti, and may we not suppose that the
separation took place before the migration of *Bufo* or *Amphibiascura* had extended far enough to have reached Jamaica before it was separated?

Stejneger (1902, pp. 561 and 562) pictures a condition which applies, as I have shown, to the mammals, when he describes the relations and origin of the Porto Rican herpetological fauna.

In analyzing the composition of the Porto Rican herpetological fauna we find that out of a total of thirty-five species (excluding the marine turtles) no less than twenty-one are peculiar, of which fifteen are peculiar to Porto Rico proper and six to Mona.

On the other hand, Porto Rico has only 2 species in common with the Caribbean Islands, the same 2 species also ranging over the other larger Antilles. Two more species Porto Rico proper shares with the latter. The rest of the species occur in the Virgin Islands. Porto Rico thus forms with the latter a group characterized by an extraordinarily great proportion of peculiar species.

But while the fauna of Porto Rico, both in itself and in combination with the Virgin Islands, shows a high amount of specialization demonstrating a considerable degree of isolation in time, it must not be imagined that the separation is very deep seated. On the contrary, the affinities with the other Antilles, especially the larger ones to the west, are very close and can readily be traced.

Leaving, then, out of consideration the two species whose introduction we ascribe to man, *Hemidactylus mabonii* and *Leptodactylus allabardis*, the herpetological fauna of Porto Rico falls into two groups, namely, the species which have in all probability originally extended their range from northeastern South America and those whose ancestors came from the west, primarily from the present mainland of Central America, and secondarily from the other Great Antilles.

Comparatively few, probably not more than five of the genera inhabiting Porto Rico, point toward South America.

*Eigenmann, discussing the fresh-water fishes of western Cuba, writes (1902, p. 221):*

"The origin of the Cuban fauna is then not far to seek. We have, as mentioned above, a number of marine species, more or less regular visitors of the fresh water. We have species widely distributed in the brackish water and coastwise streams whose presence is predicable (*Gobiidae*), and we have local modifications of families with a wide distribution in the brackish and fresh waters of the tropics of America (*Percidae*). We have, furthermore, local adaptations of marine species to fresh water (*Brotilidae* and *Atherina*). The origin of all the above is simple of explanation. The species whose presence is of greatest interest are the strictly fresh-water species of *Lepisosteus*, evidently belonging to the North American fauna, and *Symbranchus* and *Heros* as evidently members of the South American fauna. The presence of the cich in the fresh waters of Cuba is to be expected, inasmuch as it very probably breeds in the ocean near Cuba. The presence of *Symbranchus, Heros*, and *Lepisosteus tristocchus* and *Agonostoma monticola* shows that the fresh-water
fauna of Cuba has a greater affinity for that of Mexico than for that of Florida, and that these forms probably reached Cuba by way of Yucatan.

The relict nature of so much of the Antillean fauna is demonstrated to be true for the spiders as well, by Lutz (1915, p. 141):

To summarize what seems to be the facts concerning West Indian spiders: there has been considerable movement between the individual islands and also between the mainland and the islands, especially at the two ends of the island chain, even in recent times when the islands were separate from each other and from the mainland. It is therefore unnecessary to suppose that such connections ever existed. Ancient forms have had a longer time to reach the islands than the more recent ones, they were adapted to a tropical environment, and the insular character of the area has protected them, hence a large part of the fauna consists of relicts as is shown by the relationships with South Africa, Madagascar, Ceylon, Australia and the Philippines. Recent forms are now mingling with and replacing the older forms.

Simpson (1894, p. 127) believed that the distribution of the land mollusks favors a land connection between Antillean and the mainland, probably Florida. Whether one believes in such a connection or not, the nature of the land mollusk fauna is well summed up by Simpson:

It has been claimed that there has never been land connection between the islands of this archipelago, and that the homogeneousness of its land and fresh-water molluscan fauna could be accounted for by supposing that many of the species had been carried from island to island, by storms or currents, or that they had been transported by other means. While no doubt a small proportion of the forms have thus migrated, yet the number of species common to two or more islands is so small, and the distribution of many of the genera and subordinate groups is so peculiar, that I believe we are not justified in explaining the present distribution by such an hypothesis. Cuba, with nearly 700 species of land and fresh-water mollusks, has only 53 not confined to the island; Jamaica, with over 500 species, has 41; Haiti, with 270 species, has only 30; and Puerto Rico, with 130 species, has 34 stragglers to other localities.

Now, it is very remarkable that while many species of non-operculate land snails are common to the Greater Antilles and the continent, as well as to several of the different Lesser Antillean islands, not a single operculate is known to inhabit both the greater archipelago and the mainland of tropical America. Two species, Chondropoma dentatum and Helicina subglobosa, and possibly a third, Cypripoma rugulosum, all Cuban forms, are colonized in the extreme southern end of Florida, and although nearly half the species of land snails of these four larger islands are operculates, not more than 9 or 10 of them are found outside of a single island. This might be taken as evidence that the non-operculate forms were of much more ancient origin than the others, many of them reaching back to a time of former land connection, while the operculate species were of more recent development, which I suspect may be the case; or that the former are better adapted to migration across the ocean than the latter.
The fact that the operculates form so large a proportion of the Antillean land snail fauna, that a majority of the genera are found on two or more of the islands and the mainland, while nearly every species is absolutely restricted to a single island, appears to me to be very strong testimony in favor of a former general land connection.

I believe that all the evidence of the terrestrial and fluvial molluscan fauna of this region indicates that in the early Tertiary Period, perhaps, there was a general land elevation of the Greater Antilles, and possibly of some of the adjacent area; that Wallace's theory of a land connection of the greater islands is correct; that during some part of this time a landway extended across to the continent; that the species and groups of this then connected territory migrated to some extent from one part of it to another, and that a probable connection existed over the Bahama plateau to what was at that time no doubt the island of Florida. It would appear that at this time the volcanic islands of the Lesser Antillean chain were not yet raised above the sea, or that if there was land in that region it has since been submerged, and there seems to be no good evidence in favor of any land connection with the Greater Antilles since the lifetime of the present groups and species of West Indian land and fresh-water mollusks.

The distribution of the decapods of the West Indies has considerable bearing on the origin of these islands, and the following quotations are the conclusions of Ortman (1902, p. 295):

Looking over the various connections between the different isolated areas of distribution of the different groups of crayfishes, which have been suggested by the above chorological and systematical discussions, we may itemize them in the following way: . . .

2. A connection of Cuba with Central America (Mexico).

Again, on page 309:

The West Indian islands must have been once connected with Central and South America. The fresh-water crabs of the Greater Antilles point to a connection with Mexico, as well as to a connection between themselves, after they were separated from the mainland (Epirhoboecera). The fresh-water crabs of the Lesser Antilles point to a connection with Trinidad and Venezuela.

On page 317:

According to the foregoing, the history of the development of the Central American and West Indian region, as supported by the fresh-water Decapods, is the following:

Central America, the West Indies and the northern margin of South America formed in the Mesozoic period (certainly during Jurassic and Cretaceous) a continental mass (Antillean continent), which was bounded by sea to the north and south. This continent broke up at the end of the Cretaceous, the chief factor in its destruction being the formation of the Caribbean Sea. The northern remnant of this continent, consisting of the Greater Antilles and parts of present Central America, probably remained a unit up to the Eocene.
But at the end of the Eocene and during the Oligocene and Miocene the connection between the Greater Antilles and the mainland was severed. But it was reestablished toward the end of the Tertiary (Pleistocene) and again destroyed in the recent time.

The flora of Porto Rico is like the fauna, characterized by the large number of endemic forms. Britton remarks in his introduction to the Botany of Porto Rico and the Virgin Islands (1923, p. 4):

A large number of kinds of plants exist naturally only in Porto Rico and the Virgin Islands; these are termed endemic species. They are scattered in distribution, not being restricted to wet, dry, high, or low districts or to specific types of soil, though many of them appear, from our present knowledge, to be very local in distribution. All the endemic species are more or less closely related to other species inhabiting other West Indian Islands, indicating community of origin and differentiation through isolation. The cutting of the forests over the greater part of both Porto Rico and the Virgin Islands has probably eliminated some endemic species.

The number of citations which might be included are so great that it is beyond the province of this paper to attempt inclusion of even a small part of them. The authors selected will serve to show that there is a correlation and agreement in the various branches as to the peculiar nature of the West Indian fauna and flora. The broad facts of this distribution are beyond dispute; the interpretation of these facts and the creation of hypotheses provide ground for argument. Many writers could be quoted here whose views are opposed to those cited. These writers appear in the bibliography at the close of this paper and should be consulted for the other side of the picture. In most cases I have believed that the weight of authority was in favor of the views quoted, and limitations of space permit me to touch upon the high lights only. For a very full and thorough summing up of all the factors bearing on the history of the West Indies, the reader is referred to Scharff (1911, pp. 261–294, and 1922, pp. 65–72).

I have not discussed the possible eastward extension of the hypothetical Antillea or the possible existence of the mythical Atlantis. It is admitted that some of the features of the fauna of the Antilles could be very handily accounted for by a land connection to Africa. The evidence in favor of such a connection is, I think, far outweighed by the evidence against it, and I should be quite satisfied with the one continental contact, namely, with Central America. The facts, deduced from whatever source, strongly support the following conclusions:

1. That the faunas of the Antilles contain an unusually high percentage of relict forms and endemic types.
2. That there are rather distinct lines separating the faunas of the Greater Antilles from those of the Lesser Antilles.

3. That the waif elements in the faunas can usually be readily recognized, and that they are sharply marked off from the truly Antillean section of the fauna.

4. That the nature and distribution of the faunas favor an Antillean land-mass or subcontinent which included certainly, Cuba, Haiti, Porto Rico and the Virgins, probably Jamaica, and possibly Anguilla and St. Martins.

5. That the nature and distribution of the faunas of the Great Antilles are best explained by the assumption of a hypothetical contact with Central America at either one or two points, Yucatan or Honduras, during Tertiary time.

6. That the faunas of the Greater Antilles are not so well accounted for by a hypothetical contact through the Lesser Antilles, and that the evidence is against such a connection to South America, and also against a connection to North America through the Bahamas and Florida.

The origin of the mammalia of Porto Rico may be summarized under the following heads:

1. The mammals are predominately South American in affinities, but well differentiated through long separation.

2. The percentage of relict forms and endemic types is high.

3. No one locality on the continents as known today could supply Porto Rico with all its mammals or, apparently, with forms descended from common ancestors.

4. The correlation between the mammalia of Porto Rico and that of Cuba and Haiti indicates beyond doubt a common origin (of some antiquity, however); and a similar, but more remote, relationship with the mammalia of Jamaica is implied.

5. The theory of fortuitous distribution of life-raft transportation will not adequately account for the mammals of Porto Rico, granting that only Chiroptera, Insectivora, Edentata and Rodentia are known from the island.

6. A connection or connections with Central America during Tertiary time would allow Porto Rico to receive migrants from South America and from North America as well, and such an hypothesis explains most satisfactorily the facies of the Porto Rican mammalia. It does not explain, however, the absence of continental types we may logically expect.

7. The absence of expected mainland types on Porto Rico, while not capable of very satisfactory explanation by the land-connection theory, is outweighed by the presence of the known mammalia of Porto Rico.
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1924. Pattedyr-Slaegter, Kjøbenhavn. II.
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Map showing distribution of the species of the genus Artibeus in the Antilles, Central America and northern South America, after Anderson, P. Z. S., 1908. This group of bats has apparently arrived in the Antilles over two distinct migration routes, jamaicensis and its subspecies parvipes from Central America, palmarum procceps from South America.
# THE BIRDS OF PORTO RICO AND THE VIRGIN ISLANDS

## COLYMBIFORMES TO COLUMBIFORMES

### By Alexander Wetmore

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INTRODUCTION

The present report on the birds of Porto Rico and the Virgin Islands is one of the series instituted by the New York Academy of Sciences to cover comprehensively the natural history of this region. It is based on extensive field work by the author in Porto Rico and the western Virgin Islands, with inclusion of all published material found dealing with the avifauna of this section down to the close of the year 1926. The present account includes many personal notes not used in the author's previous work on the birds of Porto Rico, which through force of circumstances was prepared mainly as an economic report.

1 Wetmore, Alex: Birds of Porto Rico. U. S. Dept. Agric. Bull. 326, March 24, 1916, pp. 1-140, 10 plates (one in color) and map. Published also, without change in text, on the same date, as Bulletin 15 of the Insular Experiment Station, Río Piedras, Porto Rico.
In its scope the present work covers Porto Rico and adjacent islands, including Mona and Desecheo, in Mona Passage, and the Virgin Islands from Vieques and Culebra east to and including the island of Anegada, and the outlying island of St. Croix to the south (see Fig. 1).

Although for most of this region the list of birds is fairly complete, there is little or nothing known of the bird life of the many islets adjacent to St. John, Tortola, Virgin Gorda and Anegada. Investigation of these individually is well worth while, since it is important to trace the ranges of well-known birds among them. At the same time there is possibility of the discovery of forms not at present known or whose presence in this region has been unsuspected. Observations on Porto Rico will continue of interest in checking the persistence of native species, in ascertaining unknown facts concerning their lives, and in detecting additional migrants from North America during the winter season.

Physiography

Brief description of the islands (Fig. 1) included in this report on which ornithological investigation has been pursued will be of value to the reader.

The island of Desecheo (Pl. LV), in Mona Passage, located twelve miles west of Point Jigüero, Porto Rico, is approximately one mile in diameter, rounded in form, with projecting points at the eastern and western ends. In three places there are small bays with sandy beaches, in one of which, on the south side, a landing may be made in small boats. The island rises in steep slopes to culminate in a rounded hill approximately six hundred feet in elevation. The shoreline, except for the bays mentioned, is rocky and abrupt, with limestone ledges much eroded by the weather. In 1912 I found an ill-defined path around three sides, leaving the eastern end difficult of access. The soil is thin but supports a growth of the short-trunked heavy-limbed West Indian birch (Elaphrium simaruba), and the palo de burro (Capparis cyanophallophora). There are great beds of flat-pad cactus (Opuntia) everywhere, and a Cereus-like form is also abundant; all are bound by innumerable thorny creepers. A few openings amid the thickets are grown with grass.

Mona Island, also in Mona Passage, thirty-eight and one half miles distant from Cape Rojo, is about six and one half miles long by four miles wide. It is described as a limestone formation with level top that rises on three sides precipitously from the sea to a height of from 125 to nearly 200 feet. On the southwest a rough slope leads down to a terrace elevated ten or twelve feet above the sea. The limestone cliffs are honey-combed with caves in which are many bats. The surface of the island
with its innumerable projecting points and ridges of rock is extremely
difficult to traverse, as the sharp edges soon cut through the heaviest
shoes. Cactus and shrubs abound, and water is obtained at seeps along
the terrace.

Porto Rico, smallest of the principal islands of the Greater Antilles, is
approximately ninety-five nautical miles long by thirty-five miles wide
with an area of 3,668 square miles. From Mayagüez to Aibonito there
extends in a general east and west line the Cordillera Central, with an
average elevation of 2000 feet or more that in several points rises in
peaks that attain more than 4000 feet. The Sierra de Cayey extends
beyond to Humacao. The great mountain, El Yunque, in the northeast
part of the island is said from recent calculations to have an altitude of
4895 feet. Easy passage across the island from north to south is afforded
by several low divides.

As the mountain range is nearer the south coast, and as the rainfall
is governed by the northeast trades, the larger streams flow toward the
north. The coastal plain is wide on the north and narrow on the south
and is separated from the central mountain mass, mainly composed of
volcanic rock, by limestone hills (Pl. LVI) in many places eroded into
projecting points that invade the lowland plain and that in some sections,
as at Quebradillas on the northwest, reach the sea. The rainfall varies
with exposure to moisture-laden winds from an annual fall of 135 inches
near the base of El Yunque to twenty to forty-five inches on the south
coast between Cabo Rojo and Guayama. Irrigation is now practiced
extensively on the south side of the island. Originally much of the
island was covered with forest, except for areas of lowland marsh and
savanna, and the lower, more open scrubs of the arid sections. The
little original forest that remains is now found mainly in the forest
reserve of El Yunque de Luquillo (Pl. LVII) and near Maricao, with
second growth on hills and poorer lands (Pl. LVIII).

Mangrove swamps and brackish lagoons mark the mouths of the larger
rivers; groves of coconuts have been planted back of sandy beaches (Pl.
LV), and at the western end of the island are several fresh-water swamps
and lakes, the most important being the Laguna de Guánica, and Carta-
gen and Anegada lagoons in the long valley between Yauco and
Boquerón. The lowlands are cultivated extensively in cane, with scat-
tered citrus groves and pastures, and the hills support fields of tobacco
or extensive coffee fincas. Dense population (averaging nearly 400 per-
sons to the square mile) has brought so many ecologic changes that life
conditions are now unfavorable for some of the indigenous birds.
The Virgin Islands, discovered by Columbus in 1494, include in all about one hundred small islands and cays.

Vieques Island (Pl. LIX), distant at its nearest point only six miles from the east coast of Porto Rico, is eighteen miles long and three and one half miles wide at the center. Mount Pirata, at the western end, rises 981 feet above the sea, while Mount Jalobre, near the eastern end, is only half as high. A range of low hills, more or less interrupted near the middle, extends for most of the length of the island. Their slopes lead directly to the sea; on the south coast there are rocky headlands rising thirty to eighty feet from the water. In 1912 much of the western half of the island was planted in sugar cane, while the eastern portion was still wild land. On the south coast were extensive areas of low forest, and pastures were grown with dense masses of thorny bushes. There are several small lagoons. The eastern end of the island is still to be explored by zoologists. The climate is dry, with prolonged droughts at times.

Culebra Island (Pl. LX), sixteen miles east of Porto Rico, is about six miles in length east and west and three miles in greatest width. It has an irregular shoreline. The surface is hilly, with the highest elevation in Mount Resaca, which rises to 650 feet. The island is given over mainly to brush-grown pastures, with dense, dry forest on certain hills. Cacti and other thorny plants are abundant.

A mile southwest of the little town of Playa Sardine, or Culebra, is the islet of Louis Peña, or Southwest Cay, which I visited. This is one and one fourth miles in length and has a wooded hill 475 feet high. The center is low, with hills at either end. Culebrita Island (Pl. LX), less than a mile from the eastern end of Culebra, is a mile in length and has an irregular form. It rises in three hills, the highest being 230 feet above the sea, with low land between, in which there is a small lagoon. The island is covered with forest scrub.

St. Croix, the largest of the American possessions in the Virgin group, is nineteen miles long by five miles in width at the widest point. Mount Eagle, the highest peak, is 1165 feet in height. Much of the land is under cultivation, so that forest growth at present is much restricted. Knox, writing in 1852, has related that, about 1650, colonists on St. Croix found the island so unhealthy that finally they set fire to the extensive forests and burned off the densely wooded covering of the entire island. To this supposed conflagration has been attributed the present-day paucity of species in the island fauna. Eggers and Bland, however,

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discredit this tale, since Père Labat, who visited St. Croix in 1700, four years after it had been abandoned by the French, reports it as heavily forested, and forests covered the island on the arrival of the first Danish settlers in 1739. The forest growth has disappeared, having been cut away during the steady increase of cultivation.

St. Thomas is twelve miles in length and averages three or four miles in width. A range of hills extends throughout its entire length, with spurs radiating toward the sea. The greatest elevation, West Mountain, is 1550 feet in height. There are rocky headlands projecting along the coast and the level land is relatively small in extent. Much of the island is covered with brush and trees.

Sail Rock, so called from its resemblance to a vessel under sail, is about one hundred yards in diameter and rises to a height of 125 feet. Many birds are reported here at some seasons. Cockroach Island, three miles northwest of St. Thomas, is of irregular shape, with a precipitous southern shoreline and small indentations on the north. Cricket Rock, a half mile distant, of small size, is bold and abrupt, with pinnacle rocks at its summit. Water Island, at the entrance to St. Thomas harbor, is a mile and a half long and nearly three hundred feet high, and is covered with trees and underbrush. Buck Island, two miles south of St. Thomas, consists of two islets of irregular form partly covered with scrub. On the western islet there is located a lighthouse. Saba Island, between eight and nine miles southwest of the town of St. Thomas, and approximately two miles from the nearest point of St. Thomas Island, is a small cay that rises at the west to a hill two hundred feet high. At the low north end are two small lagoons. Audubon's shearwater has been collected here. Congo Cay, a high rocky island on which seabirds are said to nest, is adjacent to Lovango Cay on the north, and lies north of the western end of St. John.

The island of St. John is eight miles long with an irregular shoreline. The island is hilly, rising in Bordeaux Mountain to 1277 feet, with extensive growths of scrub. Tortola has a length of ten miles and a breadth at the widest point of three and one half miles, with rugged hills that rise from the shore to culminate in Mount Sage (1780 feet). Ginger Island, an islet between Tortola and Virgin Gorda, rises 500 feet above the sea. Virgin Gorda is rough and rugged, with many huge blocks of stone exposed along its western side. Virgin Peak, the highest point, is 1370 feet high.

The island of Anegada, covered with low scrub, is quite different in aspect from those that have been described; for, while nine miles in length and from one to two miles in breadth, it is only about thirty feet in
height. There are extensive salt-water lagoons in the interior. The island should form a highly favorable point for the study of the migration of shorebirds.

Most of the biological work in the Virgin Islands to date has been carried on, through force of circumstances, in the vicinity of the settlements found on the larger islands. A few islands that have been visited by naturalists have not yet been reported upon, so that nothing has been said above regarding them. The multitude of other islands in the group will well repay the visit of the zoologist, since the life of this section of the West Indies cannot be said to be known until all the cays and islets have been investigated. It is not improbable that some of the rarer petrels may have their breeding grounds in places where they may nest unmolested by the mongoose, and it is even possible that there may exist on some individuals of supposed extinct species known at present only from their bones discovered in caverns.

**Itinerary**

Personal field work of the author in the region here under discussion was carried on through a cooperative arrangement between the Bureau of Biological Survey, U. S. Department of Agriculture, and the Insular Government of Porto Rico, and was directed principally toward the accumulation of data for an economic study of the bird-life. During the necessary field survey extensive collections of skins were made, with comprehensive field notes on distribution and habits. Investigations were carried on in all sections of Porto Rico, so distributed as to cover the island thoroughly at different seasons. In addition, a visit was made to Desecheo Island, and a journey into the islands to the eastward to include those that at the time were a part of the American possessions in these waters. Below is the detailed itinerary followed (see Fig. 1).

On December 13, 1911, I reached San Juan, Porto Rico, from New York by the steamer Curacas, of the Red "D" line, and after two days delay spent in securing necessary permits for collecting birds and for importing my outfit, began work at Río Piedras (Pl. LVIII) on December 16. With the exception of a short trip to Fajardo on December 29 and 30, in company with Mr. J. T. Crawley, Director of the Sugar Experiment Station, and Mr. L. S. Murphy, of the Federal Forest Service, work was continued here until January 4, 1912. On January 5 I went to Caguas and worked for ten days about the tobacco fields and cane-fields in the Caguas Valley. From here a visit was made on January 12 to the caves at Aguas Buenas, where a number of bats were collected. From Caguas I went by coach on January 15 to Cayey, which is situated
approximately 1250 feet above the sea, remaining there until January 25. From January 26 to February 5 I was on the high plateau at Aibonito, studying the avifauna of the coffee plantations and small patches of natural forest and finding in the cool nights and mornings a welcome change from the heat of the lowlands. Returning via Caguas to San Juan, I reached Mameyes at the foot of El Yunque (Pl. LVII) on February 9, where, after some difficulty, lodging was obtained through the courtesy of Señor Eugenio Mendez. Until the twenty-ninth I worked here near the cultivated fields, or made excursions into the extensive mangrove swamps and shallow bays of the coastal region.

On March 2, having made previous arrangement with Señor Miguel Mir in Mameyes, I proceeded on horseback to the Hacienda Catalina, at eight hundred feet elevation, on El Yunque (Pl. LVII), while a collecting chest and a few personal belongings were borne there on muleback. From here long trips were made into the extensive areas of natural forest comprising the Luquillo Forest Reserve to obtain parrots, crows and the rare Porto Rican tanager, known at that time only from this mountain. On March 8, after a long climb through a dripping tropical forest whose trees, stunted in the higher altitudes by the power of the trade winds, were covered densely with epiphytic plants and creepers, I attained the summit of El Yunque.

After I returned to Mameyes on March 11, a few days were consumed in packing collections and in a necessary journey to San Juan. On the sixteenth, chartering a small sloop in company with some Porto Rican gentlemen, I crossed to Vieques Island (Pl. LIX). Landing at the western end, I proceeded on foot to the town of Isabel II, leaving the boat to beat slowly along the coast against the adverse trade winds to Port Mulas. On Vieques Señor José Barton accompanied me on a number of trips into the surrounding country, and from Dr. J. S. M. Pressley and Mr. H. Stiles many favors were received. On April 5 I crossed on the sloop carrying the mail to Culebra Island and remained there until the twenty-first (Pl. LX). Don Pedro Marqués kindly placed a convenient house at my disposal, as there was no hotel, and to him thanks are due also for other favors. On the eleventh Louis Peña Island, called Southwest Cay on some charts, was visited in a rowboat, and on the fifteenth a trip was made to Culebrita Island (Pl. LX), from which St. Thomas and other islands in the Virgin group were plainly visible.

Returning via Vieques to Fajardo—a two-days journey, though the distance is relatively short—I sent my collecting outfit to San Juan on a schooner. After a side trip of a day to Naguabo I continued on April 24 to San Juan. On April 25 I went by railroad to Salinas, remaining
there until May 2, and then proceeding to Guayama. On May 3 I reached Yabucoa (Pls. LVIII and LIX) by coach, where I tarried until the eleventh, collecting and observing in the cane-fields. On the way back, I spent part of May 11 near Maunabo, and until the thirteenth I was at Patillas. Then, on the sixteenth, I again set forth from Guayama by railroad to Yauco (Pl. LVI) and made that my headquarters until May 28. Inland there were broken hills with tobacco, coffee and small crops, while the lowlands were devoted to cane. The Laguna de Guánica, with its extensive fresh-water swamps, offered several novelties and birds were common all through the neighboring hills. I proceeded to Mayagüez, and thence to Maricao, in the heart of the coffee district, where, on May 29, I obtained quarters in the police cuartel, as the hotel was full. On June 5 I returned to Mayagüez and spent the succeeding two days at the Federal Experiment Station, and from June 7 to 8 I was at Añasco. I came to Aguadilla (Pl. LV) on the ninth, and on the thirteenth crossed in a small boat with two men to the uninhabited island of Desecheo (Pl. LV). After some trouble with the swift currents drawing around the island, we landed on a rocky beach, where we unloaded the boat and finally drew it up out of reach of the waves. Forced by a failing water supply to leave on the sixteenth, we reentered Aguadilla Bay that afternoon. After packing and shipping the collections on hand, I went inland to Lares on the eighteenth, taking my outfit in a large auto truck which made regular trips to that town. Until July 1 I was occupied here about the apiaries and in the coffee plantations, and then returned to Aguadilla.

From July 2 to 6 I was at Quebradillas and then went to Manati, where I remained until the eleventh, collecting in the extensive citrus groves of that region. At Ciales, farther inland, a coffee region with areas of small crops was visited from July 12 to 18, and then, after I returned to Manati, the journey was resumed next day to Bayamón, where work was carried on until the twenty-fifth. Comerio, the next point, in the heart of the tobacco country, was reached by coach, and here a sojourn was made until July 31, though few birds, and those of little interest, were found. From Bayamón I rode through, on August 2, to Toa Alta, returning the same day. On the third Arecibo was reached by railroad, and from there a journey by coach was made to Utuado, where I remained until August 9. From the tenth to the sixteenth I collected along the high ridges above the town of Adjuntas, at elevations two thousand feet above the sea. Descending to Ponce, I visited the dry region about Juana Diaz from August 17 to 22. After an inconvenient railroad journey, Cabo Rojo was reached on the twenty-fourth and the
coastal region to the west and the long reaches to the south were explored until August 31. Desiring to make observations at one more point on the east coast, I went to San Juan, crossed to Caguas, and there secured a coach for Humacao, where I worked from September 3 to 9. Returning to San Juan on September 11, I sailed for New York on the steamer San Juan.

Historical Account

Though occasional notes on the avifauna of Porto Rico are found in accounts of early explorers and priests, the first narrative giving any detailed list of the bird-life is that of Andre Pierre Ledru, published first in 1810 in French, and later translated into both German and Spanish. Ledru was primarily botanist on an expedition under Captain Baudin; the birds collected were evidently prepared by his companions, Mangé and Riedlé. Upon these skins, placed in the Paris Museum, are based descriptions of several of the endemic species of the island. The list of birds given by Ledru numbers eighty-three species and he includes a few notes on habits, which are elaborated in an appendix by M. Sonnini. As a whole, this list has little value, for it consists of a random collection of names many of which have no place in Porto Rico, as they cannot be identified with species existing there within historical times. The expedition was on the island from July 17, 1797, until April 13, 1798, confining its attention almost entirely to the north side. Many observations of interest regarding forests, people and towns are given in the report, but there is comparatively little of natural-history bearing.

About February 17, 1835, C. Moritz, an entomologist, came to Porto Rico from St. Thomas and collected on the island for four months. He landed at Arecibo, went in turn to Manatí, San Juan, Caguas, "Coramo" (probably Coamo), Ponce and Guayama, and for a large part of his stay was located at Yabucoa, on the east coast. In his account, written from Caracas in January, 1836, he speaks of wild swine in the mountains, and gives an entertaining account of his natural-history observations on the island, including many made on the birds. Parrots were said to visit the maize-fields in hordes, but paroquets were known to him by report only, none being seen.

In 1847 Dr. Hartlaub, in a discussion of the bird-life of the West Indies, printed in Oken's Isis, devotes two paragraphs to Porto Rico, listing twenty-five species after Lesson and Vieillot, and says that the avifauna is similar to that of Santo Domingo.

Mr. E. C. Taylor, in the course of studying the birds of the West Indies, reached Porto Rico May 2, 1863, and remained for a fortnight.
collecting mainly near San Juan. He spent three or four days on an estate known as "Punta," on the Rio Loisa, where he encountered several species new to him. In a general account of the birds seen during his trip, many notes on Porto Rican species are incorporated, and in the introduction he remarks that Porto Rico is richer in bird-life than are the Windward Islands, and notes especially that it abounds in pigeons.

Mr. Robert Swift, of Philadelphia, and Mr. George Latimer, for many years Consul General for the United States at San Juan, made collections of birds in the early sixties and presented them to the Smithsonian Institution. Many of these skins are still preserved in the collections of the U. S. National Museum. Dr. Henry Bryant reported upon the specimens secured in the Proceedings of the Boston Society of Natural History for 1866, describing a number of species and subspecies, and Professor Baird, in his Review of North American Birds, named as new *Vireo latimeri* and *Dendroica adeliae*, taking as his types specimens collected by these gentlemen. Dr. Bryant was evidently impressed and interested by the birds he handled, as he personally made an expedition to the island. Unfortunately, he became ill and died in Arecibo on February 2, 1867.

A collection of Porto Rican birds numbering seventy-three species was made in 1867-1868, near Arecibo, Manati and Vega Baja, by Justus Hjalmarson, a druggist in Arecibo, who sent them to Professor Sundevall. In reporting upon these in 1869, Dr. Sundevall included also records from the lists of Hartlaub, Taylor and Bryant, bringing the total known for the island to ninety species. Later this collection was examined by Gundlach, from whose notes it is possible to clear up one or two uncertainties in Sundevall's list. A few duplicate specimens retained by Sundevall have found their way through exchange into the collections of the U. S. National Museum.

Following this came the most important work of the early ornithologists on the island. On June 14, 1873, Dr. Juan Gundlach, the untiring Cuban naturalist, came to Mayagüez at the solicitation of the Jesuits, and remained until December 4, collecting at Mayagüez, Aguadilla and Quebradillas, and making an expedition to the expanse of fresh-water marshes around the Laguna de Guánica. The results of his work were embodied in a report published in the Journal für Ornithologie in 1874. Including the species given by previous authors and records secured from other sources, he lists 145 species, of which he had collected personally 116. September 14, 1875, he returned to Porto Rico, on this occasion remaining on the island for almost a year. As on his previous visit, he began work at Mayagüez, from which point he made an excur-
sion to the swamps and lagoons at Boquerón. Later he visited the region about Quebradillas, and in April, 1876, reached Arecibo, where he enjoyed the pleasures of companionship with Hjalmarson and was permitted to examine the collection reported upon by Sundevall. At Vega Baja he added to his collections, and passed some time in Utuado, in the interior, where he was still remembered at the time of my visit in 1912. In July he learned that Cuban rebels were in the neighborhood of his plantation in Cuba and resolved to go home. Returning to Arecibo, he went thence to Bayamón, where he met Dr. Stahl, and then on to San Juan. Failing to get passage for Cuba here, he came finally to Mayagüez, and on August 25, 1876, sailed for Havana.

Besides the collections which he made personally, Gundlach obtained information from Don Tomas Blanco, a druggist in San Juan, who had formed a collection of birds and placed them in the Jesuit College there. Later Blanco sent him specimens secured near Aguas Buenas, some of which came to our National Museum. Dr. Domingo Bello, of Mayagüez, who had published a list of birds of Porto Rico in 1871, also furnished several records from drawings made on the basis of specimens gathered by Dr. Celedonio Carbonel, of Cabo Rojo. Gundlach in 1878 published an extended list of the birds of Porto Rico, including 153 species, with notes on their habits and occurrence—the most complete that had appeared.

Stimulated by Gundlach's example, Dr. Augustin Stahl, at Bayamón, gathered a considerable collection representing various branches of natural history, which was finally placed on exhibition in San Juan. His catalog recording 156 birds, of which six are domesticated species, is dated 1882 on the title page, though the cover bears the date 1883. Further notes by him appeared in Ornis for 1887. His activities added several birds to the list of species known from the island.

In the early part of 1889 Mr. Clark P. Streator visited Porto Rico for Mr. C. B. Cory, and in February and March of 1892 W. W. Brown, Jr., also collected in Porto Rico. There may be mentioned in addition the visit of Dr. Ernst Hartert, who in the course of his journeys came to San Juan May 20, 1892, visited Mayagüez May 22, and collected near Ponce May 23. A brief account of his experiences is included in his book of travel.

With American occupation of the island, renewed attention was paid to its natural resources, and almost at once an investigation of the aquatic life was undertaken by the Fish Commission, work being carried on from the steamer Fish Hawk from January 2 to February 21, 1899. In behalf of the Smithsonian Institution Mr. A. B. Baker joined the
expedition, devoting his attention chiefly to the terrestrial vertebrates. A good series of bird skins was prepared, part of them collected by Dr. J. D. Milligan but, though a report on these was projected in conjunction with the papers which have appeared on the fishes and invertebrates, it was never undertaken.

In 1900 Dr. L. Stejneger and Dr. C. W. Richmond were in Porto Rico from February 12 to April 19, and formed a considerable collection of birds. The large mountain, El Yunque, was visited in March, and among other valuable specimens eight of the rare Porto Rican tanagers (Nesospingus speculiferus) were collected. Dr. Richmond later permitted me the use of his specimens and kindly placed at my disposal manuscript notes made during his journey, which have supplied valuable records.

During this same period Mr. B. S. Bowdish was devoting as much time to the study of the avifauna of Porto Rico as his military duties would allow. His observations on the island extended from February 22, 1899, to February 16, 1900, and from May 5, 1900, to October 24, 1901. In the course of his second stay on the island he visited Aguadilla and continued observations at Mayagüez. During the latter part of his work he collected for the U. S. National Museum. His report, published in the Auk, is full of interest, and with other notes which appeared in the Aukologist forms the next complete account of the birds of the island. He gives notes on ninety-one species and a supplementary list of seventy more derived from previous authors.

The extent of the work of the present writer in Porto Rico may be ascertained from the itinerary which has just been presented. The report published as the outcome of his work includes 162 bona fide forms for Porto Rico, Mona, Desecheo, Vieques and Culebra.

During the spring of 1912 W. W. Worthington also made a collection of birds on Porto Rico for the Carnegie Museum, in which were included two new records for the island, the black-throated green and mourning warblers, announced recently by Mr. W. E. Clyde Todd.

As part of the work instituted by the New York Academy of Sciences, Mr. H. E. Anthony visited Porto Rico from May 31 to August 2, 1916, and made extensive collections of bones from caverns and aboriginal shell-heaps. Though his trip was undertaken primarily to obtain mammalian remains, his collecting included considerable numbers of bones of birds. These came subsequently to the hands of the present writer for study and led to the description of six extinct forms of birds not previously known from the island, among them a crow, a barn owl, a caracara, a snipe and a quail-dove. The sixth species, a whippoorwill, revealed
by its bones, was described and named from the only skin extant, in the collection of the Field Museum, where, confused with the whippoorwill of North America, it had remained unnoticed since it was collected by Streator in 1889.

Mr. J. T. Nichols, also working for the New York Academy of Sciences, has published observations on a few water birds observed at the Laguna de Guánica on July 27, 1914. These included the least tern, the two species of yellowlegs, and some other sandpipers.

Dr. Glover M. Allen and Mr. James L. Peters were in Porto Rico on behalf of the Museum of Comparative Zoölogy in the winter of 1916-1917 and secured additional extinct bird material from caverns and middens. Mr. Peters was on the island from about January 23 to February 14, 1917, and again for a day or two early in April. As an outcome of this work, Peters differentiated the grasshopper sparrow as a new form, which he called *Ammodramus savannarum boricuensis*.

From the fall of 1921 through part of the succeeding year Mr. Parke H. Struthers, of the University of Porto Rico, at Mayagüez, carried on studies of the birds of Porto Rico, particularly of their breeding in the western part, mainly in the area easily accessible from Mayagüez, but extending through much of the western two-thirds of the island west of a line drawn between Arecibo and Ponce. His data, published in the Auk for 1923, give much valuable information supplemental to facts already known, especially as he obtained some species that had not been seen for many years before.

Mr. F. A. Potts has made extended observations on the birds of Porto Rico for a period of several years, chiefly along the south side of the island—first near Aguirre and later near Guánica. His studies have taken him to the summit of El Yunque and elsewhere along the high mountain range that divides the island, and have yielded many records of value that he has kindly forwarded to me from time to time for inclusion in this account. His observations (published in part in the Auk, 1927, pp. 120-121), particularly on various migrants from North America, will be found at various points in this paper.

Ornithological work by Mr. Stuart T. Danforth began in October, 1921, and with breaks of longer or shorter duration has continued until the present time. Mr. Danforth's observations have been made mainly in western Porto Rico and have included especially a detailed study of the bird-life of Cartagena Lagoon. He has announced records of a number of species new to the island avifauna and has described new forms from resident birds that he has collected. His detailed paper on the birds of Cartagena Lagoon, replete with observations of interest and
value, is the most recent extended account that deals with Porto Rican birds.

A small collection of animal bones secured from a kitchen midden on the Mesa Hill near Mayagüez, and sent to the U. S. National Museum by Mr. Rafael Vidal, included several bird bones, among which were those of the extinct quail-dove *Oreopeleia larva*.

Though Mona Island was one of the landmarks in Mona Passage for early voyagers, I find no mention of birds from it until 1878, when Gundlach wrote that he saw wings of a paroquet killed by Dr. Block, of Mayagüez, during an excursion to Mona. W. W. Brown, Jr., collecting for C. B. Cory, visited Mona Island in February, 1892, and secured a number of birds, among them the paroquet and the yellow-shouldered blackbird. He reported the tropic-bird and brown booby as breeding. B. S. Bowdish visited Mona from August 5 to 21, 1901, and among other birds collected the type of the ground-dove, *Chaemepelia passerina exigua*. Mr. Karl P. Schmidt, during field work for the New York Academy of Sciences, landed on Mona in 1919 and, though he devoted his attention principally to reptiles, has included in the introduction to his account of the herpetology of Mona a list of twenty-two species of birds—the only complete, separate list that has been published. Mr. Parke H. Struthers worked on Mona from July 14 to 18, 1921, and the cavern deposits of the island were investigated by Mr. H. E. Anthony in the spring of 1926. Various others have gone from Mayagüez to Mona from time to time, but no account of their observations on birds has come to my attention.

The island of Desecheo, called Zachee by Labat, was well known to early voyagers as a landmark in Mona Passage, but was not visited by a naturalist, so far as I am aware, until Bowdish landed there, June 24, 1900, and again sojourner there from July 6 to 10, 1901, though Gundlach, passing near the island in 1874 on one of his voyages from Cuba, had remarked on the large number of seabirds seen near it. I visited the island personally from June 13 to 16, 1912, and made a thorough study of the colonies of breeding birds. Struthers went there in January, 1922, and again in 1926, and the island has been visited by others, who seem to have published no notes regarding their observations. Following my report to the Biological Survey on the birds found there, Desecheo was made a bird reservation on December 19, 1912, and placed under the jurisdiction of the U. S. Department of Agriculture.

The island of Vieques is said to have been first inhabited by civilized man in 1524. It was early noted for its birds, particularly for paroquets, which are mentioned especially by Hans West at the close of the
eighteenth century and by Labat. West also reports the flamingo and doves. According to Newton, Apotheker Riise of St. Thomas sent a collector to Vieques about 1860, who secured a number of birds, including the woodpecker, the lizard-cuckoo and one specimen of Molothrus atronitens. No complete list of his collection seems to have been published. So far as known, the island was not visited again by ornithological collectors until 1899, when Mr. A. B. Baker and Dr. J. D. Milligan, of the U. S. Fish Commission steamer Fish Hawk, landed there on February 6, 7 and 8. Mr. B. S. Bowdish went to Vieques about November 5, 1899, and remained until February 10, 1900—the most extended visit made by a naturalist. In 1900 Dr. C. W. Richmond and Dr. L. Stejneger, collecting for the U. S. National Museum, worked on Vieques from March 22 to 28. Subsequently I made a trip to Vieques on March 16, 1912, and remained until April 4, with headquarters in the pleasant little village of Isabel II. Subsequently I was on the island, April 22 and 23, on my return from Culebra. As a result of this work I prepared a separate account of the birds of the island (see Bibliography).

The earliest mention of a bird from Culebra Island that I have come upon is that of a honey-creeper listed by Mr. Cory in the Auk for 1891 (p. 37), with no indication, however, of the collector. Mr. A. B. Baker and Dr. J. D. Milligan, of the Fish Hawk, seem to have made the first extensive collection of birds on the island. Later, the present writer visited the island from April 4 to April 22, 1912, and secured a representative series of skins.

On April 11 I crossed to Louis Peña, or Southwest Cay, and on April 15 visited Culebrita Island for a day, securing specimens and making observations in each instance.

In an executive order dated February 27, 1909, Theodore Roosevelt set aside the small islands surrounding Culebra (but not Culebra itself) as a preserve and breeding ground for native birds, under jurisdiction of the U. S. Department of Agriculture. The reservation includes the surrounding islets from the Washer and Cactus Cay to Culebrita and Palada cays.

St. Croix was settled early in the history of the West Indies, but except for casual mention in books of travel of a few birds, such as the little blue heron and Florida gallinule, noted by Hans West in 1794, and pigeons and the domestic cock and hen, which, according to Father Labat, had gone wild, little was published on the birds of the island until the comprehensive account of the Newtons in the Ibis for 1859, based on field work by Alfred Newton from February 20 to August 6, 1857, and by Edward Newton from March 4 to September 28, 1858. This is the
most extended account that has appeared and is replete with information. A note by Alfred Newton in the Ibis for 1860 announced a specimen of *Sphyrapicus varius*, sent to Professor Reinhardt from St. Croix with no indication, however, as to the collector. In the spring of 1890 Cyrus S. Winch visited St. Croix in the interest of C. B. Cory and made a collection that included twenty-four species of birds, as announced by Mr. Cory in the Auk for 1891. Mr. M. J. Nicoll from February 19 to 21, 1904, secured skins of eight species on St. Croix, but reported birds as relatively scarce. Dr. Th. Mortensen in the course of his biological work in St. Croix made many observations on the birds, and in 1909 issued in the periodical Atlantien an account of the birds that includes records from St. Thomas and other of the then Danish possessions, based on published accounts and on his own notations. This was reprinted in the journal of the Danish Ornithological Society, and was followed by a second article in Atlantien in 1910, in which is included an account of the game birds and their hunting. In June and again in September, 1914, Mr. G. K. Noble, in the course of field work in the West Indies for the Museum of Comparative Zoology, collected on St. Croix and secured series of the native birds. Though no account of these specimens has appeared, I have been permitted by the authorities of the institution mentioned to examine the skins and to include useful records in the present paper.

Kitchen-midden deposits on St. Croix have given valuable records for a number of birds not otherwise known from the island. The late Theodoor de Booy, working for the Museum of the American Indian, Heye Foundation, during January, 1917, secured bones of birds, while making excavations on the north coast along the western bank of Salt River near its mouth. The skeletal material included the extinct land-rail *Nesotrichis debooyi* and the Porto Rican crow. Additional bones forwarded to the National Museum by Mrs. Hugo Hark from a kitchen midden on the Richmond estate near Christiansted have contributed more remains of the crow and fragments of the red-tailed hawk.

In an historical account of the island of St. Thomas, John P. Knox in 1852 published a brief list of the birds that contained the commoner species of the island. Shortly after, Robert Swift was transferred from Porto Rico to St. Thomas. Here he continued actively to collect specimens of birds, part of which were sent to the Smithsonian Institution and part to the Academy of Natural Sciences in Philadelphia. In 1860 John Cassin published, through the latter institution, a catalog of the birds of St. Thomas. Alfred Newton made brief observations on this island in connection with his studies on St. Croix, and came in touch
with the Danish pharmacist Riise, who subsequently forwarded collections to England from which Sclater described *Elainea rüsti*. These observations were undertaken in 1860 and 1861. Little is known of Riise, who may have been inspired in his work by Swift; if he made extensive collections, their whereabouts is not known to me. It is possible that birds from St. Thomas received by the Smithsonian from the taxidermist John Akhurst, of Brooklyn, early in 1863 may have come from Riise, but there is no definite indication who collected them. E. C. Taylor, *en route* to Porto Rico, speaks of spending three days ashore at Charlotte Amalie, but makes only casual mention of a few common birds. The next bird collection of importance appears to have been made by F. A. Ober in 1880, while J. E. Benedict and W. Nye, naturalists on the U. S. Fish Commission steamer *Albatross*, secured a good series of skins in the week from January 17 to 24, 1884—the basis for a report in the same year by Mr. Ridgway. Cyrus S. Winch worked briefly in St. Thomas, apparently late in 1889, though only seven species are listed by Cory in his collections on that island. Hartert was there on May 19 and 20, 1892, and Nicoll collected a few birds between February 21 and 24, 1904. Nicoll’s published list includes ten species. Theodoor de Booy, in excavating kitchen middens at Magen’s Bay, on the north coast, in December, 1916, secured the first specimens of the extinct land-rail, with bones of Audubon’s shearwater and other birds. J. L. Peters visited St. Thomas from February 15 to 25, 1917, but accounts of his collections have not yet appeared. According to information kindly furnished me by Dr. Robert Cushman Murphy, R. H. Beck, collecting for Brewster and Sanford, visited Cockroach Island, Cricket Rock, Buck Island and Water Island, near St. Thomas, on August 10, 1916. On August 14 he collected in the eastern section of St. Thomas proper, securing paroquets, yellowlegs, doves and various passerine birds. On August 21, in a visit to Sail Rock between St. Thomas and Culebra, he recorded boobies, noddies and terns, with further noddies on Saba Island (an islet off the south coast of St. Thomas). On August 22 he collected on Tobago Island, near Jost Van Dyke, and on September 4 secured shearwaters and other water-birds on Saba.

The earliest statement regarding the birds of the island of St John that has come to my notice is that of Alfred Newton, who remarks in 1860 that Mr. Riise had recently arrived in Europe with a small but interesting collection of birds made chiefly in St. Thomas and St. John. F. A. Ober collected on St. John in 1880, and among other specimens secured the type of the coot described by Ridgway as *Fulica caribaea*. Cory cites various specimens from St. John and probably had his col-
lectors visit that island, though he did not prepare any definite list of the birds.

Mortensen has reported the tropic-bird and other seabirds nesting on Congo Cay between St. Thomas and St. John.

Tortola, Virgin Gorda and Anegada were visited by Cyrus S. Winch, collecting for Cory, during the winter of 1889-1890. Specimens were taken subsequently by J. L. Peters on Tortola between March 1 and 7, 1917; on Anegada, March 8 to 16, 1917, and on Virgin Gorda, March 17 to 22, 1917. Mr. Peters also visited Ginger Island, between Virgin Gorda and Tortola, on March 23, 1917, being the only ornithologist apparently who has had that privilege.

**Discussion of Avifauna**

The complete list of birds at present known from the region treated in this report, which covers Mona, Desecheo, Porto Rico and the Virgin Islands east to the Anegada Channel, includes 188 species and subspecies. There are eighteen in addition that have been recorded by other authorities on what is believed to be insufficient grounds, so that they are here placed in brackets as of hypothetical occurrence. Of the entire list there are twenty-six that are at present known only from the island of Porto Rico. Of these endemic species five are described from bones discovered in caverns or kitchen middens, so that no living specimens have been known. These include the following:

\[ Polyborus latebrosus \]  [Tyto cavatica]
\[ Capella anthonyi \]  [Corvus pumilis]
\[ Oreopeleia larva \]

They represent, in the order given, a caracara, a snipe, a quail-dove, a small barn owl and a small crow. The known fragments have come mainly from the interior, from deposits that are probably prehistoric, and may be from 500 to 1000 years old.

There remain twenty-one forms of living birds peculiar to the island of Porto Rico proper, as indicated in the following list:

\[ Accipiter striatus venator \]  [Chlorostilbon maugaeus]
\[ Columba inornata exsul \]  [Anthracothorax viridis]
\[ Amazona vittata vittata \]  [Todus mexicanus]
\[ Saurothera vieilloti \]  [Tolmarchus taylori]
\[ Gymnasio nudipes nudipes \]  [Blacicus blaneri]
\[ Asio portoricensis \]  [Mimocichla ardosiaeae portoricensis]
\[ Antrostomus noctitherus \]  [Vireo latimeri]
One of these, the lizard-cuckoo, *Saurothera vicilloti*, is reported as having occurred on Vieques and St. Thomas, but casually; so that the records would seem to indicate stray birds out of their usual haunt. There may be, in fact, some doubt as to the authenticity of their occurrence.

Several other species of birds that have been considered ordinarily as peculiar to the Porto Rican avifauna range also to one or more of the smaller islands near by. The paroquet, *Aratinga chloroptera mangel*, and the yellow-shouldered blackbird, *Agelaius xanthomus*, occur on Porto Rico and Mona Island. Porto Rico and Vieques share four species endemic in this region, namely, the Porto Rican woodpecker, *Melanerpes portoricensis*; the Antillean flycatcher, *Myiarchus antillarum*; Adelaide’s warbler, *Dendroica adelaidae*, and the Porto Rican grackle, *Holoisicus niger brachypterus*. The woodpecker is recorded also from St. Thomas, but very doubtfully. The Antillean flycatcher I am satisfied I heard calling on Culebra; so that it will probably be included in the list for that island eventually, as will the Porto Rican grackle, of which I had report from Culebra.

The Porto Rican grassquit, *Tiaris olivacea bryanti*, ordinarily attributed to Porto Rico alone, ranges also to Vieques and Culebra. A form of clapper rail, *Rallus longirostris* (given in the list beyond as “caribaeus”), which is not yet described to science, is found on Porto Rico, *Coereba newtoni*, that is replaced by another form in the other Virgin Islands. The resident yellow warbler, *Dendroica petechia cruciana*, ranges through Porto Rico and the Virgin group so far as the latter area has been explored ornithologically. The Porto Rican crow, *Corvus leucoquaphalus*, long supposed to be restricted to Porto Rico proper, is represented in St. Croix by bones found in kitchen middens at two separate localities, which would indicate that it was formerly of regular occurrence on the latter island, though none have been reported in historic times. A curious land-rail, unable to fly, is represented by bones from kitchen middens on St. Thomas and St. Croix and from middens and caves in Porto Rico. It was formerly common, if one may judge from the number of remains that have been found, but is unknown to science except through its bones. There may be mentioned finally the limpkin, *Aramus pictus elucus*, and the yellow rail, *Porzana flariventer hender-
soni, that occur in both Porto Rico and the adjacent island of Santo Domingo.

The island of St. Croix has one bird peculiar to it: a honey-creeper, Coereba newtoni, that is replaced by another form in the other Virgin Islands. A subspecies of the Porto Rican parrot, Amazona vittata gracilipes (now probably extinct), is considered peculiar to Culebra Island, but may possibly have occurred in Vieques at an early day. Newton's owl, Gymnocebus nudipes newtoni, is reported only from St. Croix, St. Thomas and St. John, but may possibly occur on Vieques, and the Virgin Island honey-creeper, Coereba portoricensis sanctae-thomae, and a form of elaenea, Eulaeoa martinae riisii, are restricted to the Virgin Islands. Finally, there is a subspecies of ground-dove, Chaemepelia passerina exigua, described from Mona Island, that ranges also to Inagua, in the southern Bahamas.

Like other islands in the Greater Antilles, Porto Rico is notable for the list of migrants that visit it from the mainland of North America. These include at present sixty-one forms. Some of these are abundant during the winter months and form an important part of the avifauna of the island. Others are rare and are little known. The list is as follows:

- Botaurus lentiginosus
- Mareca americana
- Dafila acuta tzilzilhoa
- Querquedula discors
- Spatula clypeata
- Nyroca affinis
- " collaris
- Charitonetta albicilla
- Circus hudsonius
- Pandion haliaetus carolinensis
- Falco peregrinus anatum
- " columbarius columbarius
- Porzana carolina
- Creciscus jamaiicensis jamaiicensis
- Charadrius melodus
- " semipalmatus
- Orychus vociferus vociferus
- Pluvialis dominicus dominicus
- Squatarola squatarola cynosurae
- Arenaria interpres morinella
- Capella delicata
- Phaeopus borealis
- " hudsonicus
- Bartramia longicauda
- Actitis macularia
- Tringa solitaria solitaria
- Totanus fluvipes
- " melanoleucus
- Pisobia minutilla
- " melanotos
- " fuscicollis
- Linodromus griseus scolopaceus
- Micropalaima himantopus
- Erycettalus pusillus
- " maoui
- Limosa fedoa
- Crocelia alba
- Chlidonias nigra surinamensis
- Coccyzus erythropthalmus
- Antrostomus carolinensis
Megaceryle alcyon alcyon  
Dendroica striata

Riparia riparia riparia  
"  "  "

Hirundo erythrogaster  
"  "  "

Mniotilta varia  
Seiurus noveboracensis

Compsothlypis americana pusilla  
Seiurus noveboracensis notabilis

Dendroica tigrina  
Seiurus noveboracensis palmarum

" magnolia  
" motacilla

" caerulescens caerulescens  
" aurocapillus aurocapillus

" coronata coronata  
Oporornis philadelphica

" virens virens  
Geothlypis trichas brachidactyla

" dominica dominica  
Setophaga ruticilla.

In addition the North American green heron, *Butorides virescens* virescens, has been reported casually from Porto Rico; the bobolink, *Dolichonyx oryzivorus*, is recorded from Porto Rico and Vieques, and the yellow-bellied sapsucker, *Sphyrapicus varius varius*, from St. Croix.

While migrants are under discussion, it may be well to note that two birds—the Caribbean martin, *Progne dominicensis*, and the Jamaican vireo, *Vireo calidris calidris*—nest in Porto Rico and the Virgin Islands, but migrate in fall to some winter home in South America.

Finally, it may be recorded that there are five birds that have been introduced into Porto Rico, viz:

*Cathartes aura aura*  
*Spermestes cucullatus cucullatus*

*Colinus virginianus cubanensis*  
*Estrilda melpoda melpoda*

*Numida galeata*

Of these the quail and guinea-fowl are now believed to be extinct. There is another form, the troupial, *Icterus icterus ridgwayi*, that is recorded from Porto Rico and St. Thomas and that is supposed to have been introduced. There is a possibility, however, that the bird may be of *bona fide* status on the list, for specimens seen from St. Thomas offer certain peculiarities of color, not found elsewhere, which may indicate an Antillean race of a species otherwise known from northeastern South America and the islands adjacent to its coast.

A form of quail thought to be *Colinus virginianus virginianus* was brought to St. Croix and at one time was common, but is now extinct. A crested quail, *Eupsychortyx sonnini sonnini*, and a paroquet, *Eupsittula pertinax pertinax*, are reported as naturalized on St. Thomas. The quail, it is said, exists there no longer, but the paroquet is still found.

Further additions to the listed avifauna of this region will come principally from the detection of other North American migrants as casual visitors, from random occurrences of forms of extra-liminal range, and
from the discovery of other extinct species in kitchen-midden and cavern deposits. Investigation of these latter sites promises important results, as our knowledge of the extinct fauna of Porto Rico is now based principally upon the material obtained by one expedition, that of Anthony in 1916. Many of the caves in Porto Rico have had much of the soil on their floors removed for use as fertilizer, but there must remain a number that have not yet been explored. Investigation of their bone deposits offers a rich field for study and should yield birds not at present known. As our knowledge of the extinct fauna grows, many apparent anomalies in the present distribution of avian genera in the greater Antilles will be explained. It is the writer’s opinion that the key to the puzzle presented by modern distribution of avian life in the Antillean region lies buried in the caves of the various islands, since it seems probable that most, if not all, of the genera concerned originally had representation on all of the principal islands of the Greater Antilles, where a part have persisted to the present day and a part have become extinct through the operation of natural causes controlling life in these regions. The investigation of the deposits in question is one of fascinating interest.

Acknowledgments

In his earlier account of the birds of Porto Rico the writer has made note of the many favors extended to him during his stay on the islands. The friendly reception and hearty cooperation accorded him by those in authority in the Insular Government, and by the many residents in the island with whom he came in contact, are most gratefully remembered, as they made the results obtained in his field work possible.

In preparing the present account, published reports of many authors have been consulted and credit has been given in each case for records or information cited. The author is especially indebted to Mr. F. A. Potts, of Fortuna, Porto Rico, for notes and specimens that have made possible a number of additions to current knowledge of Porto Rican bird life.

During work on the present report the writer was able to spend some time at the Museum of Comparative Zoology, where he was accorded every privilege in the examination of specimens and the citing of records. Mr. J. L. Peters, in addition, has given information regarding specimens and his own field work in this region that has added measurably to the results. Dr. Robert Cushman Murphy, of the American Museum of Natural History, has supplied certain data from the skins and diaries of R. H. Beck with regard to St. Thomas and adjacent islets.

The Museum of Comparative Zoology, the American Museum of Natural History and the Field Museum have coöperated in the loan of
specimens for examination, and the Bureau of Biological Survey has afforded facilities in the use of field notes and photographs made in its service. The authorities of the Biological Survey have also kindly permitted use of the plates of birds prepared by Mr. L. A. Fuertes as illustrations for an earlier report on the birds of Porto Rico, and also of photographs exemplifying typical sections of the country. The latter were taken by the author during his field work in 1911 and 1912. The line drawings of bones of extinct birds are taken from those used in the original descriptions of the species concerned, through the courtesy of the American Museum of Natural History. The writer wishes finally to acknowledge his indebtedness to his colleagues, Dr. C. W. Richmond and Mr. J. H. Riley, for references and opinions during the progress of this work, and to Dr. H. A. Schwarz, editor for the New York Academy of Sciences for friendly coöperation in arranging the report for the press.

**Method of Treatment**

In each of the forms covered in the report that follows, the current scientific name, with the authority, is given first, followed by the English and Spanish names by which the bird is known either locally or in published works. The first reference to literature is, in all cases, that in which the form was first proposed under the accepted name, and includes in parentheses the type locality. There follows a brief synonymy that includes synonyms where an endemic bird has been redescribed, and gives the major pertinent references to the scientific names or common names under which the form has been recorded from Porto Rico and the Virgin Islands. Such references are distinguished from original descriptions by a comma placed after the scientific name and before that of the author. They include in parentheses brief statements as to occurrence or other matters of interest. By consulting this synonymy it will be possible to coördinate names used in lists of older authors with modern usage and so eliminate confusion that may exist in the mind of the student who does not have access to large libraries. There has been no attempt to make the list of references exhaustive or wholly complete, since it is believed that this would be useless labor, but indication has been given of all notes of interest or value, so far as they have come to attention.

The first paragraph in the general account gives in brief a summary of the range of the bird under discussion in Porto Rico and the Virgin Islands. This is followed by statement in some detail of occurrence and habit in the various islands, the order adopted for forms of universal distribution being Mona, Desecheo and Porto Rico on through Vieques, Culebra and the other islands of the Virgin group.
As the writer's previous general account of the birds of Porto Rico, published in 1916 as Bulletin 326 of the U. S. Department of Agriculture, was given over largely to economic discussions, this phase of the topic has been summarized very briefly in the present paper. Detailed discussion of the food and economic relations of the majority of the birds here covered will be found in the paper mentioned. In the case of all resident birds and most migrants there has been added a brief statement of size and color that will assist in field identification. These data are included, as there is no handbook easily available that covers this region. The student will find Dr. F. M. Chapman's Handbook of the Birds of Eastern North America (published by D. Appleton and Company of New York City) a useful work of reference, though it does not cover the forms peculiar to the West Indies, it gives consideration to the many migrants from North America as well as the majority of the water-birds.

ANNOTATED LIST OF FORMS

Order COLYMBIFORMES

Family COLYMBIDAE

Colymbus dominicus dominicus Linnaeus

Dominican Grebe, Least Grebe, Tigua, Zaramagullón


Colymbus dominicus, Cory, Cat. West Indian Birds, 1892, p. 81 (Porto Rico).


Apparently a fairly common resident in fresh-water ponds of the lowlands in Porto Rico. Not known from other islands except for the statement of Ledru, an uncertain authority, that it is found in the Danish Islands.

Dr. C. W. Richmond recorded this species in a collection of birds in San Juan prepared by Dr. Stahl, and I have seen a mounted specimen in
the Museum of Comparative Zoölogy (no. 29043) received from Stahl. In the U. S. National Museum there is a skin (no. 5989?) received from the Bryant collection, marked Porto Rico without other data.

The Dominican grebe is shy and retiring, but is apparently fairly common, for Mr. F. A. Potts informs me that he found a good many on Coamo Reservoir, north of Santa Isabel, January 23, July 26 and August 25, 1921, but he has seen it only once elsewhere. Struthers noted it in numbers on the larger lagoons of the western part of Porto Rico, and recorded during the period of his observations from November 5, 1920 to April 2, 1921 nests containing from one to seven eggs. After the breeding season he found it congregated in flocks in the open water of the larger lagoons. His notes controvert Stahl's observation that the species is present only as a migrant in winter.

Danforth notes its regular occurrence on Cartagena Lagoon and reports that it nests in the shelter of growths of cat-tail. He found complete sets of eggs to number only from one to three. The nests, placed where water stood from one to three feet in depth, were composed of decaying cat-tail leaves heaped in a rounded mass with a damp concavity at the top in which the eggs were placed. When first laid, the egg is white, but soon becomes deeply stained, as the parents cover the nest on leaving it. He found this grebe breeding mainly in April and May and from September to November, and thought that two broods were reared each year. Natives destroy many eggs.

This species is easily distinguished from the Antillean grebe by its more slender bill and much smaller size, as it has only half the bulk of the larger species. The head and neck appear smaller and more slender in life. The bird is brownish black above, with the sides of the head and the neck in the adult dark gray and the under surface whitish mottled with dusky. In flight across the surface of the water the light tips of the secondaries, it is said, show prominently.

**Podilymbus podiceps antillarum** Bangs

Antillean Grebe, Zaramago, Zaramagullón


Faun. Puerto Rico, 1883, pp. 66, 153 (Porto Rico, three in collection).—Cory, Auk, 1890, p. 375 (Virgin Gorda); Cat. West Indian Birds, 1892, p. 81 (Porto Rico and Virgin Gorda).—Bowdick, Auk, 1902, p. 357 (Aguadilla).


Resident in fresh-water lagoons of the coastal plain in Porto Rico, where it has been definitely recorded at the Laguna de Guánica, Laguna de Manatí, Cartagena Lagoon, near Aguadilla, and in ponds near the Bayamón River. Cory has recorded one specimen taken by Cyrus S. Winch on Virgin Gorda. Grebes, probably of this species, were reported to me at Playa Grande, on Vieques Island and from lagoons on Culebra. The species doubtless is found wherever there are suitable marshy ponds. In Porto Rico it is fairly common and probably occurs in all suitable fresh-water ponds where there is sufficient cover for it.

Status of the Antillean Grebe as a form distinct from the bird of the United States is based solely on its smaller size. In the present connection I have been able to examine a fair series from Cuba (including the type of *antillarum*), Jamaica, Santo Domingo (a good series from Haiti, taken by Dr. W. L. Abbott), Porto Rico, Antigua, Barbuda and Guadeloupe. The difference evident is mainly in the wing, which in males (seven specimens) ranges from 120.1 to 124.5 mm., with an average of 122.9 mm., and in females (five specimens) from 111.5 to 116.0 mm., with an average of 114.0 mm. Six others, including the type of the race, with sex not indicated measure from 109.5 to 122.8 mm., so that they fall within these limits. Birds in adult dress from the United States offer the following measurements: males, 128.1 to 133.7 mm. (average, 130.6), and females, 116.0 to 126.5 mm. (average, 122.2 mm.). The difference, as stated, is slight, but seems regular and constant, so that Todd's statement (Ann. Carnegie Mus., 1916, Vol. X, p. 170) that *antillarum* cannot be recognized appears invalid.

Two adult females in the U. S. National Museum (Biological Survey Collection) taken at Lerma, Mexico, July 3, 1904, and at La Barca, Jalisco, June 28, 1903, have the wing 108.0 mm. and 116.0 mm. respectively, and a male from Manzanillo Bay, taken by John Xantus in February, 1863, measures 109.0 mm. Thus the breeding bird of Mexico must be identified as *antillarum*, which perhaps ranges throughout Tropical America.
The case is somewhat analogous to that of *Calidriss atra*, the West Indian form of which is found in Mexico.

It may be noted that I have examined a male taken December 28, 1902, at Ocotlán, Jalisco, with a wing measurement of 128.6 mm. This I consider a winter migrant of the northern form. Likewise a bird in the Museum of Comparative Zoology (no. 41954) secured from Cuba by Henry Bryant—an immature individual of unknown sex, in winter plumage with a wing measurement of 131.1 mm.—I believe to be true *Podilymbus p. podiceps*, migrant from the north. From this it appears that two forms of this grebe are to be credited to the Cuban avifauna.

This grebe is not rare in suitable localities, as Danforth has reported ten seen in one day on Cartagena Lagoon. Where water is permanent, it is probably strictly sedentary—a circumstance that has resulted in its shortened wing as compared with individuals from North America. It must, however, fly at times, since it occurs on lagoons that in dry seasons contain no water.

On large lagoons it is found swimming about in open water, where it is adept, as always, in evading the shot of the gunner by disappearing mysteriously beneath the surface, or by diving with such celerity as to evade the shot directed at it. It is found at times in small pools, as in the lowland charcos bordering the lower courses of such streams as the Bayamón, where a heavy covering of vegetation, growing in one to three feet of water, gives it opportunity to hide securely on the rare occasions when man invades its haunts. When approached suddenly, it sinks slowly beneath the surface, as though pulled down by some invisible hand; but, if greatly startled, disappears like a flash, trusting always to submergence for escape and never attempting to fly.

Struthers has recorded a nest containing six eggs on February 18, 1922, while on July 9, 1912, I saw grebes engaged in mating antics on the Laguna de Manatí; thus the breeding season appears to vary as for many other birds resident in regions of equable climate. From Cartagena Lagoon Danforth has reported young December 7 and 11, 1923, and March 17 and April 30, 1924. Three eggs constituted the largest set that he observed. Many nests are destroyed by eggers.

Stomachs of birds of this family invariably contain masses of their own feathers, plucked and swallowed, which are regularly ground up and passed on into the intestines. One that I killed had eaten twenty-five crayfish and the larva of two dragon-flies.

This species is easily distinguished in the field from the only other grebe of this region by its larger size and its thick bill, which in the breeding season is encircled near its center by a band of dark color. The
upper surface is brownish-black and the lower ashy, with more or less black-spotting visible. In breeding plumage the throat is black; in winter birds it is white, sometimes with a concealed black patch. Birds in worn plumage become very dark below. Even at a distance, the head and neck in life appear thick and heavy.

Order PROCELLARIIFORMES
Family Hydrobatidae
Subfamily Puffininae

Puffinus Iherminieri Iherminieri Lesson
Audubon's Shearwater


Audubon's shearwater is recorded as breeding in Bermuda, the Bahamas and islands in the Lesser Antilles. Among bones secured by the late Theodoor de Booy during December, 1916, from an Indian kitchen midden on the shore of Magens Bay, an indentation on the north coast of St. Thomas, I have identified an ulna and a humerus as belonging to the present species—the first known record of the bird for this area. Since then Bent has recorded it as breeding at St. Thomas. I consider it uncertain on the island of St. Thomas proper, and assume that this note applies to specimens taken by R. H. Beck for Dr. L. C. Sanford on Little Saba Island, five miles south of the western end of St. Thomas. Dr. Robert Cushman Murphy informs me that Beck took two adult shearwaters from a burrow there on August 21, 1916, and that on May 9, 1917, he found well-grown young there. Such rocky islands as Cay Lobo (Cross Key) and others in this general region may also afford shelter to the species, as they are suited for its abode.

Audubon's shearwater, about twelve inches long, is sooty black above and white below, with the tubular nostrils and sharply hooked bill characteristic of shearwaters in general. These birds are most active about their island breeding grounds by night, when they crouch on their breasts near their nesting holes or shuffle awkwardly about. The legs are located far back; as a result the birds walk with difficulty and after a few steps sink on the breast. The single white egg is deposited in a
hole or crevice a short distance from the surface. The downy young is dusky gray in color, becoming whitish on the abdomen. Adults may be captured in the nesting hole without trouble by one sufficiently hardy to brave the bites of their sharply pointed bills and the scratch of their strong claws.

The species should be looked for among outlying rocky islets. Further information regarding its occurrence in this region is desirable.

[Puffinus puffinus (Brünnich)?

Manx shearwater

Procellaria puffinus Brünnich, Orn. Bor., 1764, p. 29. (Faroe Islands and Norway.)

A broken humerus I have examined among bones secured by De Booy from a midden near the mouth of Salt River, on the north coast of St. Croix, is that of a shearwater larger than Audubon’s shearwater. It may represent the present species, of which a subspecies, Puffinus puffinus bermudae, has been described by Nichols and Mowbray (Auk, 1916, p. 195) from Bermuda. Dr. J. Dwight (Auk, 1927, p. 243) considers bermudae a synonym of Puffinus p. puffinus, an opinion in which I concur.

The Manx shearwater is similar to Audubon’s shearwater in color, but is slightly larger in size (length about 15 inches), with stronger bill and feet. It is found in similar situations.]

[Pterodroma hasitata (Kuhl)?

Black-capped Petrel


A tibio-tarsus secured by De Booy from a midden at Magens Bay, St. Thomas, I have identified as a petrel of this genus from the form of the cnemial process, but through lack of comparative material I have not been able to decide certainly its specific identity. It is probable that it represents P. hasitata.

Though now rare, this bird is hardly extinct, as J. T. Nichols (Auk, 1913, pp. 507-508, 509) has recorded one seen on January 25, 1913, at sea two hundred fifty miles east of Savannah, Georgia.

I wish to place on record also notes made in 1920 from a steamer in passage from New York to Rio de Janeiro that must pertain to this
species. On June 1, near latitude 30° N., longitude 62° W., I had a glimpse of what I was certain was a black-capped petrel. During the following forenoon three were seen circling back and forth far at one side and at intervals crossing in front of the bow, when they frequently passed within thirty or forty feet of me. Unlike the smaller petrels that accompanied us at times, these paid no attention to the wake of the vessel, and after each approach to the ship veered far out to the side. Flight was fairly swift, performed with stiffly spread wings that were seldom flapped, and with frequent changes of course. The birds seldom rose more than ten feet from the water. Occasionally the three individuals joined and circled near one another, and once all were in the field of my binoculars at the same time. One that I saw several times very near at hand had a dark, apparently black crown, a white line behind it, more or less grayish cast to the back, and white rump and white underparts with a smoky tinge along the sides. The lower surfaces of the wings were white outlined in black, with the dark margin heavier in front. Above, the primaries appeared black. Two more petrels were noted June 3, so the species was recorded from the point first noted in a southeast line to about latitude 24° N., longitude 51° W.

Individuals may appear near the Virgin Islands at times and, when seen, should be carefully recorded.

Small petrels of unknown species have been noted by A. and E. Newton (Ibis, 1859, pp. 372-373) in the vicinity of St. Thomas and St. Croix, as the latter states that "On the 14th of June, 1858, being between St. Thomas and St. Croix, a pair of small storm-petrels came under our lee for some minutes," and again, "On September 28th I saw some two hundred storm-petrels of a larger size ... near the harbor of Christiansted." He supposed that these birds were Wilson's and Bulwer's petrels, respectively. Observers should watch for them, as any information regarding petrels from this region is desirable.

Order PELECANIFORMES

Suborder PHAETHONTES

Family PHAETHONTIDAE

Phaethon lepturus catesbyi Brandt

Yellow-billed Tropic-bird, Rabijunco, Chirre de Altura


Mathews, Auk, 1915, pp. 195-197 (name considered applicable to present species).


*Phaëthon*, sp., Bowdich, Auk, 1902, p. 328 (Mona, Desecheo, San Juan harbor).


*Phaëthon aethereus* og candidus, Mortensen, Atlanten, Vol. VI, No. 67, June, 1909, pp. 650-651, Fig. 310 (St. Croix: Congo Cay, nesting).


Found in small numbers along the coasts of Porto Rico, particularly where there are cliffs above the water. It has thus been recorded at Isabella, Quebradillas, Punta Salinas and San Juan. It is common at Mona Island and is reported from Culebra (Louis Peña). There can be little question that tropic-birds that have been noted from Desecheo and St. Croix were the present form.

Mathews (Auk, 1915, pp. 195-197) has indicated that *Phaëthon catesbyi* Brandt should replace the current *P. americanus* for this bird. Since the West Indian bird is closely similar to *P. lepturus* of the Pacific, and Indian oceans in color and differs only in size, it may stand as a race of *lepturus* (as proposed by Oberholser, Auk, 1919, p. 556).

The tropic-birds, of gull-like appearance, found near or over the sea, are distinguished at once by the two central tail-feathers that project from twelve to fifteen inches beyond the others as a slender plume that undulates gracefully in the wind. Often one of the long feathers is missing and occasionally birds are seen in which both are broken or gone. They may then be told by the pointed appearance of the tail, which is entirely different from the square or forked tails of gulls and terns. The plumage in general is white with a silken gloss. There is a black mark in front of the eye extending back along the sides of the head, a broad black band on the wing coverts, black tertials and black shafts on the central rectrices. The English name is a misnomer, since in life the bill appears clear coral red.

The species was recorded by Gundlach as breeding near Quebradillas,
with fresh eggs on April 5. The single egg laid is handsomely colored with pinkish, covered with many spots of brown. It is usually laid on a shelf of rock or in some cavelike recess in the cliffs, but in Bermuda the species has been noted nesting on the ground under low bushes or in little depressions in the side of a sand dune. W. W. Brown, Jr., collecting for Cory, found it nesting abundantly on Mona in February.

On April 11, 1912, I recorded six or eight about a rocky point on Louis Peña, an islet near Culebra, and collected two specimens, both adult females. These birds were in breeding condition, but the nests were not discovered. The species was seen in this vicinity also on April 13. On July 5 three were recorded near rocky cliffs on the shore north of Quebradillas. They are reported near San Juan, and may be looked for on the seaward side of the castle. Mortensen notes that they nest on Congo Cay, between St. Thomas and St. John, laying their eggs in crevices in the rock, usually on the face of a cliff.

The birds are strong and graceful on the wing, flying with rapidly beating wings and tail blowing in the wind. On land they are awkward in the extreme and shuffle about by shoving along on the breast, as they do not stand erect. The usual note is a sharp *kik* or a series of sharper, harsher notes.

*Phaëthon aethereus* Linnaeus

Red-billed Tropic-Bird


The red-billed tropic-bird is known from St. Vincent, Grenada, Bequia, Carriacou, and neighboring islands in the West Indies, and has been noted casually north to Bermuda. Records for this species for Porto Rico are uncertain and appear to be due to confusion with the related form, as no specimens are known. Cory, cited above, mentions no specimens, and apparently took his notes from Taylor, who mistook the yellow-billed species for this form in birds seen flying in the harbor at San Juan.

The present bird, which should be found occasionally, may be distinguished from *Phaëthon lepturus catesbyi* by the narrow transverse black bars on the back and scapulars.]
Suborder PELECANI
Superfamily PELECANIDAE

**Pelecanus occidentalis occidentalis** Linnaeus

Brown Pelican, Alcatraz


Common in occurrence along the shores of Porto Rico. Recorded from Vieques, Culebra, St. Croix and St. Thomas, and must occur throughout the Virgin Islands. Danforth noted a pair at Mona Island, July 16, 1921.

The brown pelican is reputed to breed on the low islet known as Caballo Blanco, off Port Mulas, Vieques Island, but in passing near it in a small sloop on April 23, 1912, I saw no evidence of a colony. I was told that the birds bred also on low islands near the port of Humacao. On May 8, 1912, I saw a young bird three-fourths grown on a mud bank at the mouth of a stream near Yabucoa. Mr. C. Harris, in a letter dated August 27, 1917, states that pelicans nest in mangroves on islands south of Porto Rico, and sent me with his letter a photograph of young in the nest taken during the first week in July, 1917, on an island six miles west of Ensenada. He noted three eggs in nests examined.

These great birds are found most commonly in shallow bays, or where shallows are protected by off-lying reefs. Their food, small fishes,
is secured by diving from the air, at times in very shallow water, and again in greater depths, when the birds may disappear entirely beneath the surface. The pouch serves as a scoop to secure prey, not as is commonly believed—in accordance with the statement of a well-known limerick—as a sack for storage of food, since the fish captured are swallowed and held in the capacious stomach.

Native fishermen relate gravely that, when the alcatraz grows old and feeble, rather than suffer death by starvation it commits suicide by hanging itself by the head from the fork of a mangrove or a crevice between two stones. Those familiar with the clumsiness of the great birds can readily understand that this belief arises from observation of individuals that slip and are caught so that they cannot escape. It is not unusual to find them thus suspended by the head when they nest in trees, for if they slip and fall, they easily become entangled.

Ledru in his work published in 1810 records, p. 210, the white pelican (Pelecanus erythrorhynchos), but probably in error, since the only known record for the West Indies of which I am aware is that of a bird secured by Gundlach in Cuba.

Brown pelicans seen in April at Culebra in the main showed the brown feathering on the head and neck that marks the breeding season, though some had the white plumage in this area that signifies winter dress, and some were dark birds still in immature feather. An adult male that I collected February 21, 1912, at Punta Picua, near Mameyes, Porto Rico, was in full winter dress.

Superfamily SULIDES

Family Sulidae

*Sula leucomastra leucomastra* (Boddaert)

Brown Booby, Pájaro Bobo, Pájaro Bobo del Mar, Buguere, Ruy

Pelecanus leucomaster Boddaert, Tabl. Planch. Enl. 1783, p. 57. (Cayenne.)

*Dysporus sula*, Newton, Ibis, 1859, p. 369 (near St. Croix and St. Thomas).


*Sula sula*, Cory, Auk, 1888, p. 72; Auk, 1892, p. 229 (Mona Island breeding); Cat. West Indian Birds, 1892, p. 84 (Mona, Porto Rico, St. Croix).—Boddish, Auk, 1902, p. 358 (Mona, Desecheo, Porto Rico).

Breeding commonly on Desecheo and Mona islands and said to nest on two small rocks north of Culebrita Island. Recorded from the coasts of Porto Rico, particularly near Aguadilla and Mayagüez, Vieques, St. Thomas and St. Croix. Bones found in a kitchen midden at Magen's Bay, St. Thomas.

The brown booby is slightly larger in size than the red-footed species and, when adult, is marked by the white of the lower breast and abdomen, set off by a sharp line from the dark brown of the upper breast and the rest of the plumage. The young are hatched naked but are covered soon by soft white down. In immature plumage the bird is entirely grayish brown, paler below than above, with the primaries blackish. It somewhat resembles the red-footed booby at a similar stage, but is larger and lacks the red feet, besides differing slightly in color.

The brown booby, it is said, nests near Culebrita Island in May and June. On Mona W. W. Brown found these birds breeding in February, while on Desecheo they were said to breed from late June until October. From June 13 to 16, 1912, I noted only grown young, though adults were playing with sticks as if they contemplated nest-building. Two taken showed no development of the sexual organs.

The island of Desecheo, which furnishes a home to the principal colony in this region, lies seven leagues from the port of Aguadilla, on the west coast of Porto Rico. The island, an isolated rock rising from the restless waters of Mona Passage, with its treacherous currents, is hot and dry for a large part of the year, but is swept occasionally by tempestuous downpours of rain.

On this interesting rock, boasting but eleven resident avine forms, the brown booby has established its home, and here from June 13 to 16, 1912, I studied the habits of this ungainly bird. Between eight thousand and ten thousand boobies, at a conservative estimate, occupied the rookeries spread over the entire island, but they were so distributed on the steep, brush-covered slopes that an accurate census was impracticable. Though they were in evidence at the top of the higher of the two hills, the greater number were found gathered in groups within four hundred feet of the beach. The young were nearly all caring for themselves, though a few showed traces of down feathers clinging to the tips of the
feathers about the head. I should consider February or March a probable date for their nesting. Birds in all possible stages of intermediate plumage were seen, and immature specimens were much more common than those fully adult, with smooth dark-brown heads and white underparts.

The young birds were averse to flying when they could avoid it, and preferred to scramble awkwardly away under the bushes, falling over sticks and stones in their haste. Even the adults could not take flight from a level surface, but had to launch themselves from the cliffs and sail down for a distance before being able to rise with strong wing beats. From the limbs of trees they flew readily, but on the ground I captured several by merely pinning them down with my gun barrel as they flopped awkwardly about. They showed little real fear of me, for many, snapping and hissing, stood their ground as I approached; it was the part of wisdom to keep beyond reach of their sharp, powerful beaks. It rather gave me the shivers occasionally to see one or another flounder and flop through and over a bed of prickly pear, but the birds seemed careless of the thorns. Numbers were seen with spines or even small lobes of cactus hanging to the feet or wings, and the dissemination of these plants from island to island by this means can be readily pictured.

At a gunshot there was a great rush among those near by and the air for a few minutes would be filled with birds circling and crossing, frequently almost within reach. The confusion among them would cease gradually and they would presently be all around again, eyeing me curiously or, forgetful of my presence, busy with their own affairs. On the rough limestone blocks above the sea, decorated with splashings of excreta, they sat in rows in the blazing sun, rather upright, occasionally waddling along a foot or two, but usually motionless. Birds came and went during the day, flying out to sea to feed, sometimes for considerable distances offshore, but they were most active in the morning and evening, and at night, whenever I woke, there was always much commotion evident among them. The common call note was a loud quack, quack, quack.

Formerly I was told egging parties visited this island, but the labor involved in the crossing and the difficulty in landing prevented this practice from becoming common and now the birds should be safe, as the island has been made a Federal bird reservation.

It is possible that there has been a decrease in their number, for Struthers (in litt. March 3, 1922) recorded only 2500 as present during January, 1922. Bowdish, in August, 1901, noted their abundance on Mona Island, but no estimate of the numbers there has come to my atten-
tion. The species seems to feed mainly at sea, since it is seldom seen near the coast of Porto Rico.

**Sula piscator** (Linnaeus)

Red-footed Booby, Pájaro bobo


The only known breeding colony of the red-footed booby in this area is that on Desecheo Island, where, curiously enough, the birds had been overlooked until my visit in June, 1912, though Bowdish, in 1900 and 1901, suspected another species among the brown boobies that he saw. I noted the species at sea between Porto Rico and Aguadilla, and it should occur at times along the Porto Rican coast. I have also identified remains of this booby among bones taken from a kitchen midden near the mouth of Salt River, on the island of St. Croix.

Some recent authors have called the present species *Sula sula* (Linnaeus) on the ground that *piscator*, the name in common use, is a composite that cannot be identified. (See Mathews, G. M., Birds of Australia, Vol. IV, Pt. 3, 1915, pp. 212-216, and Auk, 1920, pp. 180-181.) I have discussed the matter fully in another connection (Bull. Mus. Comp. Zool., August, 1919, Vol. LXIII, pp. 167-170) and need not review the matter here. The name *piscator*, as here used, has been accepted for use in the A. O. U. Check-list (Auk, 1923, p. 524).

Plumages in the present species are puzzling. The immature bird when fully grown is sooty gray, paler on the head and lower surface, with a very faintly indicated darker band across the breast and whitish tips on the tail. In a succeeding stage the under surface is white or almost white, with occasionally a few darker feathers to indicate the pectoral band; the head and neck are paler, and there are whitish tips on the dorsal feathers. This is succeeded by the adult stage, in which the entire plumage is pure white, with the primaries black and the greater wing coverts and secondaries tipped with black, the dark color everywhere being obscured by a wash of gray.

There still remains to be mentioned a seemingly aberrant plumage in which the tail coverts, flanks, lower back, rump and tail are pure white and the rest of the plumage dark gray, as in the immature bird. This type of bird has been described by Maynard as *Sula coryi*. It is sup-
posed to represent a phase of plumage of the red-footed booby, but there is still a possibility that it may be a distinct species. The phases of plumage described above are all to be noted in the eight skins that I collected on Desecheo.

The present species, when grown, may be distinguished in any plumage from the brown booby by the distinctly red tarsus and feet.

The red-footed booby ranges widely through tropical and subtropical seas of the world and has recently been divided into subspecies. In material available to me at this moment I cannot distinguish between Pacific and Atlantic birds; I desire to go into the matter more fully a little later in another connection when more comprehensive material is at hand. If the Atlantic bird is separable, it should be known apparently as \textit{Sula piscator sula} (Linnaeus).

On Desecheo in 1912 the red-footed boobies were gathered in a colony in the shrubs and trees above the little cove where I made my camp. At that time (June 13 to 16) young were grown, an indication that the breeding season had come earlier. Fishermen said that they nested from October to December, while Struthers (in a letter dated March 3, 1922) states that they were nesting that year from January 22 to 24. He recorded only two hundred individuals, though in 1912 I had found about two thousand. It is probable that the nesting season may vary somewhat from year to year. These birds seemed more wary and suspicious than the brown booby; they were also more active and took flight more readily. They nest in trees or bushes wherever possible.

The red-footed booby secures its food from the sea by diving and is expert and graceful on the wing. The white birds at rest in the rookery are very conspicuous against the gray-green of the shrubbery.

\textbf{[Family \textit{Phalacrocoracidae}]}

\textbf{[\textit{Phalacrocorax olivaceus mexicanus} (Brandt)]}

\textit{Mexican Cormorant, Fresh-water Cormorant, Corma}


\textit{Phalacrocorax?}, Newton, Ibis, 1859, p. 370 (reported from St. Croix).


The Newtons state that "some species of this sort of birds must sometimes occur in St. Croix, according to the accounts we have received," but had no certain record. Danforth notes that "a small cormorant,
which appeared to be of this species, was observed at Cartagena Lagoon on October 17, 1924.”

The Mexican cormorant, with the Florida cormorant (*Phalacrocorax auritus floridanus*), is found on Cuba and the Isle of Pines and has been recorded from the Bahama Islands. It is not known from Jamaica or Santo Domingo. As the Porto Rican bird mentioned by Danforth was not taken, there is some uncertainty as to its species; it is, therefore, included here in brackets.

Cormorants are diving birds as large as small geese that fly readily. All four toes are included in a single web and the bill is strongly hooked. At a distance they appear black, while near at hand immature individuals are blackish brown. The Mexican cormorant, which frequents fresh or brackish waters, is smaller, with a wing less than 11 inches in length, while the Florida cormorant, found usually on salt water, is larger, with a wing more than 11 inches long.]

Suborder FREGATAE

Family FREGATIDAE

*Fregata magnificaens* Mathews

Frigate-bird, Man-o’-war Bird, Hurricane Bird, Rabihorcedo, Rabijunco, Tijerilla

*Fregata minor magnificaens* Mathews, Austr. Av. Rec., December 19, 1914, Vol. II, p. 120. (Barrington Island, Galápagos Archipelago.)

Man-of-war Bird, Danforth, Oologist, 1922, p. 10 (Mayagüez).


Distributed along the coasts of Porto Rico and the Virgin Islands; certainly of universal occurrence, but recorded to date only from Mona, Desecheo, Porto Rico, Vieques, Culebra, Louis Peña and St. Croix. Breeding colonies found on Desecheo and Mona islands, and a small islet opposite Parguera, on the southwest coast of Porto Rico.

The man-o'-war bird of the West Indies is characterized in the adult male by uniform black plumage, with a greenish sheen on the back and a purplish gloss on the breast. The bare throat pouch is orange or brilliant red, according to the season. The female is brownish black with white breast and an obscure brown bar extending along the wing coverts. The bird is distinguished by its large size and long, deeply forked tail. Lowe (Nov. Zool., Vol. XXXI, 1924, pp. 303-305) has upheld Mathews' contention (Birds Austr., 1915, Vol. IV, p. 280) that the man-o'-war bird of the present type that breeds on the Galápagos Islands is different from the West Indian resident because of its larger size. This distinction does not hold in a small series from the western coast of Mexico that I have seen, nor is it evident in the measurements cited by Lowe. The species is here considered uniform, in accordance with the review of Rothschild (Nov. Zool., 1915, Vol. XXII, pp. 145-146). Lowe has given the type locality for magnificens as Barrington Island.

In 1912 I found about 175 adults on Desecheo Island, where they nested in four separate colonies, one group near the top of a hill but the majority near the water in company with boobies. In June the nests contained young, mainly about three-quarters grown, with feathers of the immature plumage appearing, though some, not so mature, carried the white down of the first dress. Ordinarily the young sat quietly in their stick nests, occasionally fencing with one another when nests were near together. At my approach they snapped and clattered their bills loudly and, if too closely pressed, gave up offerings of partly digested fish.

During the early morning adults were observed about the rookeries, but from then until evening they spent most of their time wheeling about in the air in flocks, sometimes so high overhead that they appeared as mere specks in the sky. Only occasionally did one descend near the nests. The young apparently were fed morning and evening. At dusk the adults came in to roost and, until all were comfortably settled, there was considerable uproar among them.

Struthers recorded three hundred here in January, 1922, and thirty on Mona in July, 1921. Bent refers to their breeding on Mona. The species lays one egg.

These great birds appear occasionally along the coasts of Porto Rico and the Virgin Islands, and August 1 I observed one in San Juan
harbor, where it soared around, hovering with evident interest above men at work on the water front. Native fishermen connect the presence of the man-o’-war bird with bad weather, as it is seen frequently along the coast during storms. Danforth reported these birds occasionally over Cartagena Lagoon and says that there is a breeding colony on an islet opposite Parguera.

The species is parasitic in its habits, and lives by robbing its neighbors, the terns and boobies, of their prey. At Louis Peña Island, on April 11, 1912, one picked up a tropic-bird that I had shot and carried it a few feet before dropping it into the water.

In addition to a pair that I collected on Desecheo, June 15, 1912, there is in the U. S. National Museum collection a female secured at Fajardo about February 13, 1899.

Order CICONIIFORMES
Suborder ARDEAE
Family ARDEIDAE
Subfamily ARDEINAE

Ardea herodias adoxa Oberholser

West Indian Great Blue Heron, Garzon Cenidiento, Garzon Cenizo, Yaguasa


West Indian Great Blue Heron, Danforth, Bird-Lore, 1924, p. 52 (two, Cartagena Lagoon, December 22, 1923).


Fairly common in the coastal region of Porto Rico (one seen near Martin Peña, below Río Piedras, January 2, 1912; vicinity of Mameyes, February 9 to 29, fairly common; two, Laguna de Guánica, May 26; one,
Cataño, August 1). Struthers records it at Anegado Lagoon and Boquerón, and Danforth recently has found it regularly at Cartagena Lagoon, where he collected a female February 27, 1924, and reports it also at Mayagüez, Toa Baja, Guayanilla, Boquerón and near Cabo Rojo Lighthouse. Dr. C. W. Richmond (MSS.) in 1900 saw one on March 3 near Luquillo, and several near San Juan on March 19. Newton many years ago reported it from St. Croix in March, April, June and August, and thought that it might breed. There are no recent records for that island, nor has the species been recorded elsewhere in the Virgin group, though it must occur on other islands.

Gundlach says that he has found young in November and fresh eggs in January, but does not state definitely that these records refer to Porto Rico. Indeed, they may represent observations elsewhere, since in the following sentence he cites localities that include the United States, Cuba, Jamaica and the Bahamas, in which he has seen the species. During the summer, in Porto Rico, this heron is limited in its range and, if it breeds, resorts to remote swamps. I saw birds at that season only at the Laguna de Guánica. Inland it is rare. From January 5 to 14, 1912, one was reported several times along the Río Caguítos near Caguas, but I did not see it.

This bird is found in open reaches amid mangrove swamps or in shallow bays or lagoons. Its large size distinguishes it from all other herons. Gundlach and Stahl had specimens, and Hjalmarson sent one, taken in winter, to Sundevall, but few modern collectors have reported skins. There are none from Porto Rico in the U. S. National Museum and, in fact, skins of the West Indian form of this heron seem rare in collections in general.

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<th>Ardea occidentalis</th>
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*Ardea occidentalis* Audubon, Birds Amer. (folio) 1835, Vol. 111, Pl. 281. (Keys near Key West, Florida.)


*Ardea occidentalis*, Cory, Auk, 1887, p. 324 (Porto Rico); Cat. West Indian Birds, 1892, p. 89 (Porto Rico).

Gundlach included this bird in his list from Porto Rico with the statement: "vi en la orilla de la laguna de Guánica una garza blanca que por su tamaño no puede ser otra que la especie *occidentalis* . Además me
aseguró mi amigo D. Tomas Blanco haberla observado en sus excursiones desde la capital.” In another place he remarks: “Ich sah einen sehr grossen weissen Reiher fliegend und später am Ufer der laguna gehend. Ich konnte ihn nur für occidentalis halten.” He examined no specimens and none have been reported as taken in Porto Rico. As the records are indefinite, the species is here indicated as of doubtful occurrence.

Gundlach’s observation at the Laguna de Guánica was made in November, 1873.

**Casmerodius albus egretta** (Gmelin)

_Egret, Garza Real, Garzon Blanco_


American Egret, Danforth, Bird-Lore, 1921, p. 52 (one, Cartagena Lagoon, December 22, 1923).


_Casmerodius egretta_, Struthers, Auk, 1923, p. 470 (Boquerón).

_Casmerodius alba_, Wetmore, Auk, 1925, p. 446 (bones from kitchen midden, St. Croix).

Found in small numbers in the coastal region of Porto Rico and reported from Vieques Island; seen on Piñero Island opposite Fajardo. During field work in 1912 birds were observed near Mameyes, February 9 to 29; on Piñero Island, off Fajardo, March 16; near Salinas, April 29 and May 2; Laguna de Guánica, May 26, and Cabo Rojo, August 26 and 30. Mr. F. A. Potts (in a letter dated August 5, 1923) reports seeing one in Guánica Bay. Danforth has recorded one from Cartagena Lagoon, and Struthers has found as many as ten at one time at Boquerón. I have identified remains of this species among bones from a kitchen midden on the Richmond estate near Christnsted, St. Croix, presented to the U. S. National Museum by Mrs. Hugo Hark. There is no modern record for the bird from this island.
In Comezon Cove, on the coast near Mameyes, I found, February 14, 1912, a nest in a clump of mangroves standing isolated in shallow water. The structure, a loosely made platform of sticks, held one young bird, apparently less than a week old, and two addled eggs. The young bird, a female, which was preserved as a specimen, is covered with long, straggling white down, elongated into a fuzzy crest on the crown. It exhibits the bare aterion on the back of the neck found in adult herons, and in addition has the foreneck, throat and face in front of the eyes entirely bare. An adult female with dorsal plumes fully developed was shot on February 14. There is also an immature bird in the U. S. National Museum, taken near Porto Real, January 27, 1899, by Dr. B. W. Evermann. Danforth says that the bird occurs regularly at Cartagena Lagoon, but is so shy that no hunter has ever succeeded in killing one. He saw it at Añasco, November 24, 1923; near Boquerón, March 8, 1924; near Cabo Rojo Light, April 26 and 27, 1924.

Gundlach recorded this species as very common, but since his day it has been sought for its plumes and now must be classed as rare.

The birds usually are shy and difficult to approach. They are seen ordinarily wading in search of food in shallow water or in flight at a distance. They come at times into wet lowland fields near the coast.

The species, pure white in all plumages, is distinguished from the snowy heron and the white phase of the little blue heron by its decidedly larger size.

_Egretta thula thula_ (Molina)

Snowy Heron, Garza Blanca


Snowy Heron, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).

Snowy Egret, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez).

_Egretta?,_ Newton, Ibis, 1859, p. 263 (St. Croix, reported).


_Ardea candidissima,_ Cory, Auk, 1887, p. 324 (Antilles); Cat. West Indian Birds, 1892, p. 89 (Porto Rico).


_Egretta thula thula,_ Wetmore, Auk, 1916, p. 410 (Vieques).

Resident on Porto Rico; seen on Piñero Island near Fajardo, and fairly common on Vieques; reported from St. Croix.
The snowy heron is found on Porto Rico among the lagoons in the coastal plain, in swampy areas near the mouths of rivers and about fresh-water lagoons. It is encountered usually near the coast, but after the breeding season wanders more or less casually inland to the foothills. On August 8, 1912, I saw one flying along the Río Vivi near Utuado. The species was recorded as follows:—

Along the Guajataca River at Quebradillas, July 5, 1912; Bayamón, July 20 and 23; Río Piedras, December 22, 1911; Mameyes, February 9 to 29; Humacao, September 3 to 9; Salinas, April 26 to May 2; Laguna de Guánica, May 26; Cabo Rojo, August 24 to 31; Aguadilla, June 11; Piñero Island, near Fajardo, March 16, and Vieques Island, March 16 to April 3.

The hand of the plume-hunter has been raised so persistently against this beautiful heron that it has maintained itself successfully only in the more inaccessible swamps, while in recent years its retreats have been curtailed through the activities of woodchoppers and charcoal-burners. I was informed in 1912 that snowy herons nested on Piñero Island, opposite Fajardo, and on low, mangrove-covered islands offshore from Salinas. At the end of April little bands were observed flying between these islands and the mainland, lending credence to this statement.

The snowy herons fed with other species in shallow water over the bays and reefs at low tide, or at the borders of lagoons, where they waded at times in water nearly up to their bodies. They also came frequently into lowland cane-fields, especially when these had been recently plowed, and occasionally were seen searching for food in dry, upland pastures. Their sad experiences with man have made them wary and suspicious and, when found with other species, the snowy herons are usually the first to take alarm. Danforth reports that the species seems to be increasing slightly in numbers—a matter for gratification, as it is an interesting and beautiful bird.

The species is marked by its pure white plumage and black legs.

The food consists of small fishes, aquatic insects, lizards, amphibians and crustaceans. It is probable that birds come to cultivated fields and pastures to search for the changa, or mole cricket, and other Orthoptera.

**Hydronassa tricolor ruficollis** (Gosse)

*Louisiana Heron, Garza, Garza de Cuello Rojo, Garza de Vientre Blanca*

_Egretta ruficollis_ Gosse, _Birds Jamaica_, 1847, p. 338. (Jamaica.)

*Louisiana Heron, Danforth, Bird-Lore_, 1924, p. 52 (Cartagena Lagoon).

*Dendrocygna ruficollis_, Guindach, _Journ. für Ornith._, 1874, p. 313 (recorded by Dr. Bello); _Journ. für Ornith._, 1878, pp. 161, 187 (Boquerón); _Anales_
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Ardea tricolor ruficollis, Cory, Auk, 1887, p. 327 (Greater Antilles); Cat. West Indian Birds, 1892, p. 89 (Porto Rico).

This heron is only fairly common in the bays and lagoons of the coastal region of Porto Rico. Gundlach found it very common at Boquerón, but did not record it elsewhere. On May 3, 1912, I shot an adult male at La Playita, near Salinas, and recorded several others. Struthers saw the species occasionally at the borders of mangroves, swamps and lagoons in western Porto Rico, but does not cite definite localities. Danforth found it in small numbers at Cartagena Lagoon, where he recorded young not quite grown on October 7, 1924. He found the species also at Anegado Lagoon, Caño Corazón, near Mayaguez, and at Boquerón.

This heron is about as large as the little blue heron, but is more slender, with longer neck and bill. It is distinguished by the pure white breast and abdomen, in contrast to the bluish-gray back and neck. A tuft of head plumes is mixed white and dark chestnut and the foreneck is mottled with white and dark reddish brown. The immature bird has the head and neck light brown.

The specimen that I secured was a breeding individual. Its stomach contained a goby and several killifishes.

Florida caerulea caerulescens (Latham)

Little Blue Heron, Garza azul, Garza, Garza Pinta, Garza Blanca

Ardea caerulescens Latham, Index Orn., 1790, Vol. II, p. 690 (Cayenne.)
Little Blue Heron, Danforth, Bird-Lore, 1922, p. 41 (Mayaguez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).
Common in Porto Rico. Recorded also from Vieques, Culebra, St. Croix and Tortola, and unquestionably occurs elsewhere.

Riley (Smiths. Misc. Coll., November 9, 1904, Vol. XLVII. p. 279) has separated the little blue heron of the West Indies from that of North America on the basis of duller coloration. Todd (Ann. Carnegie Mus., 1916, Vol. X, pp. 179-180) recently has considered the two identical, but in this, I believe, is in error. In this connection I have examined a large series from the islands between Cuba and Grenada, for purposes of comparison with birds from the southeastern United States, and find that those from the West Indies unquestionably average duller and darker, both above and below, than skins from Florida and South Carolina. In comparing these birds it must be recognized that fatty oils, when present on the feathers, darken their coloration perceptibly, so that examination of clean skins must be made. In such the distinction is easily perceptible. The West Indian bird will thus continue as Florida e. caerulea, while that of the United States will be known as F. c. caerulea. Material from Mexico and Central America has not been considered in this connection.

On Porto Rico the little blue heron was common near the coast in the vicinity of marshes and lagoons. It was not observed beyond the confines of the coastal plain and in 1913 was more abundant near Mameyes, Yabucoa and Guánica than elsewhere. It was the most common heron on Vieques, and a few individuals were recorded on Culebra. The species was found at the following localities:—

Along the Río Guajataca near Quebradillas. July 5, 1915; at Bayamón, July 20 to 25; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Salinas, April 26 to May 2; Juanita Diaz, August 17 to 22; Laguna de Guánica, May 26; Cabo Rojo, August 24 to 31; Añasco, June 7 to 12; Vieques Island, March 16 to April 3, and Culebra Island, April 5 to 21.

Gundlach found the little blue heron nesting from May to July, but modern dates differ, since I noted, February 9, near Mameyes nests that had apparently been built recently, and killed a breeding male on Vieques, March 29. A colony of one hundred fifty pairs was found.
near Yabucoa, May 8. The nests are loose structures of twigs placed in trees from twenty to thirty feet from the ground. When disturbed in this rookery, the birds circled in great confusion overhead, emitting harsh squawks, or settled on commanding dead limbs, where they might view the intruder.

In many regions herons were hunted as game, which rendered them wild, and in such cases it was difficult to approach them. Where undisturbed, they were, however, tame. Many were observed feeding on tidal flats when the water was low, retreating to the shelter of mangroves later. Others fed in cane-fields, where the growth was small, and occasionally they fed in dry pastures. From breeding colonies at times they traveled several miles to feed, and on many occasions were found in small flocks. After the nesting season they are more widespread in their distribution and pass inland to the edge of the foothills or occasionally, where the valleys are broad, wander back among the hills, as in August I saw individuals on the Guanajibos River below San Germán. At Cartagena Lagoon Danforth found young in white plumage appearing in August and becoming abundant in September.

This species, like the green heron, eats the changa, or mole cricket, as well as other Orthoptera, crustaceans, lizards, fishes and miscellaneous insects.

Cory reports it from Tortola, and Hans West, in 1794, records it from St. Croix. Mortensen also reports it from the latter island.

The plumage of the adult is bluish gray, with a wash of warm brown on head and neck. Some of the young are dull slaty gray and others are white, in which condition they may be distinguished from the snowy heron, of similar size, by the greenish tarsi and feet and by a wash of gray concealed on the tips of the primaries. Some young are curiously pied with light and dark.

**Butorides virescens virescens** (Linnaeus)

*Little Green Heron*


An adult male, taken at Fajardo, Porto Rico, February 16, 1899, has the following measurements: wing, 180 mm.; tail, 67 mm.; exposed culmen, 60.7 mm.; tarsus, 48.0 mm. This bird is somewhat larger than any other noted in Porto Rico and has been regarded as an accidental
visitor from North America. It is so included here, with the observation that a slight average difference in size is the main character to support separation of a West Indian form of the little green heron.

As at present accepted, the bird here under discussion represents the only record for the West Indies of the North American bird, which is supposed, however, to range in migration to Bermuda, where it is not at present known to breed.

**Butorides virescens maculatus** (Boddaert)

West Indian Green Heron, Green Gauin, Garling, Martinet, Martin Pescador

*Cancroena maculata* Boddaert, Tabl. Planch. Enl., 1783, p. 54. (Martinique, Lesser Antilles.)

Cuban Green Heron, Danforth, Bird-Lore, 1922, p. 41 (Mayaguez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Common on Porto Rico; recorded from Vieques, Culebra, St. Croix, St. Thomas, Anegada, Tortola, St. John and Virgin Gorda. Supposed
to be resident everywhere, and actually recorded breeding on Porto Rico, Vieques and St. Croix.

On Porto Rico the green heron (Pl. LXI) is distributed all through the coastal plain and is one of the most common of birds. During the course of my own field work it was noted in the following localities:—

Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Maunabo, May 11; Salinas, April 26 to May 2; Juana Díaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 12; Maricao, June 3; Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Aibonito, January 26 to February 5; Caguas, January 5 to 14; Vieques Island, March 16 to April 3, and Culebra Island, April 5 to 21.

Inland through the foothills green herons range along streams, being abundant to about 500 feet altitude (Caguas, Comerio, Ciales and Utuado). Above this they occur in small numbers but irregularly, being noted below Hacienda Catalina (on El Yunque), at Cayey, Aibonito (1900 feet), above Adjuntas (2000 feet) and near Lares and Maricao. Few of those found in the higher country appeared to be breeding birds, and after the breeding season individuals seem to wander inland from the coastal plain.

The irrigated lands of the south coast are peculiarly adapted to the needs of the martinete, and here it was found in numbers along ditches and channels through the fields. Near Yabucoa these birds were most abundant, and there on May 8 I estimated the number seen in the course of a forenoon as between 1500 and 2000 individuals. In dry regions, as near Quebradillas and many areas on the south side of Porto Rico, they were found mainly at the borders of streams, but occasionally searched for food in dry upland pastures.

On Vieques Island the species was fairly common about lagoons and on Culebra a few were noted in mangroves bordering the bay known as Ensenada Honda, and at Flamenco Lagoon.

The question of subspecies in the green heron has been discussed exhaustively by Oberholser (Proc. U. S. Nat. Mus., 1912, Vol. 42, pp. 529-577), with recognition of a subspecies cubanus from the Greater Antilles and a number of additional forms from the Lesser Antilles. With twenty skins, taken personally, available from Porto Rico, Vieques and Culebra, I have made critical comparison to determine their subspecific status. In color the series from Porto Rico is closely similar to skins from the eastern United States, but the Porto Rican birds are.
on the average, slightly smaller in size. (Wing measurement in ten males, 163.0 to 170.5 mm.; average, 166.9 mm.; in ten females, 158.5 to 175.0 mm.; average, 169.6 mm.)

Survey of the data offered by Oberholser fails to indicate, in my opinion, adequate grounds for segregation of birds from the Antilles into a number of races. The form from the Greater Antilles recorded formerly as Butorides virescens cubanus is here considered to range throughout the Antillean region and must, therefore, bear the older name, Butorides virescens maculatus.

The green heron may nest singly or in scattered colonies. A laying female was taken on Vieques Island May 27, 1912, and a male in breeding condition was shot on Culebra April 13. Breeding females were secured at Yabucoa on May 4. At this place, too, many occupied nests were observed. Nesting sites were chosen occasionally in clumps of bamboo but more often in mangroves and similar growth near the lagoons. Struthers has recorded, April 2, 1921, nests built among reeds at Guánica Lagoon—an unusual site for this species, which normally nests in trees, and due possibly to destruction of tree growth in its usual haunts. The nests are simple structures of twigs laid carelessly together. On May 8, 1912, near Yabucoa, I collected a set of three fresh eggs from a nest fifteen feet above the ground, in a thick tree at the border of a lagoon. Danforth states that the main breeding season is in April and May, but records one nest on November 30, 1923. He reports nests in bamboo and in coconut palms.

Green herons are nearly always tame, unsuspicous birds that seldom fly until closely approached, except in regions where they are much hunted. When flushed, they rise with a series of squawking notes, but before going far alight on the ground, on a fence post or the limb of a tree. Sometimes they endeavor to escape notice by drawing the body up, pointing the bill straight in the air and presenting the striped breast to the observer. In feeding they follow slowly along the borders of marshes and lagoons, seldom wading in the deeper water as the larger, longer-legged herons do, or walk along rows of cane in the cultivated fields. Open pastures are also favorite haunts. Here they work through the short grass, preferring the damper areas, but not neglecting those that are high and dry. Unless very hungry, they are rather slow and sluggish and may spend an hour or more standing wooden-like with the neck drawn in on the shoulders. Where the slopes along streams are steep and abrupt, as at Comerio, the birds do not go far into the fields, remaining close to the water. In more level localities they wander a great deal.
The ordinary note is a harsh squawk, though frequently they give a clucking note, especially after alighting from flight. A note of anger may be represented by Kek kek chuck chuck. A gunshot along a stream where they are common always calls forth a series of protesting squawks from birds hidden in clumps of bamboos or other tree growths at the edge of the water. At the end of the breeding season young birds are abundant and are harried and pursued continually by the adults, who fly after them in the air and run at them on the ground with open mouths, so that only in the bushes are they safe from attack.

From field observations it appeared that the breeding season may extend from February 1 to the end of May. The young are well grown by July 1.

The martine is one of the greatest enemies of the destructive mole cricket, or changa, as I found that this creature formed slightly more than one-half of the heron's food. The bird also consumes other Orthoptera, small fishes, crustaceans and amphibians. It has been hunted as a game bird in the past, but should be carefully protected as a valuable ally of agriculture. Its presence may be encouraged by leaving areas of thicket cover about lagoons, streams and ditches. Since the recent introduction of bamboo, the martine has taken kindly to this cover. It uses the dense clumps as resorts during the heat of the day and even nests in them.

The green heron exceeds the least bittern in size, but is smaller than any of the other herons of the region in question, as it is only sixteen to seventeen inches in length. In the adult the crown is greenish black, the back dark green, more or less washed with gray. The throat and foreneck are buffy white, on the latter more or less mixed with black, with the rest of the underparts dark gray. The neck, except in front, is deep rufous chestnut. Immature birds are streaked with blackish below and are less deeply colored above.

**Nycticorax nycticorax naevius** (Boddaert)

Black-crowned Night Heron, Yaboa, Yaboa Real

*Ardea naevia* Boddaert, Tabl. Planch. Ent., 1783, p. 56. (Cayenne.)
Black-crowned Night Heron, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December 22, 1923).


The present species, it is said, was at one time fairly common in Porto Rico, and specimens are recorded from the collections of Hjalmarson at Arecibo and Stahl at Bayamón (five specimens catalogued). Gundlach saw it in Hjalmarson’s possession, and later collected it personally. I did not find it but it has been recorded recently by Struthers, who saw six birds near Mayagüez, October 29, 1921, and noted others at Anegado Lagoon, near La Plata. Danforth has recorded one, April 8, 1922, at Cartagena Lagoon, and noted it as fairly common in 1923 and 1924. He collected one on June 28, 1924.

I have examined no specimens from Porto Rico. The immature bird of the present species is browner than the yellow-crowned night heron. The adult is nearly white below, gray on wings, tail and neck, with the back and crown dull black with greenish sheen. Long plumes springing from the back of the head are white. The eye of the adult is colored a deep red.

The black-crowned night heron deserves its name, in that it pursues its vocation of fisherman in the main by night, when its passage through the air to its fishing grounds, though concealed from ordinary view, is heralded by loud squawking calls. During the day it frequents dense tree growths in the fastnesses of swamps.

*Nyctanassa violacea violacea* (Linnaeus)

Yellow-crowned Night Heron, Yaboá, Yaboá Real, Guanába


*Nyctanassa violacea*, Bello, Zool. Gart., 1871, p. 350 (Porto Rico).—Cory, Auk, 1888, p. 48 (Porto Rico, St. Thomas, St. Croix); Auk, 1890, p. 375, (Virgin Gorda); Auk, 1891, p. 47 (St. Croix); Cat. West Indian Birds, 1892, p. 90 (Porto Rico, St. Thomas, Virgin Gorda, St. Croix).

Formerly common in coastal mangrove swamps and lagoons of Porto Rico, now reduced in numbers; recorded recently from Mameyes, Humacao and Salinas (Wetmore), and vicinity of Guánica (Struthers); a few in swamps at Manuel Qui and elsewhere in Vieques. Recorded by Bowdish as common on Mona Island, and found on St. Thomas, St. Croix and Virgin Gorda.

Bangs and Penard (Bull. Mus. Comp. Zool., April, 1918, Vol. LXII, p. 31) have separated the yellow-crowned night heron from Surinam as Nyctanassa v. cayennensis (Gmelin) on the basis of darker color and smaller size (wing in adult 252, tarsus 78, exposed culmen 78, one specimen), and have also designated the bird from the West Indies as Nyctanassa violacea jamaicensis (Gmelin), as they consider it separable from the typical form of North America by paler general coloration, with the gray edgings of the dorsal feathers lighter.

In a considerable series of the yellow-crowned night heron in the U. S. National Museum there are no pertinent specimens from South America. The measurements given for the single adult from Surinam are slightly less than those of other birds that I have handled, so that, without examination, cayennensis is held valid. It may be noted, however, that Todd (Ann. Carnegie Mus., 1922, Vol. XIV, p. 138) finds that skins from the Santa Marta region of Colombia are similar to those from North America.

After careful comparison of a good series, including adults from Andros Island, Cuba, Jamaica, Santo Domingo and Porto Rico, I can find no distinguishing characters of color or size to separate these from birds obtained from various localities in southeastern United States. There is considerable variation in depth of coloration in this species throughout its range, but this seems wholly individual. Adult males show the following measurements:

West Indies (Greater and Lesser Antilles), wing, 275–290 mm.; tarsus, 84.5–100 mm.

United States (Florida to Texas), wing, 275–300 mm.; tarsus, 94.0–101.4 mm.

The mainland bird may average very slightly larger, but the difference is so small as to be intangible.
Four adults from St. Eustatius, Barbuda, Grenada and Guadeloupe have the dark median lines on the dorsal feathers narrower than in the average specimens from other parts. With more material it is possible that a Lesser Antillean form may emerge, but it must be recorded that the skins in question are equaled in this character by an adult from the Tres Marias Island, off the western coast of Mexico. Other skins from Mexico and Central America to Darien are like those from North America. It appears to me certain that the yellow-crowned night heron from the Greater Antilles is identical with that of the North American continent, and it is so listed here.

The present species frequents mangroves and swampy forests, where it remains rather quiet during the day, becoming more active at nightfall. At Mameyes I flushed one from the top of a coconut palm, at Salinas birds were seen in mangrove swamps, and near Humacao I flushed a young bird from a ditch in a cane-field. On Vieques Island a few were seen in thick trees at the border of a dry lagoon. Struthers in 1923 recorded them from the lagoons of Guánica Valley and the coastal mangrove swamps, and Bowdish in August, 1901, found them common on Mona Island. In the Museum of Comparative Zoölogy there is a female from Bayamón, taken by Dr. Stahl. Bones were found in the kitchen middens of St. Thomas and St. Croix.

As late as the opening of the present century Bowdish recorded the yaboa as common, and its lessened numbers in recent years may be attributed to the fact that it is hunted as a game bird and to the cutting away of the cover of its native haunt.

The immature birds are grayer than the same stage in the black-crowned night heron and are also distinguished by their heavier bills. The adult in general is gray, strongly streaked with black on back and wings, with the head black except for the cheeks, crown and long slender muchal plumes, which are white.

Subfamily Botaurinae

**Botaurus lentiginosus** (Montagu)

American Bittern, Yaboa


Migrant straggler to Porto Rico, for it appears from published accounts that there are four definite records. Gundlach found it at the Laguna de Guánica in November, 1873, and, though he does not definitely say so, leads us to infer that he secured a specimen. He also records a skin in the collection of Blanco. More recently Struthers shot one, September 23, 1921, in a mangrove thicket south of Boquerón. Danforth saw one at Cartagena Lagoon on November 30, 1923.

The American bittern is somewhat larger than the night herons and is distinguished by its very buffy brown coloration, with a glossy black streak on either side of the neck and a plain brown crown.

Ixobrychus exilis exilis (Gmelin)
Least Bittern, Martinete Chico, Martinete


Porto Rico: locally fairly common in fresh-water marshes. Recorded at Anegado, Cartagena and Guánica lagoons, near Mayagüez, Arecibo and the Río Toa near Dorado. There are two skins, taken by Dr. A. Stahl, in the Museum of Comparative Zoology that are marked Bayamón, and there is a specimen in the U. S. National Museum secured at Porto Real on January 27, 1889. Mr. F. A. Potts (in litt. May 15, 1921) found the least bittern fairly common near Aguirre, and recorded it at a reservoir three miles west of Guayama, April 22, 1921. Danforth found it fairly common at Cartagena Lagoon.

The least bittern prefers for its habitat fresh-water marshes. There it is found usually amid rushes and grass growing in one or two feet of water. At the approach of an intruder it sometimes remains motionless,
with bill pointed straight in the air. Its appearance at such times is so unbirdlike that it may be overlooked. At other times it is extremely wild and rises in flight at a considerable distance. The bird flushes with dangling legs and outstretched neck, but at once the feet are extended straight behind, the neck is folded, and the bird flies rather swiftly away over the marsh vegetation to drop into securer cover. When not alarmed, it rests quietly in the rushes or clammers about with extraordinarily long strides, grasping the vertical plant stems with its long, slender toes. On May 26, 1912, I found least bitterns fairly common at the Laguna de Guánica and collected three. One was flushed, December 22, 1911, in a mangrove swamp on the coast below Río Piedras and was shot, but fell where it could not be retrieved. The unusual environment suggests that this bird may have been a migrant.

The food of this species is made up of small fishes, amphibians and occasionally insects.

Gundlach secured three eggs from a nest at Arecibo on May 7, and Struthers found eggs at Guánica on April 2, 1921. F. A. Potts writes me that he noted a young bird covered with pin feathers in a nest at a reservoir near Guayama on April 22, 1921. Danforth reports nests from Cartagena Lagoon, April 11 and May 9, 1924. These contained from two to three pale bluish-white eggs. Two collected on May 9 measured 1.30 x 0.95 inches (33 x 24 mm.). The nest is a slight cradle of reed stems placed in a clump of rushes.

The least bittern of the West Indies appears slightly smaller than that from eastern United States and may prove to be a distinct form. In three males the wing measures 101.7, 106.6 and 108.0 mm., while in four females it is 100.4, 109.3, 110.5 and 112.2 mm. respectively.

The species in Porto Rico is easily distinguished as the smallest of the herons, marked by buffy underparts, which in females and young are more or less streaked. In the adult male the crown and back are greenish black, while in females and young these areas are rich brown.

Suborder CICONIAE
Superfamily THRESKIORNITHIDES
Family Threskiornithidae
Subfamily Threskiornithinae

[Plegadis falcinellus falcinellus (Linnaeus)]
Glossy Ibis, Coco, Coco Oscuro, Coco Prieto

Tantalus falcinellus Linnaeus, Syst. Nat., ed. 12, 1866, Pt. 1, p. 241. (Austria, Italy.)


The first notice of this species for Porto Rico is that of Bello, who cites it in a list without comment.

Gundlach included it in his various papers, as he found it pictured in the drawings of birds made by Dr. Bello, of Mayagüez. No specimens have been recorded and the species is of doubtful occurrence.

Guara alba (Linnaeus)

White Ibis, Coco Blanco


Eudocimus albus, Gundlach, Journ. für Ornith., 1874, p. 313 (reported); Journ. für Ornith., 1878, pp. 161, 157 (reported, east coast); Anales Soc. Esp. Hist. Nat., 1878, p. 364 (reported, northeast coast).—Stahl, Faun. Puerto Rico, 1883, p. 64. (listed); Ornis, 1887, p. 452 (rare).


Accidental in Porto Rico.

Dr. Richmond in 1900 found a mounted specimen of the white ibis in the Stahl collection in San Juan—the only definite basis for the inclusion of the species in the avifauna of Porto Rico. The species was reported to Gundlach, but he did not see it personally.

Suborder PHOENICOPTERI

Family Phoenicopteridae

Phoenicopterus ruber Linnaeus

Flamingo, Flamenco

Phoenicopterus ruber Linnaeus, Syst. Nat., ed. 10, 1758, Vol. 1, p. 139. (Jamaica, Cuba and Bahamas.)


Formerly found on the south coast of Porto Rico (Boquerón); reported as of former occurrence on Vieques, Culebra, St. Croix and St. Thomas.

Gundlach records the flamingo at Boquerón, and heard rumor of its presence elsewhere on the south coast and to the eastward in Porto Rico. Ledru states that birds were found near Río Loisa. Hans West in 1794 writes admiringly of their plumage as seen on Vieques and in 1912 I heard rumor of their occurrence there. Formerly, it is said, the flamingo ranged to Culebra, where a large lagoon today is known as Flamenco. The Newtons heard of the bird on St. Croix, and call attention to the name "Flamingo-pan Bay" on St. Thomas as further indication of its presence. There seems to be no mention of specimens unless Gundlach secured some, which is not certain. Mortensen reports a specimen in the Zoological Museum at Copenhagen, taken on St. Thomas in 1852, and heard of the species on Anegada.

Order ANSERIFORMES
Suborder ANSERES
Family Anatidae
[Subfamily Anserinae]

[Chen atlantica] Kennard

Greater Snow Goose, Ganso Blanco, Guanana


Perhaps a rare winter visitant in Porto Rico. Several reports of wild white geese came to Gundlach’s attention, and I was told such birds came at times to the lagoons at Manati. No specimens have been preserved and the species is here cited as of uncertain status.]
Subfamily Dendrocygninae

Dendrocygna arborea (Linnaeus)

West Indian Tree-Duck, Black-bellied Tree-Duck, Yaguasa, Chiriria


Lowland regions of Porto Rico, where it was formerly common; now locally fairly common; recorded from St. Croix and Virgin Gorda. Gundlach found this duck very common, and mentions especially that he saw it near Mayagüez, Arecibo and the Laguna de Guánica. During my work on the island I did not succeed in locating it, though it was reported to be in the mangrove swamps near Mameyes. Struthers has been more fortunate, as he noted four at Anegado Lagoon on December 3, 1921, and took two eggs and two nestlings from a hollow in a dead tree at this point on December 18, 1922. He also saw six that were held as captive birds near Cabo Rojo. Danforth found the tree-duck fairly common at Cartagena Lagoon, where it came to feed regularly at night, according to native reports, at times in flocks containing from twenty-five to one hundred birds, and was occasionally flushed in the marshes during the day. He was told that a second species occurred rarely, but this must be considered doubtful until substantiated by specimens. The
only other tree-duck recorded from the West Indies is the white-faced species (*Dendrocygna viduata*), which has been recorded casually from Cuba. I have identified bones of this species from cavern deposits near Uruado and Morovis.

The Newtons said the species was in their day fairly common on St. Croix, and record a male taken July 21 and a female September 17, 1858. There are no other known records for the island. Cory lists the species for Virgin Gorda without comment, probably quoting Salvadori, who noted in the British Museum a juvenile specimen from Virgin Gorda taken by Cyrus Winch.

This duck inhabits forested swamps and at times is found in mangroves. It is reported as inactive during the day, but flies at dusk, when it attracts attention by its shrill whistling calls. It is said to feed regularly on the fruit of the royal palm.

The species is distinguished by its habit of alighting in trees, by its long neck and legs and dark-brown plumage, with whitish lower breast and abdomen heavily spotted and barred with black.

**Subfamily Anatinae**

**Mareca americana** (Gmelin)

*Baldpate, American Wigeon, Pato Lablanco*


Rare winter visitant. The only record for Porto Rico based on a specimen is that of one in the collection of Hjalmarson, presumably shot somewhere near Arecibo. Danforth records ten on February 27 and March 1, 1924, and a pair on March 11, at Cartagena Lagoon. Newton remarks that Riise secured one on St. Thomas, and Bent lists the bird from St. Croix.
This duck is distinguished from others found in this area by its very small bill and extensive white on the wings.

**Dafila acuta tzitzihoa** (Viellot)

Pintail, Pato Pescuezilargo, Pato Silvestre


Pintail, Danforth, Ööllogist, 1922, p. 177 (one, Lajas, April 8, 1922).


Apparently of rare occurrence in Porto Rico. Gundlach’s records are conflicting. In 1874 he said that he saw one in the collection of Hjalmarson. (Sundevall, however, did not record it.) In the Journal für Ornithologie for 1878 Gundlach notes that this bird was shot by a friend, who described it to him; in another paper, written in Spanish, in the same year, he says that the bird was killed near Arceibo, but that he did not see it.

Danforth saw a male at Cartagena Lagoon on April 8, 1922; six on February 15, 1924; ten on February 27 and two on March 11, 1924. None were taken. In my first list I included the pintail as a hypothetical species, but in view of Danforth’s records I have admitted it to the list.

**Dafila bahamensis bahamensis** (Linnaeus)

Bahama Pintail, Bahama Duck, Pato de la Orilla, Pato Criollo, Pato de Florida


Bahama Duck, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December 22, 1923).

Dafila bahamensis, Cory, Auk, 1888, p. 62 (Antilles); Auk, 1890, p. 373 (St. Thomas, specimen); Cat. West Indian Birds, 1892, p. 86 (Porto Rico, St. Thomas).


Resident and breeding in the lowlands of Porto Rico. Recorded from Culebra, Culebrita and St. Thomas.

Guendlach found this species at Boquerón and saw a specimen taken by Blanco near San Juan. Struthers noted it breeding at Anegado Lagoon, where he recorded a nest with twelve eggs, February 18, 1922, and Danforth has described it as common at Cartagena Lagoon. Cyrus S. Winch collected a specimen on the island of St. Thomas. I found it breeding commonly at the Laguna de Guánica on May 26, 1912, and on April 9 examined two breeding birds in very worn plumage shot at Playa Brava, on Culebra Island. Others frequented the Flamenco Lagoon in company with lesser scaup ducks. On April 15 I shot eight from a flock of twenty-five on a nearly dry lagoon on Culebrita Island. The birds were resting quietly on a mudbank and seemed little alarmed at the noise I made in working through the mangroves to a point within range. Their flight was rapid, and on the wing their long necks made them resemble the ordinary pintail. The flock circled swiftly over the dead birds several times before departing. The series taken includes five males and two females in breeding condition and an immature female able to fly though not quite grown.

At the Laguna de Guánica pairs or single birds rose from growths of grass and rushes standing in water and circled swiftly about. One female attempted by the usual broken wing ruse to lead me from a brood of recently hatched young, but I succeeded in capturing two before the youngsters disappeared in the rushes. (My earlier statement that these young were about five days old was in error.) Their call was a low peep peep. The adults call softly when in company, as do many related ducks. Natives reported to Danforth that this duck nests in grassy fields some distance from water. At Cartagena Lagoon he found young unable to fly on October 7, 11 and 17 and December 11, 1923.

This duck is the most common of the resident ducks of the island. It is easily distinguished by the prominent white of cheeks and throat, in sharp contrast to the dark crown, and by the light-brown tail. The base of the bill bears in life a spot of bright red.

The species should be guarded carefully against eggers during the breeding season.

The genus Poecilonetta, which is in common use for the Bahama pintail and its relatives, is currently said to be separated from Dafila by a difference in the relative width of the speculum and the light tip at the end of the secondaries, and by the amount of concavity of the culmen.
On examination of skins I find that in *Dafila acuta*, *D. spinicauda* and "*Paecilonetta* galapagensis" the speculum is broader than the light tip at the end of the secondaries, in *bahamensis* the two are about equal, and in *erythrorhyncha* the speculum is narrower than the light tip. In *acuta* the concavity of the culmen from a straight line representing its chord runs from 2 to 2.6 mm.; in *spinicauda*, from 2.2 to 3 mm.; in *bahamensis*, from 2.4 to 3 mm.; in *galapagensis*, from 2 to 3 mm.; in *erythrorhyncha*, from 2 to 2.3 mm. As there is evident no line of demarcation, I have united the two supposed groups under the name *Dafila*.

**Querquedula discors** (Linnaeus)


Blue-winged Teal, Danforth, Oölologist, 1922, p. 176 (abundant near Lajas, winter); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Regular winter resident in lagoons on coastal plain of Porto Rico (Anegado and Cartagena lagoons, near Lajas, and San Juan). Not recorded as yet from other islands.

Potts found this species near Central Aguirre, March 25, 1923. Struthers notes that the birds arrive in October (earliest date, October 8, 1921) and the majority depart in March, and he states that they come from the North in bands containing as many as three hundred individuals that break into smaller groups. Danforth recorded their presence near Boquerón until April 8, 1922, when 250 were seen. He saw 275 on Cartagena Lagoon December 22, 1923, and more than 1,000 at Anegado Lagoon on March 4, 1922. In 1924 he noted the last at Cartagena on May 2, and the first in the fall on September 6. They were common from December to April.

This teal inhabits fresh or brackish waters and may be expected in any of the lagoons of the Porto Rican lowlands. It is reported as rang-
ing through the Antilles, but has not yet been recorded from the Virgin Islands.

The species is distinguished by its small size and the pale blue color on the bend of the wing.

**Spatula clypeata** (Linnaeus)

Shoveller, Spoonbill, Pato Cuchareta, Pato Inglés


Shoveller, Danforth, Oölogist, 1922, p. 177 (near Lajas, one seen April 1, 1922).


Winter visitor to Porto Rico, where it is not uncommon; one record for St. Thomas. According to Gundlach the shoveller comes to Porto Rico in the fall and remains until April. Danforth has recorded one at Cartagena Lagoon, May 30, 1924, and another questionably at Anegado Lagoon, April 1, 1922. Struthers saw six on Anegado Lagoon, February 18, 1922.

Newton noted a specimen killed on St. Thomas by Ruise.

The species, differentiated from all other ducks by the greatly expanded bill, is an inhabitant of lakes and ponds.

**Subfamily Fuligulinae**

**Nyroca affinis** (Eyton)

Lesser Scaup Duck, Pato del Medio, Pato Silvestre, Pato Morisco

*Fuligula affinis* Eyton, Mon. Anatidae, 1838, p. 157. (North America.)

Lesser Scaup Duck, Danforth, Oölogist, 1922, p. 177 (recorded through winter to March 4, 1922, near Lajas); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).

**Aythya affinis**, Cory, Auk, 1888, p. 65 (Porto Rico, St. Croix); Auk, 1890, p. 373 (specimen, St. Thomas); Cat. West Indian Birds, 1892, p. 87 (Porto Rico, St. Thomas, St. Croix, Virgin Gorda).


Porto Rico, regular winter visitant from December to the first part of March; taken on St. Thomas by Cyrus Winch; reported from Vieques and St. Croix; ducks of this species noted by author on Culebra.

The lesser scaup is one of the common migrant ducks that comes to the lagoons of Porto Rico during winter, where it is recorded regularly from December to March. A few linger apparently through the summer, for at the Laguna de Guánica, on May 26, 1912, I shot a female and saw a dozen other ducks that I believed to be this species. On Culebra ducks that all seemed to be this species were recorded on the lagoon known as Flamenco. During the first part of April I saw about twenty-five, but on April 19, my last visit, there remained only eight. The bird taken at Guánica was a cripple unable to fly.

There are two skins in the Carnegie Museum taken at Loiza, Porto Rico, on February 11 and 12, 1912, by W. W. Worthington. Danforth found this duck common at Cartagena Lagoon, where he reported its arrival September 23, 1924, and noted the last on May 16, 1924. He has recorded it on Guayabal Reservoir.

The lesser scaup frequents open water in the large lagoons and ventures near shore only at night or in the early morning. Its food is secured mainly by diving.

In the adult male the head and neck are black glossed with purplish, and the back and scapulars are crossed by wavy bars of black and white. Immature males and females are brown, with a light mark at the base of the bill. The wing speculum is white.

**Nyroca collaris** (Donovan)

Ring-necked Duck, Pato del Medio, Pato Silvestre


**Aythya collaris**, Cory, Auk, 1888, p. 66 (Porto Rico); Cat. West Indian Birds, 1892, p. 87 (Porto Rico).


Accidental in Porto Rico.

Gundlach says that Blanco killed this species near San Juan. All published notes refer to this record.

The species is generally similar to the lesser scaup duck, but has the wing speculum gray.

**Charitonetta albeola** (Linnaeus)

Bufflehead, Pato Pinto


Casual in Porto Rico. Dr. C. W. Richmond in 1900 found in a collection in San Juan a mounted bird taken by Stahl, which constitutes the only record for the island. Gundlach secured a bird many years ago in the market at Havana, Cuba—the only other West Indian record.

**Subfamily Erismaturinae**

**Erismatura jamaicensis jamaicensis** (Gmelin)

West Indian Ruddy Duck, Pato Chorizo


Ruddy Duck, Danforth, Oologist. 1922, p. 177 (found on lagoons as late as June 28, 1922); Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December 22, 1923).—Potts, Auk, 1927, p. 120 (Guayama to Guánica).

**Erismatura dominica?** Newton, Ibis, 1859, pp. 367-368 (St. Croix, refers to ruddy duck, not to the masked duck).

**Nomonyx dominicus**, Cory, Cat. West Indian Birds, 1892, p. 87 (St. Croix; apparently citing Newton as above).


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**Erismatura jamaicensis jamaicensis** (Gmelin)

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Ruddy Duck, Danforth, Oologist. 1922, p. 177 (found on lagoons as late as June 28, 1922); Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December 22, 1923).—Potts, Auk, 1927, p. 120 (Guayama to Guánica).

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**Nomonyx dominicus**, Cory, Cat. West Indian Birds, 1892, p. 87 (St. Croix; apparently citing Newton as above).


Resident in Porto Rico (recorded from Cartagena, Anegado and Guánica lagoons, Guayabal Reservoir, and near San Juan). Potts (in litt., September 18, 1921) reports it in numbers from July 15 to September 3, 1921, on fresh-water ponds near the Central Aguirre. He alludes to it as the commonest duck between Guayama and Guánica. Danforth in 1922 reported it to the Biological Survey from lakes near Boquerón, where it was common as late as May 28. Newton found a band of ducks on St. Croix that he called the masked duck, but from his detailed account they appear to have been this species.

Gundlach, in November, 1873, found the species in abundance at the Laguna de Guánica and recorded it as breeding. Stahl also stated that it nests. During a visit to Guánica on May 26, 1912, I failed to find it, and in my previous account of the birds of Porto Rico considered the species doubtfully resident. Its breeding in Porto Rico is now established by Struthers, who located twenty-two nests at Anegado Lagoon between December 1, 1921, and March 1, 1922. Downy young were observed February 18, 1922, and sets of eggs recorded contained as many as twelve eggs. The eggs are of very large size compared with the bulk of the duck and resemble small goose eggs.

Danforth secured several specimens of this duck and on comparing them critically with birds from North America separated them as a new species, which he named Erismatura alleni. He distinguished alleni from the bird of North America on the basis of shorter wing and tail and the lack of eclipse plumage.

Through the kindness of Dr. Arthur A. Allen, I have had the privilege of examining a series of six of Danforth’s birds, including the type of alleni, now in the museum of Cornell University. The male ruddy duck of North America molts in fall into a dark plumage that is maintained for several months and corresponds to the eclipse dress of males of many other species of ducks, which usually lasts for a few weeks only, during the period of wing molt. Danforth’s statement that the ruddy duck in Porto Rico does not possess this eclipse is seemingly open to question. In one of his specimens, an adult male taken at Desengaño, Porto Rico, March 1, 1924 (Cornell University Museum No. 2482), which is in molt with wing quills about half grown and tail in process of renewal, I find that somewhat more than half of the red feathers of the
breeding plumage remain. The incoming growth of the new plumage is
dark, not red, so that partly grown feathers of a dusky hue are scattered
among the older ones of red color on the foreneck, sides of neck, back and
sides. Nowhere do I find newly growing feathers that are red. This
specimen is evidently in molt into an eclipse plumage. It is not im-
probable that this molt is irregular in appearance, as Porto Rico exhibits
little seasonal variation through the year. This would account for high-
plumaged males at all seasons. The matter should be further investi-
gated.

Comparison of a series of ruddy ducks does not reveal as great differ-
ence in size for the West Indian bird as Danforth has noted. There is
much variation in depth of red in breeding males, many birds from
scattered localities in North America being as dark as the few seen from
the West Indies. According to my measurements, in seventeen breeding
males from Oregon, Utah, Arizona, Mackenzie, Alberta, Manitoba and
North Dakota, the wing ranges from 137.0 to 148.0 mm. (average,
142.2), the culmen from base 37.2 to 42.9 mm. (average, 40.9) and the
tarsus 33.1 to 36.0 mm. (average, 33.7). In two males from Porto Rico
the wing ranges from 134.7 to 136.8 mm., in three the culmen from base
runs from 39.8 to 42.6 mm. and the tarsus 31.6 to 32.4 mm. A male
from Spanishtown, Jamaica, has the wing 139.4 mm., the culmen 41.1
mm. and the tarsus 32.6 mm.

In sixteen females, taken in the breeding season from California, Utah,
New Mexico, Arizona, North Dakota and Pennsylvania, the wing ranges
from 133.7 to 148.0 mm. (average, 139.7), the culmen from base 39.0
to 43.0 mm. (average, 40.8) and the tarsus from 31.0 to 34.0 mm.
(average, 32.3). In one female from Porto Rico the wing measures
132.2 mm., while in two the culmen runs from 41.0 to 42.0 mm. and the
tarsus from 30.0 to 32.4 mm. A female from Grenada has the wing 130.0
mm., culmen 40.1 mm. and tarsus 31.2 mm.

In all these the length of tail is disregarded, as the rectrices in this
species are subject to such great wear that their measurement has little
value.

Judging from the data above, the West Indian birds are seemingly dis-
tinguished from the North American group by slightly lesser size on
the average—a distinction that does not appear when single skins are
examined. The difference is 5 per cent or less, and is the only basis for
differentiation of the two forms, which thus appear poorly characterized.

Though the West Indian bird may be recognized as slightly different,
the name Erismatura aleni becomes a synonym of Erismatura jamaicen-
sis jamaicensis, since the latter has Jamaica as its type locality, and a
skin from Jamaica in the U. S. National Museum does not differ from those from Porto Rico that were examined. The North American bird will be known on this basis as Erismatura jamaicensis rubida (Wilson).  

The ruddy duck is short and compact in body, with a thick, heavy neck and broad bill. It frequently swims about with the tail spread and held up at an abrupt angle with the line of the back—a peculiarity that serves to distinguish it from other ducks (except possibly from the masked duck) at a distance where colors cannot be seen. It prefers to swim or dive to escape enemies and, when forced to flight, spatters along, kicking the surface of the water with its large feet for a considerable distance before it is able to rise. Unlike most of our ducks, the male ruddy does not have an enlargement of the trachea at the side of the syrinx, but instead has developed an air-sac, connected with the trachea, that distends the entire neck. The North American bird has many peculiar mannerisms during the breeding season, and no doubt the southern representative of the species will repay watching during the nesting period.

Danforth has given an interesting account of the ruddy duck on Cartagena Lagoon, where he found it common and estimated that in 1924 one hundred pairs or more were breeding. He came upon nests from December to May, but most of the birds were breeding from February to May, with March as the height of the season. The nests were bulky masses of sedge and grass-stems, usually placed in clumps of sedges growing in water a foot deep, but occasionally floating, or at times built where the marsh was nearly dry. From four to eight eggs constituted the usual set, though he was told of one clutch of twenty-two found near Cabo Rojo. The eggs are white and measure from 62 x 48 to 65 x 50 mm. The birds were much disturbed by eggers and were hunted incessantly. They were even pursued with dogs when they were in molt and unable to fly, as at this period all the flight feathers are lost simultaneously.

The throat and back in the male of this species are rufous-chestnut, and in the female grayish brown. The bird is characterized in any plumage by the stiffly pointed tail-feathers and the very short upper coverts.

**Nomonyx dominicus** (Linnaeus)

Masked Duck, Pato Dominica, Pato Chorizo


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2 *Anas rubidus* Wilson, Amer. Ornith., 1814, Vol. VIII, p. 128. Pl. 71, Fig. 5. (Delaware River.)


Formerly of rare occurrence in Porto Rico; now perhaps extinct. A record for St. Croix by Cory apparently is based on Newton, who seems to have mistaken the ruddy duck for this species. Gundlach recorded skins in the collections of Hjalmarson, Blanco and Stahl, taken at Arecibo and San Juan. At one point, in speaking of this species and the ruddy duck jointly, he says: “Ich fand sie in Guánica,” but apparently was referring only to the latter species, since in his more comprehensive paper, published in Spanish, he states distinctly that he did not see the masked duck during a week spent at the Laguna de Guánica.

The species inhabits fresh-water ponds and lakes, where abundant aquatic growths afford it cover.

It is similar in appearance to the ruddy duck, but is smaller and is distinguished by the white spot on the wing and by the darker crown, which is black in the adult male.

Order FALCONIFORMES
Suborder CATHARTAE
Family CATHARTIDAE

Cathartes aura aura (Linnaeus)

Turkey Vulture, Aura, Aura Tíaosa

Vultur aura Linnaeus, Syst. Nat., ed. 10, 1758, Vol. I, p. 86. (State of Vera Cruz, Mexico.)

Turkey Vulture, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Established in the Guánica Valley, Porto Rico; recorded north to Añasco and east to Salinas; seen casually on the summit of the Mata Platano, above Adjuntas.
The turkey vulture, it is said, was brought to Porto Rico from Cuba many years ago by Spanish governmental agencies, and has established itself in the southwestern corner of the island, where it is increasing very slowly if at all. The statement sometimes made, that these birds were brought in by the Guánica Central, seems without foundation. Gundlach in 1874 is emphatic in his statement that the species does not occur, and as he spent a week in November, 1873, at the Laguna de Guánica, it must be concluded that the birds were introduced at a later date, for they are too conspicuous to be overlooked. They must have made their appearance soon after his visit, however, as an old man living at Yauco told me that he had known them all his life. Mr. A. B. Baker (MSS. notes), who recorded several near Guánica in the latter part of January, 1899, seems to have been the first naturalist to observe them.

In May, 1912, I noted them regularly over the dry limestone hills above Guánica, and heard report of them from Añasco to Yauco, mainly over the coastal plain, though I was told that one had come to feed on a dead animal exposed on the summit of the Mata Platano, above Adjuntas. Mr. H. S. Brandon (in a letter to W. V. Tower, dated January 26, 1912) states that he saw buzzards on a number of occasions near Santa Rita, Fraternidad and Limón.

On May 22, 1912, I shot two adult females in the section known as La Paloma, a short distance southwest of Yauco, and preserved them as specimens. As I skinned them, I counted sixteen others circling above me and was inclined to estimate the total number here at about twenty-five. Since that time they seem to have increased somewhat, for Struthers in 1922 estimated that about fifty inhabited the Guánica Valley. He noted one near Añasco, June 13, 1921, and one at Ponce, December 23, 1921, as the only birds recorded outside the area mentioned. Danforth reports that seventeen is the largest assemblage that he has seen near Cartagena Lagoon. Potts has found the turkey vulture frequently near Santa Isabel, and once near Salinas, and reports twenty in one flock at Tallaboa.

The two females taken have wing measurements of 495 and 500 mm. respectively, and in size and color are representative of typical *auru*

The turkey vulture soars easily on graceful wing in a manner that characterizes it readily, even when so far distant that its head, bare of feathers, may not be seen. It feeds on carrion and gathers in rookeries to roost at night. Its large brown-spotted eggs are laid in the shelter of some overhanging rock, in a small cave or in the hollow of a tree. Reports that this bird is responsible for dissemination of diseases among
domestic stock are wholly without foundation and it should be protected as a useful species.

Suborder FALCONES
Superfamily FALCONIDES
Family Accipitridae
Subfamily Accipitrinae

**Accipiter striatus venator** Wetmore

Porto Rican Sharp-shinned Hawk, Haleon


Porto Rico, rare; apparently confined to a small area in the forested hills above Maricao. Formerly the bird must have had a much wider range, though the only certain evidence of this is afforded by a few bones taken from a cave near Morovis.

On May 30, 1912, while I was descending the Cerro Gordo above Maricao, a small hawk soared over my head through an opening in the forest with something in its talons. I killed it by a quick shot, expecting to secure a sparrow-hawk, and was astonished, when my boy brought the bird to me, to discover that it was a fine sharp-shin, which proved to represent an undescribed form; the genus had not been recorded previously from the island. A second bird was seen on the same day, and a third I shot in the same locality on June 4, but lost it. Struthers records specimens from this region taken November 11 and December 26, 1921.

The species is distinguished from the sparrow-hawk by its blackish brown upper surface, finely barred lower parts and long, square-ended tail. The one taken had eaten a Latimer’s vireo and a honey creeper, so that apparently the species has the same food preferences as have the related forms.

Subfamily Buteoninae

**Buteo borealis jamaicensis** (Gmelin)

West Indian Red-tailed Hawk, Guaraguou, Guaraguou de la Sierra, Lechuza


Fairly common resident on Porto Rico, particularly in hilly regions; a few found on Vieques and Culebra. Formerly ranged to St. Croix, as among bones from a kitchen midden near Christianssted, St. Croix, presented to the U. S. National Museum by Mrs. Hugo Hark, there are a few remains of this species. It has not been recorded in life from the island last mentioned.

During my field work the red-tailed hawk was recorded from the following localities:—

Manati, July 7 to 11, 1912; Toa Alta, August 2; Mameyes, February 9 to 29; Maunabo, May 11; Salinas, April 30 and May 1; Juana Diaz, August 22; Yauco, May 16 to 28; Maricao, May 29 to June 5; Lares, June 22 and 26; Utuado, August 5 and 9; Adjuntas, August 10 to 16; Ciales, July 15; Aibonito, January 26 and 29; Comerio, July 27; Cayey, January 18 to 25; Caguas, January 8; Hacienda Catalina, below El Yunque, March 2 to 11; Vieques Island, March 16 to April 3, and Culebra Island, April 5 to 21.

In considering the status of the present subspecies I have had available thirty skins, all of which, except as specified, are in the U. S. National Museum: Jamaica (Spanishtown, Hartford), five (one in Museum of Comparative Zoology); Haiti (Sanchez, El Rio, Saona Island, Constanza and Chocó, Dominican Republic; Moline, Morne de St. Vincent, Moustique, Gonave Island and Jeremie, Haiti), nineteen (one in Museum of Comparative Zoology); Porto Rico (Manatí, Mayagüez, Utuado), five (one in Carnegie Museum), and Vieques Island, one. These indicate that the form from the islands in question differs from *Buteo b. borcalis* in smaller size and heavier markings on the under surface, which form a distinct patch across the lower breast and upper abdomen, with the dark markings on the throat also more pronounced. Five males from Porto Rico and Vieques have the wing measurement varying from 325 mm. to 344 mm. (average, 335 mm.), while in one female the wing measures 367 mm.
Buteo tropicalis Verrill is a synonym of jamaicensis of Gmelin, since birds from Jamaica, Haiti and Porto Rico appear identical.

The red-tailed hawk is found wherever tracts of forest clinging to the sides of hills afford it secure aeries, but where the slopes of the land are gentle, with resultant clearing away of the trees to permit cultivation, it is rare or absent. It follows that it is most common in the region of limestone hills and where forests are still found in the mountains. In habits and notes it is identical with the red-tails of the United States. In the cooler portions of the day it is seen circling on broadly extended wings above the hills, occasionally screaming shrilly kee-ee-ee you, a wild cry that carries for long distances. During the warmer hours it remains on perches among the trees. It is wary, as natives kill it to eat and shoot it on every occasion. One secured for me by my friend the padre at Adjuntas was eaten by peons while the padre was busied in another part of his finca.

On January 18, 1912, I saw one carrying material to a nest on Mount Pelado near Cayey, and from then on until June the birds were observed in pairs and all seemed to have nests. A young bird only recently grown was killed at Manati, July 11, and another young bird recently from the nest was recorded at Juana Diaz, August 22. Struthers reports a nest with two eggs on April 16, 1921, near Mayagüez.

According to the country people, the red-tail takes many chickens. As it is the custom to allow domestic fowl to run at distances from houses, such depredations would not be surprising. The hawk is also reported to eat rats and lizards. The latter must have formed a considerable part of its food before the advent of the white man brought other animals for its sustenance.

This hawk is distinguished by its large size, dark patch in the center of the lower surface and reddish-brown tail in the adult.

Its common name is guaraguou, an Indian cognomen that has survived in modern parlance. Many of the country people call it lechuza, which properly signifies an owl.

**Buteo platypterus platypterus** (Vieillot)

Broad-winged Hawk, Guaraguou de Sabana


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Buteo latissimus, Cory, Auk, 1887, p. 40 (Porto Rico); Cat. West Indian Birds, 1892, p. 99 (Porto Rico).

Buteo platypterus platyptenis, Wetmore, U. S. Dept. Agric. Bull. 326, 1916, p. 32 (listed; Utuado). Rare in Porto Rico; according to Gundlach, formerly common, but now perhaps extinct on this island.

The status of the present species is somewhat uncertain. Gundlach indicates that he took specimens, but does not say so definitely, nor did Stahl have it in his collection, though he listed it as a rare migrant. Dr. C. W. Richmond is certain that he saw one near Utuado on April 6, 1900, but did not secure it. There appear to be no specimens from Porto Rico extant, nor has the species been recorded by recent observers.

In general appearance this species is similar to the red-tailed hawk, but lacks the reddish-brown tail in the adult and is much smaller, being only sixteen inches or slightly less in length.

Subfamily Circinae

Circus hudsonius (Linnaeus)
Marsh Hawk


Danforth records a hawk of this species as seen from November 30 to December 27, 1923, at the Cartagena Lagoon. The bird, which was apparently immature, was not taken. Potts reports two on January 6, 1923, north of Central Aguirre. The marsh hawk can be only a casual visitant to Porto Rico; for, though it goes regularly to Cuba and the Bahamas, it is not known to range elsewhere in the West Indies.

It is a hawk of large size, distinguished by its long tail and white rump, that flies near the ground over marshes.

Subfamily Pandioninae

Pandion haliaetus carolinensis (Gmelin)
Osprey, Aguila marina, Guincho


Pandion haliaetus, Wetmore, Auk, 1925, p. 446 (bones from kitchen midden, St. Croix).

Winter visitant from North America in small numbers to the coasts of Porto Rico, Mona, Vieques and Culebra; formerly at least to St. Croix.

The osprey was first recorded for Porto Rico by Moritz in 1836, but was not seen by Gundlach, who recorded it in his lists on the authority of Blanco. Stahl noted it as a migrant at the mouths of rivers, but never penetrating far inland, and secured a female. Bowdish recorded four birds on Vieques, and secured one December 31, 1899. In 1901 he also examined the foot of one killed on Mona Island.

Near Mameyes, in February, 1912, I found a few individuals at the playá, where they perched on stakes in the water or circled, screaming shrilly, in the air. A male taken here February 12 is in partial molt. At Culebra Island I recorded them on April 8 and 17.

Mr. F. A. Potts has written me that he saw the osprey near Aguirre from October, 1920, to June 6, 1921; it may remain, therefore, late in spring. Danforth noted one on Boquerón Bay, March 22, 1922, and at Cartagena Lagoon on March 11 and September 27, 1924, and Struthers secured one two miles east of Boquerón on January 15, 1921.

The Newtons were uncertain as to its occurrence in St. Croix, but recently I identified bones of this species in material presented to the U. S. National Museum by Mrs. Hugo Hark from a kitchen midden on the Richmond estate near Christiansted—proof of the former occurrence of the bird.

The osprey is a bird that soars on broad pinions above coastal lagoons or bays; it preys on fish, which it secures by swiftly darting into the water and grasping its finny prey in its strong, rough-surfaced feet to carry it off to some perch where it may be devoured. The bird is distinguished by the pure white underparts, with occasionally a spot of
brown on the breast, blackish upper surface, and white marks on the head and nape. It is marked by a strong oily odor that never leaves the feathers, as I have found it persistent in birds that have been mounted for sixty years.

**Family Falconidae**

**Subfamily Polyborinæ**

**Polyborus latebrosus** Wetmore

Porto Rican Caracara


The caracara of Porto Rico is an extinct species, known only from a broken metacarpal (Figs. 2 and 3) and part of an ulna found in cave deposits near Utuado. It is hoped that further search will bring to light additional specimens. The material indicates merely that the bird from Porto Rico is intermediate in size between *Polyborus cheriway* and *P. plancus*.

These carrion hawks are so well fitted for life in an area like Porto Rico that it is difficult to understand why they should have become extinct. The species must have lived until pre-Columbian times.

**Subfamily Falconinæ**

**Falco peregrinus anatum** Bonaparte

Duck Hawk, Gavilán, Halcón de Patos

*Falco anatum* Bonaparte, Geog. and Comp. List, 1838, p. 4. (Egg Harbor, New Jersey.)

Duck Hawk, Danforth, Oologist, 1922, p. 177 (a few near lagoons, winter; Lajas, April 1, 1922).


Rare migrant and winter resident about larger lagoons in the coastal plain of Porto Rico. Recorded on St. Croix, and one taken by Cyrus Winch on Virgin Gorda. Stahl records a specimen from Porto Rico without giving definite data, and Gundlach notes that he saw one repeatedly at the Laguna de Guánica in November, 1873. Struthers shot a male at Anegada Lagoon on December 3, 1921, and observed the species during winter at that point and at Cartagena Lagoon. His earliest fall record is August 8, 1921. Danforth found it an irregular winter resident at Cartagena Lagoon and saw it April 1, 1923, at Anegada Lagoon. The Newtons, from St. Croix, describe the sternum and other bones of one wounded in the autumn of 1856 and kept alive for some time. Edward Newton noted a bird that he supposed to be this species on March 17, 1858.

The duck hawk is a large species that flies with great dash and vigor. It usually frequents large bodies of fresh water where waterfowl abound, and strikes terror into ducks, gallinules, coots and shore-birds, as it kills them for food with the greatest ease.

In the adult the upper surface is dark-bluish slate color, while in the immature it is brownish black. The underparts are cream buff or darker, streaked, spotted or barred with black, with a prominent mark of black below the eye. The long pointed wings and swift graceful flight differentiate it from other large hawks of this region.

Falco columbarius columbarius Linnaeus

Pigeon Hawk, Gavilán

Pigeon-hawk, Danforth, Oölogist, 1922, p. 177 (Quebradillas, April 12, 1922); Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December 22, 1923).

Hypotriorchis columbarius, Gundlach, Journ. für Ornith., 1874, p. 310 (specimen taken by Hjalmarson); Journ. für Ornith., 1878, pp. 158, 163 (female taken, Quebradillas; seen Laguna de Guánica); Anales Soc. Esp. Hist.


A rare migrant and winter resident in Porto Rico. Noted from St. Thomas and Virgin Gorda.

Sundevall lists a specimen taken by Hjalmarson, and Gundlach collected one at Quebradillas and saw the species at the Laguna de Guánica. Stahl had two specimens in his collection. Dr. Richmond saw a hawk at the Hacienda Catalina in March, 1900, that he believed to be this species, and on November 8, 1920, Struthers collected a male near Mayagüez. Danforth has reported it from Quebradillas, April 12, 1922; Sabana Grande, April 25, 1924, and La Plata, December 14, 1923, and March 29, 1924, and found it regularly in winter at Cartagena Lagoon (earliest October 24, 1924; latest, April 18, 1924). There are three males in the collection of the Carnegie Museum taken at Fajardo, Porto Rico, on February 21 and 26 and March 7, 1912, by W. W. Worthington.

The pigeon-hawk is a true falcon that preys extensively on birds. Although similar to the sparrow-hawk in size, it differs wholly in the lack of reddish brown on the back, the adult being slaty gray and the young dusky brown, with the underparts cream buff, streaked with black. The common name in English is given on account of its resemblance to a pigeon both in flight and repose, particularly when viewed at a distance.

**Falco sparverius caribaearum** (Gmelin)

Antillean Sparrow Hawk, Killi-Killi, Halcón


Porto Rican Sparrow-hawk, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Falco caribbacarum, Cory, Auk, 1890, p. 374 (Anegada); Auk, 1891, p. 48 (St. Croix); Cat. West Indian Birds, 1892, p. 99, 139, 140 (Porto Rico, St. Thomas, St. Croix, Tortola, Virgin Gorda, Anegada).


Common resident on Porto Rico, generally distributed, but on the north coast more abundant in the foothills. Recorded during personal field work as follows:—

Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Bayamón, July 24 and 25; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Aguadilla, June 11; Lares, June 18 to July 1; Adjuntas, August 10 to 16; Aibonito, January 26 to February 5; Cayey, January 18 and 22; Hacienda Catalina, below El Yunque, March 2 to 11.

The species was common on Vieques Island from March 16 to April 3, and on Culebra from April 5 to 21. It is recorded from St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda and Anegada.

Mr. J. H. Riley (Smiths. Misc. Coll., November 9, 1904, Vol. XLVII, p. 284) separated the sparrow hawk from Porto Rico and the Virgin Islands as a subspecies loquacula (type locality Vieques Island), which he considered distinct from the Lesser Antillean form caribbacarum in
deeper brown on the breast, dark back, less heavily barred tail and back, and under wing coverts more spotted with black; females darker above, with more pronounced rufous spot on head and more heavily marked below. In the list of the birds of Porto Rico published in 1916 I accepted this race as valid, but on reexamination with more extensive material I find that the supposed differences are not constant. The birds from Porto Rico and the Lesser Antilles must, therefore, all be known as *caribaearum*.

Individual variation is considerable. The series examined at this time includes the following eighty-four specimens:

<table>
<thead>
<tr>
<th>Location</th>
<th>Males</th>
<th>Females</th>
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<tbody>
<tr>
<td>Porto Rico</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Vieques</td>
<td>5</td>
<td>1</td>
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<tr>
<td>Culebra</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>St. Croix</td>
<td>2</td>
<td>2</td>
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<tr>
<td>St. Thomas</td>
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<td>Anegada</td>
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<tr>
<td>Saba</td>
<td>1</td>
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</tr>
<tr>
<td>St. Bartholomew</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Guadeloupe</td>
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<td>6</td>
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<td>St. Eustatius</td>
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</tr>
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<td>1</td>
</tr>
<tr>
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<td>3</td>
<td>5</td>
</tr>
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</tr>
<tr>
<td>Dominica</td>
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</tbody>
</table>

In Porto Rico the sparrow hawk was most common in dry areas of open brush and was found in greatest abundance on the south side. A few were observed in coconut groves on the north coast, but the species was more common in the hills above an altitude of one thousand feet.

Like all sparrow hawks, this form watches for prey from commanding perches. It is often common in coffee plantations, and the spike projecting from the summit of the royal palm is always a favorite perch. The call note is a rapid *killy killy killy* and the flight fairly swift. The bulk of the food is made up of Orthoptera, including the destructive changa, or mole cricket, as well as mice and a good many of the abundant lizards of the genus *Anolis*. Sparrow hawks were observed on a number of occasions dashing at woodpeckers or blackbirds and one examined nests of the cliff swallow along a rock ledge. Mr. A. B. Baker saw one strike an aní. Such actions seem due in many cases more to petulance or exuberance of spirit than to a desire to kill, as sparrow hawks were
seen on several occasions dashing at soaring red-tailed hawks, which they could not hope to harm. In the stomachs of the forty-eight sparrow hawks that I examined I found remains of only two birds, and with the exception of the ground doves small birds paid little attention to them.

The nesting season began in April and extended through May and June. Breeding females were taken on Culebra Island April 6, 17 and 19, and at Salinas, Porto Rico, April 30. Nests were located in holes in palms or other trees; several adults (both male and female) taken in the breeding season had the tips of the rectrices much abraded from friction in or about the nesting cavity. Gundlach states that they deposit from three to five eggs, but the largest family that I observed myself consisted of three young. The young, when first emerging from the nest, seem to feel the heat of the sun and seek perches sheltered from its rays.

These falcons are often very tame and during the breeding season scold vociferously at all intruders.

The sparrow hawk, but little larger than the blackbird or thrush, is easily recognized by its bright brown back, more or less barred with black.

Order GALLIFORMES
  Suborder GALLI
  Superfamily PHASIANIDES
  Family Perdicidae
  Subfamily Odontophorinae

**Colinus virginianus virginianus** (Linnaeus)

Bob-white, Quail


*Ortix virginianus*, Newton, Ibis, 1859, pp. 254-255 (St. Croix, introduced);
Ibis, 1861, p. 114 (introduced, St. Croix).

*Colinus virginianus*, Cory, Birds West Indies, 1889, pp. 223-224 (St. Croix, after Newton).

St. Croix, introduced.

The Newtons, writing in 1859, state that the quail had been introduced into St. Croix about fifty years before by one of the governors, and that the birds had become very numerous. They bred from the end of April to the middle of July and laid from twelve to fifteen eggs. Since that day the species has entirely disappeared from this island, as there are no further reports of its occurrence there.

There is possibility that the records here given should be cited under
the Cuban quail introduced in Porto Rico, as no skins have been
examined. I know of no specimens extant from St. Croix.

Colinus virginianus cubanensis (Gould)

Cuban Quail, Codorniz

(Cuba.)

601 (Porto Rico, many specimens).

Ortyx virginianus cubanensis, Gundlach, Journ. für Ornith., 1874, p. 313
(Porto Rico, introduced; specimens in collection of Hjalmarson); Journ.
für Ornith., 1878, pp. 161, 186.

duced, Porto Rico).

Ortyx cubanensis, Stahl, Faun. Puerto Rico, 1883, pp. 62, 149 (two specimens,
Porto Rico).

Colinus cubanensis, Cory, Auk, 1887, p. 223 (Porto Rico); Birds of West
Indies, 1889, p. 223 (Porto Rico).

Colinus cubanensis, Cory, Cat. West Indian Birds, 1892, p. 96 (Porto Rico).

Colinus virginianus cubanensis, Bowdish, Auk, 1902, p. 360 (Mayagüez, seen).—

Porto Rico, introduced. Probably now extinct.

According to Gundlach, the Cuban quail was brought to Porto Rico
from Cuba by Don Ramón Soler, who established it in the Hacienda
Santa Ines near Vega Baja, perhaps about 1860. Gundlach examined a
specimen in the collection of Hjalmarson in Arecibo that had been sent
to Hjalmarson, but does not seem to have found the bird himself. Stahl
listed a male and a juvenile specimen in his collection, but informed Dr.
Richmond in 1900 that he believed the bird had been exterminated.
Bowdish flushed one on a hillside near Mayagüez, but did not secure it.
There are no further records known to me.

Eupsychortyx sonnini sonnini (Temminck)

Crested Quail

(French Guiana.)


(St. Thomas, specimens).—Newton, Ibis, 1860, p. 308 (St. Thomas, speci-
men).—Cory, Cat. Birds West Indies, 1892, p. 96 (St. Thomas).—Hartert.

Ortyx sonnini, Newton, Ibis. 1861, pp. 114-115 (St. Thomas).
Euphyctcolorix sonnini sonnini, Todd, Auk, 1920, p. 201 (St. Thomas, specimens).

Introduced in St. Thomas; formerly common, present status uncertain.

Cassin, in 1860, recorded specimens taken by Robert Swift, with the statement that "Mr. Swift has had the kindness to inform me that this species was introduced into the Island of St. Thomas some years since from Venezuela, and that it has now become of frequent occurrence, quite naturalized, and rearing young freely throughout the island." Knox in 1852 recorded "quail" as very rare. There are no recent published accounts that mention the species; therefore, its present status is in doubt.

Todd has identified three skins from St. Thomas that he personally examined as pertaining to the typical subspecies, E. s. sonnini. This quail is smaller in size than the bobwhite and is heavily mottled with brown, black and white. It is easily distinguished by its slender crest.

The crested quails merge so gradually with the smooth-headed species that the two groups are of doubtful generic distinction. It is probable that Euphyctcolorix eventually will be considered merely a subgenus of Colinus.

Family Numididae

Numida galeata Pallas

Guinea Hen, Guinéa, Gallina de Guinéa, Pintado


Introduced in Porto Rico; formerly common, but now of doubtful occurrence except under domestication. Ledru informs us that guinea fowl were brought to the Antilles as early as 1508, and that he found
them established there at the time of his voyage. Moritz, in 1836, recorded them from the mountains of Porto Rico, and it was reported to Sundevall in 1869 that they were not rare. Gundlach found them and notes a specimen; he remarks that they sometimes cause damage in banana plantations by destroying the fruit. Stahl had a specimen in his collection, and, according to manuscript notes received from Dr. Richmond, shot one at Cabo Rojo years ago. Dr. Richmond, in 1900, noted one in a collection of mounted birds in San Juan. Bowdish, in 1900 and 1901, reported the species as common in certain localities.

In 1911 and 1912 I was told that guinea fowl still ranged in areas of natural forest on the Cerro Gordo and Monte del Estadio above Maricao, in Caguana near Barros, and on El Yunque de Luquillo. They were extremely shy and I saw none. They may still exist in the larger forest areas, though doubt attaches to their present status.

The feral guinea fowl of the Antilles has been described as darker than the bird found in domestication. I have seen no specimens from Porto Rico.

In Lares, in June, 1912, I was shown a hybrid produced by a cross between a male guinea fowl and a domestic hen, a bird of curious appearance, larger than a guinea and with long neck, small head, drooping tail, and a mottled brown coloration. It was said to call somewhat like a guinea, but its note I did not hear. Such crosses are reported frequently from eastern Brazil, where they are well known.

Dr. Hartert\(^5\) has indicated that the ordinary guinea fowl must be known as *Numida galeata* Pallas, since *Phasianus meleagris* Linnaeus of 1758 (which antedates *Numida meleagris* Linnaeus 1766) refers to the species that has been called previously *Numida philorhyncha* Lesson, and must be transferred to that form.

Order MEGALORNITHIFORMES
Suborder MEGALORNITHES
Superfamily MEGALORNITHIDES
Family ARAMIDAE

*Aramus pictus elucus* Peters
Limpkin, Carrao, Guareao


Porto Rico; resident, now rare. The only locality where the limpkin has been definitely known to exist in recent years is on the Hacienda Jobo between Utuado and Arecibo. In 1912 Mr. Leopold B. Strube, of the plantation in question, told me a dozen pairs were living there in a small tract of natural forest, and presented me with a specimen taken in June. In the Carnegie Museum is a male secured likewise at this place, May 20, 1912, and marked "through kindness of Mr. Leopold Strube." In addition to these, there are in the collections of the U. S. National Museum two skins secured by Latimer in the sixties.

The bird was reported in 1912 from the lower slopes of El Yunque above Rio Grande, and among the peaks of El Guílar or west of Adjuntas. The latter locality may be uncertain, as natives are prone always to attribute some rare bird to a locality difficult of access. Gundlach records the species near Lares, Quebradillas and Utuado, and said that it nested in December and January.

The species is ibis-like in appearance, slightly more than two feet in length, glossy olive-brown in color, streaked on head, neck and body with white. It is found in wooded swamps or marshy savannas, where it feeds largely on snails. At the approach of anyone it rises with a curious flight in which the extended wings are checked slightly at each upward stroke, so that the method of wing movement suggests that of some huge butterfly. The limpkin is given its native name of Carrao in imitation of its cry.

The stories told me to the effect that the limpkin runs through wet growth in early morning until its feathers become too wet for flight, with the result that it may be run down and captured by hand, may apply properly to the large flightless rail, Nesotrichis debooyi, since in my experience the limpkin is a bird that is heron-like in its alertness and takes to wing at any immediate danger.
Superfamily RALLIDES

Family RALLIDAE

Subfamily RALLINAE

Rallus longirostris caribaeus Ridgway

Caribbean Clapper Rail, Pollo de Laguna, Pollo de Manglar


Porto Rico, Vieques, Culebra, St. Thomas, St. Croix; resident.

The clapper rail in this region is found in the mangrove swamps and, so far as I am aware, does not range elsewhere. Though common in some localities, it is so shy that it is seldom seen. Its presence is usually indicated by its grunting calls from the depths of the swamps, or by its long-toed tracks in soft mud, often made at night in open runs where it does not venture to appear by day.

Near Mameyes, on February 12, 1912, while watching for birds in a mangrove swamp, I secured a clapper rail as it slipped like a gray shadow through the muddy aisles of its haunt. The birds were numerous here, but in spite of long watching I saw no others. In the swampy region called La Playita, at Salinas, from April 26 to May 2, I was more fortunate. Here I found clapper rails abundant and secured eight specimens (six on April 29 and two on May 2). As the growth of mangroves covering the swamp in this area was fairly open, the birds were easily seen. Their calls came to me constantly and their tracks covered the mud everywhere. At times they were observed feeding in fairly open stretches and occasionally were noted swimming across small pools to reach desirable cover on the opposite side. When forced from shelter
in small isolated clumps of bushes, they sometimes ran swiftly, with long strides and head held well forward, across open spaces, perhaps pausing to look back curiously from the safety of a distant cover, or again flew with slow, direct flight to safer quarters. At times, when they were really frightened, the flight was fairly swift.

At this period the birds were breeding. On May 2, I secured a young bird about ten days old, coal-black in color, with stocky legs and big feet. On this occasion, too, an adult and six or eight small young were seen picking their way across the mud; at a slight noise all disappeared in the brush.

A specimen was taken at the border of a small lagoon north of Manatí, July 8, and calls and tracks of clapper rails were recorded from the mangrove swamps in the vicinity of Cabo Rojo. One bird was seen south of Aguadilla, June 11. Gundlach found the clapper rail near San Juan, Boquerón and Cabo Rojo; Bowdish secured it on San Juan Bay, and there is a skin in the U. S. National Museum obtained at San Juan, January 4, 1899, by J. D. Milligan. Struthers found a nest containing eight eggs near Boquerón, September 23, 1921.

On Vieques Island, in the latter part of March, 1912, I saw tracks of these birds in mud at the border of lagoons, and on Culebra Island from April 5 to 21, I found clapper rails common in the narrow fringe of mangroves bordering the bay called Ensenada Honda. Their loud, explosive calls came from the swamps all day long, but I saw only one individual, an adult male, that I collected, April 11, after waiting a half hour for it to appear.

The Newtons report the species as breeding in fair numbers at a large lagoon in the south of St. Croix. Cassin notes specimens sent from St. Thomas by Robert Swift, but errs in calling the birds migrants from the United States. There is one skin in the U. S. National Museum taken on St. Thomas by F. A. Ober.

Comparison of skins from Porto Rico, Culebra and St. Thomas indicates that these differ from two examined from Jamaica (type locality of *caribaeus*) in decidedly grayer, less buffy coloration both above and below. I marked them in 1912 as "*caribaeus*" pending the appearance of a revision of the species by Dr. Oberholser, and for this reason still record them here also under the same heading. Skins from Culebra, St. Thomas and Porto Rico seem to me closely similar.

The food of these rails, so far as may be judged from the eleven stomachs that I examined, is composed principally of Crustacea, mainly of the abundant fiddler crabs (*Uca pugnax rapax*). This rail is of some
importance as a game bird and should be carefully protected during the breeding season, which seems to extend from February to September.

The clapper rail is brownish above, with dark-centered feathers edged with gray; the throat is white, the breast is buffy brown and the flanks are barred with black. It is about as long as a coot, but has a more slender body.

**Porzana carolina** (Linnaeus)

*Sora, Gallinula, Gallareta Chiquita, Gallareta de Cienaga, Dagaretilla*


*Sora Rail, Danforth, Oölogist, 1922, p. 177 (Porto Rico, common, winter); Bird-Lore, 1924, p. 52 (Cartagena Lagoon, December).*


Porto Rico; regular winter visitant. As the species is recorded from St. Bartholomew, Grenada and Barbadoes, it may be expected to occur casually at least in the Virgin Islands.

The sora rail has been recorded in Porto Rico as a winter visitant from October to April, and at times has been common. Danforth reported it at Cartagena Lagoon until April 8 in 1922, and April 18 in 1924, and recorded fourteen birds on December 22, 1923. His earliest fall record is October 14, 1924. Struthers reports it from the large lagoons of western Porto Rico until March 25, 1921, while during the fall of that year it arrived from the north on October 8. F. A. Potts has seen it near Aguirre, March 28, April 17 and November 13, 1921. On March 5, 1900, Dr. C. W. Richmond collected a specimen at Luquillo, Porto Rico, but was unable to skin it because of illness. In the U. S. National Museum is an adult secured from Latimer, marked as from the northern side of Porto Rico. Newton tells us that on St. Croix a female was brought to him alive on April 24, 1858.

The species resides in marshes, usually where the water is not deep. There it flushes to fly for short distances with dangling feet.
The back is olive-brown, with black centers to the feathers that produce a spotted appearance, and the sides of the back are streaked with white. The breast is gray or brownish gray, the abdomen white, and the sides are barred heavily with black and white. It is about eight inches long. Adult birds have the throat black—a mark lacking in immature individuals.

**Porzana flaviventer hendersoni** Bartsch

Yellow-bellied Rail, Gallareta Chiquita, Gallaretilla


Yellow-bellied Rail, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico; resident.

This small rail is found in marshes, in heavy aquatic growth, where it so readily escapes attention that it is probably less rare than the few records of its occurrence indicate. On May 26, 1912, at the Laguna de Guánica, I flushed two of these birds from plants growing in two feet of water at the border of a small, open pond. They rose quickly, flew high and swiftly for rails, and dropped into a dense growth of cat-tails, where they were lost to view. On July 23 one was shot, but lost in a similar situation, at the border of a small pond near the Bayamón River, a short distance from Bayamón. Mr. F. A. Potts, in a letter dated May 15, 1921, informs me that on November 14, 1920, he flushed one at the edge of a fresh-water swamp a mile north of Aguirre. Danforth noted the species regularly at Cartagena Lagoon.

Thomas Barbour, in his Birds of Cuba (Mem. Nuttall Ornith. Club, No. 6, June, 1923, p. 55), states that, though considered rare, the Cuban form of this little rail in reality swarms in extensive bonnet beds in Lake Ariguana and the ponds of the Cienaga. When frightened, the birds hop into a bonnet leaf and hide until assured that danger is past. He secured a series by beating this cover with a long bamboo and flushing the rails, when they afforded a quick shot. Similar methods might
reveal their presence in Porto Rico in greater numbers than is supposed to be the case.

The nest of this species, so far as I am aware, is unknown. In the U. S. National Museum there is one skin from Porto Rico, without definite data, from the Bryant collection.

Through the kindness of the authorities of the Museum of Comparative Zoology, I have had for examination from their collections a fine series of eighteen skins of this species, which have been supplemented by six in the U. S. National Museum. This material is distributed as follows: Surinam, 2; Cuba, 8; Jamaica, 11; Haiti, 2; and Porto Rico, 1.

The birds from Surinam, which may be assumed to represent typical Porzana flavigaster flaviventer (Boddaert), are generally similar to those from the West Indies, but have a much deeper wash of buff on the breast and foreneck. Barbour has indicated that the bird from Cuba and Jamaica may be called Porzana flavigaster gossei (Bonaparte).

In the series available I find that in birds from Cuba and Jamaica the wing ranges from 65.1 to 71.4 mm., with an average of about 67 mm., and the culmen from 16.2 to 17.9 mm. In two skins from Haiti, which are similar in color to those of Jamaica and Cuba, the wing measures 62.0 and 63.5 and the culmen 14.6 and 15.9 mm., respectively. On this slight difference in size Porzana flavigaster hendersoni Bartsch may be held as valid. One bird seen from Porto Rico, from the old Bryant collection, measures: wing, 61.0; culmen, 16.3 mm. It belongs thus with hendersoni, which on this evidence seems to be the form of Porto Rico. With larger series the supposed form from the eastern Greater Antilles may merge with P. f. gossei.

In addition to its tiny size, the yellow-bellied rail is distinguished by its whitish underparts, with a faint wash of buff on the breast and heavy bars of black on the flanks and under tail-coverts. Above, it is deep buff and black, streaked somewhat with white, and has a dusky crown. It is only from five to six inches in length.

**Creciscus jamaicensis jamaicensis** (Gmelin)

Black Rail, Gallaretilla


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Nesotrochis debooyi Wetmore

De Booy's Rail

Known only from bones taken from kitchen middens on the shore of Magens Bay, St. Thomas, near the mouth of Salt River, and on the Richmond estate near Christiansted, St. Croix, and from caves in the vicinity of Morovis and Utuado on Porto Rico.

This remarkable flightless rail (Figs. 4 to 8), discovered during archeological investigations by the late Theodoor de Booy, of the Museum of the American Indian, in New York City, has been represented subsequently in kitchen midden material from the Richmond estate on St. Croix, presented to the U. S. National Museum by Mrs. Hugo Hark. Cave remains extend its range to Porto Rico and eventually it may be discovered elsewhere. It was described originally from femora and tibio-tarsi, while more recent finds have included humeri (which are so slight as to make it certain the species was truly flightless), and parts of a pelvis and metatarsus.

Nesotrochis seems to have been allied to the wood rails of the genus Aramides, though quite distinct from them in the more robust legs and weakened wing. It was about as large as a small domestic fowl.

That the flesh of this rail was prized by Indians seems certain from
THE EXTINCT DE BOY'S RAIL (Xenotrichis dehooii)

Fig. 4 (upper left).—Left tibio-tarsus. Internal view. Natural size. From cavern deposits of Cueva San Miguel.

Fig. 5 (upper right).—Left tibio-tarsus. Anterior view. Natural size. From cavern deposits of Cueva San Miguel.

Fig. 6 (upper middle).—Left femur. Anterior view. Natural size. From cavern deposits of Cueva Clara.

Fig. 7 (lower left).—Left humerus. Anterior view. Natural size. From Cueva San Miguel.

Fig. 8 (lower right).—Left humerus. Posterior view. Natural size. From Cueva San Miguel.

(Courtesy American Museum of Natural History.)
the abundance of its bones in the vicinity of ancient residence sites. None of the remains known seem particularly old, and it is possible that the species was in existence in small numbers during historic times. While in Porto Rico, in 1912, I was told that in earlier days the natives were accustomed to hunt a large bird known as the _carrao_ on foot with dogs in the early morning when vegetation was drenched with heavy dew. As the bird fled from its pursuers through the grass and fern, its feathers in a short time became so thoroughly soaked that it was unable to fly and eventually was tired out and captured alive. The _carrao_ of today is the limpkin (_Aramus pictus elucus_), a species that, like a heron or ibis, flies at the slightest alarm to a safe distance. It is so strong on the wing that one can hardly imagine its becoming so wet as to be unable to fly, which opens the interesting supposition, mentioned more briefly on an earlier page, that the _carrao_ of earlier days may have referred to the large flightless rail.

Where bones of any description are found in caves or kitchen middens, they should be saved for study in the possibility that they may fill some of the many gaps in our knowledge of this and other species.

**Subfamily Gallinulinae**

**Ionornis martinicus** (Linnaeus)

Purple Gallinule, Gallareta Platanera, Gallareta Martiniqueña, Gallareta, Dagareta


Purple Gallinule, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon, Porto Rico).


*Ionornis martinica*, Cory, Cat. West Indian Birds, 1892, p. 91 (Porto Rico).

Porto Rico, resident. Formerly common, now seemingly rather rare. Taylor in 1864 recorded the purple gallinule, and Gundlach, a few years later, also found it common. It was taken by all the early naturalists, and Hjalmarson, of Arecibo, forwarded seven skins to Sundeval. In more modern times the species became less numerous. Dr. Richmond, on March 3, 1900, observed the bird among mangroves near Luquillo, and F. A. Potts, in a letter dated May 15, 1921, informs me that he saw one in a pool in the Guaimini River bed, about two miles south of Guayama, on May 9, 10 and 13, 1921. Struthers has found it recently at Anegado and Cartagena lagoons. At the latter locality Danforth has found it fairly common but very shy. He reports nests in April and May and again in September and October, so that these birds appear to have two breeding periods in the year. The majority of the nests that he found were placed in clumps of cat-tails from two to six feet from the water. He found from two to six eggs in a set and describes them as light buff with blotches and spots of rufous brown and pale lavender. They measure from 1.60 x 1.15 inches to 1.70 x 1.20 inches (40.6 x 29.2 mm. to 43.2 x 30.5 mm.).

In the Museum of Comparative Zoology there are two skins from Porto Rico, one secured from Dr. Stahl and another (received from the U. S. National Museum) taken by G. Latimer. In the collections of the U. S. National Museum are three old skins, including two immature specimens secured from Latimer, and an adult from the Bryant collection. For none of the five mentioned are there definite data.

The present species is of a form similar to that of the common gallinule, but is smaller, and is marked in the adult by the rich purple of the breast and neck, and the green of the back.

_Gallinula chloropus portoricensis_ Danforth

_Antillean Gallinule, Gallareta de Agua, Yagareta, Dagareta, Gallinaza_

_Gallinula chloropus portoricensis_ Danforth, Auk, 1925, p. 560. (Cartagena Lagoon, Porto Rico.)

_Fulica chloropus, West, Beytr. Beschr. St. Croix, 1794, p. 243 (St. Croix)._


Resident in Porto Rico; recorded from Vieques, Culebra, St. Croix and St. Thomas.

On Porto Rico in 1912 I found this gallinule near Añasco, June 8; Joyuda, August 24 to 31; Bayamón, July 24; Laguna de Guánica, May 26, and Yabucoa, May 3 to 8. The species is reported as abundant at Cartagena and Anegado lagoons, and is recorded from the Rio Arecibo, Aguadilla, Mayaguez and Cabo Rojo Lighthouse. It is reported reliably from Vieques, and I secured a specimen on Flamenco Lagoon. Culebra Island, on April 19, 1912, where I considered it migrant. Newton reported it as breeding commonly on St. Croix, and Swift sent a specimen from St. Thomas to Cassin.

When compared in series, gallinules of this species from the Antilles (and Bahamas) differ from those of the continent of North America in restriction of the brown coloration of the back, which in most specimens does not extend markedly onto the wing coverts. From *G. c. galeata* of South America they are separated by slightly darker shade of gray. Danforth has distinguished the bird from Porto Rico as *Gallinula c. portoricicensis*, a name that will apply to the birds of the Greater Antilles, the Lesser Antilles south at least to Dominica, and part at least of the Bahamas, as I have found by examination of a fair series of skins in the U. S. National Museum. I have identified as this form skins from the following islands: Watlings Island, Bahamas (one), Cuba (three), Jamaica (one), Santo Domingo (four), Porto Rico (four), Culebra Island (one), Barbuda (two), Antigua (four), Montserrat (two), Guadeloupe (three) and Dominica (two). A bird in worn plumage from Tobago is assigned here with some question.
Gallinula chloropus cerceris Bangs, described (Proc. New England Zoöl. Club, May 17, 1915, Vol. V, p. 98) from St. Lucia, is distinguished by its very dark, almost blackish color. The type, which I have examined in the Museum of Comparative Zoölogy, is darker than any other I have seen. A second specimen (M. C. Z., No. 28,592), marked from the same island, does not differ, however, from other West Indian birds. If the latter is correctly labeled as to locality, it brings up the interesting possibility that the type of cerceris is a melanistic, and therefore an abnormal, individual. Should this prove true, then cerceris will replace portoricensis as the name for the West Indian bird.

It is probable that G. c. cachinnans of North America is migrant to Cuba and perhaps elsewhere in the Greater Antilles.

The gallinule in form and color is superficially similar to the coot, but may be distinguished easily by the bright-red frontal shield. In the hand the smooth toes, without the broad fringing lobes of those of the coot, are easily diagnostic. Ordinarily the gallinule is found in marshes, where it has the secretive habits of a rail, but on occasion it swims about with nodding head in the open water of channels or ponds where it moves freely, seemingly with as much ease as though its feet were webbed. When startled, it makes at once for the cover of the reeds, either across the surface of the water or on the wing. Occasionally gallinules perch on branches or in rushes several feet above the water.

At the Laguna de Guánica in 1912 gallinules were abundant; their cackling and calling from the high grass was the dominant sound of the marsh.

Danforth has reported them nesting in Porto Rico at all times of the year, but most commonly from February to May. Struthers noted a nest containing four eggs at Anegado Lagoon, December 10, 1921, and seven newly hatched young at Cartagena, August 18, 1921. I found newly hatched young near Yabucoa, May 8, 1912, and observed nests with eggs at Guánica, May 26 of the same year. The nests are shallow platforms of grass and cat-tail stems, built to an elevation of two to six inches above the water. The eggs, from three to eight in a set, resemble those of coots closely, so that care must be used not to confuse the two. Danforth gives average measurements as 1.8 x 1.2 inches (15.7 x 30.5 mm.). The young, when first hatched, are jet black.

Newton noted that on St. Croix they nested in April. An adult male that I shot on Flamenco Lagoon, Culebra Island, April 19, 1912, had the sexual organs small, while a male and two females secured at Yabucoa, May 6 and 8, were breeding.
Subfamily Fulicinae

**Fulica caribaea** Ridgway

Caribbean Coot, Gallinazo, Gallareta, Yagareta, Dagareta negra


Coot, Danforth, Oologist, 1922, p. 177 (Western Porto Rico, nesting in October).

American Coot, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon, Porto Rico).


Porto Rico, common resident on large lagoons (Guánica, Cartagena, Anegado, Guayabal, Camuy, Río Arecibo); St. Croix, recorded doubtfully by Newton; Culebra Island; St. John (type locality).

There has been much confusion with regard to the resident coot of Porto Rico, which for years was recorded as the American coot, *Fulica americana*, and was so listed by me in my Birds of Porto Rico, published in 1916. A subsequent examination of the only specimen of this bird that I secured revealed my error, and in 1917 I called attention to the fact that the resident species of Porto Rico was *Fulica caribaea*. The Caribbean coot is exactly similar to the North American form in appearance and habits, and differs only in more or less enlargement of the frontal shield, which has its surface somewhat wrinkled. This frontal shield is light in skins and is also light-colored in life. Danforth has attempted to separate the Porto Rican coot as a subspecies, *Fulica caribaea major*, on a supposed basis of greater size, but this appears inadvisable. For three males from Porto Rico he gives wing
measurements of 190 to 195 mm., and for one female, 191 mm. I have personally examined fifteen specimens from the following localities: Haiti (four), Porto Rico (one), St. John (two, including the type of *caribaeus*), Barbuda (three), Antigua (three) and Guadeloupe (two). In five males the wing varies from 178.0 to 191.0 mm. and in eight females from 165.0 to 186.0 mm., without reference to locality. (The two not included above are from Guadeloupe without designation of sex, and measure 174.0 and 183.0 mm.). The type specimen of the species from St. John has the wing 191.0 mm., equal to Danforth's measurements of his Porto Rican birds. Under these circumstances I must consider that he is mistaken in his premise that the Porto Rican bird differs, especially since the female that I secured personally at the Laguna de Guanica has the wing only 171.0 mm. long.

In the table herewith are measurements of specimens that I have examined.

<table>
<thead>
<tr>
<th>Museum and number</th>
<th>Sex</th>
<th>Locality</th>
<th>Date</th>
<th>Wing</th>
<th>Tail</th>
<th>Culmen with frontal shield</th>
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<tr>
<td>U. S. N. M. 252,872</td>
<td>♂</td>
<td>Tron Caiman, Haiti</td>
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<td>♂</td>
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<td>61.5</td>
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<td>49.0</td>
<td>44.4</td>
<td>54.4</td>
</tr>
<tr>
<td>U. S. N. M. 191,066</td>
<td>♀</td>
<td>Antigua</td>
<td>July 30, 1903</td>
<td>183.0</td>
<td>50.1</td>
<td>50.5</td>
<td>57.2</td>
</tr>
<tr>
<td>U. S. N. M. 191,064</td>
<td>♀</td>
<td>Barbuda</td>
<td>Sept. 23, 1903</td>
<td>186.0</td>
<td>49.3</td>
<td>50.3</td>
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<tr>
<td>U. S. N. M. 109,046</td>
<td>?</td>
<td>Guadeloupe</td>
<td></td>
<td>183.0</td>
<td>45.2</td>
<td>55.4</td>
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<td>Guadeloupe</td>
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<td>174.0</td>
<td>47.0</td>
<td>49.0</td>
<td>57.2</td>
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The Caribbean coot is a species of dark slate coloration, blackish about the head, with markings of white on wings and tail, that is seen swimming in large lagoons. As it moves, it nods the head rapidly, in time with the strokes of its large, widely lobed toes. The frontal shield in life is clear white.

Coots feed by picking with their sharp bills at the surface of the water
or dive in the shallows to secure food below. When startled, they start out with rapidly beating wings, but stroke for some distance with their large feet before they are able to rise completely in the air. As they rush away, little jets of water spurt up behind at each stroke of the toes.

Gundlach found them nesting at the Laguna de Guanica in November, and Struthers records eggs at Anegado Lagoon from November 11, 1921, to March 1, 1922. He observed from four to seven eggs in a set. The species is much molested by egg hunters, and Struthers recorded that one thousand two hundred eggs were marketed during the season noted above. The prolongation of the breeding period was probably due to this systematic robbery. As many as three thousand birds were counted at Cartagena Lagoon in the summer of 1921, when the lagoons at Guanica and Anegado dried during a prolonged drouth, and Danforth recorded an equal number at the same place on December 22, 1923. He found them breeding throughout the year, but most abundantly in April, May and October. Of more than three hundred nests seen, the greater part were concealed in sedges or grass, while a few were anchored to cat-tails standing in water. Complete sets varied from one to eight eggs, with an average measurement of 1.95 x 1.3 inches (49.5 x 33.0 mm.).

On Culebra Island I shot one of these birds at Flamenco Lagoon, April 13, but lost it through theft by a cat. Another was seen on April 19. I was under the impression that these birds were migrant, but in this supposition I may have been mistaken. Newton records coots as doubtfully seen on St. Croix, but did not list them positively, as he shot no specimens. A pair from St. John in the U. S. National Museum, the male of which is the type of the species, constitutes the only record for that island.

[Fulica americana Gmelin

Coot


For many years the coot of Porto Rico was listed as the present species, but, as has been recounted above, the breeding bird of the island proves to be Fulica caribaea. The North American bird is common in winter in Cuba, and I have examined specimens taken on the island of Haiti. It is not improbable, therefore, that it will be found eventually as a winter migrant in Porto Rico, for it is a species of relatively strong flight when once on the wing. Until specimens have been collected, it must be held in the hypothetical list.

Fulica americana may be distinguished from caribaea by the narrower frontal shield, with surface smooth and hard, and colored deep red or
reddish brown at the upper end. In *caribaea* the frontal shield is light in color throughout, is broadened and widened behind, and has the surface wrinkled and roughened in skins (possibly smooth but soft in freshly killed specimens). Care must be used to avoid confusion in immature specimens of *caribaea*, which have the frontal shield narrowed as in *F. americana*; in *caribaea*, however, this shield is light in color.

Order CHARADRIIFORMES
Suborder CHARADRII
Superfamily JACANIDAE
Family Jaeanae

*Jaeana spinosa violacea* (Cory)

West Indian Jaeana, Gallito.


Porto Rico; apparently accidental.

The only record is that of Gundlach, who states that Blanco received a specimen from Trujillo, but in such a state of decomposition that it served only to identify the species. The bird is found regularly on the adjacent island of Santo Domingo.

The jacana has a body about as large as that of a snipe, mounted on stiltlike legs and greatly elongated toes, which enable it to run about on vegetation floating on the surface of the water in ponds and swamps. The head and neck are black, the body purplish brown, and the wing quills yellowish green. The bend of the wing bears a formidable, sharply pointed spur.

Superfamily CHARADRIIIDAE

Family Haematopodidae

*Haematopus palliatus palliatus* Temminck

Oyster-catcher, Coracolero, Ostrero.


*Haematopus palliatus*, Newton, Ibis, 1861, p. 115 (St. Thomas, specimen).—

Porto Rico (reported near San Juan); Desecheo: Culebra (reported); Culebrita (reported); St. Thomas.

In recent years the oyster-catcher has been found only on the rocky island of Desecheo, where it was seen by Bowdish in 1900 and 1901, and where I noted three individuals at intervals from June 13 to 16, 1912. These birds frequented rocky beaches and were so wild that I secured none for specimens. On Porto Rico the species is known only from the records of Gundlach, who examined a specimen taken by Blanco near San Juan, and of Stahl, who lists it but had no skins. On Culebra and Culebrita I was told that the birds came at times to rocky points, where indeed conditions were wholly favorable for them. Newton years ago saw a specimen taken by Riise on St. Thomas. I know of no skins in the United States from this region.

The oyster-catcher is a shorebird of large size, distinguished by its long, reddish-orange bill, black head and neck, grayish-brown back and white underparts. Its note is a shrill high-pitched whistle.

**Family Charadriidae**

**Subfamily Charadriinae**

**Charadrius melodus Ord**

Piping Plover, Playero, Playante, Frailecillo Melodico


Porto Rico; rare migrant.
Gundlach examined a specimen taken near San Juan in the collection of Blanco. Stahl records the species as arriving in August, and had two specimens, which were identified in 1900 by Dr. C. W. Richmond in San Juan. There are no further records.

The piping plover should occur on beaches and mud flats near the coast. It is one of the smallest of our plovers. Though somewhat similar to the semipalmated plover, it may be recognized by the fact that the back is light gray in color and the dark breast-band is usually interrupted at its center.

**Charadrius semipalmatus** Bonaparte

Semipalmated Plover, Playero, Playante

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*Acgialitis semipalmata*, Cory, *Auk*, 1887, p. 229 (Porto Rico); *Auk*, 1890, p. 374 (Anegada, specimen); *Cat. West Indian Birds*, 1892, p. 95 (Porto Rico, Anegada).


Porto Rico, Vieques (seen) and Anegada. Migrant from north, most common from October to May.

The semipalmated plover is distinguished from other small plovers of this region by the dark-brown back. The chest is crossed by a prominent dark band and there is a distinct web between the middle and inner toes.

The species is found in coastal regions on sandy beaches or mud flats, often in small bands. Gundlach noted it near Mayagüez and Arecibo, and recorded it in September, April, May and June. According to Stahl, it arrives from the north about the middle of August. A specimen from his collection was seen by Richmond in San Juan in 1900, who, further, shot two near Luquillo on March 5, 1900, but was ill at the time and therefore not able to skin them. A bird in winter plumage, collected by Stahl, is now in the Museum of Comparative Zoology. Struthers has taken these birds during every month in the year (on the
western coast), but notes that they are more common from October to May. In the Carnegie Museum there are two skins obtained by W. W. Worthington at Loiza, on February 12, 1912.

On March 30, 1912, I saw one on the beach of Vieques Island, but failed to secure it; for when approached, it flew directly north over the sea until lost to view. Winch collected a specimen on Anegada for Cory.

The species may be expected to occur on all the islands concerned in the present report.

**Pagolla wilsonia wilsonia** (Ord)

Wilson’s Plover, Playero, Playante, Corredor, Fraillecillo Cabezón

*Charadrius wilsonia* Ord. in Wilson, Amer. Orn., 1814, Vol. IX, p. 77, Pl. 73, Fig. 5. (Cape May, New Jersey.)


*Aegialitis wilsonia rufinucha*, Bowdish, Auk. 1902, p. 360 (Vieques).


*Eupoda wilsonia rufinucha*, Wetmore, Auk. 1916, p. 411 (Vieques); Auk, 1917, p. 58 (Culebra, specimen).


Wilson’s plover is found in small numbers on sandy beaches along the coasts of the various islands. Though nowhere common, it is widely distributed and should be recorded on other islands in addition to those listed. It is supposed to be resident but may travel to some extent outside the breeding season.

The Wilson’s plover of the West Indies was at one time supposed to
be different from that of North America, but recent studies have shown that birds from the two localities are identical. I have compared series and can see no differences.

Gundlach secured this bird at Cabo Rojo and Arecibo, and it is probable that it occurs near San Juan, since Stahl had specimens in his collection. Struthers has collected it near Añasco, July 23, 1921, and at Porto Real, July 25, 1921. Mr. F. A. Potts writes me that he found it from December, 1920, to May, 1921, at Las Marías, southeast of Salinas, and that it was seen through the summer of 1921 near the Central Aguirre in flocks of fifteen to fifty birds. He observed it, July 23 and 27, 1923, on Guánica Bay. In the Carnegie Museum there are four skins, collected at Loiza on February 12, 1912, by W. W. Worthington. Danforth took one at Cartagena Lagoon June 3, 1924.

On Vieques Island Bowdish noted Wilson's plover on the beaches, sometimes in flocks that contained a dozen individuals, until December 1, 1899, and secured one on November 5. Richmond recorded them here on March 23, 1900, and collected three on March 27, which are in the U. S. National Museum. For Culebra the only record is that of a bird taken, February 11, 1899, by J. D. Milligan of the Fish Hawk expedition. Cassin reported several specimens secured by Robert Swift on St. Thomas, and there is a skin from this island in the U. S. National Museum. Cyrus S. Winch, collecting for C. B. Cory, obtained skins on Virgin Gorda and Anegada.

Wilson's plover is a small plover in which the male has a single black band across the chest, a black mark from the bill to the eye, and the forepart of the crown black behind a white forehead. In the female these marks are grayish brown. The species is distinguished from all of its allies by its large, heavy bill, which is two-thirds or more the length of the head.

**Oxyechus vociferus vociferus** (Linnaeus)

Killdeer


*Charadrius vociferus* Cory, Auk, 1890, pp. 374-375 (Virgin Gorda, Anegada; specimens); Cat. West Indian Birds, 1892, p. 95 (Virgin Gorda, Anegada).

Virgin Gorda, Anegada; migrant in winter.

Four skins taken by Cyrus S. Winch from the two islands mentioned above have been borrowed for examination through the courtesy of the authorities of the Field Museum. Two males from Virgin Gorda taken December 13 and 15, 1889, have wing measurements of 165.0 and 160.00
mm. respectively. A male and a female from Anegada, shot December 20, 1889, measure 170.0 and 160.0 mm. All four are darker and browner above than the average of O. v. rubidus. They are identified as the North American form, present as winter migrants.

This bird should occur on Porto Rico as well.

**Oxyechus vociferus rubidus** Riley

West Indian Killdeer, Playero, Playante, Pluvial Sabanero, Frailecillo Sabanero


*Aegialitis vociferus*, Newton, Ibis, 1860, p. 307 (St. Thomas, specimen).—Cory, Cat. West Indian Birds, 1892, p. 95 (Porto Rico, St. Thomas).—Bowdish, Auk, 1902, p. 360 (Porto Rico, common).


Porto Rico and Vieques, resident, common; St. Thomas, recorded.

The West Indian killdeer, distinguished from all other plovers of this region by the two black bars across the anterior underparts, is separated from the North American form by smaller size and grayer coloration of the dorsal surface, with rufescent edgings to the feathers slightly more in extent. The usual statement that the West Indian form is darker is in error, since the bird of the mainland is distinctly darker and browner above. The wing in eight males that I collected in Porto Rico in 1912 ranges from 139 to 148.5 mm. (average, 145.3), and in six females from 139 to 153 mm. (average, 146.7). Winter collecting may reveal the northern bird as a migrant on Porto Rico, for the typical killdeer goes south regularly to Cuba (specimens in U. S. National Museum) and even to Jamaica (one skin examined). Possibly records for St. Thomas may pertain to migrants of the continental form.

In 1912 I found killdeer at Quebradillas, July 5; Manati, July 7 to 11 (eight specimens); Rio Piedras, December 22; Mameyes, February 9
Humacao, the town coast; July run by taken At Mameyes young. tremulous bars and easily to March I habit

The 1921. Charadrius Choradritis species, Guanica, Charadrius Orthoptera (three Avo specimens); Guanica, Charadrius Pluvialis (specimen); Utuado, August 3; Ciales, July 15, and Comerio, July 26 to 31 (specimen).

Struthers has recorded eggs taken at the Laguna de Guanica, May 9, 1921. A female that I collected at that point, May 26, 1912, was laying and I secured grown young with nestling down still adherent to the tail on June 7 at Añasco, and on July 8 near Manatí. In February at Mameyes killdeer were apparently mated. During the breeding season I found them usually about the dry open shores of lagoons near the coast; near Manatí numbers frequented the citrus groves between the town and the sea. In July killdeer appeared to wander inland along the valleys of the larger streams well within the confines of the foothills. At this season they appeared in the vicinity of Utuado, Ciales, Comerio and other towns of the interior, where they were seen on broad gravel bars in the streams. There is a specimen in the U. S. National Museum taken at Caguas, January 12, 1899, by A. B. Baker.

On Vieques Island one was seen in the section known as Martinez on March 16, 1912, and a pair was collected, March 23, near Isabel Segunda. The female was about to lay.

The killdeer is noisy and vociferous and attracts continual attention by its loud cries, particularly when its breeding haunts are invaded. At such times its reiterated calls may become monotonous and disagreeable to nerves jaded by the strain of long residence in the tropics. The birds run rapidly on the ground and often fall on the breast with outspread, tremulous wings to draw one away from the real vicinity of eggs or young. In fall and winter they become quieter and at this season are easily overlooked.

Analysis of its food has shown that the killdeer is a highly beneficial species, as it eats numbers of the immature mole crickets as well as other Orthoptera and many beetles. It is especially valuable because of its habit of feeding in fields and orchards.

**Pluvialis dominicus dominicus** (Müller)

American Golden Plover, Chorlito, Pluvial

*Charadrius dominicus* Müller, Natursyst. Suppl., 1776, p. 116. (Santo Domingo.)


Pluvialis dominica dominica, Struthers, Auk, 1923, p. 473 (Anegado Lagoon, specimen).

Porto Rico, St. Croix; migrant in fall.

Sundevall listed two specimens sent him by Hjalmarson, and Gundlach speaks of collecting the golden plover at Arecibo in November. Stahl had two specimens. F. A. Potts has written me that he recorded a bird on September 10, 1931, near Central Aguirre, and Struthers shot one from a flock of six at Anegado Lagoon, November 4, 1931. On February 16, 1912, I saw one on the beach at the mouth of the Rio Mameyes but failed to secure it. This individual was probably a stray, as Porto Rico is supposed to be east of the regular line of spring migration.

On St. Croix Newton speaks of the golden plover as a fall migrant, often in large numbers; he noted the first arrivals on August 31, 1858. Mortensen states that they come at the end of August and the beginning of September. If the wind holds northeast, few are seen; but if it shifts to south or southwest, many are found on grassy plains, where they afford good hunting. Careful observation will reveal the species on other islands, since the fall flight regularly carries these birds south through this area.

The golden plover, a bird ten inches or more in length, will be confused only with the black-bellied plover. It differs from that species in having only three toes.

Squatarola squatarola cynosurae Thayer and Bangs

American Black-bellied Plover, Pluvial, Pluvial Grande


Charadrius squatarola, Cory, Auk, 1887, p. 227 (Porto Rico); Cat. West Indian Birds, 1892, p. 94 (Porto Rico).

Porto Rico, rare visitant.

Gundlach records specimens of this plover taken at San Juan Bay; Stahl had two in his collection. Lately F. A. Potts has noted one near Central Aguirre on September 9 and 10, 1921, still in summer plumage, and a flock of six or seven, seen on several occasions during December, 1920, at Las Mareas near Salinas.

The species is distinguished from the golden plover by the presence of a fourth toe.

Subfamily Arenariinae

Arenaria interpres morinella (Linnaeus)

Ruddy Turnstone, Playero Turco


Porto Rico, St. Croix. Culebra, Culebrita; common in coastal areas during winter.

Gundlach found the ruddy turnstone at Mayagüez, Cabo Rojo, Quebradillas and Vega Baja, and states that it remains in Porto Rico from September to May. Other early collectors obtained specimens. I found a small flock at Punta Miquillo, on the coast north of Mameyes, February 15 and 21, 1912, and secured specimens, but I did not meet with it elsewhere. Struthers has recorded it especially from Guanajibo Point, south of Mayagüez, and notes that the latest observation was on May 7, 1921, and that the earliest in fall was on August 9, 1921. Danforth found the ruddy turnstone the most common shorebird along the salt water, and states that the last observation for 1922 was on May 4, in lagoons.
near Boquerón. F. A. Potts has observed it throughout the entire summer at Central Aguirre.

On St. Croix Newton recorded several in early April, 1857, and took two on September 8, 1858. In the U. S. National Museum there are two skins from Culebra Island, taken February 11, 1899, by A. B. Baker and J. D. Milligan, and I shot one from a flock of three or four on Culebrita Island, April 15, 1912.

The ruddy turnstone is partial to mud flats and bars exposed by the falling tides, but is also found on sandy beaches or about pools immediately behind them. In the West Indies it is seldom seen except on salt water. The species comes regularly and remains in small numbers throughout the winter, usually in little flocks. With further observation it will be recorded on other islands, as it is a common bird of widespread distribution.

The ruddy turnstone is about nine and one-half inches in length and in its winter plumage has the upper parts blackish, with the feathers bordered with brownish gray or ashy, the lower back white, and the tail white with a black band near the end. The breast is black variegated with white and the rest of the underparts are white. In breeding dress the upper parts are strikingly marked with rufous, black and white.

Family SCULOPACIDAE

Subfamily SCULOPACINAE

**Capella delicata** (Ord)

Wilson’s Snipe, Becasina

*Scolopax delicata* Ord, Reprint of Wilson’s *Ornith.,* 1825, Vol. IX. p. cccviii.

(Wilson’s Snipe, Danforth, Géologist, 1922, p. 177 (Porto Rico, winter).


[9] The generic name *Gallinago* Koch, 1816, is ante-dated by *Capella* Frenzel, 1801. *Gallinago* has been accepted as valid in opinion 67 of the International Commission on Zoological Nomenclature, rendered before Frenzel’s work was known, so that apparently it will require action on the part of the Commission to recognize *Capella* officially.


Porto Rico, common in migration, a few through winter; St. Croix, tolerably common in fall.

Gundlach reported the Wilson’s snipe from September to spring in fair numbers. Hjalmarson sent five skins to Sundevall, from which, it would seem, he encountered the species in some abundance. On December 19, 1911, I found a dozen in short grass in a swampy locality about a small pool below Río Piedras, and collected one as a specimen. Another was flushed here at the border of a mangrove swamp on December 22. F. A. Potts (in litt. May 15, 1921) reports one or more seen near Central Aguirre at various dates from November 14, 1920, to March 12, 1921. Danforth, in western Porto Rico, reports it as a winter resident, at times abundant, arriving December 27, 1923, and October 7, 1924, and remaining in spring until March 22, 1922, and April 15, 1924, at Cartagena Lagoon.

Struthers noted the earliest arrival as August 29, 1921, and found it very common at the Laguna de Guánica, October 22, 1921. A few birds remained through the winter.

On St. Croix Newton found the species irregular in fall and reported one September 24, 1858.

From these records it appears that considerable numbers of Wilson’s snipe migrate through the West Indies, apparently passing on to South America, since comparatively few remain to winter in Porto Rico.

The species is found about pools in the lowlands, often in areas where swampy meadows are covered with short grass. It frequents fresh-water swamps in the main and obtains its food by probing in soft mud. As one looks across an area of grassy swamp, it may appear wholly deserted, but as one steps forward, a long-billed snipe showing a dark back with distinct light stripes on either side, rises with a harsh call, perhaps from cover seemingly too scant to conceal it, and darts away with a twisting, turning flight that finally becomes straight, when the bird feels that it has placed sufficient distance for safety between itself and the cause of its alarm. For many days this may be one’s only observation of the wary Wilson’s snipe. Again, if conditions are proper in early morning or evening, one may see the birds walking about at the borders of pools. At such times their short legs, long bills and heavy bodies give them a somewhat grotesque appearance.
Everywhere this species is highly prized as a game bird because of the difficulty offered to the gunner by its twisting flight.

**Capella anthonyi** (Wetmore)

*Porto Rican Snipe*


*Porto Rico;* extinct.

The Porto Rican snipe (Figs. 9 to 13), an extinct species, is known from bones collected by Mr. H. E. Anthony (in whose honor the species *is* named) among deposits in Cueva Catedral and Cueva Clara, near Morovis. It was a bird distinctly larger than the migrant Wilson’s snipe, and apparently existed in the island within a short period of years, as many of the remains do not seem particularly ancient. It is known from the humerus, metacarpal, coracoid, tibio-tarsus and tarso-metatarsus.

**Subfamily Numeniinae**

**Phaeopus borealis** (J. R. Forster)

Eskimo Curlew, Chorlo, Curlis

*Scolopax borealis* J. R. Forster, Philos. Trans., 1772, Vol. LXII, p. 431. (Fort Albany, Hudson Bay.)


*Porto Rico;* casual.

Gundlach reports an Eskimo curlew sent to him from near San Juan by Blanco. There are no other records for the species, which, though formerly common, is now near extinction.

In my opinion this species is not separable generically from the Hudsonian curlew and its allies. It is distinguished from the species mentioned by smaller size.

**Phaeopus hudsonicus** (Latham)

Hudsonian Curlew, Chorlo, Curlis, Barga

*Numenius hudsonicus* Latham, Index Ornith., 1790, Vol. II, p. 712. (Hudson Bay.)

The extinct Porto Rican snipe (Capella anthonyi)

Fig. 9 (upper left).—Right humerus (type). Posterior view. About natural size. From cavern deposits of Cueva Catedral.

Fig. 10 (upper right).—Right humerus (type). Anterior view. About natural size.

Fig. 11 (lower left).—Right metatarsus. Anterior view. Natural size. From cavern deposits of Cueva Catedral.

Fig. 12 (lower middle).—Right metatarsus. Posterior view. Natural size. From cavern deposits of Cueva Catedral.

Fig. 13 (lower right).—Right metatarsus. Distal outline of trochlea. Twice natural size. From Cueva Catedral.

(These cuts are reproduced by courtesy of The American Museum of Natural History.)

Porto Rico, Anegada; rare during migration.

Gundlach reported a Hudsonian curlew in the collection of Blanco, and later on shot one at the mouth of a little stream at "Punta Arenas" south of Mayagüez. Stahl secured two, which were examined by Richmond in the collection at San Juan in 1900.
The only recent records for the species are those of F. A. Potts, who secured one on May 21, 1921, near Las Mareas, east of Salinas, and was fortunate in observing others from July 31 to September 24, 1921, near Central Aguirre. The specimen mentioned, which was sent to me for examination, has been generously presented by Mr. Potts to the U. S. National Museum and is preserved in its collections.

Winch secured one for Cory on the island of Anegada.

Large size and a strongly curved bill distinguish this curlew from any other shorebirds in this region.

**Bartramia longicauda** (Bechstein)

Upland Plover, Ganga


Upland Plover, Potts, Auk, 1927, pp. 120-121 (Guayama, Santa Isabel).


Porto Rico; casual in migration.

The first specimen known from Porto Rico was secured by Stahl and placed on record by Gundlach. The only other notes for the species are those of F. A. Potts, who, in a letter written September 18, 1921, informs me that he saw one near Central Aguirre, September 10, and on September 13 shot another from a flock of fifteen in a wet pasture near Santa Isabel. This skin has been presented to the U. S. National Museum. Mr. Potts reports yet another seen, August 26, 1926, near Fortuna.

**Actitis macularia** (Linnaeus)

Spotted Sandpiper, Zarapico Mosqueado, Zarapico Manchado, Playero Manchado, Playero


Spotted Sandpiper, Danforth, Oologist, 1922, pp. 10, 177 (western Porto Rico).


Mona, Desecheo, Porto Rico, Vieques, Culebra, St. Croix, St. Thomas, Tortola; winter visitant, present in numbers throughout most of the year.

On Mona Island Bowdish reported the spotted sandpiper common from August 9 to 21, 1901, and collected an adult female in worn breeding dress on August 11 (in collection of U. S. National Museum). Mr. P. H. Struthers, in a letter dated March 3, 1922, reports one seen from January 22 to 24, 1922, on Desecheo Island—the first record of the species for that rock.

In Porto Rico proper this species is the most common shorebird, and is found alike on sandy beaches, mud flats, mangrove swamps, or the borders of streams and lagoons. Though most common on the coast and over the coastal plain, it extends inland within the line of the foothills to the base of the higher ranges, and probably follows casually along mountain streams through suitable sections, though not yet recorded above Caguas and Comerio, except for one bird seen by L. Stejneger on April 12, 1900, between Utrado and Adjuntas. In 1911 and 1912 I recorded it at Manati, July 9; Bayamón, July 20 to 25 (specimen); Río Piedras, December 22 (specimen); Mameyes, February 9 to 29 (specimen); Humacao, September 3 to 9; Yabucoa, May 6 to 8; Patillas, May 13; Salinas, April 29 and May 2; Cabo Rojo, August 24 to 31 (specimen); Comerio, July 26 to 31; Caguas, January 8 and 10 (specimen); and forks of the Río Mameyes below Hacienda Catalina, March 6.

On Vieques Island Bowdish found it quite common from November to February, and I saw it there occasionally from March 16 to April 3, 1912. There is a specimen in the National Museum taken on Culebra Island, February 9, 1899, by A. B. Baker, and I noted the bird as common at this point from April 5 to 21 (specimen preserved April 9). On St. Croix Newton reported it as fairly common, and in 1858 noted that it was absent only from April 27 to July 27. Winch secured one on Tortola when collecting for Cory. The species unquestionably ranges through all of the islands concerned in the present report. The U. S.
National Museum formerly had a specimen from St. Thomas, received from John Akhurst, taxidermist (in 1863).

The spotted sandpiper is present in this region throughout most of the year, since in 1912 I noted the last for the spring near Patillas on May 13, and fall migration began with a bird recorded at Manatí on July 9. By July 24 the species was fairly common, and during August was present in numbers. It is found abundant through April, when it is in migration north, and stragglers (non-breeding individuals) remain much later. Struthers has recorded them throughout the summer. First arrivals in fall seem to be adults, and in 1912 I did not observe immature birds until July 27, after which they were common. Danforth reports the last at Cartagena Lagoon on May 23, 1924, and the first in fall on August 13, 1924.

The spotted sandpiper has the upper surface brownish gray with a faint greenish tinge. In summer dress the underparts are heavily spotted with dusky, while in immature birds and adults in winter plumage the undersurface is white.

The spotted sandpiper frequents the borders of small streams and ponds, where open bars of gravel or mud offer it feeding grounds, and delights to penetrate the darkest depths of mangrove swamps. There I have observed birds in shade so black that movement alone betrayed their presence. When watching for clapper rails in such situations, I have had the sandpipers walk quietly about within a few feet of me.

As the spotted sandpiper flies, it utters a low peet weet and scales off just above the surface of the water, showing a prominent light bar in either wing as the feathers are expanded. On land the body is kept in constant motion by the twitching of the posterior portion, so that the bird is never still. So incessant is this motion during the day that one wonders whether it is continued when the bird is asleep. Where the water is deep in the swamps, these sandpipers run about on the roots and arching stems of the mangroves, frequently several feet above the water.

**Tringa solitaria solitaria** Wilson

Solitary Sandpiper, Zarapico Solitario, Solitario

*Tringa solitaria* Wilson, Amer. Orn., 1813, Vol. VII, p. 53, Pl. 58. Fig. 3. (Probably Pennsylvania.)

Solitary Sandpiper, Danforth, Oïologist, 1922, p. 177 (Lajas, Porto Rico).


Helodromas solitarius, Bowdich, Auk, 1902, p. 360 (Porto Rico).


Tringa solitaria solitaria, Struthers, Auk, 1923, p. 473 (Porto Rico).

Porto Rico, St. Croix; winter visitant. The solitary sandpiper comes regularly to Porto Rico for the winter season. It is common and seemingly occurs in greater numbers in the western part of the island. In 1912 an immature female was taken on the Río de la Plata above Comerio on July 29. At Cabo Rojo the species was common from August 24 to 31, and a few were noted on the Río Humacao, below Humacao, from September 3 to 9. At present this is the only record for the eastern end of the island; I did not find it in that area when working there in the winter and spring. Struthers recorded it near Porto Real, from November, 1920, to May 7, 1921, while Danforth has reported it from Anegado Lagoon on March 4, 1922, and Cartagena Lagoon, August 30 to October 7, 1924. F. A. Potts has written me that at Central Aguirre it arrived from the north on July 31, 1921.

On St. Craix Newton found it fairly common, arriving July 26, in 1857, and August 5, in 1858. There is a specimen from St. Croix in the Museum of Comparative Zoology, collected by G. K. Noble on September 15, 1914.

Four skins that I have examined from Porto Rico (two in the National Museum and an old skin received from Stahl, in Cambridge, and the one taken by Noble on St. Croix, all represent the eastern subspecies.

The solitary sandpiper is in the main a bird of fresh water, and is found about ponds and streams in the lowlands. The only one that I observed inland for any great distance was taken on a gravel bar in the La Plata above Comerio, within the line of the foothills. Near Cabo Rojo I found the birds distributed in the lowlands about pools of water left after heavy rains, in newly plowed fields where there was standing water, or about the shallows of the coastal lagoons.

The species is active and sprightly in its movements and frequently calls when flushed. The white tail and barred under wing-coverts serve for identification in the field.
Catoptrophorus semipalmatus semipalmatus (Gmelin)

Willet, Chorlo


Symphemia semipalmata major Stahl, Faun. Puerto Rico, 1883, p. 151. (Porto Rico, specimen; nomen nudum.)


Porto Rico, Anegada; present during winter in small numbers.

Gundlach secured this bird at Boquerón, and Stahl found it about San Juan Bay. Dr. Richmond has examined specimens in San Juan prepared by the latter collector. Struthers observed a flock of thirty south of Boquerón from November, 1920, to March 25, 1921, and recorded two on December 17, 1921. Gundlach's belief that the species may have nested in Porto Rico may have been in error, since the bird is known to come only as a winter visitant.

Winch, collecting for Cory, secured it on Anegada.

The willet is one of our larger shorebirds, distinguished by straight, rather heavy bill, grayish coloration, and wings prominently marked with black and white.

In two females taken at Boquerón, Danforth found the wing 172 and 191 mm., respectively, and the tail 81 mm. As the wing measurement of the second specimen is above the average for the eastern form, he proposes the subspecific name longicaudis tentatively. The matter is one that will require more specimens to establish. He found flocks of twenty-five at Boquerón, February 22 and March 8, 1924, and one bird at Cartagena Lagoon on September 23.

Totanus flavipes (Gmelin)

Lesser Yellowlegs, Chorlo, Caballero, Pata amarillo, Playante


Puerto Rico, 1883, pp. 64, 151 (Porto Rico, specimens); Ornis, 1887, pp. 449, 450 (listed).


Porto Rico, Vieques, St. Thomas, St. Croix, Anegada; during migration and in winter.

Stahl has recorded the earliest arrival in his experience as August 9, 1886, when a flock was seen. Nichols observed a dozen at the Laguna de Guánica July 27, 1914, and Bowdish has recorded the species October 7, near Aguadilla. Struthers indicates that it is common during winter, recording its arrival in fall on August 1, 1921, and its departure in spring on April 9, 1921. Mr. F. A. Potts has written me that he has found it in flocks containing up to one hundred individuals from November to April on the flats between Central Aguirre and Santa Isabel. He reports the last observation in spring as April 10, 1921, and the first in fall as July 4, 1921, near Central Aguirre. Danforth found these birds common at Cartagena Lagoon, most common in October, when flocks of one hundred or more were seen. He reports that a few linger through the summer.

The only record for Vieques is a manuscript note by Richmond of a bird seen on March 25, 1900. On St. Croix Newton reported it July 26, 1857, and August 3, 1858. The U. S. National Museum formerly had a specimen from St. Thomas secured through J. Akhurst (catalogued in March, 1863). Winch collected a specimen on Anegada.

The lesser yellowlegs is found about the coastal lagoons or the fresher waters inland, but is reported only from the coastal plain. Like many other water birds, it is more abundant in the western part of Porto Rico, for conditions there are best suited to its needs. From August 24 to 31, 1912, I found it in small flocks near Cabo Rojo, feeding in overflowed lands near the lagoons or in plowed fields made soft by heavy rains. Individuals were observed flying from north to south and it appeared that they were in the height of their southward migration. Captain Cheney, of the sailing schooner Francis H. Goward, told me that one came aboard his ship about August 1, midway between Bermuda and Porto Rico.
The bright yellow tarsi differentiate the two yellowlegs from other shorebirds. The lesser species is distinguished by small size (wing, 149 to 163 mm.). The birds feed in the open, on bars or barren shores, where they are easily seen and often greet intruding man with their clear, whistled calls.

**Totanus melanooleucus** (Gmelin)

Greater Yellow-legs, Playero, Chorio, Caballero Chillon, Zarapico Blanquinegro, Playante


Greater Yellowlegs, Danforth, Oïologist, 1922, p. 177 (Porto Rico, winter).


Porto Rico, during migration and winter.

Stahl observed the greater yellowlegs on August 9, 1886, and records it as lingering late in spring. Nichols saw one at the Laguna de Guánica on July 27, 1914, and Struthers reports it as frequent in winter, with July 23, 1921, and March 19, 1921, respectively, as his earliest and latest dates.

Potts, at Central Aguirre (in a letter dated September 18, 1921), reports the earliest observation as August 12, 1921, and the latest in spring as May 15, 1921. Danforth noted the species near Boquerón until April 22, 1922, and states that a few remain at Cartagena Lagoon throughout the summer.

The species has not been recorded as yet from the Virgin Islands.

The greater yellowlegs has the habits and appearance of the lesser species, but is distinguished by greater size (wing, 180 to 199 mm.), while to a discriminating ear there is a slight difference in the calls of the two species. On May 2, 1912, I saw three of the greater yellowlegs at a shallow lagoon below Salinas and collected a male. One was noted at the Laguna de Guánica on the extraordinarily late date of May 26, while in fall the greater yellowlegs was recorded on mud flats near Porto Real on August 26. This species is usually less common than its smaller relative.
Subfamily Calidriniae

**Pisobia minutilla** (Vieillot)

Least Sandpiper, Zarapico Menudo, Zarapico Pequeño


Least Sandpiper, Danforth, Oologist, 1922, p. 177 (Porto Rico, migration).

*Actodromas wilsoni*, Newton, Ibis, 1859, p. 258 (St. Croix).


*Tringa minutilla*. Cory, Cat. West Indian Birds, 1892, p. 93 (Porto Rico, St. Croix).


Mona, Porto Rico, St. Croix; present in migration, and on Porto Rico during winter.

Struthers has recorded two seen on Mona Island, July 15, 1921. Bowdish reported the species from that point in the Auk for 1902, page 360, but the specimen that he secured proves to be *Ereunetes pusillus*; his notes are, therefore, placed under that species.

In Porto Rico Stahl found the first arrivals of members of this species at the end of August, 1886, and believed that a few remained throughout the summer. One of his specimens is preserved in the Museum of Comparative Zoölogy. In 1912 I noted a least sandpiper at the Laguna de Guánica, May 26, and shot one at Joyuda, near Cabo Rojo, on August 28. Nichols found a dozen at the Laguna de Guánica, July 27, 1914. F. A. Potts writes me that flocks containing many individuals were found on the mud flats west of Central Aguirre during the winter of 1920-1921, and were still present at the date of writing, May 15, 1921. Though some may have been semipalmated sandpipers, a specimen collected was the present species. Danforth recorded the species near Boquerón through the winter until March 4, 1922, and at Cartagena Lagoon until May 30, arriving from the north July 5. Struthers reports it as seen in each month of the year, but more abundantly in September and May, when it is in migration.

On St. Croix Newton found it in autumn, and recorded the first arrivals in 1858 on August 19.
The least sandpiper ranges on the mud flats of the coast and the open lagoons of the coastal plain in company with others of its family. From the semipalmated sandpiper, which it resembles in tiny size, it is distinguished by the greenish tarsus and, in the hand, by the lack of webs between the toes.

**Pisobia melanotos** (Vieillot)

Pectoral Sandpiper, Zarapico Manchado


*Tringa maculata*, Newton, Ibis, 1859, p. 258 (St. Croix, specimens).—Cory, Cat. West Indian Birds, 1892, p. 93 (Porto Rico, St. Croix).—Bowditch, Auk, 1902, p. 359 (Aguadilla, specimens).


Porto Rico, St. Croix; during migrations and occasionally in winter; most common during fall migration.

In Porto Rico Gundlach reported the pectoral sandpiper as a winter visitant from September to April, while Stahl, in discussing its migratory movement in the island, saw it late in spring and said that a few were found the year round—a statement to be taken with some reserve. Bowditch recorded it in western Porto Rico on September 26 and October 2, 1900. I noted a flock of a dozen near Guayanilla, August 24, 1912. F. A. Potts has written me that it was seen in the spring of 1921 near Central Aguirre until March 12, and arrived in the fall migration of that year on July 31. With his notes he forwarded a specimen to check his identification. Danforth reports its arrival at Cartagena Lagoon August 13, 1924, and found it at Anegado Lagoon until April 1, 1922. At Cabo Rojo Lighthouse he collected four on April 27, 1924. Struthers reports it as common at the Laguna de Guánica, October 22, 1921, and as seen occasionally during winter.

On St. Croix Newton recorded the pectoral sandpiper after September 14, 1858, and secured specimens.
The pectoral sandpiper, the largest of its group in this area, is found on mud flats and about pools in meadows. It is known only in the lowlands. The dusky-streaked breast, differentiated sharply from the white abdomen, and the greenish legs are excellent field characters. It may be found singly or in little bands. (For change in the scientific name from *Pisobia maculata* to *Pisobia melanotos*, see Wetmore, U. S. Nat. Mus. Bull. 133, 1926, p. 153.)

**Pisobia fuscicollis** (Vieillot)

White-rumped Sandpiper


*Tringa fuscicollis*, Bowdish, Auk, 1902, p. 360 (Aguadilla, specimen).


Porto Rico, Culebrita; found in migration.

The first record for Porto Rico is that of a female taken by B. S. Bowdish on the coast near Mayaguez, October 2, 1900 (data through the kindness of Mr. Bowdish). On April 15, 1912, I saw two birds on the north short of Culebrita and shot one that fell in the sea and was swept away by strong tidal currents. Danforth has found the species uncommon at Cartagena Lagoon in fall, where in 1924 he recorded it from August 26 to October 20.

The bird is slightly larger than the least sandpiper and has greenish legs and a white rump, exhibited during flight.

**Limnodromus griseus scolopaceus** (Say)

Long-billed Dowitcher


*Macrochampus scolopaceus*, Cory, Auk. 1890, p. 374 (Anegada, specimen); Cat. West Indian Birds, 1892, p. 92 (Anegada).


Anegada; casual migrant.

A specimen taken by Cyrus S. Winch, the only record for this bird, is, according to Cory, the long-billed form of the dowitcher.

**Mieropalania himantopus** (Bonaparte)

Stilt Sandpiper, Zarapico Zancudo


Porto Rico, Anegada; in migration.

Gundlach reported the stilt sandpiper as arriving from the north in September, and says that he has found it at the borders of inland streams as well as at the coast. Stahl had a specimen in his collection. On August 28, 1912, I secured an immature female from two birds that came driving swiftly down the coast at Joyuda, near Cabo Rojo. Danforth reported it at Cartagena Lagoon from August 20 to September 27, 1924, and collected specimens. Cory records the species for Anegada.

In life the stilt sandpiper presents the general appearance of a small lesser yellowlegs, but may be distinguished by its longer legs, which are dull in color, not yellow. It is found about pools and mud flats and delights in wading in water nearly to its body.

Ereunetes pusillus (Linnaeus)

Semipalmated Sandpiper, Zarapico Gracioso


Ereunetes petriciclatus, Newton, Ibis, 1859, pp. 257-258 (St. Croix).


Tringa minitilla, Bowdich, Anu., 1902, p. 360 (specimens, wrongly identified).

Mona, Porto Rico, St. Croix, St. Thomas, Anegada; common in fall migration.
There is in the U. S. National Museum a female taken by Bowdish on Mona Island, August 11, 1901.

In Porto Rico Stahl records the semipalmated sandpiper as arriving at the end of August, 1886, and remarks that it lingers late in spring, a few individuals remaining through the summer. A specimen that he collected is located in the Museum of Comparative Zoology. A specimen in the U. S. National Museum was taken by Bowdish near Mayagüez on September 23, 1901 (recorded by Bowdish erroneously, with the skin from Mona, as *Pisobia minatilla* and included in my previous account under that species). In 1912 I found the semipalmated sandpiper common on the mud flats of the coastal region near Cabo Rojo from August 24 to 31, and on August 26, 27, 28 collected five. Nichols observed two at the Laguna de Guánica, July 27, 1914. Danforth noted the species in flocks at Cartagena Lagoon from August 13 to October 20, 1924, and on August 20 estimated that 100,000 were present. He saw it also at Hormigueros and Boquerón. There are no definite winter records for the species.

Newton recorded it in fall on St. Croix, and states that in 1858 it arrived on August 14. Winch secured a specimen on Anegada. The U. S. National Museum in March, 1863, catalogued one from St. Thomas, received from the dealer J. Akhurst.

The species is an inhabitant of muddy shores about bays, lagoons and ponds in the coastal region. One of the smallest of its kind, it is distinguished from the least sandpiper, the only species other than *E. maun* *w* with which it may be confused, by its black tarsi and feet and by the distinct webs between the toes. The characters that distinguish it from *E. maun* *w* are indicated in the following account.

**Ereunetes maun** Cabanis

*Ereunetes maun* Cabanis. Journ. für Ornith., 1856, p. 419. (Cuba.)

*Ereunetes maun*, Danforth, Auk. 1925, p. 362 (Cartagena Lagoon, specimen):

Journ. Dept. Agric. Porto Rico, 1926, Vol. X, pp. 73-74 (Cartagena La-

*goon*).

Porto Rico; casual in migration.

The only record is that of a female reported by Danforth taken from a flock of semipalmated sandpipers at Cartagena Lagoon, August 26, 1924. The species is distinguished with difficulty unless specimens are in the hand, when it may be told from *E. pusillus* by its longer bill (which is as long as the tarsus or slightly longer, instead of shorter) and the greater proportion of rusty on the dorsal surface.
Linosa fedoa (Linnaeus)

Marbled Godwit, Barga, Chorlo

Scolopax fedoa Linnaeus, Syst. Nat., ed. 10, 1758, Vol. 1, p. 146. (Hudson Bay.)

Linosa, Newton, Ibis, 1850, p. 257 (questionably on St. Croix).


Porto Rico; casual in migration.

The only known occurrence is that of a specimen taken near Boquerón and recorded by Gundlach.

The marbled godwit, distinguished by large size, brown plumage and slightly upward-curved bill, is accidental in this region, as its main migration route leads it farther to the west.

Crocethia alba (Pallas)

Sanderling, Arenero

Tryanga alba Pallas, in Vroeg. Cat. Rais., 1764, Adumbr. p. 7. (Coast of North Sea.)


Crocethia alba, Struther, Auk, 1923, p. 473 (Anáscar, specimen).

Porto Rico, St. Croix, Anegada; rare during migration, found occasionally during winter.

Gundlach lists a male taken near Bayamón by Stahl, who in the catalog of his collection cites two specimens, and in another place remarks that the sanderling lingers late in spring, so that he may have collected it at that season. Struthers recorded two on March 4, 1922, at the mouth of the Rio Blanco near Anáscar, and collected one. There are two specimens in the Carnegie Museum taken at Loíza, February 12, 1912, by W. W. Worthington.

Newton records a female taken on St. Croix, September 13, 1858, and Winch collected one on Anegada.
The sanderling, distinguished from other sandpipers by its very light color (in winter dress, the plumage ordinarily seen, it appears almost white), and lack of a hind toe, is found usually in little bands on sandy beaches or sometimes on mud bars. Its preferences are for salt-water habitats.

**Family Recurvirostridae**

**Himantopus mexicanus** (Müller)

Black-necked Stilt, Viúda, Playante, Yegüita, Zancudo

*Charadrius mexicanus* Müller, Natursyst., Suppl., 1776, p. 117. (Mexico.)


Porto Rico, resident; Vieques, St. Croix, Tortola, found formerly, possibly still present.

Gundlach in the seventies reported the black-necked stilt in Porto Rico at Puerto Real, Cabo Rojo, Boquerón and near the Río Arecibo.

On May 2, 1912, I found a small colony and collected two adult males in the lagoon region below Salinas, where the birds were breeding. On May 26 the species was fairly common at the Laguna de Guánica, and stilts were reported from Boquerón, but I did not find them in the course of my work in that vicinity. At Cartagena Lagoon Danforth noted the black-necked stilt from March or early April until October, but it was absent during the winter season. The birds began nest-building in May, placing their nests in a colony on little hummocks of grass or *Persicaria* and laying from five to seven eggs—an extraordinary number. The first sets were all taken by eggers. In a second attempt at nesting, begun at once, the birds spread over the marsh, concealing their nests in any available cover. These second sets contained from three to five eggs. The eggs were variable in color, the more usual type being buffy-clay, thickly spotted with rufous-brown and a few markings of lavender. Others were
olive-green spotted with chocolate. They varied normally from 1.72 x 1.25 inches (43.7 x 32.7 mm.) to 1.75 x 1.30 inches (44.4 x 33.0 mm.).

Struthers observed the stilt throughout the year at the Laguna de Guanica and found eggs and young on August 1, 1921.

A stilt was reported to Dr. Richmond on Vieques Island on March 24, 1900. Newton found the species in the fifties at Krausse’s Lagoon on St. Croix, and Cory has recorded it from Tortola. It was probably resident formerly at these three points, but its present status in the smaller islands remains to be ascertained. I did not see it on Vieques in March, 1912. It is possible that it ranges through the small islands east of Porto Rico after the breeding season.

As one nears the breeding haunts of the stilt, birds with snow-white underparts and dark backs come flying overhead, uttering sharp barking calls, incessantly reiterated, as they circle about from side to side. Suddenly one alights in shallow water and stands half erect, with wings extended and waving rapidly, apparently in the greatest distress. One may forget their incessant clatter for a moment in marveling at the apparently disproportionate length of the extremely slender legs. Though appearing useless on land these stiltilike members come in good play when the birds wade in the shallows. It is there they seek their food, walking about in water at times nearly up to their bodies.

After the breeding season, old and young form little bands and feed and rest in quiet contrast to their noisy attitude when nesting. The few dates available indicate a somewhat irregular breeding period in Porto Rico, where the species is confined to a few lagoons offering extensive areas of shallow water and mud flats suitable as feeding grounds.

**Suborder LARI**

**Family Laridae**

**Subfamily Larinæ**

**Larus atricilla** Linnaeus

Laughing Gull, Gaviota, Gaviota Forastera, Gaviota Boba, Gallego


Mona, Desecheo, Porto Rico, Vieques, Culebra, Culebrita, St. Croix and St. Thomas; of regular occurrence but not known definitely to breed.

The laughing gull is found about the coasts and will unquestionably be listed for all of the islands concerned in this report, since it is a bird of strong flight that ranges regularly across channels of the sea. As the Virgin Islands all lie in a chain and those adjacent to each other are easily visible from either shore, there is no bar to visitation on the part of these birds.

Gundlach and Stahl recorded them as present through the entire year and Gundlach thought that they nested, but on analysis of his records it appears that he did not actually find them breeding.

Bowdish noted laughing gulls at Mona Island, August 9 to 21, 1901, and Struthers reported thirty there during July, 1921.

Bowdish found the species on Desecheo Island on June 24, 1900, and July 6 to 10, 1901, to the number of eight or ten pairs, but did not record their breeding. From June 13 to 16, 1912, I estimated that thirty birds were present. An adult male taken June 14 had the sexual organs somewhat enlarged, but was far from breeding condition.

In San Juan, Bowdish found that natives frequently had laughing gulls alive with one wing clipped to prevent escape, and that they sold them for food. He purchased one April 28, 1900. Struthers recorded them in Mayagüez harbor in the summer of 1921 from April 23 to August 17. Danforth has reported them in the same locality as early as March 10, 1922 (when six were observed), and has seen the bird casually at Cartagena Lagoon. In 1912 I recorded them in San Juan harbor, July 19 and 22 and August 1, and in the port at Aguadilla June 10 to 11.

I saw one in Port Mulas, on Vieques Island, April 22, and observed the first one on Culebra Island April 13, at Playa Sardine. On April 15 four or five were noted in Ensenada Honda, and I shot a male not yet in breeding condition near Culebra Island. It may be mentioned that I
began observation on the bays at Culebra on April 5 and had both under daily observation from the little house in which I lived, but I did not see laughing gulls until more than a week after my arrival.

On St. Croix Newton reported seeing them. There is a male in the collection of the Museum of Comparative Zoölogy taken at St. Croix on September 25, 1914, by G. K. Noble. Newton reports one secured at St. Thomas.

All definite records for this gull—and the available data are scanty—pertain to the summer season, which may indicate that the birds segregate somewhere for breeding and subsequently wander. Breeding colonies probably occur somewhere among these islands, but are as yet unknown. Birds scolded me as I passed along the beaches of Desecheo, and from their behavior it seems possible that that is a nesting place.

The laughing gull, as the only gull of these waters, cannot be confused with any other bird. The adult is distinguished by the dark-hooded head, and adults and immature have the ends of the wings extensively black.

These gulls are seen in flight along beaches or cliffs in search for food; on Desecheo one or two came daily to examine refuse food thrown out from my camp. At times they circle high in air or again rest on buoys or other supports in the water. Their call is a loud hah hah hah.

Noble (Bull. Mus. Comp. Zool., August, 1916, Vol. L.X, pp. 367-368) has separated a North American form of this gull as Larus atricilla megalopterus (Bruch) on the basis of larger size, giving a series of measurements to support his contention. Dwight (Bull. Amer. Mus. Nat. Hist., December 31, 1925, Vol. LII, pp. 266-267) has reviewed this question and has found from an independent series of measurements¹⁰ that, though West Indian birds seem smaller, there is overlapping in size in both sets of birds that he has available. Among the specimens in the U. S. National Museum I note that most of the West Indian birds have short wings, but that occasional individuals have measurements as large as those of birds from North America. Though there may be two forms concerned, I believe that this can be established only when a series of birds from definitely known breeding colonies in the West Indies are available, since it is possible that the North American bird ranges in West Indian waters when not nesting. A male that I shot at Culebrita Island on April 15, 1912, has the wing 331.5 mm., while one from Desecheo taken June 14 measures 318.0. One from St.

¹⁰ Measurements given by Mr. Ridgway in U. S. Nat. Mus. Bull. 50, Pt. 8, 1919, p. 637, pertain to North American birds only, as I have ascertained by consultation of his original sheets of measurements.
Kitts has the wing 294.0 mm., while in one from Jamaica it is 305.4. For the present the species is left undivided.

Subfamily Sterninæ

_Gelochelidon nilotica aranea_ (Wilson)

_Gull-billed Tern_

_Sterna aranea_ Wilson, Amer. Ornith., 1814, Vol. VIII, p. 143, Pl. 72, Fig. 6. (Cape May.)


_Porto Rico: _rare.

Danforth reports a female taken at Cartagena Lagoon, July 9, 1924, and remarks that others were seen during the summer from May 20 to September 3. They did not nest. The bird is distinguished from other terns by its heavier bill, which is black in color.

_Sterna hirundo hirundo_ Linnaeus

_Common Tern, Gaviota, Palomita_


_Porto Rico: _of regular occurrence on southwest coast, possibly breeding there.

On August 28, 1912, in the bay at Joyuda, near Cabo Rojo, a little band of these terns followed a school of mackerel hunting in the shallows behind the reefs. They dived excitedly when minnows were driven to the surface and, after hunger was satisfied, gathered in a close flock on rocks standing in water. I collected three, all adult males, which constitute the first record for Porto Rico. Struthers has reported the common tern as a summer visitor to the western coast of Porto Rico, where it was noted until October 29, 1921, arriving again on March 4 of the following year. It is possible the bird may breed somewhere near Cabo Rojo. The species is distinguished by the dark outer margin of the outer tail-feather and is distinctly larger than the roseate tern.

_Sterna dougallii dougallii_ Montagu

_Roseate Tern, Gaviota del Paraüso_

_Sterna dougallii_ Montagu, Suppl. Orn. Diet., 1813, text and plate (not numbered). (Cambrae Islands, Firth of Clyde.)

_Sterna_, Gundlach, Journ. für Ornith., 1874, p. 314 (Porto Rico, taken by Blanco).


Porto Rico: recorded from San Juan, Joyuda, Aguadilla and Manatí.

Notes given under Sterna paradisaea in my first list belong under the present species, as shown by reexamination of the records, for paradisaea of Gundlach and Stahl refers to the roseate tern.

Gundlach was the first to record the present species from a specimen taken by Blanco near San Juan. Stahl had three specimens in his collection.

My first sight of the roseate tern in these waters was on June 16, 1912, when I encountered a small flock at sea between Desecheo and Aguadilla. The birds fed for a time by striking at small fishes in the usual tern fashion and then rested on the water in a close group.

On July 8, 1912, I found a few roseate terns flying along the curiously eroded limestone ledges that form the shoreline north of Manatí. Their note was a harsh cack cack. Two were shot, but one of these fell at sea and was lost. The one taken proved to be an adult female in somewhat worn plumage. This bird has the base of the bill (in the dried skin) dull orange and the tip black. On August 28 half a dozen roseate terns were found with common terns in the bay at Joyuda, near Cabo Rojo, where I collected a female in winter dress. In this bird the bill was wholly black.

From this occurrence in June and July it may be inferred that roseate terns nest in this area, but this still remains to be established. Those seen near Manatí acted as though nesting.

In summer adults have the crown black, while in winter the anterior third or more of the pileum is white. The bird is distinguished from the least tern by larger size and different head markings, and from the common tern by smaller dimensions and white tail.

Sterna anaetheta melanoptera Swainson

Bridled Tern, Gaviota


Mona, Desecheo, breeding; Porto Rico, recorded from western coast.

The handsome, bridled tern, with sooty back and wings, black crown and forehead, and white underparts, was first recorded from this area by Bowdish, who found it breeding commonly on Mona and Desecheo, and reported it frequent on the western coast of Porto Rico. On Mona he noted it as abundant from August 9 to 21, 1901. On Desecheo, on June 24, 1900, the breeding period had only just begun, as three eggs found were nearly fresh. An incubated egg was collected on July 6, 1901.

In 1912 (during work from June 13 to 16) I estimated that fifteen hundred birds were present on Desecheo. Many were gathered on large rocks off shore, while others frequented the limestone cliffs and huge boulders of the main island. At this season many were nesting, though some apparently had not laid. Males stood on the rocks above incubating females and, as I approached, swooped at my head with angry cries. At a gunshot all those near rose in a swarm and circled in the air. The nests examined were in hollows on the tops or sides of huge blocks of limestone, in situations protected from the blazing rays of the sun. Some were placed out of sight, in holes eroded deep into the rock. The nests, each containing a single egg, were made of a few loose pebbles or rough stones gathered together, sometimes with the addition of a feather or two. Two eggs that I collected were badly incubated.

In the collections of the U. S. National Museum there are two eggs of the bridled tern from Desecheo Island, Porto Rico, one secured by Bowdish July 6, 1901, and the other collected by me June 15, 1912. The ground color in these is slightly brighter than pale olive buff, while over the entire surface are scattered dots and spots of warm sepia to walnut brown and burnt umber, mixed with spots and blotches of pale neutral gray. One of these eggs has the brown spots small; in the other they are large. These two eggs measure 49.0 x 34.2 mm. and 46.4 x 33.6 mm. respectively.

On the wing the birds were quick and graceful, and frequently in little groups darted swiftly out over the blue water to return to their perches later in a leisurely manner.

Stern&aelig; fuscat&aelig; fuscat&aelig; Linnaeus
Sooty Tern, Gaviota Oscura

Stern&aelig; fuscat&aelig; Linnaeus, Syst. Nat., ed. 12, 1766, Vol. 1, p. 228. (Santo Domingo.)


Mona; Porto Rico, found occasionally on north and south coasts; Tortola.

Bowdish noted the sooty tern as common on Mona Island from August 9 to 21, 1901. The species is supposed to breed there and the author in question speaks of an immature bird that dashed at night against the glass at the lighthouse. Struthers observed this tern, July 15, 1921, at sea between Porto Rico and Mona, and Gundlach found it on the north coast (in the month of July) and at Mayagüez. Gundlach reports a specimen taken by Blanco. Stahl remarks that he shot one on the southern shore of Porto Rico. In the bay at Joyunda I saw one with a flock of common terns on August 28, and near Rincon noted another in company with laughing gulls, September 2.

Alfred Newton believed that terns observed between St. Croix and St. Thomas toward the end of May were this species, and Cassin reports a skin from St. Thomas, taken by Robert Swift. In the market at St. Thomas, Taylor purchased half a dozen eggs said to have come from Tortola.

The species is distinguished from the bridled tern by slightly larger size and lack of white in the forehead. It usually breeds in large colonies. Where the ground is level these may cover several acres.

Sterna albitrons antillarum (Lesson)
Least Tern, Gaviota Antillana

Sterna Antillarum Lesson, Compl. OEnvres Buffon, 1847, Vol. XX, p. 256. (Guadeloupe Island, West Indies.)

Porto Rico; reported breeding near Cabo Rojo lighthouse.

Gundlach included the least tern in his lists on the basis of a specimen taken by Blanco at San Juan, and of birds recorded by Stahl at the mouth of the Río Toa. The latter lists three specimens in his collection and considered them migrant, as he says that they appear in September. Bowdish recorded two off Cabo Rojo lighthouse August 22, 1901. Nichols saw one on the Laguna de Guánica, July 27, 1914, and Struthers, August 9, 1921, found twenty nesting on a sandy beach near the lighthouse at Cabo Rojo. This last report establishes the species definitely as resident in Porto Rico.

The least tern has the white breast, light-gray back and black crown of several other species, but is distinguishable from all by its tiny size. Hartert (Vög. pal. Fauna, February, 1921, Vol. II, Pts. 7-8, p. 1715) has included the North American forms as subspecies of the Old World *albifrons*. This is apparently correct, since *antillarum* is distinguished from *albifrons* only slightly by color and size.

**Thalasseus maximus maximus** (Boddart)
Royal Tern, Gaviota, Chirre, Gaviota Regia

**Sterna maxima** Boddart, Tabl. Planch. Ent., 1783, p. 58. (Cayenne.)

**Sterna cayana** Bello, Zool. Gart., 1871, p. 350 (listed).


Porto Rico, Vieques, Culebra, Culebrita. St. Croix, St. Thomas, Anegada; found throughout the year.

The royal tern, which frequents the coasts of Porto Rico and adjacent
islands in numbers, may be expected anywhere, but is more frequent in bays, since there its food of fish is more easily procured. In 1912 I found it on February 21 at Punta Picua, opposite Mameyes, where two were taken; in San Juan harbor, opposite Cataño, August 1; at the Mayagüez by Bowdish, who found it breeding commonly on Mona and Desecheo playa, June 6, and near Aguadilla, June 9 and 11. Gundlach shot it at Mayagüez, and Struthers secured two specimens near the Rincón light-house on June 22, 1921.

On Vieques Island I found royal terns occasional along the coast from March 16 to April 3, 1912, and on Culebra noted a few feeding with pelicans in the shallow bay at Playa Sardine (one taken) from April 5 to 21. *Daily the birds crossed above the little village from the inner bay flying high in air, always attracting attention by their harsh calls. On April 15 a hundred or more were circling over a flat rock near Culebrita Island and may have been preparing to nest there. Newton received a specimen from St. Croix in 1854 and recorded others. Swift sent to Cassin a young tern from St. Thomas, that was probably this species, and Winch collected the species on Anegada.

These birds strike at fish in the water with dash and abandon. They are seen ordinarily flying back and forth over the quieter waters of bays, or resting, head on to the wind, on stakes or rocks standing in the water. They are harassed by frigate birds to some extent, but on occasion flocks band together and in turn put their tormentor to flight.

The species is the largest of the terns in this region, being almost as large as the laughing gull.

*Thalasseus sandvicensis acuflavidus* (Cabot)


Cabot's Tern, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico; rare.
Gundlach recorded a specimen of Cabot's tern shot at Mayagüez, and supposed that it was common, while Stahl secured two for his collection. In the Museum of Comparative Zoology there is a specimen in winter dress from Bayamón, Porto Rico, taken by Dr. Stahl, probably one of the two just mentioned. The only recent record for the bird is that of Danforth, who reports one from Cartagena Lagoon, December 4 to 22, 1923.

The species apparently is rare. From other small terns it is distinguished by the extremely long and slender bill.

**Chlidonias nigra surinamensis** (Gmelin)

Black Tern, Gaviota, Gaviota Negra, Gaviota Prieta, Gaviota Ceniza, Pitirre de Agua


Porto Rico: during migration.

Gundlach reported a specimen seen in the collection of Blanco in San Juan. This remained as the only record for many years. In 1921, however, Struthers observed twenty at Cartagena Lagoon from August 18 to September 10, and secured specimens. Danforth found it common at this locality from August 20 to October 7, 1924. The species is one found regularly only over fresh or slightly brackish marshes and ponds. In breeding dress the head and underparts are black, while in winter these areas are white. During migration many individuals in intermediate stage of plumage may be noted.

The black tern hunts for food on the wing, quartering steadily across its territory of water or marsh, dropping down to the surface to secure its prey of insects or small fishes. Its flight, like that of other terns, is exceedingly light and graceful.

**Anoïs stolidus stolidus** (Linnaeus)

Noddy, Gaviota, Cervera


The type locality as here given is taken from the A. O. U. Check-list, 3rd ed., 1910, p. 47. Linnaeus, who described the bird from a specimen procured apparently through or by Magnus Lagerström, lists it as "Habitat in Americæ Pelago."


Desecheo, Mona, breeding: Porto Rico, of random appearance along western and northern coasts; St. Croix and St. Thomas, of questionable occurrence.

Gundlach recorded the noddy tern from the north coast of Porto Rico and examined specimens in the collections of Hjalmarson and Blanco. Bowdish found it occasionally on the western coast of Porto Rico, and on June 16, 1912, I saw a number in the outer harbor of Aguadilla.

On Desecheo Island Bowdish saw it nesting in numbers on June 24, 1900, when the nest contents ranged from heavily incubated eggs to well-grown young, and on July 6 to 10, 1901, when young were abundant and only a few nests still contained eggs. From June 13 to 16, 1912, I found noddies abundant on Desecheo, and estimated that two thousand birds were then on the island, congregated in half a dozen principal colonies, with others still to come in from the open sea. The birds inhabited rocky ledges, where they gathered in groups that ranged from a few individuals up to five hundred. The single egg, deposited in some slight hollow of the rock, had a small collection of little, flat stones, a stick or two, and perhaps a feather arranged under it or about it as a nest. The adults flew about, calling harshly whenever I approached, some darting fiercely at my head and some remaining on the nest until I approached near enough to touch them. Above my camp was a colony of perhaps two hundred that was in continual bustle and confusion, as many birds were selecting their nesting sites, quarreling with birds already located, or examining suitable hollows with much nervous excitement. They were more or less active, both in flying about and calling, throughout the entire night. Their usual call is a harsh kur-r-rk, while a scolding note may be represented as kwok kwok. I secured four birds, one male and three females, all breeding. In the U. S. National Museum, there is a further series of eight specimens from this island taken by Bowdish.

There are two eggs in the U. S. National Museum from Desecheo.
Island, Porto Rico, collected by B. S. Bowdish on July 6, 1901. These have the ground color very pale buffy white, with scattered spots and blotches of warm sepia, walnut brown and burnt umber, interspersed with others of pale neutral gray. The markings are abundant about the larger end and are absent or scattered elsewhere. One of these eggs is elongated and the other more ovoid. They measure 49.0 x 35.5 mm. and 55.4 x 34.3 mm. respectively.

Bowdish records the noddy in numbers from Mona Island. The occurrence of the species east of Porto Rico is uncertain. Newton thought that it came to St. Croix, and I have tentatively identified a fragmentary humerus from a kitchen midden at Magen’s Bay, St. Thomas, as that of this bird.

The noddy is unmistakable in its sooty grayish-brown coloration and light gray, almost white, crown.

[Family Rynchopidae]

[Rynchops nigra nigra Linnaeus

Black Skimmer


Rynchops nigra?, Newton, Ibis, 1859, p. 371 (between St. Thomas and St. Croix).—Cory, Cat. West Indian Birds, 1892, p. 83 (St. Croix).


Edward Newton states that “on June 14, 1858, between St. Thomas and St. Croix, a bird, I believe of this species, passed close to the vessel I was in; I could see its black back and white belly distinctly.” This is the only basis for listing the species from St. Croix and is too uncertain to be accepted as definite. The skimmer, larger than the royal tern, is separated from all birds of similar form by the thin, laterally compressed, bladelike bill with the lower mandible projected prominently beyond the upper.]

Order COLUMBIFORMES

Suborder COLUMBAE

Superfamily COLUMBIDES

Family Columbidae

Columba leucocephala Linnaeus

White-crowned Pigeon, White-head, Paloma Cabeza Blanca, Viequera, Torcaza


Mona, Porto Rico, Vieques, Culebra, St. Croix and Virgin Gorda; formerly common, now lessened in numbers.

On Mona Island Bowdich found the white-crowned pigeon abundant from August 9 to 21, 1901, and on August 11 secured three specimens, which are in the U. S. National Museum. Cory also listed this species from Mona in his work published in 1892.

Gundlach, in the seventies, found the white-crowned pigeon common in Porto Rico, but in modern times it has decreased in numbers, probably through the cutting away of the forest growth that gives it shelter. On January 31, 1912, I saw one at the border of a field near Aibonito, but did not encounter the species elsewhere in the uplands. Near Mameyes from February 9 to 29 these doves were common in swampy forest near Punta Picua, where the growth of vegetation was so thick that it was difficult to observe them. They perch amid the thickest leaves and are hard to distinguish. Late in the afternoon numbers flew out to feed in more open growth on the fruit of the icaco (*Chrysobalanus*). Their flight is strong and they often make great sweeping circles. As they rose, their wings made a loud clapping sound, and they darted swiftly through the trees, keeping well behind cover. Adult females taken February 9 and 12 were preparing to breed, which controverts local belief that the birds nest on Vieques and come at certain seasons to the eastern coast of Porto Rico to feed on ripening wild fruits. They were known locally as “Viequera.” One bird taken February 21, though fully grown, was in decidedly immature plumage. A few were recorded on July 9 in heavy brush about the Laguna de Manatí. Bowdich found
this species at Mayagüez, and Struthers mentions a pair taken in a citrus grove near that town on December 15, 1921.

A few bones of this species were identified in remains from a cave near Morovis.

On Vieques Island I found a number, March 25, in a strip of heavy swampy timber near Porto Ferro and collected a female. They were said to nest in this region and to range widely with the ripening of various wild fruits.

The Newtons, in the fifties, found the white-headed pigeon less common on St. Croix than the scaled pigeon. They report a young bird taken July 28, 1858, only a few days after leaving the nest. It must have been hatched on the island in spite of local belief that this dove comes from Porto Rico. Cory also reported the species from St. Croix and received it from Virgin Gorda in collections made by Winch.

The iaco, or beach plum, berries of various palms and other small fruits form its main food. The plumage of this pigeon in general is slaty gray, with the top of the head white more or less obscured by grayish. The present pigeon and the scaled pigeon have been segregated by some in a genus *Patagioenas*, but this I consider as only of subgeneric rank.

**Columba squamosa** Bonnaterre

Scaled Pigeon, Paloma Turca


*Columba*, Bowdish, Ölogist, 1900, p. 72 (Vieques, specimens).


12 Schlegel, Mus. Pays-Bas, Pt. 4, No. 35, 1873, p. 68, states that the type of *Portoricensis* described by Temminck comes from Haiti, not from Porto Rico.


Mona, Desecheo, Porto Rico, Vieques, Culebra, Culebrita, St. Croix, St. Thomas, St. John; fairly common, breeding on most if not all of the islands listed.

Bowdish found the scaled pigeon common on Mona Island from August 9 to 21, 1901, and Struthers reported it there in abundance in July, 1921. On Desecheo a fisherman who accompanied me reported seeing a pair of these pigeons occasionally from June 13 to 16, 1912, and said that on previous visits he had found them at times common.

In Porto Rico, in 1912, I found the species common in the hills and mountains, where small tracts of natural forest and extensive coffee fincas offered it shelter, but saw it seldom on the coastal plain, where there was in the main little shelter to attract it. I recorded it at Manatí, July 7 to 11 (adult female taken July 9); Rio Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29 (adult males taken February 12 and 24); Yauco, May 27; Cabo Rojo, August 31; Maricao, May 29 to June 5 (adult male, May 31; young, June 1); Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; above Ciales, July 15; Aibonito, January 31; Comerio, July 26 to 31; El Yunque, March 2 to 11 (four males, March 6, 8 and 10). The dense forests covering the slopes of El Yunque de Luquillo, in the northeastern part of Porto Rico, harbored great numbers of these birds, which ranged commonly up to 2500 feet above the sea. In late afternoon and evening, near the Hacienda Catalina, it was a common sight to see them circling about high in the air. In spite of their large size, they were difficult to see in the trees, even in the thin foliage of the cacao rosetta (*Sloanea berteriana*). Thus it often happened that bird after bird flew out from amid the limbs, with loudly clapping wings, yet failed to offer a shot, while I peered vainly upward in search for their hidden companions. When one of the big males chanced to drop in near another, a great flapping of wings ensued until one was forced to take flight. The ordinary call note was a loud, strongly accented *who hoo hoo*, while a burring guttural *hoo-o-o-o*, given with a throaty rattle, was almost startling when heard from directly overhead. Many birds descended to feed amid the tall trees fringing small streams at the foot of the mountain, and some were encountered in the dense swampy forests.
near Punta Picua, beyond Maneyes. Males rest and call at times in the tops of tall, dead trees.

It is a common belief in Porto Rico that the scaled pigeon is only a migrant on the island—a belief promulgated, it may be said, by gunners who desire an open season covering the entire year. That this is erroneous was proven on March 8, 1912, when without special search I found three nests on El Yunque, while there was no doubt whatever that the dozens of birds flushing on every hand were breeding. The three nests definitely located were made of sticks loosely piled together and placed about fifteen feet from the ground on horizontal limbs, or on refuse piled on large air plants. Two were empty, while one contained a single egg, plain white in color with a slight gloss, which was collected. This egg had had about five days' incubation. It measures 34.8 x 26.7 mm. At Maricao, on June 1, a native brought me a young bird about two-thirds grown, and said it was the only one in the nest. Gundlach has said that two eggs are laid, but from these instances it would seem that a single egg in a set is not unusual.

The paloma turca is said to occur in large flocks during fall, and to gather in numbers where wild fruits are ripening, at which time many are killed. It is common belief that these flocks are entirely migratory, but there can be no doubt that they come mainly from the forests on El Yunque and elsewhere in the interior.

Near Manatí I found the pigeons in dense bush about the Laguna de Manatí, and secured a female that was evidently breeding. At Rio Piedras a few were seen in the small tract of forest above the Sugar Experiment Station. Elsewhere on the coastal plain they were noted casually below Yauco and near Cabo Rojo. In the U. S. National Museum are two specimens taken at Caguas, January 9, 1899, by A. B. Baker. Bones of this species were identified in cave deposits near Morovis.

On Vieques Island Bowdish reports taking three in 1899. An adult male, now in the U. S. National Museum collection, was secured March 28, 1900, by C. W. Richmond. I recorded one near Porto Ferro on March 25, 1912.

On Culebra Island an adult male was secured on February 2, 1899, by A. B. Baker. I shot one on April 10, 1912, in mangroves near the inner bay, and another was heard calling. It was said that the pigeons had been common here formerly.

The Newtons found the species in small numbers on St. Croix, and Cory has reported a specimen from the same island. Robert Swift forwarded a number from St. Thomas to Cassin, and in the U. S. Na-
tional Museum there is a male from St. Croix taken by F. A. Ober, with two more secured by the same collector in 1880 on St. John.

The scaled pigeon, which has the posterior part of the body slaty gray, like the white-headed pigeon, is distinguished by the reddish brown suffusion of the head, neck and anterior part of the breast, with squama-tions of deep reddish brown on the hind neck, from which the bird takes its name. It feeds on wild berries and fruits, with occasional succulent leaves or shoots. The berries of various palms, wild figs, the moral (Cordia), and jagua (Genipa americana), with various wild legumes, are eaten extensively.

The species is the only game bird of importance in the inland region of Porto Rico and affords excellent sport, as it is wary, strong on the wing, and is found only in the wildest, roughest country. It should be protected from February 1 to October 15 each year, if not longer, to permit it to breed, as otherwise it cannot maintain its status.

Though large numbers breed on Porto Rico, the scaled pigeon seems migratory to some extent between the various Antillean islands. I was told that the number to be found on Desecheo Island fluctuated greatly, and the Newtons, on St. Croix, report one, April 29, 1858, that, boys said, had just come in from the sea.

**Columba caribaeae** Jacquin

**Jamaican Band-tailed Pigeon**


*Columba lamprauchen* Wägler, Syst. Av., 1827, p. 244. (Described from Porto Rico.)

*Columba caribbea*, Gosse, Birds of Jamaica, 1847, p. 296 (Porto Rico).


The position of this pigeon in the avifauna of Porto Rico is wholly uncertain. Wagler described it, under the name of *Columba lamprauchen*, from a bird ascribed to Porto Rico; Gosse informs us that "Mauge found it at Porto Rico, where it is said to associate in flocks of many hundreds." Other older authors apparently included the species in their lists because of these statements and there are no modern records for it.
On the basis of this information, the species is included here for the present, but it is my impression that the records noted are given with an erroneous locality, or that, if rightly assigned to Porto Rico, they refer to *Columba inornata exsul*, from which *caribaea* differs mainly in the plain, grayish brown head, neck and breast, with metallic sheen on hind neck and the prominent light bar across the end of the tail.

At the present time *caribaea* is known certainly only from the island of Jamaica.

*Columba inornata exsul* (Ridgway)

*Porto Rican Pigeon, Blue Pigeon, Paloma Sabanera*


*Columba inornata*, Cory, Cat. West Indian Birds, 1892, p. 97 (Porto Rico).


Porto Rico; rare.

Gundlach obtained this pigeon only near Lares, in the vicinity of the Cueva Pajita. It was reported to him in the section known as Caguana, near Utuado, and was also said to occur in the mountains of the eastern part of the island. Stahl possessed one specimen, while I identified bones of this pigeon from cave material secured by H. E. Anthony in the vicinity of Morovis and Utuado.

The type specimen, in the U. S. National Museum, from the old Bryant collection, is without definite data. In the Museum of Comparative Zoölogy is a skin from the same source (Cat. No. 72,266), an adult bird with the wing 205 mm., tail 114.3 mm., culmen with cere 29.5 mm. and tarsus 30 mm. This bird bears out the characters assigned to the Porto Rican subspecies, as it is decidedly darker above and below than a specimen of *C. i. inornata* from Cuba, with wider edgings of white on middle and greater wing coverts.

The only recent specimen known to me is a female in the Carnegie Museum (No. 39,313) taken April 28, 1912, at Utuado, Porto Rico, by W. W. Worthington. This bird has the following measurements: wing, 209 mm.; tail, 128. 5m.: culmen from base, 19.9 mm.; tarsus, 29 mm.

Nothing is known to me of the habits of this pigeon in Porto Rico. In appearance it is similar in a way to the scaled pigeon, but much paler,
with a vinaceous wash extending over the underparts and no squama-
tions or metallic color on the hind neck.

Sportsmen were familiar with the name of this bird in 1912, but I
failed to find it personally.

\[**Crossoptilhalmus gymnophthalmos** (Temminck)

Bare-eyed Pigeon

*Columba gymnophthalmos* Temminck, Pigeons, 1808-1811, Vol. I, second fam.,
p. 48, Pl. 18. (No locality cited.)

Pt. 7, p. 322 (St. Thomas, introduced?).

In the U. S. National Museum there is an excellent skin of an adult
male of this species, marked “St. Thomas, W. I., A. D. Ormes.” It
bears no date, but was catalogued in 1874. The specimen is in good
plumage and shows no evidence of having been in captivity.

As the natural habitat of the species is the arid Caribbean coast of
Venezuela and Colombia, and the adjacent islands, and because of lack
of substantiating information, I believe the locality given for this
specimen to be erroneous.

It may be noted here also that Ledru has listed a green pigeon
*“Columba sancti-thomae* Gm. les iles danoises,” and that Knox, in his
Historical Account of St. Thomas, W. I., published in 1852, records
(page 221) a green pigeon from Porto Rico with the remark that “they
visit the island at certain seasons, for the berries.” These must be con-
sidered erroneous records.

**Zenaida zenaida zenaida** (Bonaparte)

Zenaida Dove, Tortola Sanjuanera

*Columba zenaida* Bonaparte, Journ. Acad. Nat. Sci., Philadelphia, June, 1825,
Vol. V, p. 30. (Florida Keys.14)

(Porto Rico).—Sundevall, öfvers. Kongl. Vetensk.-Akad. Förh., 1869,
p. 601 (Porto Rico, specimen).

**Zenaida amabilis** Newton, Ibis, 1859, p. 253 (St. Croix, common).—Cassin,
Proc. Acad. Nat. Sci. Philadelphia, 1869, p. 378 (St. Thomas, speci-
für Ornith., 1874, p. 312; Journ. für Ornith., 1878, pp. 161, 186; Anales

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13 So far as I have ascertained, no type locality has ever been cited for the present
species.

14 See Zoöl. Journ., 1827, Vol. III, p. 55, where it is stated that the species was
described from a single specimen from the Florida Keys.


Zenaidura macroura, Cory, Auk, 1887, p. 112 (Porto Rico); Cat. West Indian Birds, 1892, p. 97 (Porto Rico).—Bowdish, Oölogist, 1900, p. 72 (Vieques, specimen); Auk, 1902, p. 361 (Porto Rico).


Mona, Desecheo, Porto Rico, Vieques, Culebra, Louis Peña, Culebrita, St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda; apparently resident throughout the islands enumerated.

Cory has listed this species for Mona, probably from specimens collected by W. W. Brown. Bowdish reported it common there from August 9 to 21, 1901, and in his manuscript notes (which I have seen) reports on August 11 a young bird in captivity.

On Desecheo, from June 13 to 16, 1912, I found Zenaida doves common in growths of West Indian birch and other shrubs that covered the arid slopes. Males called throughout the day, but were so wild that in the thick brush it was difficult to approach them, so that I was at much trouble to secure a single specimen. Scattered birds fed in small openings or along trails, and at low tide numbers were observed about pools of salt water left by the receding waters on the rough limestone of the shore. The one shot on June 15 was breeding. Struthers secured a specimen on Desecheo, January 22, 1922.

On Porto Rico the Zenaida dove is common and widely distributed
through the entire island. In 1912 I reported it as follows: Quebradillas, July 2 to 6; Manatí, July 7 to 11 (specimen); Bayamón, July 24 to 25; Mameyes, February 9 to 29 (five specimens); Yabucoa, May 3 to 10; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Laguna de Guánica, May 26 (specimen); Cabó Rojo, August 24 to 31 (specimen); Añasco, June 7 and 8; Lares, June 18 to July 1; Utuado, August 5 and 8; Adjuntas, August 12; Ciales, July 12 to 18; Aibonito, January 26 to February 5 (specimen); Comerio, July 26 to 31 (specimens); Caguas, January 5 to 14; Cayey, January 23. It is largely a bird of the cultivated valleys and lowlands, roosting in clumps of trees, coffee plantations, small areas of second growth, or mangroves, and flying out to feed in the fields and citrus groves during the morning and evening. The flight is strong and direct and it flushes with a loud clapping of wings. On the ground this species resembles the mourning dove, as it walks quickly about with nodding head, and it has a cooing note almost indistinguishable from that of the bird mentioned.

During the breeding season the males are frequently seen sailing out in cireles, with the wings held stiffly, and their cooing notes come from the hillsides all day long. They are also observed at times walking rapidly about on the ground near the females, striking at each other with their wings. Breeding birds were taken in February and a young bird, not quite adult, but able to fly strongly, was collected near Manatí, July 8. Near Aguadilla Bowdish shot a female, May 28, 1900, that contained an egg nearly ready to be laid, and Struthers collected eggs during June, 1921. At Comerio, July 29, I took a female feeding young. Although in some localities the doves nest on the ground, nests in Porto Rico are usually placed in trees; otherwise the birds would not be able to hold their own against the mongoose. Danforth has reported two nests built in cat-tails at Cartagena Lagoon. Two eggs, white in color, constitute a set.

Between nine and ten in the morning the Zenaida dove comes in to streams or ponds for water, usually in pairs, swiftly flying high in the air. On the gravel bars of the larger rivers they walk about quickly, quenching their thirst and picking up bits of sand and gravel. Usually they are quite wary, but sometimes prefer to hide and let an intruder pass, rather than fly.

The species frequents open country and is thus the only one of the large pigeons in Porto Rico that prospers with the clearing of the land. In some localities it is hunted constantly, and then is very wild; elsewhere it is quite tame.
I found bones of this species common in cavern deposits near Morovis and Utuado.

The coloration of warm browns and grays and the dark spot on the side of the head are strongly suggestive of the mourning dove (*Zenaida dura macroura*), a resemblance heightened by the cooing notes of the male that at a distance seem identical with those of the species mentioned. The *Zenaida* dove is easily distinguished, however, by the square-ended tail, as the mourning dove has the central tail feathers greatly elongated. It is probably this resemblance in color and note that has led to accounts of the mourning dove's presence in Porto Rico. Apparently the mourning dove does not range east of Santo Domingo, since I find no definite records of it for any of the islands under discussion. References pertaining to it are, therefore, placed under the *Zenaida* dove.

On Vieques Island the *Zenaida* dove was first recorded by Bowdish, who found it common and secured specimens on December 19 and 22, 1899. From March 16 to April 3, 1912, I noted it as very common in the dense scrubs covering the forested hills and in brush-grown pastures. This was apparently the height of the breeding season, and males were cooing constantly. It was said that flocks gathered in May and June to feed on the fruit of the *palo blanco* (*Drypeles sp.*). Specimens in breeding condition were preserved on March 25 and 27.

On Culebra Island *Zenaida* doves were fairly common from April 5 to 20, 1912, and an adult male (breeding) was taken on April 11. The species was noted also on Louis Peña and Culebrita islands.

The Newtons found the *Zenaida* dove very common on St. Croix, and recorded it as nesting in trees from April to the end of July, with two eggs constituting a set. G. K. Noble secured an adult male here, September 15, 1914, and I have identified bones of this species from a kitchen midden on the Richmond estate, near Christiansted, in material presented to the U. S. National Museum by Mrs. Hugo Hark.

The species was first collected in St. Thomas by Robert Swift in the late fifties. One of his skins is preserved in the U. S. National Museum, with another taken by F. A. Ober in 1880. The latter collector secured a female during the same year on St. John, and skins were sent to Cory by Winch from Tortola and Virgin Gorda.

Noble described the bird from St. Croix as a subspecies under the name of *Zenaida zenaidea lucida*, distinguished by the brighter brown color of the head—a form that has been said to range from Porto Rico to Antigua in the Lesser Antilles. On examination of a series, including the type of *lucida* (seen in the Museum of Comparative Zoölogy), I find
no basis for separation of these birds as a distinct race, since the supposed differences appear to be wholly individual. There is considerable variation in depth of color throughout the entire range of the typical form.

The bulk of the food of this dove consists of seeds, including many wild legumes, euphorbias, mallows, knotweed and pigweed. Waste grain is also taken and various small wild fruits in season. The species is a valuable game bird and should be carefully protected during the breeding season.

**Zenaida aurita** (Temminck)

*Martinique Dove*


*Zenaida martinicana*, Cory, Auk, 1891, p. 48 (St. Croix, specimen).

*Zenaida castanea*, Cory, Cat. West Indian Birds, 1892, p. 97 (St. Croix).


St. Croix, Virgin Gorda.

Cory reports a specimen of this bird from St. Croix collected in March or April, 1890, by Cyrus S. Winch. Mr. Ridgway has examined an adult female from Virgin Gorda in the collection of the Field Museum, but did not see the skin attributed to St. Croix. The species, primarily distributed in the Lesser Antilles, is readily distinguished from the similar Zenaida dove by the white of the posterior underparts, which contrasts conspicuously with the brown of the anterior portions.

**Chamaepelia passerina trochila** Bonaparte

*Porto Rican Ground Dove, Rola, Rolita, Tortolita*


*Columbigallina passerina*, Cory, Auk, 1890, pp. 374, 375 (Anegada, Tortola, Virgin Gorda, specimens); Auk, 1891, p. 48 (St. Croix); Cat. West Indian Birds, 1892, p. 97 (Porto Rico, Tortola, Virgin Gorda, Anegada, St. Croix).—Bowdesh, Öflogist, 1900, p. 72 (Vieques); Auk, 1902, p. 361 (Porto Rico).—Hartert, Nov. Zoöl., 1902, Vol. IX, p. 276 (St. Thomas).


Chamaepelia portoricensis Lowe, Ibis, 1908, p. 108. (Described as new, type locality, Guánica, Porto Rico.)

Porto Rico, Vieques, Culebra, Culebrita, Louis Peña, St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda and Anegada; found universally wherever conditions are suitable for it.

In 1911 and 1912 I recorded the ground dove at Quebradillas, July 2 to 6; Manatí, July 7 to 11 (specimens); Río Piedras, December 16 to January 4; Mameyes, February 9 to 29 (specimens); Humacao, September 3 to 9; Maunabo, May 11; Salinas, April 26 to May 2 (specimens); Juana Diaz, August 17 to 22; Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 12; Lares, June 24; Utuado, August 3 to 9; Ciales, July 12 to 18; Comerio, July 26 to 31; Cayey, January 19 (specimen); Caguas, January 5 to 14; and Hacienda Catalina, March 2 to 11. On Porto Rico the species is restricted mainly to the coastal area below an altitude of five hundred feet, but follows inland along the courses of the streams and occasionally ranges up to twelve hundred feet, as at Cayey and Lares, where a few were seen. With increased clearing they may spread to higher altitudes. Ground doves occur in plowed fields, on stony hillsides, pastures, and open country in general. They walk about quickly on the ground with long steps and rapidly nodding heads, picking up food and gravel as they go. Before an intruder they travel rapidly away, raising the tail nervously, or crouch to the ground, to rise with a sudden flutter of wings that exposes the reddish brown under surface of the remiges, as they dart swiftly away. When several rise at once, there is considerable confusion, as the birds zigzag back and forth, crossing and recrossing one another's line of flight. After flying a short distance they
drop to the ground again or perch in rather open trees, sitting close together. When alarmed, they sidle quickly along the limbs, hiding behind them, or suddenly take flight and whirl swiftly away. The males have a loud note, coo-coo-coo-coo, given as they perch in the trees; during the summer these notes come from every side, as the birds answer back and forth. The males also sail out in short circles with the wings stiffly spread—an action like the similar display of the mourning dove. At such times they have a curious kitelike appearance. The birds are usually found in pairs, though occasionally, before or after the breeding season, they are encountered in small flocks.

The breeding season appears to extend from the first week in March until the last of August. Nests observed in Porto Rico were usually slight and flimsy, so that in many cases the eggs could be seen from beneath. Two eggs, white in color, form a set, and at least two broods are reared in a season, with apparently a third one at times.

Struthers reports eggs taken May 7, 1921, near Guanajibo Point. At Yauco and Guánica in 1912 the latter half of May appeared to be the height of the breeding season. One nest near Yauco was placed six feet from the ground, on the slanting limb of a calabash tree. On May 20 I found a young bird on the ground which had fallen from a nest in a tree above. This bird, only a few days old, still had the egg tooth, though the wing quills had begun their growth. It was covered rather sparingly with wiry down buffy white in color. At Manatí during early July I found flocks composed of grown young, while adults were busy with a second brood. A female taken contained an egg ready for the shell. From August 17 to 22 grown young were abundant at Juana Díaz. The calling of the males lessened perceptibly in August, though they were heard occasionally into September.

Bowdish found a nest with fresh eggs near San Juan July 19, 1899, placed twelve inches from the ground in a dead bush. At Aguadilla one seen June 9, 1900, was eight feet from the ground, on the horizontal branch of a mango tree; one noted June 24 was placed on a stump amid sprouts, nine feet from the ground; one observed July 12 was two feet from the ground and contained fresh eggs, and one, July 22, was twelve inches above the earth in a thorn bush and it, too, had fresh eggs. An egg in the National Museum taken by Bowdish in Porto Rico (without definite data) is white with a faint gloss and measures 21.1 x 16.3 mm.

A number of bones of this species were encountered in cavern deposits near Morovis, in material collected by H. E. Anthony.

While females were incubating, males were found feeding together.
often in yautia or cane-fields. When caring for their young, females feed in the early morning, filling the crop with seeds, and then about nine fly to water, usually following well-defined routes across the slopes of the hills. After drinking, they perch quietly in the trees, and in a short time the “pigeon’s milk” begins to form as a thick curd, in the lower portion of the crop. After June it was a common sight to find flocks of a dozen or more young gathered by themselves. Formerly the birds were said to have nested on the ground, but now they build almost entirely in trees to escape the mongoose.

This species is one of the few that is found in the cane-fields, where it occurs regularly, even when the cane is well grown, either in the roads leading through the fields or between the rows. These doves are very timid and show great fear of sparrow hawks, sometimes refusing to fly when the latter are in the neighborhood. During the breeding season the males were found in the early morning feeding in the cane-fields or else cooing from the hills, while the females were above on the hillsides. When there was a heavy dew, the birds were inactive until the ground became dry, at ten or eleven in the forenoon.

On Vieques Island this dove was common and universally distributed in pastures and cane-fields. On March 30, 1912, I flushed a male from a nest containing two eggs in which incubation had just begun. The nest was placed seven feet from the ground on the horizontal limb of a tree, and was a deep, cupped structure, containing much more material than is usual in the nests of doves.

On Culebra Island the ground dove was one of the most abundant birds, probably because here the mongoose is absent. The doves spread also to the small islands of Louis Peña and Culebrita.

On St. Croix the Newtons found them very common, and noted their nests on the ground, in bushes, sugar cane or trees. They described the nest as a large, well-built structure. In the Museum of Comparative Zoology there is a series of eight skins, secured in June and September, 1914, by G. K. Noble, that appear identical with birds from Porto Rico and St. Thomas. Nicoll found them abundant here from February 19 to 21, 1904. The species is plentiful on St. Thomas and has been observed and collected there by many naturalists. Benedict and Nye secured nine skins for the U. S. National Museum from January 17 to 24, 1884, and specimens have been taken by Robert Swift, Hartert and Nicoll.

Cyrus S. Winch collected specimens for Cory on Anegada, Tortola and Virgin Gorda, while Ridgway lists skins from St. John.
Practically the entire food of the ground dove is composed of seeds, as in seventy-two stomachs that I examined minutely there occurred only a few fragments of ants and occasional individuals of the spherical scale insects known as ground pearls, all probably taken by accident. Weed seeds constituted about one-fourth of the mass.

**Chaemepelia passerina exigua** (Riley)

*Mona Ground-Dove*


*Columbixallina passerina*, Cory, Cat. West Indian Birds, 1897, p. 97 (Mona).—Bowdish, Auk, 1902, p. 361 (Mona).


Mona Island; resident.

The ground dove of Mona Island is a form distinct from that on the adjacent island of Porto Rico, distinguished by paler coloration. The subspecies *exigua* is found also on the island of Inagua, in the southern Bahama Islands.

Bowdish, who collected the type and two additional specimens now in the U. S. National Museum, reported these doves common on Mona from August 9 to 21, 1901. He found a nest containing two partly incubated eggs, three feet from the ground, in a bush, August 11, and also found a single fresh egg on the bare rock in a path. The two eggs mentioned in the collections of the U. S. National Museum are white with a slight gloss, and measure 21.2 x 16.4 mm., and 21.4 x 16.2 mm. respectively.

**Oreopeleia montana** (Limaenus)

*Ruddy Quail-dove, Perdiz, Perdiz del Monte, Boyero*


Ruddy Quail-dove, Struthers, Auk, 1923, p. 474 (listed).


Cory, Cat. West Indian Birds, 1892, p. 97 (Porto Rico, St. Croix).—
Bowdish, Auk, 1902, p. 361 (Mona, Aguadilla, Vieques).—Wetmore, U. S.
(Vieques).—Schmidt, Field Mus. Nat. Hist., ZoöI. Ser., 1926, Vol. XII,
p. 151 (Mona).

(Porto Rico, St. Thomas).—Wetmore, Bull. Amer. Mus. Nat. Hist., 1922,
Vol. XLVI, p. 314 (bones from caves near Utuado and Morovís).

Mona, Porto Rico, Vieques, St. Croix, St. Thomas; resident.
Bowdish, the only naturalist who has found this bird on Mona Island,
reports it as common there from August 9 to 21, 1901.
The ruddy quail-dove is an inhabitant of dense growths of jungle and
finds cover to its liking mainly in the hills and mountains above the
coastal plain. It is probable that its distribution is governed somewhat
by the abundance of the mongoose near the coast, since from its terres-
trial habits the dove is subject to depredation by this manimal.

Gundlach secured this dove near Mayagüez and in the interior of the
island, while Bowdish found it near Aguadilla. In 1912 I observed it
in dense brush about the Laguna de Manatí, north of Manatí, from July
7 to 11, this being the only point at which I noted it on the coastal plain.
The growth here was so dense that it was difficult to catch sight of the
birds. Above the coastal plain it was found at Maricao, from May 29 to
June 5 (adult male taken May 30); Utuado, August 3 to 9 (reported);
Aibonito, January 26 to February 5 (adult female taken February 2);
Caguas, January 5 to 14 (adult males taken January 8, 9 and 11), and
the Hacienda Catalina, March 2 to 11.

At times the ruddy quail-dove is seen in coffee plantations, where these
are not kept too clean of brush, but it is usually found in areas of dense
second growth on the slopes of hills. As such cover becomes restricted
in area, these doves grow steadily less abundant. To observe them it
is necessary to walk noiselessly along footpaths, crouching low to obtain
what vision may be had of the ground beneath the dense brush. If the
doves feel that they are liable to observation, they rest motionless, and
at such times it is almost impossible to detect them. If approached too
closely, they rise and dart into the dense growth. At other times they
walk rapidly to one side, with quickly nodding heads, and it is then that
they may be momentarily visible. Their flight begins with a loud flutter-
ing of feathers, but after a few feet they set their wings and sail away on
noiseless pinions. Occasionally they were seen on low limbs in the trees,
perhaps six to ten feet from the ground, but this was unusual.

No nests were found, but it appeared from the actions of the birds
that breeding had begun in March. A male taken at Maricao, May 30, was in breeding condition. They are said to nest on the ground. Males during the period in question give utterance to a low, resonant note of such character that it seems always to come from a distance, though the singer may be near at hand; this resolves itself into a deep coo-oo-oo, with a peculiar undertone as of the humming of wind across the end of a gunbarrel—a striking sound and one whose source is difficult to locate. The birds are usually found in little groups that, however, make no pretense at flock formation.

During the orange season these doves feed mainly on the seeds of wild sweet oranges, secured from fruit that has fallen to the ground and has partly decayed, enabling the birds to peck open the skins and reach the seeds at the center. They do not touch this fruit except when on the ground, and cannot open oranges except when the skin is soft through decay, so that no injury in orange groves may be charged to them. Near Manatí they were eating the fruits of the manchineel.

Bowdish secured a male on Vieques Island, December 30, 1899, and the species was reported to me on Vieques from March 16 to April 3, 1913, but I did not see it. Cory has recorded it from St. Croix and Mr. Ridgway has listed it from St. Thomas.

The ruddy quail-dove is to be confused with no other pigeon on Porto Rico; the male is bright brown and the female olive brown, while it has somewhat the size of the zenaida dove there are no light markings in the tail.

**Oreopeleia chrysia** (Bonaparte)

*Key West Quail-dove, Perdiz Martiniqueña, Barbequejo*

*Geotrygon chrysia* Bonaparte, Compt. Rend., 1855, Vol. XL, p. 100. (Florida.)


Recorded from Mona and Porto Rico; of uncertain occurrence.

Mr. Bowdish reports this quail-dove as seen several times on Mona Island, August 9 to 21, 1901. Gundlach noted a specimen in the collection of Blanco, and in addition found it figured in the album of Dr. Bello. Stahl records a male in his collection.

The species is of somewhat uncertain occurrence, and unless specimens are secured, I am inclined to wonder whether the Porto Rican records cited may not apply to Oreopeleia m. mystacea, from which chrysia differs mainly in the decidedly whiter underparts and more rufous back. Like that species, it has a distinct white streak from the gape back beneath the eye.

**Oreopeleia mystacea mystacea** (Temminck)

Bridled Quail-dove

*Columba mystacea* Temminck, Les Pigeons, 1808-1811, Vol. 1, p. 124, Pl. 56. (America.)


St. Croix, Culebra.

Cory reports a specimen from St. Croix, and there is in the U. S. National Museum an adult male taken February 9, 1899, on Culebra Island by Mr. A. B. Baker (U. S. Nat. Mus. No. 169,028). Nothing further is known of the bird in this region.

The species is distinguished from the ruddy quail-dove by the prominent moustachial streak and from *O. chrysia* by the darker, more rufescent brown underparts.

**Oreopeleia larva** Wetmore

Porto Rican Quail-dove


Porto Rico, extinct; known from bones from Cueva Clara and Cueva Catedral near Morovis, a cave on the property of Don Gervacio Tóraño near Utuado, and from a kitchen-midden deposit on Mesa Hill near Mayagüez.
This quail-dove is represented by a series of leg and wing bones (Figs. 14-16) and was described with a tarso-metatarsus as type. From the slender proportion of this bone, the bird appears to have been allied to Oreopeleia caniceps of Cuba and O. leucometopius Chapman of Santo Domingo. It seems to have been a bird of moderate body frame, slightly larger than O. montana, but smaller than Geotrygon versicolor. The trochlea are slighter than in Oreopeleia martinica and the bird is larger than O. chrysia and O. montana. It is, as indicated, representative of a type known from Cuba and Santo Domingo.

The species, described originally on the basis of a very fair amount of material from cavern deposits, has been discovered more recently (in the form of a left tarso-metatarsus) among kitchen midden deposits near Mayagüez. This indicates that, though now extinct, the species has no great antiquity, since it appears contemporaneous with the aboriginal inhabitants of the island.
# The Birds of Porto Rico and the Virgin Islands

## Psittaciformes to Passeriformes

**By Alexander Wetmore**

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Order Psittaciformes
Family Psittacidae
Subfamily Pioninae

Amazona vittata vittata (Boddart)

Porto Rican Parrot, Cotorra

Psittacus vittatus Boddart, Tabl. Plan. Enl., 1783, p. 49 (Porto Rico.)


Porto Rico, formerly abundant and widespread (recorded from Isabela, Quebradillas and Utuado definitely), now restricted to mangrove swamps near Mameyes, the eastern slopes of El Yunque de Luquillo and the forested region between Arecibo and Utuado.

Moritz, in 1836, reported great flocks of parrots, and Taylor, in 1864, noted them as common. Gundlach found them at Quebradillas and Utuado, and said that they occurred mainly in the interior, where they often damaged corn in the milky stage. Stahl reports one skin in his collection, with a tendency to xanthochroism, that came from Isabela. Two skins collected by Stahl are preserved in the Museum of Comparative Zoology.

It appears that until thirty years ago the parrot was a common species in Porto Rico, but now has disappeared except in a few localities, mainly in the northeastern portion of the island, on the mountain known as El Yunque de Luquillo and immediately around its base. From February 9 to 29, 1912, I found about twenty ranging through the dense swampy
forests north of Mameyes (one taken), while perhaps fifty were seen between March 2 and 11 around the west fork of the Río Mameyes, or were heard calling in the dense forests covering the summit of El Yunque itself. (Eight, all adult, were taken here.) Parrots were said to be still fairly common around Preston’s Ranch, above Naguabo. On the western end of the island they had practically disappeared, though birds were reported from below San Sebastian, and Mr. Leopold B. Strube, of the Hacienda “Jobo,” between Arecibo and Utuado, said that during the winter months fifty or sixty were found on his plantation, though none nested there. At Lares I was told that no parrots had been seen for ten years.

Near Mameyes they remained in the swamps during the day, coming out to the borders morning and evening to feed, but, when alarmed, flew back inland immediately. Sometimes a small flock was found feeding in company with white-crowned pigeons in the tops of trees, when, due to their green coloration, the parrots were the less conspicuous of the two. Frequently the parrots hid in the trees and remained quiet for half an hour or more, and then flew out in sudden alarm.

Around El Yunque the birds were somewhat tamer, as they were not hunted so much, and a few were secured about a large clearing above the Río Mameyes. The birds were in pairs or small bands during March and were then breeding. During the early morning and evening they fed in the forest and in passing often stopped in high, dead trees that were standing in the clearing. After heavy rains that came at intervals during the day, they alighted there also, to dry their feathers in the sun. The call-note, given on the wing, was a rapid, strident *kar, kar*, that could easily be heard at the distance of a mile, and served to alarm the entire forest. When they were feeding, low chuckling notes were heard frequently. In the trees the birds went through the characteristic posturings of *Amazona* in captivity, swinging head down and then climbing to an upright position by the aid of their bills, or watched suspiciously to see what I was about. When it rained heavily on the mountain, many birds descended to the warmer valleys, returning when the weather cleared.

These birds nest during March and April and it is said lay two eggs, depositing them in a hollow tree. The parrots are greatly sought by the natives, who keep the young as pets and teach them to speak a few words of Spanish, though most of the captive birds on the island are another species, brought from the island of Haiti. The adults are also hunted as game birds and are prized for their flesh. Formerly parrots
traveled in large bands that damaged cornfields, gonduros and other crops, and men engaged in school work told me that, as late as 1903, children were frequently kept from school by their parents to drive parrots out of the fields. The handful remaining is, however, too small to do any great damage, and the birds should be protected or they will soon be extinct and one of the most interesting forms will be lost from the avifauna of the island.

From personal observations and what I was told, it seems that the parrot is almost entirely frugivorous, practically all wild fruits being eaten in season. These birds are fond of the fruits of the wild fig (*Ficus*) and the jagua (*Genipa americana*), while in swamps near Mameyes the ground beneath the icaco trees (*Chrysobalanus*) was strewn with husks which they had dropped. In eight stomachs examined I found vegetable matter alone, with the seeds of tabonuco (*Dacryodes excelsa*) and allied species in the same family (*Burseraceae*) predominating. A parrot taken near Mameyes had eaten icacos (*Chrysobalanus*). In the birds obtained on El Yunque it was common to find the stomach filled predominantly with small seeds, while the crop was distended with larger fruits and drupes. The hard seeds in the gizzard seemed in this case to take the place of the gravel used by many birds as a triturating element. While they served to grind up larger fragments, they were in their turn pulverized and utilized as food. In localities where the parrots were feeding commonly, the ground was always littered with seeds, bits of pericarp and other waste matter which they had discarded.

The plumage of this bird is clear green, with the outer webs of the primaries blue, the forehead and lores red, and the bill and feet flesh-color.

**Amazona vittata gracilipes** Ridgway

Culebra Island Parrot, Cotorra


*Amazona vittata?*, Wetmore, Auk, 1916. p. 413 (Vieques, reported).

Culebra Island; now apparently extinct.

The only specimens known of the Culebra Island parrot are three in the U. S. National Museum, two males and a female (including the type
of the subspecies), secured by A. B. Baker on February 11 and 12, 1899. In his manuscript notes Mr. Baker has stated that the bird at that time appeared to be common and was said to injure plantations and bananas. I did not find it during my collecting on the island in 1912 and it is thought to be extinct.

The Culebra Island subspecies is smaller than the form of the main island. In the three specimens available the wing measures 170 and 175 in the males and 175 mm. in the female. In six males from Porto Rico the wing ranges from 184 to 196 mm.; and in six females, from 173 to 184.5 mm.

On Vieques Island, in 1912, I was told that parrots were seen formerly in the heavy forests of the southern part of the island. It was thought that they came from Porto Rico, as they were found in the rainy season. Señor José Barton, a local hunter, was well acquainted with them and told me that they were considered a valuable game bird. I saw none during my work there. It may be mentioned that Hans West (Beyträg Beschr. von St. Croix, 1794, p. 268) remarks on the screaming of green parrots from the trees during his visit to Vieques.

Knox, writing of St. Thomas, reports parrots as quite abundant in the hills at Havensigt, on the eastern side of the harbor, in the same locality as that favored by the paroquet. There is nothing further known of true parrots on that island.

Subfamily Arinæ

**Aratinga chloroptera mauegi** (Souancé)

Porto Rican Paroquet, Periquito


Formerly said to have occurred on Porto Rico, but now extinct; Mona Island.

A paroquet was formerly found on the island of Porto Rico, but disappeared before the days of modern collectors. According to the Catalogue of Birds in the British Museum (1891, Vol. XX, p. 189), the type of the present form is preserved in the Paris Museum, while there is a second specimen in Leyden. The locality for these two is not definitely stated; but, since Salvadori gives the range as "Porto Rico (?) and Mona Island, between Porto Rico and St. Domingo," it may be inferred that they are from Mona. Ledru speaks of paroquets found in large bands, but his records are uncertain. Moritz, in 1836, notes a very small parrot said to live on the northern side of Porto Rico, but did not see it personally. Gundlach heard of it in the seventies in the eastern interior, but Stahl says that in his time the oldest inhabitants knew of it only through their parents. It was reported to Bowdish from mountains near Lares, but this information was certainly erroneous, judging from my own experience. In 1912 I was told by a number of persons that paroquets were still in existence, but always at a distant point that ever receded before me; so that I never entered what were, according to popular accounts, their haunts.

I saw numerous paroquets in captivity in Porto Rico, but all were birds imported from either Venezuela or Haiti.

From Mona Island Gundlach received, through Dr. Block three wings that were described by Cabanis as Conurus gundlachi. Stahl noted the bird from Mona, and Cory received from W. W. Brown, Jr., a skin from Mona taken February 25, 1892. A recent record of living specimens in 1913 in the aviaries of Walter Rothschild and H. D. Astley, in England, is said on investigation to refer to another species. (See Av. Mag., 1913, vol. V, p. 153).

The single specimen in the Field Museum (which I have examined) has been the basis for recognition by Mr. Ridgway of a race distinct from the form of Haiti. This one bird differs from a fair series of Aratinga chloroptera chloroptera (Souancé) in slightly smaller and more darkly colored bill, lighter red of the under primary coverts, and in having the lesser coverts of the outside of the wing entirely green. According to my
personal records, the wing measures 157.5, tail 159.5 and culmen 26.6 mm. The wing is slightly shorter than in birds from Haiti.

Paroquets were reported to Gundlach from Vieques Island, and I was told that they appeared there sometimes in the rainy season from June to August, but this I considered extremely doubtful.

**Eupsittula pertinax pertinax** (Linnaeus)

*Curaçao Paroquet*


Island of St. Thomas; formerly common, but now said to be rare.

Mr. Ridgway finds that the paroquet of St. Thomas is identical with the typical subspecies of *Eupsittula pertinax*, native to the island of Curaçao, and suggests that the bird has been carried from that point to St. Thomas. Though that may well be true, the paroquet has long been established near Charlotte Amalie, as the following will show.

Ledru reports paroquets from the Danish Islands, while Knox, in 1852, is more specific, stating that these birds are quite abundant near Havensigt on St. Thomas. The Newtons, in 1858, found them restricted to this locality, which, they inform us, refers to the hills on the eastern side of the harbor. Swift sent specimens to John Cassin (recorded in 1860). Baron Eggers, in 1878, reports the bird from Flag Hill. M. J. Nicoll, writing at St. Thomas, February 21 to 24, 1904, regarding the paroquet, says: "Some told me that it was extinct, but one

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15 Though the type locality in the original description is given as "Indies," in the twelfth edition of his work (1766, p. 142) Linnaeus corrected this to America.
man, a doctor, informed me that he had occasionally seen a few at the eastern end of the island. During our short visit I did not meet with it. Dr. Lowe, of the S. Y. 'Emerald,' shot one from a small flock at the east end of the island a few weeks before our visit. I have had the pleasure of examining this specimen in Dr. Lowe's collection." Mortensen, writing in 1909, says that he saw the paroquet in a valley at the eastern end of the island. This is the most recent published reference to the bird, but Dr. Robert Cushman Murphy informs me that R. H. Beck secured specimens in eastern St. Thomas on August 14, 1916.

In the U. S. National Museum there are two skins from St. Thomas secured from A. H. Riise, one taken January 19, 1860, and the other without data. A third (No. 26947) is the only remaining skin of a series of eight secured from John Akhurst, formerly a dealer and taxidermist in Brooklyn, N. Y., without other data than the locality, except that they were catalogued March 2, 1863. A fourth specimen, a male, was collected by F. A. Ober.

I was told that a paroquet was found at times on Vieques during the period of summer rains, but considered this doubtful.

The fact that Alfred Newton described this bird as Conurus xantholae-mus, in a paper privately printed under the title Psittaci novae Speciei ad Conurum Genus pertinentis Descriptio, has been generally overlooked. The date of this publication is August 30, 1859; so that it appeared at about the same time and apparently prior to P. L. Sclater's description, also as Conurus xantholae-mus, in the Annals and Magazine of Natural History for September of the same year. Newton's paper, of which I have a copy, is cited in his bibliography, but reference to his description has not met my eye in any synonymy that I have examined. As the tract is so rare that it is accessible to very few, it is here transcribed in its original form:

PSITTACI
NOVAE SPECIEI
AD CONURUM GENUS
PERTINENTIS
DESCRIPTIO.

AUPTORE A. NEWTON, A. M.,
COLL. S. B. MAR. MAGD. AP. CANT. SOC.,
S. L. S., &c.

SITOMAGI ICENORUM:
MDCCCLIX.

CONURUS XANTHOLAEMUS. (Sp. nondesc.)
The Curaçao paroquet has the plumage in general green, with the forehead, sides of head and neck and a patch on the abdomen orange, and a blue band across the crown between the orange and green that have been mentioned.

Order CUCULIFORMES

Suborder CUCULI

Family Cuculidae

Subfamily Cuculinae

[Coccyzus erythropthalmus (Wilson)]

Black-billed Cuckoo, Pájaro Bobo

Cuculus erythropthalmus Wilson, Amer. Orn., 1811, Vol. IV, p. 16, Pl. 28, Fig. 2.
(Probably near Philadelphia, Pa.)


The black-billed cuckoo is of doubtful occurrence in Porto Rico. Gundlach informs us that he saw a drawing of the bird in the album of Dr. Bello, who had received a specimen from the interior of the island. There is no other report of it, and the only other West Indian record seems to be of a specimen taken by Gundlach many years ago, near Cardenas, Cuba.]
Coccyzus americanus americanus (Linnaeus)

Yellow-billed Cuckoo, Pájaro Bobo, Pájaro Bobo de Costa


Mona, Porto Rico, St. Croix; fairly common.

Bowdish shot an adult on Mona Island, August 17, 1901—the only record of the bird for that island (specimen in U. S. National Museum).

On Porto Rico the species is of regular though uncommon occurrence, and thus far has been recorded only on the coastal plain. Gundlach secured one at Mayagüez, one at Aguadilla, and two at Arecibo, but does not give the dates at which these were taken. Stahl secured two specimens, and Bowdish shot two at Aguadilla—a female, May 18, and a male, May 20, 1900. On August 27, 1912, I heard one calling in an almendro grove at Joyuda near Cabo Rojo, and on collecting it found it to be an immature female in molt into first fall plumage. Another that I supposed to be the same species was heard in this locality on August 31. F. A. Potts records it, June 20, 1921, near Guayama and, July 6, 1923, north of Ponce. It would appear that the species breeds here, but this is not yet certain.

On St. Croix the Newtons reported the yellow-billed cuckoo as confined to the south side of the island. A female containing a nearly formed egg was taken on June 2, 1858, and June 29 of the same year a nest containing three eggs was found. The species is reported also to have bred in Cuba and is said to nest commonly in Jamaica.

The yellow-billed cuckoo is distinguished easily from the mangrove cuckoo by its white breast. The yellow base of the lower mandible is characteristic.
Coccyzus minor teres Peters

Mangrove Cuckoo, Pájaro Bobo, Pájaro Bobo Menor


Mangrove Cuckoo, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez).


*Cuculus dominicus*, Ledru, cit. supra, pp. 201, 260 (listed).


*Coccyzus minor dominicus*, Cory, Cat. West Indian Birds, 1892, p. 102 (Porto Rico).

*Coccyzus minor maynardi*, Cory, cit. supra, p. 102 (Porto Rico).

*Coccyzus minor dominicata*, Bowditch, Oologist, 1900, p. 72 (Vieques).

*Coccyzus minor nesiotes*, Bowditch, Auk, 1902, p. 364 (Mona, Porto Rico, specimens).


Mona, Porto Rico, Vieques, Culebra, Culebrita, Louis Peña, St. Thomas, St. Croix, St. John, Tortola, Virgin Gorda; apparently resident; in many localities common.

On Mona Island Bowditch found this cuckoo common from August 9 to 21, 1901, and collected six specimens, which are in the U. S. National Museum. These appear very slightly paler below than the average from
other localities, and may with further study represent a local race, though scattered individuals from other regions equal them in this character.

On Porto Rico this form of cuckoo is widely distributed wherever there are thickets or forests, from the mangroves of the coasts to the tops of the highest mountains, and from the rain-drenched forests of El Yunque to the dry hills of the southeast coast. In 1912 I recorded it at Bayamón, July 20 to 25; Mameyes (coastal region), February 9 to 29 (specimen, February 14); Maunabo, May 11; Salinas, April 26 to May 2; between Juana Diaz and Coamo, August 22; Lares, June 27 (specimen); Caguas, January 5 to 14 (one taken January 8); Cayey, January 22 (two taken); Aibonito, January 26 to February 5 (one taken, January 27); below the summit of El Yunque, March 8. In the U. S. National Museum there are skins collected at Porto Real, January 27, 1899, by J. D. Milligan, and at Luquillo, March 5, 1900, by C. W. Richmond.

This cuckoo is found in mangrove swamps, coffee plantations, dense thickets overgrown with vines along streams, or in heavier forests, but is easily overlooked, as it is retiring in habit. Its loud, sonorous calls, similar to those of the yellow-billed cuckoo, are heard more often than the bird itself is seen. It is slow and methodical in movement, seldom flying far in passing from covert to covert, and often remaining motionless for several minutes on one perch. In early morning it frequently rests on dead limbs in the sun, silent or occasionally calling.

Bowdish notes that a female shot near Mayagüez in September, 1901, would have deposited an egg the following day. There is no other data available regarding the breeding of these birds, but it would appear to be irregular.

From Vieques Island Bowdish reported several in 1900, and C. W. Richmond secured a female on March 22. From March 16 to April 3, 1912, I found the birds common on the southern side of the island, where they inhabited a jungle so dense that it was difficult to see them. Their notes came frequently from dense, dry, thorny thickets in the intense heat of the middle of the day, but the birds, working slowly through this cover, usually near the ground, remained securely hidden. Three specimens taken March 25 were about to breed.

On Culebra Island they were fairly common from April 5 to 21, 1912, and I secured adult females with ovaries enlarged on April 13, 17 and 19. The birds were calling on Louis Peña on April 11, and on April 15 I heard a number on Culebrita and secured a female.

The Newtons report a female shot on St. Croix, March 23, 1858, as the only one seen. Specimens from St. Thomas were sent by Robert Swift
to Cassin (two skins from this source are in the U. S. National Museum), and Benedict and Nye, of the Albatross, secured three here from January 17 to 24, 1884. M. J. Nicoll collected skins of this bird on St. Thomas between February 21 and 24, 1904. There is a specimen in the U. S. National Museum taken on St. John by F. A. Ober, and Cory reports skins from Tortola and Virgin Gorda secured by Winch.

_Coccyzus m. teres_ described recently by Peters is distinguished from _nesiotes_ of Jamaica when examined in series by grayer, less rufescent upper breast. Other differences alleged do not appear clear. The two forms are so closely allied that they must be examined in series as individuals are distinguished with difficulty or not at all. The Porto Rican bird is similar to that of Hispaniola.

The mangrove cuckoo is grayish brown above, and deep buff below, with a black line through the eye and a black tail tipped widely with white. Like the yellow-billed cuckoo, it has the base of the mandible yellow. The bird lives mainly on various forms of Orthoptera, on caterpillars, and on beetles. As is often the case in birds of this genus, a number of the stomachs that I examined were lined with hairs from caterpillars that had been eaten, stuck firmly in the stomach lining. The species is rated as a thoroughly useful bird.

**Saurothera vieilloti** Bonaparte

Porto Rican Lizard-Cuckoo, Pájaro Bobo, Pájaro Bobo Major, Pájaro de Agua


Porto Rico; fairly common resident: Vieques, St. Thomas; casual (formerly resident?).

Early visitors to Porto Rico recorded the lizard-cuckoo as abundant, but in the last fifty years it has decreased until now only in the heavy forests near Maricao may it be said to be common. In 1912 I found it at Quebradillas, July 2 to 6 (adult male taken July 5); Manatí, July 7 to 11; Río Piedras, December 18, 1911, and January 4, 1912; Mameyes, February 12 (adult male taken); Añasco, June 8; Maricao, May 29 to June 5 (three taken May 30 and June 4); Lares, June 18 to July 1 (three taken June 21, 22 and 28); Ciales, July 12 to 18; Aibonito, January 30 (adult female); and Comerio, July 26 to 31.

In the U. S. National Museum there is an adult female shot by B. S. Bowdish, at Mayagüez, August 2, 1901, and a juvenile male from the same locality secured September 30. The latter is only recently from the nest and has a juvenile dress that differs from the adult plumage in a cinnamon wash on the breast, and cinnamon edgings to the feathers of back and wing coverts. A male was secured at Caguas on January 11, 1899, by J. D. Milligan. The naked space about the eye in this bird is marked as vermilion except for a crescent-shaped white spot below.

Struthers recently has found the lizard-cuckoo very common at Maricao and has seen it near Mayagüez. I identified bones of this species from material collected by H. E. Anthony in caves near Morovis and Utuado.

During my own collecting I secured an adult female, May 31, 1912, at Maricao and an adult male, June 22, 1912, in the vicinity of Lares that were near the pairing season, though others taken at the same time showed no indication of breeding. It appears from this that the period of nesting is irregular. Struthers noted a pair nest-building near Consono, February 13, 1921.

In spite of its large size, this bird is inconspicuous, as its long tail, instead of making it prominent, aids its protective coloration by giving it rather an unbirdlike contour. It is very tame and shows little fear of man. In passing through the trees birds of this species keep to the densest foliage and make long pauses, during which they sit motionless, merely turning the head slightly. In early morning they may come out into dead trees or on exposed limbs to get the sun, where they sit with drooping wings and ruffled feathers. Though seen occasionally on the ground, they spend most of their time in bushes and trees. The ordinary
call-notes, which are heard frequently, are cuckoo-like and resemble the syllables cow cow kuk krrk, usually given disconnectedly. Sometimes one perches in the top of a tree, giving forth a sonorous note that is almost raven-like, and on one occasion I saw a bird standing on a limb with trembling wings, giving utterance to a low cooing note.

In some localities the name pájaro de agua was given these cuckoos, due to the belief that they called before an approaching rain—a prophecy that, thanks to the locality of their haunt, usually came true before the lapse of many hours. They were common inland in the coffee plantations, but were encountered in swampy forest near Mameyes and in other localities near the coast.

Though the bird consumes insect-eating lizards in quantity, it is not sufficiently common to be of economic injury and should not be molested.

The Newtons record a specimen secured by a collector of Apotheker Riise on Vieques and sent to them for examination, and Shelley has listed a specimen in the British Museum from the island of St. Thomas. There are no other records for the species outside the island of Porto Rico.

The lizard-cuckoo is one of the strangest of the indigenous birds of Porto Rico, colored plain grayish brown above, grayish on the breast and tawny on the abdomen and lower tail coverts. The long tail, tipped prominently with black and white, makes up more than one-half of the total length of fifteen or sixteen inches.

Subfamily Crotophaginæ

_Crotophaga ani_ Linnaeus

_Ani, Black Witch, Judío_


Porto Rico, Vieques, St. Croix, Culebra, Culebrita, St. Thomas, St. John, Anegada, Tortola, Virgin Gorda; resident and common in most, if not all, of the islands mentioned.

In Porto Rico during my work in 1912 the ani was recorded as follows: Manatí, July 7 to 11; Río Piedras, December 16, 1911, to January 4, 1912 (specimens taken); Mameyes, February 9 to 20 (specimens); Humacao, September 3 to 9 (specimen); Maunabo, May 11; Salinas, April 26 to May 2; Juana Díaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31; Añasco, June 8 (specimen); Aguadilla, June 9 to 12; Utuado, August 3 to 9 (specimen); Adjuntas, August 14 and 15; Ciales (along the Río Manatí), July 12 to 18; Aibonito, January 26 to 31; Caguas, January 5 to 14 (specimen); and Hacienda Catalina, March 6. Anis are reported from Mayagüez and Cartagena Lagoon by Danforth; and near Ponce, by Hartert. There is a skin in the U. S. National Museum taken at Arroyo, February 3, 1899, by J. D. Milligan.

These strange birds are found in flocks that contain from half a dozen to twenty or more individuals, ranging mainly in pasture-lands, but going also into the cane-fields and orange groves to feed. In pastures they remain near the cattle, keeping ahead of them with long hops, in order to get the insects that the cattle scare up. Any intruder is greeted with a querulous call, and the whole flock flies in a straggling line across the fields to perch in a bush or low tree, where they crowd together and peer out curiously, their long tails and arched beaks giving them an odd appearance. In the early morning, when the grass is wet, they frequently sit in the sun with the wings extended in order to dry them or to absorb heat. The wings are small for the size of the bird, and the flight, accomplished by a series of steady wing beats alternating with short sails, is not strong. In a heavy wind the birds are almost
helpless, and they seldom rise high from the ground at any time. When on the wing, the back appears concave from the fact that the head and tail are held on a higher level.

In the heat of the day anis usually take refuge in dense clumps of bamboo along streams, remaining quietly out of the intense heat of the sun, and they also roost in these at night, as well as in mangroves around lagoons. The ordinary call-notes are a low kur-r-rk and a querulous quee ick, quee ick, varied by low chuckling notes. When the birds are at all wild, they serve to alarm the entire country, as they begin to call on the slightest provocation. They are most abundant on the coastal plain, but range in small numbers in the pastures at higher altitudes. They are birds of the open and never enter dense forests. Formerly they are said to have been more common in Porto Rico than at present, but to have lessened in numbers greatly since the introduction of the mongoose.

The breeding season varies considerably with different individuals. A female containing a fully formed egg was taken near Rio Piedras, December 20, and breeding birds or young in first plumage were noted until field work was completed in September, so that anis nest apparently the year round. Although this species often builds a communal nest, this is not always the case. Near Cayey, January 22, two anis were seen constructing a nest in a tree about thirty feet above a small stream, the male sitting on a limb above while the female was in the nest, as yet only a loose mass of sticks and weeds. She moved and turned to shape it to her body, with her long tail sticking nearly straight up in the air. Near Bayamón, July 25, a single bird slipped quietly from a bulky nest in a clump of bamboos and only its mate appeared to join it. The nests seen were all large and bulky and were located from six to thirty feet above the ground. Bowdish reports a communal nest found near Aguadilla, August 13, built eight feet from the ground, in a thicket of bushes and trees. This nest contained twenty eggs, placed in layers of four or five, each layer being covered with dead leaves to separate it from the next lot of eggs above. Eight of the eggs were partly incubated and twelve were fresh. In his manuscript notes Bowdish has recorded anis as nest-building near Cataño on July 21, 1899.

On May 20 near Yauco three anis were seen in a tree in which several mozambique had nests. The anis were very near these nests, and the blackbirds, together with a pair of gray kingbirds, were much excited, but appeared to be unable to drive out the intruders. It was certain that the anis were bent on robbing the nests, and one was shot in the act of
gulping down something which was later found to be an egg. No other instances of this evil habit were observed.

The ani was first reported from Vieques in 1900 by Bowdish, though a skin in the U. S. National Museum was collected on that island by J. D. Milligan, of the Fish Hawk, on February 7, 1899. I found these birds fairly common there in brushy pastures from March 16 to April 3, 1912, and secured skins on March 20, 23, 25 and 30. A nest found during the last week in March, six feet from the ground, in thorny bushes, was a bulky affair of twigs about two feet across, though as yet incomplete. Bowdish reports young taken January 28, 1900.

On Culebra Island the species was very common from April 5 to 21, 1912, and was found everywhere in the brush-grown pastures in little flocks. Its comparative abundance was due perhaps to the absence of the mongoose. The bird frequented the vicinity of cattle and, as the work bulls browsed along through the grass, the anis ran, hopped or flew in an endeavor to keep just ahead and secure the insects that were disturbed. Anis were seen on Culebrita Island April 15.

Knox reported them as conspicuous on St. Thomas in 1852, and Cassin received numerous skins from that island through Robert Swift. Benedict and Nye secured three birds from January 17 to 24, 1884, and there are several other skins from St. Thomas in the U. S. National Museum acquired through various sources. The Newtons found the species common on St. Croix, and Alfred Newton described a nest containing fourteen eggs, evidently common property of a flock, that was observed on June 18, 1857. Cory received skins from St. Croix in 1891, and there are two in the Museum of Comparative Zoology taken on St. Croix September 14 and 15, 1914, by G. K. Noble. Mortensen says that several birds may incubate simultaneously and records one nest containing one hundred fifty eggs placed in layers. There is a female ani in the U. S. National Museum secured by F. A. Ober on St. John, and Winch forwarded specimens to Cory from Tortola, Virgin Gorda and Anegada. One of the latter, now in the U. S. National Museum, was taken December 29, 1889.

From examination of more than forty stomachs I found that the ani feeds extensively on Orthoptera, beetles, caterpillars and bugs, consuming many of injurious habit, so that it is of decided benefit to agriculture. Small quantities of drupes are taken. I saw no sign of their having eaten ticks, in spite of popular superstition to that effect.

The ani, with its slender form, twelve or fourteen inches in length, blackish plumage and compressed, highly arched bill, from which it de-
rives its colloquial name of judío, is an unmistakable member of the local avifauna.

Order STRIGIFORMES

Family Tytonidae

**Tyto cavatica** Wetmore

Porto Rican Barn Owl


![Porto Rican Barn Owl](image)

The extinct Porto Rican barn owl (*Tyto cavatica*)

**Fig. 17** (left).—Proximal end of left metatarsus (type). Anterior view. Natural size. From cavern deposits of Cueva Toráño.

**Fig. 18** (right).—Proximal end of right metatarsus. Internal face. Natural size. From cavern deposits of Cueva Toráño.

(These cuts are reproduced by courtesy of The American Museum of Natural History.)

Porto Rico; extinct.

The Porto Rican barn owl, described from the upper end of a metatarsus (Figs. 17 and 18), is known only from the type, parts of another metatarsus, and two broken tibio-tarsi, secured by Mr. H. E. Anthony from a cave on the property of Don Gervacio Toráño near Utuado, in 1916. These indicate a form of small size related to the small West Indian species of the genus.

The bones of the barn owl in this cave aid in explaining the abundant remains of small birds and mammals found in various caves in Porto Rico. Examination of the bird bones from Cueva Catedral in particular led me to infer that the deposits came from pellets regurgitated by owls at their roosts—a belief rendered certain by the discovery first of remains
of the Múcaro (*Gymnasio nudipes nudipes*) and then of those of this barn owl.

In 1912, while traveling in Porto Rico, I made many inquiries regarding the Porto Rican owl, or Múcaro real (*Asio portoricensis*), and found two stories current concerning it. According to one tale, it was found in grassy places or marshes, the normal haunt of short-eared owls (to which group it belongs). Near Utuado, however, I was informed that it inhabited small caves amid the hills and appeared mainly at night. At the time I paid little attention to this story, but am now convinced that it related to the barn owl, since such birds are retiring, secretive in habit and adopt just such haunts. It is barely possible that scattered individuals of the barn owl may exist in isolated caves in the region in question. Though such possibility is remote, the matter is worthy of investigation by those who may have opportunity to work in that vicinity. The bones that supply our only knowledge of it at present do not seem to have any great antiquity.

**Family Strigidae**

*Gymnasio nudipes nudipes* (Daudin)

Bare-legged Owl, Múcaro


*Noctua nudipes*, Hartlaub, Isis, 1847, p. 611 (Porto Rico).


*Gymnoglaux krugii* Gundlach, Journ. füür Ornith., 1874, pp. 310, 315 (Porto Rico).


Porto Rico; fairly common resident.

From its nocturnal habits, the Múcaro (Pl. LXII) is easily overlooked, so that my records of its occurrence in 1912 do not give an adequate idea
of its abundance. I found it at Mameyes, February 9 to 29 (specimen, February 12); Yauco, May 16 to 28 (reported); Cabo Rojo, August 24 to 31; Maricao, May 29 to June 5 (specimens, June 1); Lares, June 18 to July 1 (specimens, June 27); Utuado, August 3 to 9; Adjuntas, August 10 to 16; Aibonito, January 26 to February 5 (reported); Hacienda Catalina, below El Yunque, March 2 to 11 (specimen, March 4). In the U. S. National Museum there is a series taken at Mayagüez by B. S. Bowdish, from May 27 to July 26, 1901, and one shot at Caguas, January 9, 1899, by A. B. Baker. There were many remains of this owl in the cave deposits near Morovis and Utuado, and there is unquestionable ground for considering casts of this owl as responsible for part of the accumulation of bird and mammal remains found there.

On destruction of the original forests the little owl, like the woodpecker, found a refuge in the groves of trees grown for shade in the coffee plantations. It is most common in the interior and has been recorded especially in the western part of the island. I found it on the seacoast near Mameyes, but it is not common on the coastal plain, for there little cover is to be found.

The múcaro is entirely nocturnal in habit and during the day resorts to thickly leaved trees, dense growths of vines, or small caves, where it remains quietly at rest. The natives capture these owls rather easily by slipping a noose over their heads. On the rare occasions when the birds were flushed, I found their flight swift and entirely noiseless; they secreted themselves at once in a new cover, where it was difficult to locate them. From November to May they are frequently heard calling in early evening—a low, tremulous note like that of a screech owl. Another note, heard when the birds are frightened or excited, is a loud boo boo like that of a burrowing owl, and in fighting they utter a barking call. The small birds of the forest frequently discover the little owl hiding in the leaves and gather with great calling and commotion; the owl is entirely passive and remains motionless until they tire and go away. Near Maricao one flew out from a hole in a tree, attracted by the calling of a wing-tipped vireo.

The breeding season seems to extend from April to June. At Maricao I found on June 1 a young bird, perhaps a week old, in a hollow in a tree six feet from the ground. The nest was a damp cavity six or eight inches in diameter, with two or three epiphytes growing before the entrance. At Lares, on June 27, I secured a young individual not quite old enough to leave the nest, and Bowdish, at Mayagüez, secured young on May 29 and on June 10, 12 and 21, 1901. The last three were birds
that he had had in captivity since May 16. Gundlach says that the species deposits two eggs. The small bird, about a week old, that I took at Maricao was covered with white down and had down growing on the upper third of the tarsus, as in the adult. The second juvenile plumage is already showing on the main feather tracts in this bird. This second dress is a heavy, downy plumage, grayish white, heavily cross-barred with dusky. It is followed by the adult dress. The species has two distinct color phases: one bright reddish brown and one decidedly duller. Some specimens are heavily mottled on the lower surface, while in others the lower breast and abdomen are white streaked with dusky. The adult is eight or nine inches in length.

According to native stories, the little owl is fond of coffee and does much damage to the coffee crop by biting the ripened berries, sucking the juices from the sweet inner skin, and then letting the berry fall. When carefully questioned, most of those making this accusation admitted that no one has ever seen the bird doing this, though occasionally one or another insisted that he had witnessed it in the act. The truth of the matter seems to be that the owls are heard calling in the coffee plantations at night, and the next morning the berries are found on the ground; the better informed growers attribute the damage to rats, which are very probably the real culprits. I tested the matter with captive birds, but was unable to get them to touch ripe coffee berries, though they were denied other food for two days at a time. A large green grasshopper or a honey-creeper was, on the other hand, accepted and eaten without hesitation. According to Danforth, the experiment has been repeated with the same result by Miss Rosario Brito, of Mayagüez. The owls were accused, as well, of eating gonduros (Cajanus cajan), a species of legume, but without proof of any kind.

In the stomachs of those that I examined I found only animal matter, including large insects, such as Orthoptera (including the changa, or mole cricket), many beetles (of which one bird had eaten eight), cane-weevils, root-borers (Diaprepes), moths, a scorpion, lizards and small birds (a redstart and a Carib grassquit). There was no trace of any vegetable matter and such a diet must be regarded as wholly improbable. The facts in the case are in all likelihood properly represented by a stanza in one of the songs of the gibaros (hill people) that runs as follows:
“Abre Múcaro los ojos;
Otro pájaro et engaña.
Otro esbipita el café,
Y tu trapao en la rama!”

Gymnasio nudipes newtoni (Lawrence)

Newton’s Owl


Scops porto-ricensis, Newton, Ibis, 1860, p. 307 (St. Thomas, specimen).

Gymnoglaux nudipes, Newton, Ibis, 1859, pp. 64-66 (St. Croix, specimens);


Gymnasio nudipes, Cory, Cat. West Indian Birds, 1892, p. 100 (St. Thomas, St. John, St. Croix).


St. Croix, St. Thomas, St. John; resident.

This eastern form of the bare-legged owl is represented in the U. S. National Museum by two skins from St. Thomas, one taken by A. H. Riise and the other by Robert Swift. These two differ from ten adults from Porto Rico in being duller and grayer, less rufescent above. Other alleged differences do not hold. The St. Thomas specimens appear similar in size to the bird of Porto Rico.

This owl has never been reported in numbers. On St. Croix the Newmans had one young bird from the Great Fountain estate, May 30, 1857, an adult “a few days after,” and a male taken on May 11, 1858, as well as a young bird secured September 1, 1858, from the Estate Allendale. The Newmans were told that the bird was heard calling at the River and Great Fountain estates, but were unable personally to find it. Owls have not been recorded on St. Croix by subsequent collectors and may now be extinct there.

On St. Thomas Knox reports an owl as rare. Swift and Riise both obtained specimens, and the latter brought Alfred Newton skins and two eggs from that island, as well as several skins from St. John. One of the latter is said to have been “remarkable for the bright hue of its plumage,” which suggests that the characters supposed to separate newtoni from typical nudipes may not hold.

On Vieques Island, in 1912, Señor José Barton told me that several years previously he had seen a small owl at close range in the hills at
the eastern end of the island. No one else knew of owls, so that they must be extremely rare. The record is included under newtoni on basis of probability.

**Asio portoricensis** Ridgway

Porto Rican Short-eared Owl, Múcaro Real, Múcaro de Sabana, Múcaro de Melón, Coruja, Llorona


Porto Rico; rare.

The Porto Rican short-eared owl is distinguished from the continental species by smaller size, larger bill and feet, and greater extent of dark-brown color of upper surface. The bird is about fifteen inches in length. The iris is yellow. It has not been common in recent times. Gundlach in the seventies of the last century did not see it except in the form of specimens in the collections of Blanco and Stahl, though the bird was reported to him from Toa Baja, Furnias and Utuado. Bowdish saw this owl near San Juan Bay, February 12, 1900, but did not secure it. In 1912 natives informed me that they saw it at intervals in the grass fields near Río Piedras, and I was told of its occurrence at times in the lower foothills above Mameyes, near Salinas, Utuado and Lares. I did not succeed in finding the bird. Near Lares peons said that these owls steal the hats of pedestrians who pass at night and carry them off to serve as nests!

In the Carnegie Museum is a skin of a young male only recently from the nest, taken at Utuado, May 20, 1912, by W. W. Worthington. Like adults that I have seen, this specimen is very dark on the dorsal surface. The ear-tuffs are fairly well developed.

The latest records for the bird known to me are supplied by Mr. F. A. Potts, who, under date of May 15, 1921, writes: "In August, 1919, I flushed one in a patch of malojillo grass bordering a cane-field three miles
south of Juana Diaz. Also a member of our engineering department has informed me that his men flushed two in a large pasture north of Santa Isabel. The cane guard on the Esperanza estate, two miles west of Aguirre, told me he had shot one and seen others." Under a later date he states that he has seen it near Arroyo and twice between Santa Isabel and Ponce, last on July 5, 1925. More recently still he has forwarded to the National Museum the skin of a female taken near Fortuna, April 8, 1927.

This owl rests habitually on the ground in grass or other heavy vegetation, so that its decrease in numbers is without doubt to be attributed to the mongoose.

The U. S. National Museum has three skins, including the type, and there is one, as noted above, in the Carnegie Museum. There are, in addition, specimens in the American Museum of Natural History and in the Museum of Comparative Zoology. The specimen in the latter institution (received in exchange from the American Museum) is marked "Porto Rico, J. Gundlach," but there is no indication as to how Gundlach secured it.

Order CAPRIMULGIFORMES
Suborder CAPRIMULGII
Family CAPRIMULGIDAE
Subfamily CAPRIMULGINAE

**Antrostomus carolinensis** (Gmelin)

Chuck-will's-widow, Guabairo, Capacho


Porto Rico; Vieques; winter visitant, rare.

Gundlach informs us that Krug sent him a specimen of chuck-will's-widow from Coamo Springs, and that he received another from Hjal-
marson, taken at Arecibo in February, 1876. Stahl did not possess a specimen and apparently knew of it only through Gundlach's records.

Toward the last of December, 1911, I saw one of these birds in a small second-growth forest above the experiment station at Rio Piedras and on January 11, 1912, Señor José T. Monclova, of Rio Piedras, gave me a fine bird that had been brought in alive by some boys. This proved to be a female. On Vieques Island Bowdish shot two females on December 15 and 28, 1899, and reports a number seen. These comprise the only records for the area under consideration.

The chuck-will's-widow has a loose plumage colored softly with blended brown, black and buff, and is distinguished by its tremendous mouth. It is about eleven inches in length. The bird is migrant from the United States and is entirely nocturnal; in consequence it is only flushed by chance in the dense growth in which it hides by day. As it rests frequently on the ground, the mongoose must be a serious enemy.

**Antrostomus noctitherus** (Wetmore)

Porto Rican Whippoorwill, Guabairo Chico, Guaraiba


*Antrostomus vociferus*, Cory, Auk, 1889, p. 279 (Porto Rico, specimen); Cat. West Indian Birds, 1892, pp. 105, 143 (Porto Rico).


Porto Rico, resident; possibly now extinct.

While identifying a collection of bones of birds secured by H. E. Anthony, of the American Museum of Natural History, in Porto Rican caves, I came upon several humeri of a whippoorwill of a species distinct from the bird of North America. This brought to mind a specimen of whippoorwill collected by Clark P. Streator in Porto Rico and recorded by Cory as *Antrostomus vociferus*, which had stood for years as the only record of this North American species in the West Indies. On borrowing this specimen from the Field Museum I found that it was in fact my unnamed form, so that I described the species from this skin. The type, and only known skin, a female, differs from the female of *Antrostomus v. vociferus* (Wilson) in shorter wing, more rufescent, paler markings, heavier black tips on feathers of breast, prominent spots of cartridge buff on breast, and restriction of the light bars on the three outer rectrices.

Three humeri and a metacarpal secured by Anthony in Cueva Clara
and Cueva Catedral near Morovis give us the only definite points of occurrence for the species, since the type skin is merely marked from Porto Rico. In line with the lessened length of wing in *noctitherus*, the humerus is distinctly shorter than that of *vociferus* and has characters of form that also serve to distinguish it.

The species may still exist in small numbers, for on December 23, 1911, I flushed a small goatsucker that I did not secure in a tract of second-growth forest above the experiment station at Río Piedras. I was told, too, of a bird that in former times called loudly and continuously by night, but that no one was ever able to see. This bird had not been heard in years. As whippoorwills have a call given regularly during the night hours through the breeding season, it is possible that this night-caller may have been the bird under discussion.

The species must have been decimated by the mongoose, since whippoorwills nest and rest on the ground in dense thickets during the day and are active only at night.

Oberholser has separated the whippoorwills from *Antrostomus* under the generic name *Setochalcis*. After consideration of the characters now known, I believe that the proposed group has only subgeneric value and here place the Porto Rican whippoorwill in the genus *Antrostomus*.

Subfamily **Chordeilinae**

**Chordeiles minor gundlachii** Lawrence

*Cuban Night-hawk, Capacho, Creguete, Querequete*


Porto Rico, rare.

Hjalmarson secured a specimen of a nighthawk near Arecibo, and Dr. Bello had fragments of one from near Mayagüez. These were ex-
examined by Gundlach, who observed the bird near Vega Baja, Dorado, Bayamón and San Juan, but does not state that he secured specimens. There is an old skin without data in the U. S. National Museum that represents the subspecies here under discussion.

Mr. F. A. Potts, in a letter written August 5, 1923, states that he had seen nighthawks several times and had recorded sixteen on August 4. He has found the bird from May 26 to August 25. Struthers reports a male taken near the Cabo Rojo lighthouse on August 9, 1921, and one seen August 18, 1921, at Mayagüez. Danforth has noted single birds flying at Cartagena Lagoon, May 27, June 7 and 28, 1924. Stahl has reported the nighthawk as nesting in Porto Rico, arriving in April and leaving in October. I know of no definite breeding record at this time and am inclined to believe that this nighthawk may be migrant from Cuba, where it nests commonly, but departs in fall for some winter home as yet unknown. These migrants may pass through Porto Rico. The fact that the only two skins I have seen represent respectively the Cuban and Bahaman races renders the allocation of Porto Rican records difficult. They have been included here as a matter of convenience.

The nighthawk is easily recognizable; for, though in part crepuscular in habit, it flies regularly by day. It is about nine inches in length, has long wings with a distinct light patch across the primaries, and flies with strong zigzag flight that carries it gracefully across the open fields and pastures.

*Chordeiles minor vicinus* Riley

Bahaman Nighthawk

*Chordeiles virginianus vicinus* Riley, Auk, 1903, p. 432. (Long Island, Bahama Islands.)


Porto Rico, migrant; status uncertain.

In the Museum of Comparative Zoology there is a mounted nighthawk, a female (No. 29040), taken in Porto Rico by Dr. A. Stahl, but without more definite data; it is supposed to be the female bird that Stahl in his work on the fauna of Porto Rico listed as in his collection. This bird is in rufescent phase, with preponderance of the paler markings and restriction of the darker ones. It is distinctly lighter than a series of *C. m. gundlachii* from Cuba and agrees in color with skins from the Bahama Islands. It measures as follows: wing, 168.5; tail, 95.8; culmen,
5.6 mm. I have identified it as the Bahaman nighthawk *vicinus* (in which Mr. O. Bangs agrees) and consider it a migrant.

This race is said to be a summer resident in the Bahama Islands and disappears to an unknown winter home in autumn. Its occurrence in Porto Rico, therefore, is not to be unexpected.

Additional material is needed to establish the status of the two forms of night hawk now recorded from Porto Rico. From the geographic position of the island, the Bahama race should occur regularly in passage in spring and fall.

Order MICROPODIIFORMES

Suborder MICROPODII

Family Micropodidae

Subfamily Chaeturinae

*Nephoecetes niger niger* (Gmelin)

Atillean Black Swift, Vencejo, "Golondrina"


_Nephoecetes_, Gundlach, Journ. für Ornith., 1874, p. 311 (Porto Rico).


Porto Rico; tolerably common.

The black swift is one of the resident birds of Porto Rico that is seen only under favorable circumstances. Gundlach observed individuals at Lares, Quebradillas, Arecibo and Mayagüez, and finally at Utuado encountered them under such conditions that he was able to collect both adults and young. Bowdish saw them but did not secure skins.

On December 16, 1911, I observed one flying over an open field near the experiment station at Río Piedras. On May 4, 1912, two circled high above the ground over open pastures near Yabucoa, moving swiftly in
great circles. By a fortunate shot I secured one; the second, after dash-
ing past its falling companion twice, disappeared. Single individuals
were seen near Lares, June 21, 22 and 26.

Mr. F. A. Potts has written me of several encounters with this bird.
On April 20, 1919, while he was standing on the bald rock at the summit
of El Yunque, five or six were observed flying above the peak. Others were
noted that autumn near the Coamo River west of Santa Isabel. On June
8, 1920, Potts saw one near San Germán, and July 8, 1921, five; July 15
he recorded thirteen near Santa Isabel. He reports the bird common in
summer from Guánica to Santa Isabel and has seen one hundred in a
flock. S. T. Danforth has noted it as follows: Mayagüez, March 31 to
July 28; Fillial Amor, May 16; Guayanilla, June 28, and Anegado La-
goon, March 29. There is a female in the Carnegie Museum, taken at
Utuado, May 17, 1912, by W. W. Worthington.

Whether the species is resident or not is still open to question, though
my record for December would indicate that some individuals remain
for the winter. Other notes now available pertain to the period from
the end of March to autumn, so far as they are accompanied by dates.

The black swift, though of swallow-like appearance, may be told by its
swifter flight and more rapid wing-motion. It is sooty black in color
with grayish white markings in front of the eye.

Griscom10 has concluded that the black swifts of the Antilles all be-
long to one subspecies, a statement in which I agree after comparison of
available material. The female that I secured at Yabucoa resembles
others seen from Haiti and Jamaica. It is a fully adult bird, with light
edgings on the feathers of the abdomen and with only the faintest in-
dication of them on the under tail coverts. Measurements of this speci-
men are as follows: wing, 145.3 mm.; tail, 54.4 mm.; culmen from base,
6.5 mm.; tarsus, 11.8 mm.

The black swift has not been reported as yet from the Virgin Islands.

Suborder TROCHILI

Family Trochilidae

Subfamily Trochilinae

Orthorhyncus exilis exilis (Gmelin)

Gilt-crested Hummingbird, Doctor-Bird, Zumbador


10 Auk, 1924, p. 71.
St. Kitts.  
Bellona exilis, Cory. Ank. 1886, p. 357 (Porto Rico, St. Thomas, St. Croix); Ank. 1889, p. 218 (Porto Rico, St. Thomas, St. Croix); Ank. 1890, pp. 374, 375 (Anegada, Virgin Gorda, specimens); Ank. 1891, p. 48 (St. Croix, specimen); Cat. West Indian Birds, 1892, p. 107 (Porto Rico, St. Thomas, Virgin Gorda, Anegada, St. Croix).—Mortensen, Atlanten. 1909, Vol. VI, No. 66, p. 644 (St. Croix).


Porto Rico (?), Vieques, Culebra, St. Croix, St. Thomas, Virgin Gorda. Anegada, probably resident.

This beautiful hummer was the first bird that came to my hand when I began the collection of specimens on Vieques Island, March 18, 1912. It was fairly common in suitable localities and was found at blossoms of the muñeco, the cultivated legume known as gourdoro (Cajanus cajan), and an acacia known as rallo (Vachellia farnesiana). The birds were sprightly and active and made a loud humming in flight, but otherwise were silent. Among other hummers they were distinguished by their small size. Specimens were taken March 18, 19, 23 and 29. Mr. B. S. Bowdish and Dr. C. W. Richmond both had collected on Vieques previous to my visit, but at an earlier time in the year. Neither reported this hummer, which indicates perhaps that it is migrant here. However, such tiny birds may be overlooked except when conspicuous food plants bring them to one’s attention, and the species may, therefore, have evaded their observation.

On Culebra Island I shot a female among mangroves and thought at times that I saw others, but was never certain of their identity.

There are four skins from St. Thomas in the collections of the U. S. National Museum, and the Newtons record skins from this island. Specimens from this source are noted also in the Catalogue of Birds of the British Museum (1892, Vol. XVI, p. 355).

Edward Newton shot a female at Southgate Farm, on the north shore.
of the eastern end of St. Croix, June 8, 1858, and saw another here as well as one at Salt River. Cory also obtained a specimen from this island and additional skins from Anegada and Virgin Gorda. One of his skins from Anegada, taken by Cyrus S. Winch on December 26, 1899, is in the U. S. National Museum.

Occurrence of the species on Porto Rico proper is somewhat uncertain. The various records cited for that island seem to refer to the account of Sundevall, whose complete statement in his report of Hjalmarson's collection is as follows (from reference cited above):

41. *Trochilus* (Orthorhynchus) *exilis* Gould:—Taylor l. c.—Frequens: 3 specimens, ♀♀ allata. Conf. supra, aves ex S:t Barthelemy.

42. *Trochilus* (Lampornis) *holosericeus* L.—Phures, ♀♀, simillimi illis ex S:t Barthelemy. (A. cl. Taylor in Martinique et Dominica, non in Portorico inventus.)

In his introduction Sundevall mentions specimens received through Dr. Goës from St. Bartholomew and lists these in the report. It is evident from his statements that he indicates this species and *holosericeus* from St. Bartholomew and not from Porto Rico. Two of the skins examined by Sundevall are in the U. S. National Museum; both marked as from Hjalmarson, one given as from St. Bartholomew and the other (U. S. N. M. No. 14913) as from Porto Rico. It is on this last specimen that Porto Rican records are based. I consider the locality marked on it as erroneous.

Gundlach¹⁸ has the following comment on this matter:

"En mi segundo viaje á Puerto-Rico en 1875-76 volví á ver con atencion el ejemplar de la coleccion de Hjalmarson en Arecibo, y encontré que tenfa una tarjeta con la palabra *Saint Bartholome*, escrita por otra persona y no por Hjalmarson, quien preguntado por mí de nuevo, me dijo que no se acordaba si él había tenido ejemplares muertos en la isla de Puerto-Rico, ó si los ejemplares vistas por Sundevall habian provenido de la isla de Saint-Bartholome ó otra, y habian dado, como enviados por él, motivo a creerlos puerto-riqueños. Así aunque la lista de Sundevall diga frecuentemente tres ejemplares ♀ y ♀, y aunque cite á Taylor, hemos creido deber suprimir esta especie del catálogo puerto-riqueño, porque más vale no mencionar una especie como habitante que poner una que no lo es."

On the other hand, Mr. F. A. Potts informs me that he saw one of these humming birds, January 11, 1924, southwest of Ponce.

[Archilochus colubris (Linnaeus)]

Ruby-throated Hummingbird


Gundlach included the ruby-throated hummingbird, a species that breeds in eastern North America and migrates south in winter, in his list of Porto Rican birds on the basis of a drawing seen in the album of Blanco. There is no other record and the species is considered of too doubtful occurrence to be included on this evidence. It is casual on the north coast of Cuba and is reported from Bermuda and the Bahamas, but is only found regularly in winter from Florida, Louisiana and Texas south through Mexico to Panama.

Chlorostilbon maugaeus (Audebert and Vieillot)

Porto Rican Emerald, Fork-tailed Hummingbird, Zambador, Zumzum, Collibi, Zumbadoreito

Trochilus maugaeus Audebert and Vieillot, Ois. Dor., 1801, Vol. I, pp. 71-79, 80, 93, Pis. 37, 38. (Porto Rico.)

Fork-tailed Humming Bird, Danforth, Bird-Lore, 1922, p. 52 (Mayagüez).

Chlorestes gertrudis Gundlach, Journ. für Ornith., 1874, pp. 312, 315. Described as new from Porto Rico.)


Porto Rico; resident, fairly common, particularly in the coffee plantations and forested hills of the interior.

During 1912 I recorded it as follows: Manatí, July 7 to 11; Salinas, April 30 (specimen); Juana Díaz, August 17 to 22 (specimen); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31 (specimen); Maricao, May 29 to June 5 (specimens); Lares, June 18 to July 1 (specimens); Utuado, August 3 to 9 (specimens); Adjuntas, August 10 to 16 (specimens); Ciales, July 12 to 18 (specimen); Aibonito, January 26 to February 5 (specimens); Hacienda Catalina, March 4 and 6 (specimens), and at 2500 feet altitude on El Yunque, March 8.

This hummer is most abundant on the western end of the island beyond Aibonito. It was observed in the coastal region on the north side of the island only at Manatí, but on the south side was recorded from Salinas, Juana Díaz, Yauco and Cabo Rojo. There are specimens in the U. S. National Museum from Mayagüez and Ponce.

On the eastern portion of the island I found the birds only on El Yunque, where they occurred sparingly up to 2500 feet elevation. The fork-tailed hummer prefers deep shade, and is usually found only where there is forest growth, though on shaded slopes high in the mountains it was sometimes seen feeding in the open among low bushes. The shade of coffee plantations is grateful to these birds, and here they use low perches, only going higher on cool, damp mornings to rest on dead limbs in the sun. Many times the humming of their wings was heard when the birds themselves could not be located in the dense shadows. They are very pugnacious and pursue one another with sharp, squeaking notes.

The breeding season begins apparently the first of February, and full-grown young were common near Lares in June. Struthers reports a nest containing two eggs at Maricao, March 23, 1921.

The adults molt in May and June and regain the full plumage by August 1. These birds were frequently observed working rapidly over and under the limbs of trees and about the leaves and twigs of the coffee, as well as feeding at flowers. Their food consists of tiny insects and spiders.

The species is easily recognized as the smallest of the humming birds found on Porto Rico proper. The male is shining green throughout, with bluish tail and black wings. The female is light green above and whitish below. The two long outer tail feathers in the male are very loosely affixed and are easily lost. In the male the base of the mandible is flesh color and the rest of the bill black. In females the bill is
entirely black. In the young males the flesh-colored base of the mandible is less sharply defined anteriorly than it is in the adults.

Simon\(^{19}\) includes the Porto Rican species with \textit{C. gibsoni} of Colombia in a genus \textit{Chlorolampis}, distinct from \textit{Chlorostilbon}. I see no justification for this action.

**Sericotes holosericeus holosericeus** (Linnaeus)

Green Carib, Blue-breasted Hummingbird, Doctor-Bird, Zambador

\textit{Trochilus holosericeus} Linnaeus, Syst. Nat., ed. 10, 1758, Vol. 1, p. 120. (American.)


\textit{Eulampis chlorolaemus}, Newton, Ibis, 1859, pp. 138-141 (St. Croix).


Porto Rico, found near Fajardo, possibly elsewhere; Vieques, Culebra, Culebrita, St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda, Anegada, supposed to be resident.

In the Carnegie Museum there are three males taken at Fajardo. Porto Rico, on February 19, 24 and 26, 1912, by W. W. Worthington. Gundlach informs us that in 1873 he examined two skins in the collection of Hjalmarson which the latter informed him had been taken by friends near Manati and Vega Baja. There is territory favorable to the species on the east and south coasts, but its distribution and occurrence in Porto Rico at present are uncertain.

\(^{19}\) Hist. Nat. Troch., 1921, p. 64.
On Vieques Island, from March 15 to April 3, I found this hummer common and collected a series of seven specimens (March 18 and 23). The species had not been observed here previous to my visit, and at one time I thought that it might possibly be migrant, but now believe it resident. The birds were seen in forested areas, where they sought shade during the middle of the day, and were most active when the sun was low. They are large and fly swiftly, but seem less adroit on the wing than some other hummers, as they perch frequently while feeding at flowers instead of poising constantly in air. The flowers of the gourdura, a cultivated legume, were especially attractive. Always after a short period of feeding they stop to rest on some twig for a few minutes. Females taken March 23 were feeding young.

The species was first collected on Culebra Island on February 9 and 12, 1899, by A. B. Baker, of the *Fish Hawk*. From April 5 to 21, 1912, I found it common and secured a series of fifteen skins from April 6 to 20. One was taken on Culebrita, April 15. The birds were common everywhere about tree growth, but were especially abundant in the mangroves bordering the bays and lagoons. They were sprightly and active and came frequently, with apparent curiosity, to watch me close at hand. By April 10 I observed them nest-building in the mangroves and the breeding season was well under way at the time of my departure. As the birds visited their nests without fear, it was a simple matter to find them. On several occasions I was astonished to observe a female going directly to its home within a few feet of my head.

The material used for nests was mainly a soft, cottony down from a species of cactus, while the exterior was covered with lichens. Nests were placed on small limbs from ten to thirty feet above the ground. One collected on April 19 contained two heavily incubated white eggs. Others seen at the same time were still empty. Intruding honey-creepers and warblers were driven away through the tree tops with a loud rattle of wings that I heard on many occasions, but always without being able to determine definitely how it was made. The common note was a sharp *chewp*, and in ordinary flight the wings made a loud buzzing.

The birds were seen flying across from the main island to Louis Peña. The Newtons record this species as the only common hummer on St. Croix, and found it breeding from the end of March to the first of June; the nests were placed from five to fifteen feet above the ground and contained two white eggs. Cory received two specimens from St. Croix in 1891, and M. J. Nicoll has reported it as common and the only hum-
mer seen from February 19 to 21, 1904. There is a male in the Museum of Comparative Zoology taken by G. K. Noble, June 19, 1914.

The Newtons report the bird as common on St. Thomas, and Cassin received numerous specimens from there taken by Robert Swift. The U. S. National Museum has two from this collector and two remaining from a series of sixteen received from the dealer and taxidermist, John Akhurst (catalogued March 5, 1863). One of these is a young bird just fledged, perhaps taken from the nest, as the tail is less than half an inch long. It shows no trace as yet of the blue breast spot. Hartert collected a bird of this species near Charlotte Amalie in May, 1892, and Nicoll secured it from February 21 to 24, 1904. Cory records one from St. Thomas in the Field Museum.

Dr. Lund reported this species to the Newtons from St. John, and in the U. S. National Museum there are two skins from that island taken by F. A. Ober.

Winch forwarded specimens to Cory from Anegada, Tortola and Virgin Gorda.

The species is somewhat more than four inches in length, with a long, slightly curved, black bill. It is green, with the tail and a spot on the breast metallic blue.

**Anthracothorax viridis** (Audebert and Vieillot)

Green Mango, Zumbador Verde, Zumbador


Porto Rico; resident, common in the interior hills and mountains.

The green mango is confined to Porto Rico, where it occurs mainly

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29 The description is based on a bird taken by Mauge, which must have come from Porto Rico.
inland in coffee plantations and forests, living either in the densest growth or at the borders of the woods. During my personal field work in 1911-1912 it was found at Río Piedras, December 16 to January 4 (male taken December 18); Mameyes, February 9; Mayagüez, June 6; Maricao, May 29 to June 5 (specimen, June 1); Lares, June 18 to July 1 (specimens June 28 and 29); Utuado, August 3 to 9 (specimens August 6 and 8); Adjuntas, August 10 to 16 (specimens August 13 and 14); Aibonito, January 26 to February 5 (specimens January 26 and 29 and February 3); Cayey, January 15 to 25 (specimens January 16, 18 and 23), and Caguas, January 5 to 14. There is one skin in the U. S. National Museum from Mayagüez taken on June 16, 1901, by B. S. Bowdish. The bird was common in the higher hills from Maricao and Lares to Aibonito, but was found in moderate numbers elsewhere. On the coast it was noted only once, near Mameyes, though a few were seen at Río Piedras. In dry areas it was entirely absent, none being observed along the semi-arid south side of the island, nor in the region between Aguadilla and Camuy.

The species is characterized by large size (length, four and one-half inches) and a plumage of shining green, with steel-blue tail, faintly tipped with white, black bill and blackish primaries. Male, female and young are alike in color. Even a nestling, a male, barely fledged, taken by Dr. Richmond at Adjuntas, April 14, 1900, has the plumage as in the adult.

These birds were active, pugnacious and alert, and pursued one another or other hummers about flowering plants or through the aisles of the forest with dash and vigor, the light reflecting from their brilliantly metallic plumage as they flew rapidly about. When the shrubbery was wet, I noted that they remained inactive until the sun was high in the sky.

The emajagna hedges (Paritium tiliaceum), with their large yellow flowers, were favorite hunting grounds for these birds, as were the flowers of various trumpet creepers (Ipomea). They were observed many times working over the trunks and large limbs of trees, apparently gleaning small insects from the crevices of the bark, and when little clouds of gnats were gathered high in the air above the tree tops, these large hummers poised with rapidly vibrating wings, changing to one side or the other, or whirling completely around with the greatest celerity while picking up the minute insects. When tired, they came down to shaded perches, rested for a short time and then flew up again to continue their feeding. Peons working in the tobacco fields at Caguas accused them of
eating tobacco seed, but this hardly seems probable, as from stomach examinations I found that their food is entirely animal.

Their usual call is a sharp squeak, but at times I heard them utter series of low twittering notes that might be called a song.

Gundlach reports fresh eggs in October. Personally I noted them gathering nesting material in December and February, and on February 3 saw one settle on a nest forty feet from the ground in a tall, slender tree in a coffee plantation. The bird was busy arranging the lining in her home and I assumed that no eggs had yet been laid.

The food consists of small Homoptera, flies and spiders, and it is my opinion that though the birds feed at flowers, they are attracted more by the small insects that gather there than by the nectar of the blossoms. These birds seem to form the indigestible, chitinous covering of their animal food into pellets, which are ejected from the mouth after the nutriment has been extracted. Several of these, ready to be expelled, were found in stomachs that I examined, where they were compressed into a compact mass two millimeters long by one in width.

**Anthracothorax aurulentus** (Audebert and Vieillot)

*Porto Rican Mango, Doctor-Bird, Zumbador Dorado, Zumbador, Zumzum, Colibri*


*Lampornis ellioti* Cory, Auk. 1890, p. 374. (Immature, described as new from Anegada.)

*Lampornis dominicus*, Cory, Auk. 1886, p. 348 (Porto Rico, St. Thomas?); Cat. West Indian Birds, 1892, p. 106 (Porto Rico?).


Porto Rico, Vieques, Culebra, St. Thomas, St. John, Anegada; resident.

In Porto Rico the species is common in open localities. During my field work I recorded it from Quebradillas, July 2 to 6 (specimen); Manatí, July 7 to 11 (specimen); Bayamón, July 20 to 25 (specimen); Martín Peña, January 2 (specimen); Mameyes, February 9 to 29 (specimens); Humacao, September 3 to 9; Patillas, May 12 to 14; Maunabo, May 11; Salinas, April 26 to May 2 (specimen); Juana Diaz, August 17 to 22 (specimens); Yauco, May 16 to 28; Guánica, May 20 (specimen); Cabo Rojo, August 24 to 31 (specimens); Aguadilla, June 9 to 12; Lares, June 25; Comerio, July 26 to 31; Ciales, July 12 to 18 (specimens); Aibonito, January 26 and 31 (specimen); and Cayey, January 15 to 25. There are specimens in the U. S. National Museum from Anasco, January 21, 1899; Hucarés, February 13, 1899; Arroyo, April 2, 1899; and Cataño, February 13, 1900. Struthers found the birds at Boquerón and Maricao.

This is the common hummer of the coast region and, though a few are found in the mountains, as near Cayey and Aibonito, they are not common in high altitudes, and are seldom or never seen in dense forests. They are thus complementary in ecological association to A. viridis. The large flowers of the enajagua (Paritium tiliaceum), which grew in hedges through the pastures, attracted them, and they spent much time in trees in gleaning over the bark, searching the trunks and twigs for food. One taken in a grape-fruit grove near Manatí had the throat filled with ants. The birds were active and pugnacious and were continually chasing one another, or even driving away the honey-eepers that were feeding in the same locality. In some places they fed at the same plants as A. viridis.
Bowdish reports a nest containing two half-grown young near Aguadilla, July 21, 1900, placed on a small limb ten feet from the ground. I shot breeding birds at Salinas, April 30, and at Cabo Rojo, August 27. A fully grown young bird was taken at Ciales, July 13, and at Cabo Rojo grown young were common at the end of August. It is probable that the majority nest in May and June. They utter sharp chipping notes, and Bowdish reports hearing them give a trilling song.

On Vieques Island the present species was the most abundant hummer from March 16 to April 3, 1912, and, in view of this fact, it is strange that it was not reported previous to my visit. The flowers of the molinillo (Leonotis) were attractive to it, though this plant seemed to be seldom visited by other hummers. Specimens were taken on March 18 and 19. Young at this season were fully grown.

On Culebra Island the first specimen of this hummer was taken February 11, 1899, by J. D. Milligan. From April 5 to 21, 1912, I found them far from common, but secured specimens on April 6, 10 and 19. The few seen were found in brush-grown pastures. A male taken on April 10 had the sexual organs enlarged, indicating approach of the breeding season.

Swift forwarded skins from St. Thomas to Cassin, and there are four old skins from this island in the U. S. National Museum received from Swift and Akhurst. A female (U. S. N. M. 81038) was taken on St. John by F. A. Ober. Cory had four specimens from Anegada, and in 1890 gave these a new name under the impression that they were different from skins from Porto Rico, in which, however, he was mistaken. The bird has not been recorded from St. Croix; Mortensen's note of it must refer to the other islands.

The different plumages of this hummer have caused considerable confusion. The adult male has the back, throat and sides green, the breast black with a bluish sheen, the abdomen and under tail-coverts grayish brown and the tibia white. In the immature male there is a large irregular spot of green in the center of the throat, an indication of black on the breast, and the rest of the underparts are mingled gray and white. Adult and immature females are plain grayish white below. The females have been mistaken by many for the female of viridis, which, however, is green like the male.

Simon has indicated A. aurulentus as a subspecies of A. dominicus of the adjacent island of Haiti. Females in the two are closely similar except that the Haitian bird is decidedly larger, while males of dominicus, in addition to being larger, are more extensively black below. The
differences are so decided that there is no reason for not considering dominicus and aurulenta as distinct species. Simon further has named a form from Porto Rico as "Lampornis dominica intermedia," which, however, refers only to highly colored males and must be considered a synonym of aurulenta.

This hummer feeds mainly on Homoptera, Diptera and Hymenoptera of small or minute size, and occasionally on beetles and spiders.

Order CORACIIFORMES
Suborder ALCEDINES
Superfamily ALCEDINIDES
Family ALCEDINIDAE
Subfamily CERYLINAE

**Streptoceryle aleyon aleyon** (Linnaeus)

Belted Kingfisher, Martin Pescador, Pájaro del Rey, Pitirre de Mangle, Matraca, Fraile Miguelete


Belted Kingfisher, Danforth, Oologist, 1922, pp. 10, 177 (western Porto Rico).


Mona, Porto Rico, Vieques, Culebra, Culebrita, St. Thomas, St. Croix; winter visitant.
The kingfisher is a common winter resident in the vicinity of the coast, where it is found at the borders of lagoons and bays and along the lower courses of the large rivers. I observed it at Río Piedras, December 19 and 22, 1911; Mameyes, February 9 to 29, 1912 (specimens taken February 10 and 24); and near Caguas, January 10. The species is of somewhat casual occurrence inland, as my only record was along the Río Caguitos near Caguas, as just stated. Dr. Richmond reported a bird seen by Dr. Stejneger between Utuado and Adjuntas, April 3, 1900, and recorded the kingfisher near Arecibo, April 12. Apparently the bird at times follows the larger streams back among the hills.

Struthers reports that the kingfisher arrived in fall on September 23, 1921, and that he saw the last in spring on May 21, 1921. Danforth has noted them from October 14, 1921, to April 11, 1922. Bowdish found one at Aguadilla, October 7, 1900. All of these records pertain to western Porto Rico. Mr. F. A. Potts writes me that near the Central Aguirre he has seen them from October 5 to April 14.

In my own experience the birds occurred singly and were wild and difficult to approach. They were found most frequently at the border of mangrove swamps.

Cory has reported the kingfisher on Mona, and Struthers noted two seen there on July 16, 1921, an unusually early date.

On Vieques Bowdish reports them on December 10 and 12, 1899. I saw them there occasionally from March 16 to April 3, 1912, and shot a male on March 30. They were noted in scattered trees along the beach and about partly dry lagoons. On Culebra Island I saw kingfishers occasionally from April 5 to 21, 1912, along bays and lagoons, and at times in the mangrove swamps. I noted one on Culebrita Island, April 15, and Señor Guillermo Morris, lighthouse-keeper there, informed me that he saw them now and then through the summer. From St. Thomas the kingfisher has been reported by Knox and Cassin. In the U. S. National Museum there are two skins from this island, one taken by Robert Swift and the other by F. A. Ober. The Newtons record the kingfisher as a winter visitant on St. Croix, leaving late in April.

Superfamily Todi

Family Todidae

Todus mexicanus Lesson

Porto Rican Tody. San Pedrito, Medio Peso, Papagayo, Barrancolino, Verdadon


Porto Rican Tody, Danforth, Oöl. 1922, p. 10 (Porto Rico); Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico; common through the interior of the island and found in small numbers on the coastal plain where there is suitable cover.

In 1911 and 1912 I recorded the tody (PI. LXIII) from Quebradillas, July 2 to 6 (specimens); Manatí, July 7 to 11; Bayamón, July 20 to 25; Toa Alta, August 2; Río Piedras, December 16, 1911, to January 4, 1912 (specimen); Mameyes, February 9 to 29 (specimen); Yabucoa, May 10 (specimen); Maunabo, May 11 (specimen); Salinas, April 26 to May 2 (specimen); Juana Diaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Guánica, May 20 (specimen); Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 10; Maricao, May 29 to June 5 (specimens); Adjuntas, August 10 to 16 (specimens); Ciales, July 12 to 18 (specimens); Comerio, July 26 to 31 (specimen); Aibonito, January 26 to February 5 (specimens); Caguas, January 5 to 14 (specimens), and Hacienda Catalina, March 2 to 11 (specimens).

If there be gnomes and elves in our world of birds, among them are the tiny todies, whose long, spadelike bills, light eyes, brilliant plumage and peculiar mannerisms make them the dwarfs and hobgoblins of the West Indian forests. Though brilliantly colored, they are inconspicuous, for their green backs blend with the perennial green of the leaves amid which they are found, and even the brilliant red of the throat may be mistaken for some highly colored berry. Their acquaintance is one of the greatest pleasures that comes to a foreign ornithologist traveling in their haunts.
The Porto Rican tody frequents dense forest, either primitive or second growth, or the brush-covered banks of streams. It is not restricted to the luxuriant growth of regions of heavy rainfall, being common also in some localities on the arid southern side of the island, where it inhabits areas of open scrub along dry washes in the low hills. The species is one of the few birds that I found in any number in the gloomy, dripping rain-forest that clothes the higher slopes of the great mountain El Yunque. Mangrove swamps are not attractive to these birds, and in general todies are in greatest abundance in the hills and uplands above the level coastal plain.

The tody sits quietly on some low twig, resting with bill pointing up at an angle of forty-five degrees, but it is an active flycatcher, as it flies out to capture insects with a loud snap of the bill, or flutters about the tips of twigs to pick its prey from the underside of leaves. The birds are trustful and have little fear. In fact, during a sudden down-pour of rain, I have had them come confidently to share with me the shelter of the broad leaves of a banana plant, when they rested at ease almost within reach of my hand. As they are so small and remain often quiet on their perches, it frequently happens that comparatively few are seen, and it is only on a warm morning following a day or night of fog and rain that they come into the more open trees above the brush, and one gains a true idea of their numbers.

The ordinary note of the tody is a harsh *pree* or *pree-ah*, a sound uttered in a loud tone, entirely out of proportion to the size of the bird. In calling, it raises itself to the full length of its legs, points the bill up as the note is given, and then sinks back to its normal attitude. At irregular intervals the todies fly out with a loud whirring rattle of the wings—a sound that apparently is made by the attenuate outer primary and is under the control of the bird, for in normal flight it is not heard. This strange rattle is made by both sexes mainly during the breeding season, from January to June.

One does not appreciate fully the systematic position of the tody, not far from the kingfisher family, until one comes to consideration of its nesting. Todies in Porto Rico are said to begin breeding the first week in March, and birds taken then showed earth stains on the plumage. The eggs, however, do not appear to be deposited until May or June, and I found young birds, recently from the nest, common in July. I saw my first nest of this species near Yauco on May 24. A tody flew out from the face of a cut bank in a dry pasture, and on examination the entrance of a nest tunnel was found, a hole about one and one-quarter
inches in diameter, showing the double path of an occupied home. The
tunnel went straight in through the hard earth for ten inches, and then
turned at a right angle to go eight inches farther to the terminal chamber.
a cavity three inches high, three inches wide and five inches deep. This
nest contained three eggs, as large as the end of my little finger, laid
on the bare earth. Their size was astonishing, considering the smallness
of the bird. Each egg was worked into a little hollow in the loose
earth, so that it was partly imbedded, but even then it must have been
a task for the female to cover her treasures. In color the eggs were a
beautiful transparent white, showing a rosy reflection before blowing,
and dull white with a slight gloss afterwards. They are decidedly
pointed, with slight difference between the poles, and swollen centrally.
They measure 15.9 x 13.3 mm., 15.6 x 13.3 mm., and 15.8 x 13.3 mm.,
respectively. Another nest, found near Maricao, June 3, in a clay
bank, had the entrance hole an inch and a quarter in diameter and eight
inches in depth, and beyond was a circular chamber three inches across.
This nest contained two eggs, so stained by red clay that they appeared
to be densely spotted. Young out of the nest were first seen near
Quebradillas, July 5, and from then on were common. They differ from
adults in the color of the throat, which at first is grayish white, like the
breast. Red feathers soon appear in a line on either side and rapidly
replace the lighter color, until soon the young resemble the adults, except
that the bill is shorter.

The color of the iris in the tody is grayish white or plain slate, a
difference correlated perhaps with sex—a point that I neglected to
verify.

The food of the tody is made up largely of flies, beetles, small Homop-
tera (mainly lantern-flies), earwigs and moths—all of minute size, as
would be expected in so small a bird. Occasionally I found that one
had eaten a tiny lizard, and we may imagine a strenuous battle between
the diminutive bird and an active anolis before the latter could be
swallowed. It may be added that all food taken was finely broken, so
that detailed examination of the stomachs of these birds, always packed
with insects of from fifteen to twenty or more species, was a slow and
tedious process.
Order PICIFORMES
Suborder PICI
Family PICIDAE
Subfamily PICINAE

**Melanerpes portoricensis** (Daudin)


(Weto Rico,)

Woodpecker?, Newton, Ibis, 1859, p. 150 (St. Croix; reported?).


*Centurus portoricensis*, Cory, Auk, 1902, p. 229 (Porto Rico; specimens).


Porto Rico and Vieques: common: St. Thomas?

In Porto Rico, in 1911 and 1912, I found the carpintero near Quebradillas, July 2 to 6 (specimen, July 5); Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December 16, 1911, to January 4; Mameyes, February 9 to 29 (4 skins); Maunabo, May 11 (specimen); Salinas, April 26 to May 2; Juana Díaz, August 11 to 22; Yauco, May 16 to 28 (2 specimens); Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 12; Maricao, May 29 to June 5 (3 skins); Lares, June to July 1 (2 specimens); Utuado, August 3 to 9 (speci-
men); Adjuntas, August 10 to 16 (4 specimens); Ciales, July 12 to 18 (specimen); Comerio, July 26 to 31; Aibonito, January 26 to February 5 (5 skins); Caguas, January 5 to 14 (4 specimens); Cayey, January 18 and 21 (specimen); Hacienda Catalina, March 2 to 11 (specimen).

This species is represented in the U. S. National Museum by additional skins, as follows: A series of 10 from Mayaguez, taken by B. S. Bowdish, May 27 to July 21, 1901; 2 from Hucarés, secured February 15, 1899, by A. B. Baker and Marsh; 4 from Cataño, taken March 12, April 8 and 22, 1900, by Bowdish; 1 from Lares, January 26, 1899, by A. B. Baker; 2 from Utuado, April 8 and 10, 1900, by C. W. Richmond; 1 from Adjuntas, April 14, 1900, by C. W. Richmond; 5 from Caguas, January 8, 9 and 11, 1899, by A. B. Baker and J. D. Milligan; and 1 from Hacienda Catalina, March 2, 1900, by C. W. Richmond. I found numerous remains of the woodpecker among bones from caves near Morovis (collected by H. E. Anthony).

The records that have been given show that the woodpecker has a wide range through the island of Porto Rico. It is confined to wooded sections, but has fared better than many of its avian companions in the utilization of land by the Caucasian, since when its original forest haunts were destroyed, it found a congenial home in the trees grown to furnish shade for coffee plantations. In the coastal region it is comparatively rare, because there is little suitable cover, but on the slopes of the inland hills there are broad areas through which it is common. I saw one or two woodpeckers among trees in the town of Rio Piedras, a few through the dry hills below Yauco, in pasture groves near Cabo Rojo, or in the coconut plantations near Mameyes, but they were most abundant farther inland. In habits the Porto Rican woodpecker strongly resembles the red-headed woodpecker or the ant-eating woodpeckers of the United States, and has many of the mannerisms of those birds. The flight is powerful and undulating, like that of most other woodpeckers, and while the birds are not wild, they may be difficult to approach if they notice that they are being followed. They may scold vigorously, but take care to keep concealed on the opposite side of a tree.

This is one of the few species that is common in the coffee plantations, as most of the native birds do not frequent them much. The woodpeckers seemed to feed entirely by searching the trunks of trees, for though I saw them frequently resting on commanding stubs in the sun, they appeared to make no attempt to capture passing insects on the wing, as is the custom with many related woodpeckers.

In Mameyes complaint was made that they damaged coconut trees by drilling nesting holes in them, in which, as time went on, water
accumulated and rotted the wood, until finally the tree broke at the point of decay. As it requires five or six years for a coconut tree to come into bearing, the loss of a tree is appreciable. Such destructiveness is, however, local, and is easily corrected by killing the birds concerned. Elsewhere the woodpecker is decidedly beneficial and should be protected.

On Vieques Island the woodpecker was reported by Bowdish in 1900, and I found it common from March 16 to April 3, 1912, in regions of forest. At this season all the birds were nesting. On March 25 I saw one feeding nearly grown young in a hole in a dead stub twenty feet from the ground. One secured by Bowdish, December 17, 1899, one taken by Richmond, March 27, 1900, and six that I prepared personally appear identical in color and measurement with birds from Porto Rico.

The Newtons report a woodpecker questionably from St. Croix. Cassin states that Robert Swift forwarded several specimens from St. Thomas, but no other naturalist has found them there. Since Swift collected extensively on Porto Rico and was not careful in marking his skins, the St. Thomas records are open to serious doubt.

The woodpecker has the upper surface, including the wings, glossy black; forehead, lores and rump, white; and undersurface suffused with red. In males the throat is red, often with black extending across below it, and in females it is smoky brown, like the flanks. The tips of the secondaries are usually edged with white in females and occasionally so in males. Young, when they leave the nest, are similar to adults, except that the red below is less extensive.

From examination of stomachs I found that two-thirds of the food of this bird is made up of insects, largely wood-boring larvae, ants and earwigs. Occasionally one had eaten a little frog or a small lizard. Seeds and small fruits were eaten freely, particularly figs and various berries.

**Sphyrapicus varius varius** (Linnaeus)

Yellow-bellied Woodpecker


P*icus varius*, Newton, Ibis, 1860, p. 308 (St. Croix, specimen).

*Sphyrapicus varius*, Cory, Cat. West Indian Birds, 1892, p. 104 (St. Croix).


St. Croix: casual in migration.

The only record is that of one procured by Professor Reinhardt, and reported by the Newtons in 1860. The species goes with some regularity
to the Bahamas and Cuba, but is merely a straggler on St. Croix. It has been assumed that this individual was of the eastern subspecies.

Order PASSERIFORMES
Suborder TYRANNNI
Family TYRANNIDAE

_Tyrannus dominicensis dominicensis_ (Gmelin)

Gray Kingbird, Pitirre, Chicheri


Gray Kingbird, Danforth, Oologist, 1922, p. 11 (Porto Rico); Bird-Lore, 1922, p. 41 (Mayaguez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


_Tyrannus griseum_ Taylor, Ibis, 1864, p. 169 (Porto Rico, very common).


_Tyrannus coeruleus_ Nicol, Ibis, 1904, p. 575 (St. Croix).


Mona, Porto Rico, Vieques, Culebra, Louis Peña, St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda, Anegada; so far as known, resident and breeding throughout this range.
Cory has recorded the gray kingbird (Pl. LXIV) from Mona, supposedly on basis of specimens received from W. W. Brown, Jr., in 1892. There are in the U. S. National Museum three skins taken there by Bowdish (who found the bird common August 9 to 21, 1901), one on August 11 and two on August 16, and Struthers reports a pair shot on July 16, 1923.

In Porto Rico the gray kingbird is one of the conspicuous resident birds. Taylor, in 1864, remarked upon its abundance, and it has found modern changes through cultivation favorable, so that it has maintained its numbers.

During my field work I recorded it as follows: Quebradillas, July 2 to 6; Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Maunabo, May 11; Patillas, May 11 to 13; Salinas, April 26 to May 2; Juana Díaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Añasco, June 7 to 9; Aguadilla, June 9 to 12; Maricao, June 4; Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerio, July 26 to 31; Cayey, January 15 to 25; Aibonito, January 26 to February 5; Caguas, January 5 to 14; Hacienda Catalina, below El Yunque, March 2 to 11. Specimens were taken at most of the localities and there are in addition skins in the U. S. National Museum from Arecibo, San Juan and Cataño. The gray kingbird is a species of the open, being found through the pastures, cultivated fields and waste lands from the coast to the higher portions of the island, but it is not encountered in dense forest or in extensive coffee plantations. None were seen in the forests on El Yunque, though the bird was common in the clearings about its base, and only two were noted near Maricao, which is in the heart of the coffee district.

The native name of “pitirre” is given in imitation of the call-note, which is heard constantly when the birds are near, and which at times is lengthened and softened until it might almost be called a song. The flight is direct, moderately fast and accomplished by rapidly beating wings. At nightfall these kingbirds gather in small parties along streams, to roost in bamboos or in the mangroves surrounding lagoons. In several places they were noted coming in the evening to roost in trees of plazas. The first of these gatherings was observed in Caguas, where kingbirds roosted at night in the flame trees. In Adjuntas, as it grew dusk, considerable numbers came flying in to the plaza, singly or in little groups of four or five. At first they alighted in the tops of rather high, open trees, and from here made sallies after passing insects.
abundant in the early twilight, or flew swiftly and rather erratically about, swooping and diving, apparently merely in pleasure. They were rather silent, calling only occasionally, and as it grew darker all went down into low, dense trees to roost.

At times, when drawn to some area by an abundance of food, this species is almost gregarious. On several occasions five or six individuals were observed flycatching about high breezy points in the mountains and, when they were satisfied, perching together on a dead stub, all facing the wind. Trees loaded with various fruits, as the guaraguou (Trichilia spondiodes) or wild fig (Ficus), drew large numbers. On March 6, along the Río Mameyes, at the base of El Yunque, dozens had gathered to feed on the fruit of the guaraguou and, when gorged, congregated in parties in tops of dead trees to await the process of digestion. Seventeen were counted within ten feet of one another in one small tree. The laurel berries (Phoebe elongata) are so large that the birds can scarcely swallow them; nevertheless they gulp down all they possibly can hold. In feeding on the wild fig, where the fruit grows on slender twigs, the kingbird flies out and pulls it off, returning to a perch on the larger limbs to swallow it. Quantities of the berries of the balsamo (Palicourea crocea) and camacey (Miconia racemosa) are taken also. During August the young birds rely largely upon vegetable food, which is easily obtained.

As regards the insect food of this species, a few facts worthy of note were gained by observation in the field. On two occasions birds were noted eating the caterpillars of a large sphinx moth. These were beaten on a limb and the juices were then extracted by working the body through the bill, while the skin was discarded. At Caguas, in the tobacco fields, while their services in eating these and other caterpillars were recognized, it was said that these kingbirds did a small amount of damage by breaking the leaves of the tobacco plants, either with bill or wing, when flying down to pick off the caterpillars. One bird near Mameyes was seen flying out after a yellow butterfly, but missed it, and another was observed eating a large bee. In Mayagüez a few of these birds were seen flycatching above the hot, paved streets and perching on wires and house-tops.

The nesting season appears to extend from April to August, as specimens taken during this period had the sexual organs enlarged. Bowdish records a nest ten feet from the ground on the horizontal limb of a mango tree near Aguadilla, which on June 9, 1900, furnished three slightly incubated eggs. One set of fresh eggs and two with incubation begun were taken here on July 9. He found the usual set to consist
of three eggs and secured fresh eggs from June 20 to July 22. The nests are cupped structures of fair size, composed of fine rootlets, creepers and twigs, lined with rootlets. Danforth also reports three eggs as the usual number in a set.

On Vieques Island the gray kingbird is a common resident in brush-grown pastures. Several specimens were taken in the course of my work, from March 16 to April 3, 1912.

On Culebra Island the species was likewise common, and spread even to Louis Peña and Culebrita. Dozens of the birds roosted in mangroves about Flamenco Lagoon, where they proved the truth of the common statement of the country people, that the gray kingbird is the earliest riser among the birds. At the first indication of coming dawn, one or two circled in the air, calling, while others answered from the branches below. For the next hour or more the birds called incessantly, and then began to spread into the hills and pastures for the usual routine of search for food that occupied the day. By April 10 they were in pairs and on April 13 I saw one carrying nesting material. Several specimens were collected.

On St. Croix the Newtons reported the gray kingbird as the most common and conspicuous bird. They found it nesting from the end of May to the first week in August, and recorded three eggs as the usual set. M. J. Nicoll found it still one of the commonest birds in 1904. Mortensen, in 1909, remarks on its abundance and notes that it is called chicherí. There are six specimens in the Museum of Comparative Zoology, taken June 19 and September 15, 1914, by G. K. Noble.

The species is also common on St. Thomas, where Robert Swift collected it as early as 1860 or earlier. Benedict and Nye forwarded a series of seven, taken January 17 to 24, 1884, to the U. S. National Museum. Cory reports it from Tortola and Virgin Gorda. There is a female in the U. S. National Museum collected on Anegada, December 23, 1889, by C. S. Winch, and another secured by F. A. Ober on St. John.

The gray kingbird is well named, since it is gray above, with dusky wings and tail, a dusky line through the eye, and grayish white below. There is a concealed patch of orange in the crown that is seldom seen except when the bird is in the hand.

The familiar scientific name for this species, *dominicensis*, should be replaced, according to Stresemann, by *curvirostris* of Hermann (*Sitta curvirostris*, Tab. Aff. Anim., 1783, p. 204). In this, however, he is in error since this name is based on “another sort of Loggerhead” in Hans

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Sloane's Voyage (Vol. 2, 1725, p. 301, pl. 259), which, in my opinion, can not be identified certainly from either description or figure.

From examination of a large number of stomachs, I found that three-fourths of the food was animal and one-fourth vegetable. The bird is entirely beneficial and destroys such large numbers of weevils injurious to sugar cane, as well as other noxious insects, that it should be encouraged everywhere through the cultivated fields. Those who raise bees complain that the pitirre does considerable damage by capturing queen bees during their nuptial flights, as they are large and comparatively slow-flying and so are easily picked out from the smaller, faster-moving workers and drones, and it may be necessary to kill kingbirds about apiaries when they become too numerous. This complaint should not, however, be made the basis of general destruction, for the bird is highly beneficial. Great swarms of bees about apiaries are attractive to the pitirre, but frequently I found that birds that were flycatching actively confined their captures to other insects even though the air was alive with bees.

Wild fruits, particularly those of the royal palm, espino (*Xanthoxylum*), wild figs, euphorbias and moral (*Cordia*) are eaten regularly, especially by immature birds in late summer.

[Tyrannus tyrannus (Linnaeus)]

Kingbird


The kingbird has been mentioned from Porto Rico by Hartlaub and Cory, but there is no known definite record of its occurrence.

[Tolmarchus taylori (Selater)]

Porto Rican Petchary, Clérigo

*Pitangus taylori* Selater, Ibis, 1864, p. 163. (Porto Rico.)

Porto Rican Petchary, Danforth, Oologist, 1922, p. 10 (Porto Rico); Bird-Lore, 1924, p. 41 (Mayagüez).


WETMORE, BIRDS OF PORTO RICO AND VIRGIN ISLANDS


Porto Rico and Vieques Island, common resident; Mona Island, reported.

Mr. Struthers informs us that in 1921 he recorded ten birds of this species on Mona, a locality for which there has been no previous report. As the clérigo is not known to migrate, these must be considered resident birds.

In Porto Rico I found this flycatcher at Quebradillas, July 2 to 6; Manati, July 7 to 11; Bayamón, July 20 to 25; Toa Alta, August 2; Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Yabucoa, May 3 to 10; Munnabo, May 11; Patillas, May 11 to 13; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yanco, May 16 to 28; Cabo Rojo, August 24 to 31; Aguadilla, June 9 to 12; Maricao, May 29 to June 5; Lasres, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerio, July 26 to 31; Aibonito, January 26 to February 5; Caguas, January 5 to 14; Cayey, January 15 to 25; Hacienda Catalina, below El Yunque, March 2 to 11. A series of skins was taken throughout this range. There are specimens in the U. S. National Museum from Huares, Pueblo Viejo and Arecibo. The original home of this bird would appear to be in the forests which formerly covered the island; now it is common through the coffee plantations and in second-growth forest. In the lowlands it appears to be changing its habits, as it is spread out through the pastures and fields where there are mango trees or clumps of bamboo. It was seen in extensive mangrove swamps near Mameyes. In the older citrus groves, where there are good-sized trees, it is fairly common. In Río Piedras it was noted in trees growing in yards in the town.

The birds are quiet in their habits and usually perch where they are hidden by clumps of leaves. From these points they fly out after insects, sometimes for considerable distances. Shaded perches are
nearly always chosen, especially during the heat of the day. They are
rather silent, the call-note being a loud *pi ti ti ty*, heard most often in
the breeding season. Near Cayey, in January, one was seen bathing
by darting down to the surface of a pool and then alighting and shaking
its feathers. They are rather pugnacious, but not to such an extent
as the gray kingbirds.

The breeding season appears to extend from February to June, and
after July 1 young birds were common. I took a breeding female at
Yabucoa, May 10, and secured young in juvenile dress at Lares on June
28 and at Comerio on July 29. In the dense forests of El Yunque the
adults were nesting the first week in March and scolded the crows with
harsh notes when the latter alighted above their nests. Bowdish reports
nests containing three young each at Aguadilla, June 1 and 3, 1900.

Remains of this bird were common in cavern deposits near Morovis.

On Vieques Island the species was first reported by Bowdish in 1900. I
found it fairly common from March 16 to April 3, 1912, and pre-
pared several as specimens. A mated pair was observed on March 28
and a male taken the following day was breeding. Skins secured here
are very slightly paler above than the average from Porto Rico, but
are exactly like part of the Porto Rican series, so that the difference
appears purely individual. The genus reaches its eastern limit on
Vieques.

The food of the clérigo, like that of the gray kingbird, is composed
three-fourths of animal and one-fourth of vegetable material. It eats
fewer Hymenoptera and more weevils and Hemiptera than the other
species mentioned, and also captures more of the little tree-toads (*Eleu-
therodactylus*), the difference being due to its choice of habitat amid
trees. Berries of palms, wild figs and the espino (*Xanthoxylum*) are
most abundantly represented among wild fruits in its food. Though
the bird has been accused of eating honey-bees, I found no trace of them
in stomachs that I examined minutely. The species seems wholly benefi-
cial.

The clérigo is easily distinguished from the gray kingbird by its dusky
brown back and blackish head. The under surface is grayish white and
there is a concealed crown patch of bright yellow. The bird is between
eight and nine inches in length.

Dr. Hellmayr (in the reference cited in synonymy above) has con-
sidered the six recognized forms of the genus *Tolmarchus* as related sub-
specifically to one another. Though obviously of similar stock to me it
appears that differentiation has proceeded to a point where the Porto
Rican bird at least is specifically distinct from all others. It has its
nearest ally in *Tolmarchus gabbii* of the adjacent island of Hispaniola, from which it differs abruptly in larger size throughout, there being no intergradation in measurements.

**Myiarchus antillarum** (Bryant)

Porto Rican Flycatcher, Antillean Flycatcher, Juy


Porto Rico and Vieques: resident, fairly common. Culebra, of uncertain status.

On Porto Rico this flycatcher is fairly common, being evenly distributed but nowhere abundant. I found it at Quebradillas, July 2 to 6 (specimen); Manatí, July 7 to 11; Bayamón, July 25 (specimen); Toa Alta, August 2; Rio Piedras, December 16, 1911, to January 4, 1912 (specimens); Manueyes, February 9 to 29 (specimens); Patillas, May 13 (specimen); Salinas, April 26 to May 2 (specimen); Juana Díaz, August 17 to 22; Yauco, May 16 to 28 (specimen); Cabo Rojo, August 24 to July 1 (specimen); Aguadilla, June 9 to 12; Lares, June 18 to July 1 (specimen); Utuado, August 3 to 9; Adjuntas, August 15; Ciales, July 12 to 18; Comerío, July 30; Aibonito, January 26 to February 5 (specimens); Caguas, January 5 to 14; Hacienda Catalina, below El Yunque, March 2 to 11. There are specimens in the U. S. National Museum from Mayagüez and Coamo. The juy is mainly an inhabitant of trees and is found in coffee plantations, small areas of second-growth forest, along hedgerows, brush-filled gullies or occasionally along the borders of cane-fields, where other cover is near. Near Bayamón it
was observed in citrus groves. On the mountain El Yunque it was found up to 1800 feet.

In habits these birds are quiet and unassuming and may easily escape notice. They usually choose an open perch, sometimes in a small opening in the forest, or again along the border of a coffee plantation, though they often perch in the dense leaves in the tops of the trees. Their food of insects is captured on the wing, the birds either returning to the original perch or to another near by. Their call is a plaintive peer, at times varied to pee pee re, uttered slowly. This, rendered as hwee by the ear of the native, gives the species its common name of jui (pronounced hwe). To one familiar with the habits and notes of North American birds, the present form is suggestive of the western wood-pewee.

During the latter part of April and May these flycatchers were seen inspecting holes in trees which were evidently used for nests. A breeding male was taken at Patillas, May 13, and on July 5 along the Rio Guajataca, near Quebradillas, a party of three young, just out of the nest, was observed. After this time young were common.

On Vieques Island, from March 16 to April 3, 1912, I found this flycatcher fairly common and preserved seven as specimens. A mated pair was seen March 23. The birds here inhabited brush-grown pastures and often called from perches where they could not be seen. Skins from this island appear identical in color with those from Porto Rico.

On April 6 and 20, 1912, I heard the unmistakable call of the jui in dense jungle on Punta Soldado, Culebra Island, but was unable to locate the bird amid the heavy vegetation. The species has not been reported previously from Culebra; it is, therefore, unfortunate that one was not taken.

This flycatcher feeds mainly on Hemiptera, weevils, caterpillars and occasional Hymenoptera, but eats such wild fruits as the espino (Xanthoxylum), moral (Cordia), nightshade (Solanum), and wild fig (Ficus). It is one of the beneficial species of the island.

The bird is unassuming in color and in a way seems a small edition of the clérigo, as it is dusky brown above, with light edgings on the feathers of the wings, and grayish white below, lighter on the abdomen. It is seven inches or a little more in length and is slender in form.

To the superstitious countryman the note of the jui is an omen, regarded as the forerunner of news—whether this be good or bad, the bird is credited with prescience in foretelling its arrival.

The flycatchers of this genus found in the Bahamas and greater Antilles are listed by Hellmayr as subspecies of the Jamaican M. stolidus.
Differences between them in my estimation are such as to warrant continuance of the more usual treatment of *M. antillarum* as a distinct species.

**Blacieus blancoi** Cabanis

Porto Rican Wood Pewee, Bobito, Jú, Jú Pequeño

*Blacieus blancoi* Cabanis. Journ. für Ornith., 1875, p. 224. (Porto Rico.)

*Blacieus blancoi* Cabanis. Journ. für Ornith., 1875, p. 224. (Porto Rico.)


Central and western Porto Rico; fairly common.

I found this species at Salinas, April 26 to May 2, 1912 (specimens); Juana Diaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31 (specimens); Mayaguez, June 6; Maricao, May 29 to June 5 (specimens); Lares, June 18 to July 1 (specimens); Utuado, August 3 to 9 (specimen); Ciales, July 15; and Aibonito, January 26 to February 5 (specimens). In the U. S. National Museum there is a series from Mayaguez and skins from Arecibo and Utuado, and in the Museum of Comparative Zoölogy one from San Germain. Gundlach reports it from Quebradillas and Mayaguez. Curiously enough, this species is not reported from the eastern half of the island beyond a line passing through Salinas, Aibonito and Ciales, except for a few recorded by Potts in January, 1922, north of Central Aguirre and for bones that I have identified in cavern material from the Cueva Catedral, near Morovis, taken by Anthony.

The wood pewee frequents coffee plantations or small patches of second-growth and on the south coast is found in brushty pastures. Near Cabo Rojo I encountered it at the borders of mangrove swamps. It is so inconspicuous that it is usually overlooked, with the result that very few of the country people know it or have a name for it. In the coffee plantations it is usually found near the heads of small valleys or on the
middle portion of long, steep slopes. It usually perches on dead limbs not far above the ground, from which it makes short sallies after insects, returning often to the same perch and seldom flying far. The call-note of the males is a low, tremulous *pree-e-e-e*, given at times with trembling wings, that cannot be heard more than a hundred yards, and is so ventriloquial that its direction and the distance from which it comes are difficult to determine. Frequently from a perch not thirty feet away a bird will call for several minutes before it is seen, so still does it sit and so well do its colors harmonize with its background. The females are silent and usually appear suddenly on a limb directly in front of one. Though I found no nests, the breeding season appears to be in May. In July and August the birds were molting badly.

On June 27, 1901, near Mayagüez, Bowdish found a deserted nest that he attributed to this species, hung in the tips of a branch fifteen feet from the ground, in a coffee plantation. The nest was made of fine rootlets and green moss, and was so frail that the addled egg that it contained could be seen from below. This egg, now in the U. S. National Museum, is white tinged faintly with buff, with a wreath of spots and blotches ranging from pale neutral gray to Army brown, warm sepia and Vandyke brown, with a few spots that are almost black. It measures 17.3 x 13.8 mm.

The Porto Rican wood pewee is a true insect-destroyer, as Diptera, Hymenoptera, Coleoptera and other small insects comprise practically all of its food.

As the species is only five and one-half inches long, it is easily identified by its small size. The underparts are rather dull cinnamon-buff and the upper surface dull olive-brown, darker on the head.

Distinction between *Blucicus blancoi* of Porto Rico, and *B. brunnicepilis* and *B. latirostris* of Dominica and St. Lucia, respectively, is sufficient to maintain these as distinct species. They are sufficiently similar to be considered one "Formen-Kreis" but should not be made subspecies of *latirostris* as has been indicated by Hillmayr.

*Elaenia martinica riisi* Sclater

Riise's Elaenia, Ruiseñor Pequeño


_Elaenca martinica*, Cory, Auk, 1890, pp. 374, 375 (Anegada, Virgin Gorda, specimens).
Elainea pagana martinica, Cory. Cat. West Indian Birds, 1892, p. 109 (Tortola, Virgin Gorda).


Vieques, Culebra, Culebrita, Louis Peña, St. Thomas, Virgin Gorda, Tortola and Anegada; fairly common.

On Vieques Island I secured specimens of this bird on March 25 and 27. They were found in thorny jungle on dry, hot slopes in the eastern and southern parts of the island, in areas where the scrub was almost impenetrable. Their habits differed decidedly from those usual in their family. At times they rested quietly and made sallies after passing insects like any ordinary flycatcher, and again were seen searching and climbing about among limbs like a vireo or titmouse. To collect specimens was extremely difficult. When the birds had been located by their calls, it was necessary to cut a trail into the spiny scrub before one could see them, and then to hew a further path to retrieve them when they had been shot. I did not note them until March 25, and for this reason, and since they had not been found by previous collectors, I thought that possibly they were migratory, but in this conclusion I may well have been mistaken. They were about to breed at this season.

On Culebra this flycatcher was fairly common from April 5 to 21 in dense growths of cactus and spiny shrubs that covered considerable areas over dry hillsides. They were heard calling on Louis Peña, April 11, and one was taken on Culebrita, April 15. They moved about very little, seldom flying more than a few feet at a time; so that at times I heard their sharply explosive, whistled call-notes for half an hour without being able to catch sight of them in the dense scrub. Twice I heard them singing a sweet, warbling song. Specimens were taken on April 15 and 20, and I noted about twenty individuals during the course of my work. Natives have no special name for the bird, but recognize it as a small mockingbird because of its sweet song.

The form is known from St. Thomas through the collections of Salvin, Swift and Riise in the sixties. Two skins dating from this period are in the collections of the U. S. National Museum, with a third taken by F. A. Ober. Cory, in 1890, recorded skins from Anegada and Virgin Gorda taken by Winch, but in 1892 did not mention Anegada, indicating
Tortola instead. There is uncertainty as to what he intended. Peters, however, has recorded specimens from both these islands.

In ten stomachs of these birds vegetable food, made up of seeds and drupes, mainly of euphorbias and nightshade, comprised 85 per cent. The animal food was composed of spiders, beetles and caterpillars.

The elaenia is about six inches in length, light brownish olive above and grayish white below, with prominent white wing bars and a concealed crest spot of white.

Peters, the latest authority to revise this species, has indicated that the bird from the Virgin Islands is smaller than typical *E. m. martinica*, much grayer above, with wider wing bars, and well-defined grayish white tips to the tail. With these specifications the results of my own studies fully agree.

Suborder OSCINES

Family Hirundinidae

[Iridoprocne bicolor* (Vieillot)]

Tree Swallow

*Hirundo bicolor* Vieillot, Ois. Amer. Sept., 1807 (1808), Vol. I, p. 61, Pl. 31. (Middle eastern United States.)

Tree Swallow, Danforth, Öölogist, 1922, p. 11 (seen, December).


On present evidence the tree swallow is placed in the hypothetical list of Porto Rican birds. Gundlach reports a picture of this species in the album of Dr. Bello, but did not see the bird personally. Danforth has reported it in the Öölogist as common in December in the vicinity of Mayagüez, but makes no further comment regarding it. The species passes through Cuba in enormous numbers during spring and fall and may occasionally reach Porto Rico. This, however, remains to be substantiated.

The bird is pure white below and steel blue above.]

*Riparia riparia riparia* (Linnaeus)

Bank Swallow, Golondrina, Golondrina Riberiega


Bank swallow, Danforth, Öölogist, 1922, p. 177 (western Porto Rico, seen).

**Cleidola riparia**, Cory, Cat. West Indian Birds, 1892, p. 115 (Porto Rico).


Porto Rico; rare in migration and during winter.

Gundlach reported the bank swallow on the basis of a painting seen in the album of Dr. Bello, but failed to encounter the species. Inasmuch as some other records from Bello have seemed uncertain, this statement, unsupported by other evidence, has been deemed too slight to justify inclusion of the bank swallow in the Porto Rican list. However, Danforth found it at Anegado and Cartagena lagoons from March 4 to April 8, 1922, and from February 19 to April 30, 1924, at Cartagena, and Struthers secured a specimen on February 18, 1922, at Anegado Lagoon.

The bank swallow is a species of small size, grayish brown above and white below, with a distinct dark band across the breast.

**Hirundo erythrogaster** Boddaert

Barn Swallow, Golondrina

**Hirundo erythrogaster** Boddaert, Tabl. Planch. Enl., 1783, p. 45. (Cayenne.)

Barn Swallow, Danforth, Oologist, 1922, p. 177 (western Porto Rico, winter).

**Chelidon erythrogastra**, Cory, Auk, 1886, p. 59 (St. Croix); Cat. West Indian Birds, 1892, p. 115 (Porto Rico, St. Croix).


Porto Rico, irregularly common migrant, uncommon winter resident; St. Croix, recorded.
Gundlach reported the barn swallow in Porto Rico only in September. Mr. F. A. Potts informs me that he saw a few in company with cliff swallows on December 2 and 7, 1920, at the Coamo Reservoir, three miles northwest of Santa Isabel, and that in 1921 barn swallows arrived at Central Aguirre, August 24, and were fairly common and at times abundant until the date of his letter, September 18. Nearly one hundred were seen on one occasion. Danforth has reported the species as an uncommon winter resident in 1921-1922, and recorded the last at Cartagena Lagoon on May 14, 1922, and May 23, 1924, and the first in fall, August 26, 1924. Struthers found barn swallows at Cartagena Lagoon, March 21, August 29 and October 8, 1921, and at Anegado Lagoon, February 18, 1922. In 1912 I saw one individual on the playa at Punta Picua, opposite Mameyes, February 16.

Newton reports the arrival of the barn swallow on St. Croix on September 13, 1858, and noted it daily until observations were terminated on September 28. On one occasion several hundred were seen over a lagoon.

The barn swallow has a pleasingly graceful flight that carries it low over the surface of vegetation or high in the air, according to the distribution of its insect food. It is easily told from other species by the deeply forked tail. The upper surface is steel-blue. Males are chestnut-brown below, while females are nearly white.

**Petrochelidon fulva poeciloma** (Gosse)

Jamaican Cliff Swallow, Golondrina, Golondrina de Cuevas

*Hirundo poeciloma* Gosse. Birds Jamaica, 1847, p. 64; (Jamaica.)


Porto Rico, locally common resident; restricted to favorable localities during the breeding season but afterwards wandering.

I recorded the cliff swallow as follows: Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December 16, 1911 to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Juana Díaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31, and Aguadilla, June 9 to 12. Inland it was noted only at Lares, June 18 to July 1; Utuado, August 3 to 9, and Ciales, July 12 to 18. The species is most abundant on the western half of Porto Rico and few individuals were noted on the east coast. Mr. F. A. Potts writes me that the species was common east to Guayama after September 5, 1921, and that from November, 1930, to April 14, 1931, flocks were recorded east of Central Aguirre. At the latter date they disappeared. As yet the bird is not known to breed in this southeastern section of the island. The species was generally confined to the coast region, being found inland only in the northwestern portion in an area extending from Lares through Utuado to Ciales.

This small swallow usually is seen in little parties, feeding on the wing, with light and graceful flight, above pastures, lowlands, meadows or along beaches. The usual call is a soft chu chu; males utter a chattering, twittering song while flying swiftly and directly through the air.

This species breeds from April to June, gathering in colonies for the purpose and nesting on the overhanging faces of cliffs or in caves—a practice so universally recognized that “La Cueva de las Golondrinas” is a common appellation given to caverns in Porto Rico. A mud rim made of pellets carried in the mouth is thrown up on the outer edge of small shelves or holes, and behind this a felted mass of plant downs from cactus and other growths is placed to receive the eggs. From fragments of shells examined, these appear to agree closely with the eggs of P. lunifrons, being white, spotted with reddish brown and lilac.

North of Aguadilla during the first week in June about forty pairs were nesting in small caves in the cliffs above the ocean, some being located only twenty feet above the waves. Nests found here were in holes where it was difficult to reach them. The birds circled about in a close flock before the entrance to the caverns, calling excitedly and flying up two or three at a time to hover for an instant in front of the nest before dropping back to circle with the others. It would seem that in such situations there must be great mortality among the young, for on leaving the nest they must fly out over the waves, with a considerable rise necessary to reach the safety of land at the top of the cliff. I collected one nearly fledged bird from a nest on June 10.
East of Lares, on June 20, in “La Cueva Pajita,” a grotto two hundred feet long and open at both ends, there was a colony of about three hundred of these swallows, some of them near the entrance and others so far in the interior that the birds could not be distinguished in the obscurity from the large bats that circled about with them. Some of the ledges supporting nests were so narrow that the sitting bird was forced against the wall, greatly abrading the feathers of the sides of the breast. As this wear occurs only on one side, the bird must always have faced the same way while on the nest. Both male and female incubate, for this wear was observed in specimens of both sexes. About this colony immature birds were seen on the wing, following the parents and teasing for food, while other adults were still nest-building. When tired, young birds perched in the leafy tops of the trees. Struthers reports that young on the wing are common in July.

Gundlach in the seventies noted that the cliff swallows nested occasionally under eaves of buildings, and one instance of this kind came under my observation. In the train shed of the Línea Ferrea del Oeste at Bayamón a small colony was building against the rafters inside and one pair had constructed a nest on a beam in the gable of the hotel across the street. These nests, when finished, were globular in shape, only two being seen with the long bottle neck found in the nest of P. lunifrons, and those two imperfect. The greater part had merely a large circular entrance in the side, rough in outline, and a few were simple platforms of mud. In August these swallows gathered in little bands of twenty-five or thirty, feeding over the lowlands and resting close together in twittering flocks on the telephone wires along the roads. During heavy rainstorms they seemed to have a hard time in keeping up against the downpour, as they continually struggled to rise and were as steadily beaten down. Such storms would, without doubt, prove fatal to many of the young before they became strong on the wing.

After careful comparison of a series of twenty-four skins from Porto Rico (taken personally) with ten from Jamaica, I am unable to detect any constant difference between the two groups; so that the Porto Rican bird is identified as P. f. poeciloma.

The cliff swallow lives entirely on animal food—mainly beetles, flies and true bugs. I found four hundred engraver beetles of the genus Platyptus in one bird, which indicates the success of their aerial search for food.

The Jamaican cliff swallow is steel blue above, with more or less chestnut on rump, around neck, forehead and underparts, and the abdomen is white. It will be confused only with the barn swallow, from
which it may be distinguished by the slight notch in the tail instead of the deep fork of the related species.

**Progne dominicensis** (Gmelin)

Caribbean Martin, Golondrina, Golondrina de Iglesias


Mona, Porto Rico, Vieques, common during breeding season; absent in winter.

Bowdish reports the Caribbean martin as common on Mona Island from August 9 to 21, 1901; he supposed that it nested in crevices in the rock about the mouths of caves.

My field notes record the martin from the Río Guajataca near Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Bayamón, July 20 to 25; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Añasco, June 7 to 8; Aguadilla, June 9 to 12; Maricao, May 29 to June 5; Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerío, July 26 to 31; Aibonito, January 26 to February 5; Caguas, September 2; Cayey, January 23 to 25; Hacienda Catalina, below El Yunque, March 5 and 6. The Caribbean martin is present only during the breeding season and leaves the island in fall. The first arrivals of the year were seen at Cayey on January 23, and after this I found them common. Gundlach reported them from the first of the year until September, while Dr. Stahl
says that they arrive regularly from the end of January to the first of February, and gives December 23 as the earliest date in eight years of observation. In the U. S. National Museum there is a specimen taken at San Juan, January 4, 1899, by J. D. Milligan, and one in the Carnegie Museum secured at Loiza, February 16, 1912, by W. W. Worthington. Danforth reports the earliest dates of arrival at Cartagena Lagoon as January 6, 1922, and February 19, 1924, and the latest date of departure at Mayagüez as September 9, 1924.

On August 16, 1912, while I was on the summit of the range above Adjuntas, martins were heard continually so high overhead that they could not be seen, while occasionally three or four swept down over the mountain slopes and then were away. These were evidently migrant birds, as they were working steadily southward. In some localities birds were still feeding young at this date.

Bowdish noted a bird in San Juan, October 13, 1899, as the only one seen in some time, while Struthers recorded the last one noted at Mayagüez as of October 8, 1921. At Mameyes natives informed me that in winter the large swallows flew to Africa—a tale evidently dating back to European ancestors!

In 1912, immediately on arrival, martins began with much calling and warbling to investigate nesting holes in the church towers and in the eaves of buildings. In the wilder localities a few still adhere to their ancient nesting sites in hollow trees, though the greater number now nest in the towns. Near Mameyes a male was seen disputing possession of a hole in a coconut palm with a woodpecker, and there were quite a number nesting there in such locations. Struthers reports nests in coconut palms in May, 1921. On the estate known as Manantial, north of Guánica, about thirty individuals were nesting in small openings in the sides of an old brick chimney that stood seventy-five feet high, and birds were found occupying holes in trees near the Hacienda Catalina and along the Río Guajataca near Quebradillas. They were observed carrying nesting material as early as February 9, but nest-building seemed to be rather a dilatory process, taking some time, and apparently eggs were not deposited until May 1. The first young seen on the wing were observed at Comerio, July 27; others were still feeding fledglings in the eaves of the church at Cabo Rojo the last of August, though some of the earlier-nesting birds appeared then to have left the island. Only one brood seems to be raised.

The Caribbean martin is strong and vigorous on the wing, sweeping about in great circles, with much calling and chattering in characteristic martin tone. The greater number of these martins remain in or about
towns, perching on wires and the roofs of the houses and feeding high overhead. Sometimes parties are found about the mouths of lagoons and rivers, frequently darting swiftly down at a boat in the water, turning abruptly and then rising to repeat the performance. On cold, rainy days they follow cattle in the pastures for the insects that these quadrupeds disturb in passing through vegetation, and on other occasions sweep back and forth along sheltered gullies where food is abundant. At Cabo Rojo the screaming and talking of a parrot hanging in a cage interested the martins greatly. Four or five would gather on a wire above it, peering down, twittering and lifting their wings nervously, until, at some piercing shriek, they left precipitately.

On Vieques Island Bowdish found a few at Isabel II early in February. I saw one or two pairs in the village from March 16 to April 3, 1912, but did not observe them in the surrounding country.

The martin feeds entirely upon insects and so is a beneficial species. In 1912 I saw no indications of artificial nesting boxes, but there is no reason to suppose that the birds would not use such readily if made available.

The adult male is steel blue with white abdomen. The female and young male are steel blue above, grayish brown on throat, breast and sides and white on the rest of the lower surface.

Family Corvidae

Subfamily Corvidae

**Corvus leucognaphalus** Daudin

Porto Rican Crow, Cuervo


Porto Rico; resident, rare. St. Croix; bones found in midden deposits.

Formerly the Porto Rican crow was abundant, but at the present time its numbers are few. Naturalists who visited Porto Rico with Ledru one hundred thirty years ago secured the type of the species for the Paris Museum, and apparently found the bird common, as they report its flesh as good to eat. One specimen that they took had an abnormal bill with crossed mandibles and was described as a distinct species. Moritz, in 1836, reported the crow as living on fruits, and Taylor saw and collected it in 1863 (probably on the Río Loisa at the estate of George Latimer that was known as Punta). Gundlach found many individuals at the Cueva Pajita near Lares, and in Caguana, in the vicinity of Utuado, and says that it was reported from Quebradillas and the eastern part of the island. Stahl had two specimens. Bowdish did not see it, but heard reports of it, probably incorrect, from near Caguas.

These birds have more the nature and the habits of ravens than crows—a resemblance borne out by their strange notes. They seem to thrive only where there are extensive growths of natural forest, and when these are cut down the crow disappears. I observed crows only in March, 1912, along the west fork of the Río Mameyes, where they were breeding, nests apparently containing both eggs and well-grown young. All were inaccessible, as they were located in the tops of tall tabanuco trees. The crows kept well concealed in the leaves high above, and only by patient watching could one locate them. They exhibited considerable curiosity and once, when I was hidden in some tall grass at the edge of a clearing, two came down to examine the place. On my second visit to this colony all the birds left, going higher into the mountains, though every half hour or so four or five came circling back, high in the air, and perhaps one or two would alight on some high, dead limb, projecting above the forest, where they croaked and called, lifting the wings nervously. Later on a flock of about twenty-five was found near the forks of the Río Mameyes, but these birds were very wild, keeping entirely to the higher slopes of the hills. On days when it was cold and rainy on the summit of El Yunque, the crows descended into the warmer valleys, and when it cleared rose and circled back to the higher peaks.
The ordinary call-note is a high-pitched klook, or a deep wallough, varied by any number of indescribable gutturals and gabbling calls, with none of the vociferous cawing of our crows. The natives claim that the crow lives for many years and credit it with great sagacity, including an ability to speak Spanish upon occasion—a belief which forms the basis of several stories current among the hill people. Captive birds, it is said, really learn a few words if captured when young. They are prized as food by the country people and were formerly hunted as game. At times, it is said, they descend to coastal swamps near Mameyes.

The iris is bright reddish brown.

Of nine stomachs that I examined, one contained remains of a nestling passerine bird and two bones of tree-toads, but 90 per cent of the food was made up of wild berries and drupes, such as those of the tabonuco (Daercyodes excelsa) and a palm. The crows were seen eating wild fruits of several kinds.

Mr. Leopold B. Strube, of the Hacienda Jobo, near Utuado, informed me in 1912 that there had formerly been numbers of the birds about Utuado, but that they had disappeared for no apparent reason five or six years before.

Bones of this species have come from kitchen middens in two localities on St. Croix: one near the mouth of Salt River, and the other on the Richmond estate, near Christiansted (identified in material presented to the U. S. National Museum by Mrs. Hugo Hark). Apparently the bird sojourned on this island in ancient times, when it was covered with forests, but there are no modern records for living individuals. (It is possible that the bones found in kitchen middens may have come from captive birds brought from Porto Rico by Indians, though I consider this doubtful.)

When Mr. Ridgway separated a Haitian form of this bird as Corvus leucognaphalus erythrophthalmus (Würtemberg), he had available only a few skins from Porto Rico and from the island of Haiti, a part with sex wrongly indicated. My own collections include nine skins from Porto Rico, while Dr. W. L. Abbott has recently presented to the U. S. National Museum seven from the Dominican Republic. A short time ago I compared these critically, at the request of Col. R. Meinertzhagen, for his revision of the genus Corvus, and found that birds from the two islands do not differ appreciably one from another, as they are almost identical in measurements and show no differences in color. My series from Porto Rico—all taken March 4 and 6, 1912, near the Hacienda Catalina, on the slopes of the great mountain El Yunque—have the following measurement (in millimeters):
In addition to these, there are two old skins from Porto Rico, without data, in the U. S. National Museum, one from the Bryant collection and one taken by Latimer.

The species is distinguished by its large size and totally black color, with white bases on the feathers of the head and lower surface.

**Corvus pumilis** Wetmore

Lesser Porto Rican Crow, Solitario


Porto Rico; now extinct.

While traveling in Porto Rico in 1912 I heard occasional rumor of a form of crow smaller than the ordinary cuervo (*Corvus leucognaphalus*), distinguished under the name solitario, and said to have been found many years before on the wooded hills below the town of Lares. This apparently mythical story of a species which I did not succeed in finding alive has since been substantiated by the discovery of an ulna (Fig. 19), of a crow much smaller than *leucognaphalus* in material collected in July, 1916, by H. E. Anthony in the bone deposits of Cueva San Miguel near Morovís.

The ulna that serves as a type for *pumilis* has a total length of 68 mm., while in four specimens of *leucognaphalus* this bone measures 75 to 76 mm. *C. pumilis* was thus smaller than the modern cuervo, but was somewhat larger than *C. palmarum*. Apparently *pumilis* was about the size of the fish crow of the United States.

With the discovery of *C. pumilis* there are now known two sizes of crow—one large and one small—on Cuba, Haiti and Porto Rico.
Family Mimidae

*Mimus polyglottos orpheus* (Linnaeus)

Jamaican Mockingbird, Ruiseñor, Sinsonte


Porto Rico, Vieques, Culebra, Culebrita, St. Thomas: resident. My records indicate the following distribution for the mockingbird in Porto Rico: Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Toa Alta, August 2; Bayamón, July 20 to 25; Río Piedras, December 16, 1911, to January 4, 1912 (specimens); Mameyes, February 9 to 29 (specimens); Humacao, September 3 to 9; Yabucoa, May 3 to 10; Patillas, May 13 (specimen); Salinas, April 26 to May 2 (specimen); Juana Díaz, August 17 to 29 (specimen); Yauco, May 12 to 28 (specimens); Cabo Rojo, August 24 to 31 (specimens); Mayagüez, June 6; Añasco, July 7 to 8; Aguadilla, June 9 to 12; Lares, June 18 to July 1; Utuado, August 3 and 5; Comerio, July 26 to 31 (specimen); Ciales, July 12 to 18; Àibbonito, January 26; Cagna, January 5 to 14; Cayey, January 15 to 25, and the Hacienda Catalina below El Yunque, March 2 to 11. In Porto Rico mockers are more common in the lowlands, few
being seen above a thousand feet elevation; some were found in open pastures near Aibonito, and on Mount Pelado above Cayey, among the higher points visited, but the coffee fincas and forests common in the hills were too dense to attract them generally. They seem to thrive best in a dry climate, as they are most abundant along the south coast. They frequent tree-dotted pastures, hedges and thickets; near Guánica they are common through the open cane-fields, feeding on the ground in the newly plowed lands, and following the fences through the cane, where there is little or no cover. I found them especially common in the citrus groves around Bayamón and Manati. Bones of this species were obtained from old cavern deposits near Morovis.

When hidden in thickets, mockers are shy and secretive; but the males, singing from the top of some tree or bush, flying up a few feet and then dropping back, and lifting their wings as they sing, are a most conspicuous feature in the landscape. The period of song extends from January until July, after which they become silent except for their scolding notes. The nesting season extends from January until June. Birds were seen nest-building near Caguas, January 5; and near Mameyes in February nearly all the females examined were incubating. Bowditch records a nest at San Juan, March 12, 1899, containing three young, and one at Aguadilla with seven eggs. He describes the nests as similar to those found in the United States. Gundlach reports four to six eggs as the usual set.

Mockingbirds were noted as common cage birds, and it was a frequent practice everywhere to take the young from the nest. Usually they were procured when quite young, and hung in cages in the bushes, where the adults could feed them. Fine singers among the males were valued as high as ten or fifteen dollars. In the country districts they were sometimes kept in rude cages made from a large calabash with string laced across the opening to prevent escape. The natives in some sections have a curious belief to the effect that the sex in captives may be told by the form of the tongue, which they say is split in males and entire in females! It would seem that this could be made to suit the needs of unscrupulous venders!

Mockers were observed many times running about on the ground in plowed fields far from any cover, though ordinarily they are inhabitants of thickets. The song of the male, with many rich notes and imitations of other birds, delivered from some conspicuous perch, is one of the finest sounds of the countryside, and the mockingbird is by far the best of songsters found in Porto Rico. The display that is frequent in the breeding season, in which the male flies out with slowly moving wings,
fully spread to display their flashy white markings, is as pleasing as the notes that accompany it. The usual call-note is harsh in tone.

Bowdish reported the mockingbird from Vieques Island in 1900, and I found it very common there and secured a series of specimens from March 16 to April 3, 1912. The brush-grown pastures of this relatively dry island seemed well suited to it, and it was distributed everywhere through pastures and fields. The period of my visit marked the height of the breeding season; a nest containing four young nearly a week old was seen on April 3.

On Culebra Island the mocker was somewhat less abundant from April 5 to 21, 1912 (several taken). The birds were nesting at this period. The species was observed on Culebrita Island, April 15.

Griscom has recorded a series of this form collected on St. Thomas during August and September, 1916, by R. H. Beck. The bird has not been reported previously from that point, and is not known at present from any of the other islands here under discussion.

I have carefully compared series from Cuba, Grand Cayman, Jamaica, Porto Rico, Vieques and Culebra and find birds from these widely separated islands so nearly the same in size and coloration that they must be considered representative of one form. The darker coloration at one time supposed to differentiate the bird from Porto Rico does not hold. Griscom reports skins from St. Thomas as belonging to this race. The distribution is anomalous, since the range is interrupted by the occurrence of the distinct *Mimus p. dominicus* on the island of Haiti, and one is led to speculate on the possibility of man as an agency in establishing *orpheus* in the widely separated islands that comprise its range, in view of the fact that he keeps it commonly as a cage bird. This is especially true for St. Thomas, for 1916 seems to be the first recorded date of its occurrence, though apparently it was then common.

The mockingbird, nine inches in length, is of slender form, gray above and white below, with prominent white markings in the wings and in the long tail. The young in first plumage have spotted breasts.

In this form two-thirds of the food is made up of the fruits of palms, wild figs, and other drupes and berries. The animal food includes cutworms, injurious weevils and the mole cricket, so that the species is beneficial in its relation to agriculture.

**[Mimus gilvus gilvus** (Vieillot)**

Guiana Mockingbird


Mimus gilvus gilvus, Ridgway, U. S. Nat. Mus., Bull. 50, 1907, Pt. 4, p. 235 (St. Thomas).

In a collection of birds obtained by Benedict and Nye in 1884 at various points on the shores of the Caribbean Sea during a cruise of the Fisheries Steamer Albatross, there is a single skin of the present bird marked St. Thomas. Mr. L. Griscom, in announcing a series of Mimis p. orpheus from St. Thomas, has cast doubt on this record through information obtained from Dr. Richmond.

On examining the catalog of the collection in question, I find that it includes birds from points within the usual range of gilvus. Furthermore, the specimen in question has the original label in a handwriting different from that on other specimens, so that its indication as from St. Thomas is considered erroneous. It would seem to have come from elsewhere and to have been wrongly marked by some person other than the collectors.

The form is included here to call attention to the error, since the bird has no place in the avifauna of the Virgin Islands.]

Margarops fuscatus fuscatus (Vieillot)

Pearly-eyed Thrasher, Zorzál, Zorzál Pardo, Zorzál Negro, Zorzál de los Palmares, Truche


Cichlidherminia fuscata, Newton, Ibis, 1859, pp. 141-142 (St. Croix, St. Thomas).—Cory, Auk, 1891, pp. 43, 48 (Porto Rico, St. Croix, Virgin Gorda, St. Thomas, Tortola).—Mortensen, Atlanten, 1909, Vol. VI, No. 66, p. 646 (St. Croix).


Mona, Desecheo, Porto Rico, Vieques, Culebra, Culebrita, St. Croix, St. Thomas, St. John, Tortola, Virgin Gorda; resident.

Bowdish reported the pearly-eyed thrasher as more abundant on Mona Island than any other land bird, from August 9 to 21, 1901. Ten skins that he collected for the U. S. National Museum are all in worn plumage. He found the bulky nests of twigs on shelves and crevices in the rocks near small caves.

Bowdish also secured four specimens on Desecheo Island, July 6 and 9, 1900. This thrasher is the only resident land bird now known from this bit of land, where it is so common that, from June 13 to 16, 1912, I estimated that there were perhaps 1200 individuals on the island. In the dense brush it was difficult to see them, but their notes were heard on every hand. Fishermen who visited the island from time to time had made a tiny pool on a broad rock exposure to catch rain water and I saw the thrashers often drinking this supply. I knew of no other available fresh water and wondered how the birds maintained themselves under ordinary circumstances, as in dry seasons they must subsist without a definite water supply. A pair of these birds had built a nest in a crevice in the roof of the little cave that constituted my only shelter, and apparently at this time the female was incubating eggs. I was not able to reach the nest, but it was seemingly a bulky structure, because grass and twigs projected from the openings leading into the crevice in which it was located. Noddy terns fought the two thrashers constantly, but were always worsted in the encounters. At evening the male sang his somewhat labored song from a cactus stalk above the cave entrance, continuing his calls until deep dusk.

On Porto Rico this thrasher is far from abundant in most localities, and from its habits few are seen. I found it at Mameyes, February 9 to 29 (specimens February 12, 21 and 26); Yauco, May 21 (a pair taken); near Guánica, May 24; Aibonito, January 31 (specimens); Caguas, January 11 (specimen); Hacienda Catalina below El Yunque, March 4 and 10. In the U. S. National Museum is a skin taken at Caguas, January 9, 1899, by A. B. Baker. Gundlach reports one taken at Quebradillas in November, and a pair at Utuado in July. Worthing-
ton secured birds for the Carnegie Museum at Santa Isabel on March 22 and at Adjuntas on March 27, 1912. Struthers found them quite common at Maricao, December 29, 1921, and collected two. He reports the species once from Rincón and once near Mayagüez. Mr. F. A. Potts writes me that it is quite plentiful in the upper Toro Negro Valley. I noted many of its bones in cavern material collected by Anthony near Morovis. Danforth has found it fairly common near Cartagena Lagoon, and between Ensenada and Cabo Rojo Lighthouse, and has heard it near Mayagüez.

In habits and appearance the truche resembles the shyer thrushes. It inhabits dense thickets and keeps so well under cover that, except in the drier regions, where the scrub is fairly open, it is seldom seen. The song resembles the syllables *wheur, tel leur, tsee*, given brokenly with many variations; so that, while the notes themselves are pleasing, the whole effect is disconnected and rambling. The birds sing by the hour, and the monotony and persistency of the sounds may in time become unpleasant. In singing they choose elevated perches amid leaves, and rest with wings and tail hanging loosely. At such times with care they may be approached and observed, but at any disturbance they dart at once into thick cover below. The flight is swift and direct, like that of a robin.

In the dense thickets on Vieques Island the pearly-eyed thrasher was common, and from March 16 to April 3, 1912, I secured a series of thirteen, all males. I found that here they had much curiosity, so that it was easy to decoy them from their cover to positions where they could be seen. They were noted especially in dry creek beds and ravines. A breeding male was taken on March 21, but others showed no signs of sexual activity.

The thrashers were common on Culebra Island from April 5 to 21, 1912, where I collected additional specimens. I found them also on Louis Peña and Culebrita islands.

Robert Swift collected this species on St. Thomas for Cassin, and Winch sent specimens from there to Cory. Newton remarks that the species is common on that island, and in the U. S. National Museum there are two skins taken at St. Thomas by F. A. Ober, and a third received from the Academy of Natural Sciences.

The Newtons found the pearly-eyed thrasher common on St. Croix and say that it breeds there from the end of May to the first part of July. The eggs number from four to six and are blue green, deeper in color and larger in size than those of the American robin. Cory received skins from St. Croix, and there are six females in the Museum of Comparative Zoölogy taken on September 15, 1912, by G. K. Noble.
C. S. Winch collected the bird on Tortola and Virgin Gorda, and there are two specimens in the U. S. National Museum obtained by Ober on St. John.

This species feeds mainly on wild drupes and berries, though large insects, spiders, fiddler crabs, tree-toads and lizards are eaten occasionally.

These birds are a little more than eleven inches in length and have a dull-brown plumage, variegated with white below, and a white abdomen. The eye is light in color.

Family Turdidae

*Mimocichla ardosiacca portoricensis* (Bryant)

*Porto Rican Thrush, Zorzal, Zorzal Azul, Zorzal de Patas Coloradas*


Porto Rico; fairly common resident.

I found this thrush at Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11; Trujillo Alto, December 26; Mameyes, February 9 to 29 (specimens); Yabucoa, May 10; Juana Diaz, August 17 to 22; Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31 (specimens); Mayagüez, June 6; Añasco, June 7 to 8; Aguadilla, June 9 to 21; Maricao, May 29 to June 5 (specimens); Utuado, August 3 to 9 (specimens); Adjuntas, August 10 to 16; Ciales, July 12 to 18 (specimen); Comerio,
July 26 to 31; Cidra, July 30; Caguas, January 5 to 14 (specimen); Aibonito, January 26 to February 5 (specimen); Las Cruces, January 15; Hacienda Catalina below El Yunque, March 2 to 11 (specimens).

The Porto Rican thrush is distributed over the entire island, though it is less common in the dry region of the south coast. The species inhabits dense brush or forest; in the hills it is common in the coffee plantations. Regions of small streams fringed with trees and running through brushy pastures form an especially favorable haunt for these birds. In general appearance they suggest gray-colored robins, but are shyer in habit. At times they run about on the ground in the open, but when frightened take refuge in thickets, and in general remain under cover except when undisturbed. In singing they mount to the top of a tree and perch in the thick leaves, where they utter a song composed of a series of disconnected notes, some of which are quite musical. As a whole, the song is not unpleasing, though repetition causes it to become monotonous. The call-note is a low wheer-a like the note of a thrasher. The birds were decoyed readily by "squeaking" or by a whistled imitation of their notes.

The breeding season extends from the end of January to June, varying somewhat in different parts of the island. Near Mameyes in February the birds were seen performing a mating display in which male and female ran about on the ground with heads drawn in and the widely spread tails thrown forward over the back so that the white tips were prominent. Gundlach reports that they lay from three to six eggs, in color greenish white spotted with dark reddish brown. Danforth reports a nest, April 30, 1924, at Mayagüez placed among upright shoots growing from a guanábano tree nine feet from the ground. The nest was built of shreds of bark, fine twigs, a small piece of partly rotted burlap, some string, bits of fern leaf and some feathers, lined with shredded bark. The open cup of the nest contained one egg with "a putty-colored background" mottled with rufous-brown. It measured 33 x 22 mm. I found young birds common in June and July. Taylor has described the bill, eyelids, legs and feet as bright yellow, but this does not hold in a considerable number of specimens that I examined in the flesh, as these parts were near flame scarlet (Ridgway), becoming more orange in June specimens, when the birds were in molt. Birds in full molt were taken at Maricao, June 3, while skins from Ciales, July 15, indicate that the birds were just completing the wing molt.

These thrushes are very handsome, with their dark-gray plumage, white abdomen and white throat streaked heavily with black. The young in juvenile dress has the breast washed with dull buff and barred faintly with dusky.
About two-thirds of the food of this species is composed of drupes of the laurel, morar, wild fig, royal palm and similar fruits of the forest, while in the animal food I found the mole cricket, weevils destructive to cane, cutworms, ants, snails, lizards and tree-toads.

As a species, *Mimocichla ardosiaeae* is found on Haiti, Porto Rico and the island of Dominica, indicating that it may have extended through other islands at one time, or that possibly it has been transported by aboriginal man in his wandering. Distinction between the typical form of the island of Haiti and the subspecies *portoricensis* of Porto Rico is very slight. The Porto Rican form in series is faintly more slaty gray above, while the Haitian bird has a bluer tinge. Many from the two regions are indistinguishable in color. In its dimensions the Porto Rican form is slightly larger, the difference being most evident in the bill and tail. Measurements of a series indicate, however, how little difference there is between the two.

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**[Hylocichla mustelina]** (Gmelin)

*Wood Thrush*


Gundlach found a drawing that he identified as this species in the album of Dr. Bello, who had taken it from a specimen in the collection of Don Celedonio Carbonell. There is no other record for the bird, which is here placed in the hypothetical list, since its occurrence is not sufficiently certain.
The wood thrush migrates from its summer home, in eastern North America, south into eastern Mexico and Central America, and is found casually in Cuba and the Bahamas. It is a bird of plump form with a short tail colored above bright reddish brown on head and back, duller brown on tail, and below creamy white, spotted heavily with black.]

Family **Vireonidae**

Subfamily **Vireoninae**

**Vireo latimeri** Baird

Latimer's Vireo, Julian Chiví

*Vireo latimeri* Baird, Rev. Amer. Birds, May, 1866, p. 364. (Puerto Rico, north side.)


Porto Rico; fairly common resident.

In 1912 I noted this species at Quebradillas, July 2 to 6 (specimens); Manatí, July 7 to 11 (specimen); Toa Alta, August 2; Bayamón, July 20 to 25; Río Piedras, December 16, 1911, to January 4, 1912 (specimens); Trujillo Alto, December 26, 1911; Patillas, May 13 (specimen); Salinas, April 26 to May 2 (specimens); Juana Díaz, August 17 to 22 (specimens); Yauco, May 16 to 18 (specimen); Cabo Rojo, August 26; Mayagüez, June 6; Maricao, May 29 to June 5 (specimens); Lares, June 18 to July 1 (specimens); Utuado, August 3 to 9; Ciales, July 12 to 18 (specimen); Aibonito, January 26 to February 5 (specimens); Comerío, July 26 to 31; Cayey, January 22 (specimen); and Caguas, January 5 to 14 (specimens). Bowdish secured skins for the U. S. National Museum at Cataño and Mayagüez, and Richmond obtained one at Adjuntas (April 14, 1900). Danforth reports the species near Cartagena and Anegado lagoons, Ensenada, Cabo Rojo Lighthouse and between Utuado and Arecibo.
The present species is another form that is seemingly restricted in range to the western portions of Porto Rico, since to the present time it has not been recorded east of Trujillo Alto, Caguas and Patillas. It is decidedly local in occurrence throughout its range. Latimer's vireo frequents the coffee plantations to some extent, but is most common in the dense brush, matted with creepers, that covers the limestone hills which are a prominent feature of the landscape on the north side of the island. The birds are common in the dry hills of the south coast also, and I found them almost abundant in the forest growth along the Río de la Lapa, back of Salinas. They work industriously through the brush, sometimes high up in the trees, but more often near the ground, searching systematically through the tangles for food. They exhibited some curiosity, and once one came out and scolded with a wrenlike chatter for several minutes, until the brush about me was full of peering grassquits, honey-creepers and spindalís. Females of Latimer's vireo seem to be almost silent, but the males sing incessantly, a sharply accented song, in imitation of which it gets its native name of julián chi-čí. There are two distinct strains in this song and the bird may change abruptly from one to the other. The couplets are uttered from twenty-two to twenty-three times a minute and frequently may continue without appreciable break for an hour. The scolding note may be rendered as chee chee chur chur chur.

Latimer's vireo nests in April and May. Young birds were seen July 5 following their parents with soft call-notes; Bowdish records immature birds taken in October. Gundlach says that the nest is suspended in a fork of a small branch and is a basket of soft materials, such as plant down, spider web and plant fibers. He describes the eggs as three in number, white, spotted with lilac and dull brown. In May the males sang constantly, often remaining on one perch for half an hour or so, but by the middle of June they were mainly silent.

The bulk of the food of Latimer's vireo consists of small insects and includes many little beetles, true bugs and even the nymphs of the mole cricket. About one-eighth of its sustenance comes from small wild berries and fruits, such as those of the camacéy (Miconía prasina) and espino. Most of the vegetable food is eaten in autumn.

Latimer's vireo is slightly less than five inches in length, but is plump and robust. The back is bright olive-green, the crown grayish, throat whitish and breast and underparts yellow.
Vireo olivaceus olivaceus (Linnaeus)

Jamaican Vireo, Bien-te-veo


Sylvicola altiloquus, Hartlaub, Isis, 1874, p. 611 (listed).


Vireo calidris, Cory, Cat. West Indian Birds, 1892, pp. 115, 152-153 (Porto Rico, St. Croix).—Bowdush, Oölogist, 1900, p. 74 (Vieques); Auk, 1903, p. 16 (Porto Rico, abundant).


Porto Rico, Vieques, Louis Peña, Culebrita, St. Croix, St. Thomas; a summer visitant that comes to breed, but spends the winter elsewhere.

In Porto Rico the Jamaican vireo is a common summer visitant that I recorded as follows: Quebradillas, July 2 to 6; Manatí, July 7 to 11; Toa Alta, August 2; Bayamó, July 20 to 25; Mameyes, February 14 to 29; Yabucoa, May 3 to 10; Maunabo, May 11; Patillas, May 12 to 13; Salinas, April 26 to May 2; Juana Díaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayaguez, June 6; Añasco, June 7 and 8; Aguadilla, June 9 to 12; Maricao, May 29 to June 5; Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerío, July 26 to 31; Aibonito, January 26 to February 5; Hacienda Catalina, below El Yunque, March 2 to 11.

The species is migrant, coming in February and leaving the island in September. I saw the first one near Mameyes, February 14, 1912, and immediately after that the species became common. Struthers reports the earliest arrival as February 12, 1921. The birds seem to arrive in a group and rapidly cover the entire island. Gundlach says that they come on February 14, while Stahl in 1887 noted one on February 5.
which is the earliest date of arrival known at present. In the U. S. National Museum is a specimen taken February 13, 1899, at Hucayres, by Mr. A. B. Baker. The following year Richmond collected one on the lower slopes of El Yunque, February 22.

The Jamaican vireo is found throughout Porto Rico wherever there are trees, and, though most common in the forested hills, is found in brushy thickets in pastures, or in shade trees about houses. The coffee plantations, with their extensive stretches of tall trees to protect the coffee from the sun, are especially favorable to them.

In the spring of 1912 males seemed to arrive first, as no female was actually taken until April 11, after which this sex was common. On March 9, near the Hacienda Catalina, there was a wave of migration on the part of the vireos, for in early morning the coffee plantations were full of their songs, whereas next day they were gone. In fall these birds had completed the molt by the first week in August and were restless, working rapidly through the tops of the trees. By August 16 their numbers had suddenly decreased, and after that they were evidently migrating, the last one being observed on August 31 at Cabo Rojo. Danforth records the last at Mayaguez, September 8, 1924. Gundlach reports them as leaving in August, while Stahl says that they are present until September. Migration among such birds as this vireo and the martin that nest in Porto Rico and then migrate elsewhere to winter is difficult to explain. Climate can hardly account for it, as the seasons in Porto Rico are fairly uniform. It may possibly be due to an instinct to withdraw, after breeding, to the ancestral home for winter. Two specimens have been recorded from Masinga Vieja, in the Santa Marta region of Colombia, August 19 and September 7, which indicates that they winter in northern South America. 52

The Jamaican vireo is slow and leisurely in habit, examining carefully twigs and leaves for food. It peers about in characteristic vireo fashion, sometimes pausing to sing for several minutes. It has little fear of man. The song, given constantly through the day in the breeding season, is a series of couplets closely resembling the song of the red-eyed vireo. It also utters the usual scolding note of vireos of this type.

The breeding season begins early in May and lasts through June. I found no nests, but at Lares, June 29, a boy brought me a nestling and described the nest as built in a banana plant. A juvenile female in the U. S. National Museum was taken at Mayaguez, May 30, 1901, by Mr. Bowdish.

Bowdish describes a nest found, May 1, 1900, near Aguadilla as a

well-made basket hung in the fork of a limb seven feet from the ground. It was made of fibers and cottony substance and was very handsome. Another nest found on June 9 contained two eggs similar to those of *Vireo olivaceus*. These eggs, now in the U. S. National Museum, are dull white in color. One is spotted sparingly with small spots of blackish brown, while the other is unmarked. They measure 21.8 x 15.9 mm. and 21.7 x 16.7 mm., respectively. A third nest, suspended over a road, was twelve feet from the ground. Danforth reports a nest containing three eggs at Cartagena Lagoon on July 2, 1924. Throughout July I found young birds common, either shifting for themselves or still following their parents with soft insistent calls, while the adults answered with low plaintive notes. Two seemed to be the usual number in a brood. During the breeding season each pair has a very circumscribed range, as may be determined from the singing of the male hour after hour throughout the day from the same group of trees. In August they sang seldom. Because of their leisurely movement, it is often difficult to see them amid thick leaves, particularly when these are disturbed by wind.

The iris of this species is rather a bright reddish brown in color. I found bones of this species in material from cave deposits near Morovis.

Bowdish recorded the Jamaican bird on Vieques Island, and from March 16 to April 3 I found it fairly common there and secured specimens. It seemed local in distribution. I observed it in several localities on the south coast, but on the north side of the island encountered it only along one small gully.

One specimen was taken on Louis Peña, April 11, where I found several vireos in dense mangroves, and they were observed on Culebrita, April 15. None were found on Culebra Island proper, though they undoubtedly occur there.

The Newtons report them as common on St. Croix, but very local in occurrence, ranging mainly in the south part of the island. A nest found on June 5, 1858, in a manchineel contained three eggs. They stated that the bird was undoubtedly resident, and there is little doubt that it is migrant throughout its breeding range. There are two males in the Museum of Comparative Zoölogy taken on St. Croix, June 19 and 21, 1914, by G. K. Noble.

Cassin reports several specimens forwarded from St. Thomas by Robert Swift. The bird has not yet been reported from the other islands considered in this report.

Bangs and Penard (Bull. Mus. Comp. Zoöl., Vol. 67, 1925, pp. 205-206) have shown that the specific name *olivaceus* must be transferred to
the present species, replacing the current appellation *calidris*, while the red-eyed vireo formerly called *olivaceus* will become *Vireo virescens*.

A large series that I secured in Porto Rico are all referable to the present form, and I see no distinction between these and skins from Jamaica. It is probable that *Vireo olivaceus barbatula*, which nests in Cuba, Florida and the Bahamas, may come occasionally to Porto Rico in migration, for it also is migrant and winters in Colombia, but it has not yet been taken. It is distinguished from typical *olivaceus* by whiter breast, greener back, grayer crown, lighter, more whitish superciliary, and paler sides of head.

The Jamaican vireo is a bird of slender form, greenish above, with duller, grayer head, whitish below with a yellowish green wash on sides and under tail coverts, a prominent light superciliary and a blackish malar stripe. It is about six inches in length.

The food of this vireo is made up of almost equal parts of animal and vegetable matter. Small Orthoptera, bugs, weevils, other beetles, quantities of caterpillars, spiders and little tree-toads were found in the animal food. Small fruits of the wild fig, espino (*Xanthoxylum*), guaraguou (*Guarea trichilioides*), adelia (*Adelia*) and aji (*Capsicum*) are indicative of its preferences among wild fruits and berries. Indigestible seeds or hard fragments of insects are regurgitated after digestion of the softer portions has taken place.

**[Vireo virescens** (Vieillot)]

Red-eyed Vireo

*Vireo virescens* Vieillot, Ois. Amer. Sept., 1807, Vol. I, p. 84, Pl. 83. (Pennsylvania.)


The red-eyed vireo was recorded by Gundlach on the basis of a drawing made by Bello from a specimen seen in the collection of Don Céle- donio Carbonell, of Cabo Rojo. This record is considered indefinite and the species is here included as hypothetical. It is distinguished from the Jamaican vireo by the lack of the dusky streak on the malar region.]
Family Coerebidae

Subfamily Coerebinae

Coereba portoricensis portoricensis (Bryant)

Porto Rican Honey-creeper, Reinita, Reina, Gusauero


Porto Rican Honey Creeper, Danforth, Ööllogist, 1922, p. 10 (Porto Rico);

Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico. The most abundant and widely distributed species of bird.

The honey-creeper is without question the most abundant bird of the island, as it is found wherever there is cover for it: in mangroves lining the lagoons and bays, along maya hedges through the cane-fields, in mangó trees in pastures, in coffee plantations, thickets and forests. Seemingly it is able to adapt itself to all conditions. It is the only common bird of the dense, humid rain forests that clothe the higher slopes of El Yunque, and it is equally common in arid districts on the dry southern coast where rains come seldom. The species is one of the few common birds of the coffee plantations and outnumbers all other birds to be found in such situations. It not infrequently penetrates the cane-fields from the shelter of the maya hedges. Honey-creepers are tame and trusting, coming about houses to search the eaves for spiders and even entering open doors and windows familiarly. In the little cafetins in the barrios it is a common practice to place syrup for them
in a little dish on the counter. A pair of honey-creepers with a family near by will visit this daily, bringing their young with them as soon as they are out of the nest in order to feed them. In country hotels it is not unusual to have a honey-creeper fly in at meal time to perch on the edge of the sugar bowl and help itself, unmindful of guests at the table. On one occasion, while I was shaking down some wild oranges, a bird, attracted by the motion of the limbs, alighted in the tree just above my head and refused to leave, though I was jarring the tree violently.

The song of the honey-creeper is heard incessantly through the day, an insect-like trill that may be likened to the syllables zee-e-e swees se tee, the first part given slowly, in a thin, high tone, and the last more rapidly. The call-note is a sharp, chipping note, heard usually when the birds are alarmed about their nests. Sometimes, while singing, the male remains for several minutes on one perch, but usually the song is given while he is hunting for food. In the dark forests on the upper slopes of El Yunque, the note of the honey-creeper was the only song heard, though in the obscure light that filtered through the thickly interlaced branches the birds were seldom seen. Nothing appears to daunt them. After a cloudburst near Adjuntas, when torrents of rain were accompanied by violent, shifting winds, honey-creepers began singing cheerfully the instant that the heaviest part of the downpour was over. The young birds sing as soon as they are fully feathered, and frequently are breeding before they have lost the juvenile plumage, at which time they cannot be more than six or seven months old.

The nesting season appears to extend without definite break throughout the year, though occupied nests are most abundant from February to June. Several broods are raised; how many can be told only by extended observations on one pair. The nests are round, globular affairs, placed in a semipendant fashion at the tips of limbs, from five to thirty feet from the ground. They are built of weeds, leaves and grasses, lined with finer material. The opening is always below, so that the birds go in from underneath. Dr. George N. Walcott, under date of May 30, 1920, sent me a nest found near Point Cangrejos that contained in its material a large number of egg clusters of a spider of the genus *Gasteracantha*.

Both sexes assist in building, bring straws and other material and fix them in place, at first forming merely a rounded mass, with a semblance of the opening in one side, which later is molded into its proper form. Although the male is allowed to assist, he brings material only when the female is absent, for when she catches him in the nest, she immediately drives him out. The nests, when empty, are used as sleeping quarters. These birds sleep late, not coming out in the morning until
half an hour after other birds have become active. The usual number of young is two or three. The nests are often built without attempt at concealment. They should be protected rigidly, as hundreds of eggs are destroyed wantonly by boys.

There are three sets of eggs of the honey-creeper in the U. S. National Museum, the first consisting of one egg taken at Luquillo, Porto Rico, March 3, 1900, by C. W. Richmond, the second of two eggs, secured at Fajardo, March 13, 1900, by the same collector, and the third of three eggs collected at Mayagüez, Porto Rico, by B. S. Bowdish on May 25, 1901. These have the ground color white. The set of two eggs is marked with fairly well-defined fine spots of army and natal brown, distributed over the entire egg, but most abundant, almost confluent, at the large end. The remaining eggs have the brown markings present more as a wash that is fainter, less defined into spots, and in two forms a wreath about the larger end. The single egg has little of the ground color visible through the brown. The eggs of these sets measure 18.5 x 12.4 mm.; 17.3 x 12.5 mm. and 17.2 x 12.3 mm.; 18.2 x 13.4 mm., 17.0 x 13.3 mm. and 17.2 x 13.6 mm.

In their quest for food, honey-creepers search all flowering plants, but of these the molinillo (*Leonotis*) is perhaps visited most frequently. The birds cling to the rounded flower heads and probe each one in turn. The muñeco (*Cordia collococca*) and bucare (*Erythrina*) when in blossom are also a great attraction. When the flower of the banana opens, it contains a great deal of nectar and is visited repeatedly. Honey-creepers, it is said, occasionally pierce ripe bananas; but, as the bunches are cut for human consumption while green, the birds do not deprive man of the fruits they injure. A honey-creeper that I shot near Cayey, January 17, 1912, had the throat filled with the pulp of red raspberries (*Rubus rosifolius*) and it was not unusual to find clear nectar in the esophagus. Near Río Piedras one visited a ripe guanábano (*Anona muricata*) that had been torn open by a spindalis, and ate for nearly five minutes, hanging head down from a twig above and pulling and nibbling at the inside of the fruit. Undamaged fruit in the same tree was not touched, even after the guanábano that was already open was removed. There is some complaint among fruit-growers that this species pricks ripe oranges and destroys them, but personally I observed nothing of the kind, the nearest approach to it being when fully ripe fruit had been opened by other agencies and the honey-creepers thereupon came to sip the juice. Birds taken in the citrus groves were invariably feeding on insects. A large part of the food of the honey-creeper is composed of small spiders and tiny insects, such as lantern flies, small beetles, cater-
pills, flies and Hymenoptera. The species seems in general beneficial to agriculture.

The reinita is so universally known to Porto Ricans that a description seems almost superfluous. It is a tiny bird, only four and one-half inches long, with curved bill, yellow breast and rump, gray throat, sooty black upper surface, with a white spot on the wing and a white line over the eye. The young are duller in color and have the superciliary stripe dull yellow.

The type specimen of this bird in the U. S. National Museum, taken by George Latimer, is marked “Porto Rico, N. side.”

**Coereba portoricensis sancti-thomae** (Sundevall)

*Virgin Island Honey-Creeper, Sugar-bird*


_Certhiola sancti-thomae_ Ridgway, Proc. U. S. Nat. Mus., 1885, p. 28. (Described as new from St. Thomas.)


_Coereba dominicensis_, Cory, Auk, 1890, p. 374 (Anegada).


Vieques, Culebra, Culebrita, Louis Peña, St. Thomas, St. John, Virgin Gorda, Tortola, Anegada; resident.

On careful comparison of a large series I find that the honey-creeper of the Virgin Islands (except St. Croix, which is inhabited by a distinct species, _Coereba newtoni_) is distinguished from the bird of Porto Rico by the brighter, clearer yellow of the under surface and the paler coloration of the flanks. The difference is constant in a large series from Vieques and Culebra and in a smaller number from St. Thomas and St. John. It is assumed to hold for individuals from Virgin Gorda, Tortola and Anegada, from which I have not seen specimens.

Mr. Ridgway noted this distinction in 1885, and curiously enough
described the bird from Saint Thomas as *C. sancti-thomae*, not recognizing that Sundevall earlier had bestowed upon it the same name. Lowe has also observed differences in color between Porto Rican and Virgin Island birds, but did not recognize them by name. The Virgin Island form is easily evident and merits separation.

On Vieques Island the honey-creeper is common, but is relatively less abundant than on Porto Rico. It is found in forests, through scattered groves of trees, or in maya hedges bordering cane-fields, but is rarely associated in numbers. It is common about the flowers of the muñeco (*Cordia colococca*), from whose blossoms it obtains nectar, small spiders and insects. In 1912 it came familiarly about houses, and in the little hotel where I stopped in Isabel II one entered daily to search the blossoms of cut flowers placed in vases in the parlor. A large mirror was a never-ending attraction and the bird frequently perched before it, puzzled by its own reflection and that of the room beyond, which it always attempted to enter. As it fluttered before the glass, the bird on the opposite side rose always to meet it, and after several attempts to evade the reflection, first on one side and then on the other, it would drop down, baffled, to its perch before the glass and scold its image sharply with quickly flitting wings. From March 16 to April 3 several young in juvenile plumage were taken, while adults were preparing for another brood.

On Culebra Island the honey-creeper was also common wherever there was cover for it. In April it was busily engaged in nest-building, apparently beginning a new breeding season. It was seen on Louis Peña and Culebrita islands, and on the latter there was a nest constructed of cotton which was highly conspicuous because of the white material.

In the U. S. National Museum there are specimens taken on St. Thomas by Robert Swift and by Benedict and Yce. One of the latter is the type of Ridgway's *Certhiola sanctae-thomae*. Nicoll shot specimens here between February 21 and 24, 1904.

Two taken on St. John by F. A. Ober are also in the U. S. National Museum, and Cory had specimens from Tortola, Virgin Gorda and Anegada collected by Winch.

**Coereba newtoni** (Baird)

*St. Croix Honey-Creeper, Sugarbird*

Nicoll, *Ibis*, 1904, p. 575. (St. Croix.)


St. Croix; said to be fairly common.

The Newtons state that the honey-creeper of St. Croix breeds from March to August. Nicoll found it fairly common in February, 1904, but reports that it frequented thick brush, where it was difficult to locate. Mortensen says that it is known as the sugar-bird from its habit of entering refinery buildings to eat sugar.

There are thirteen specimens in the collection of the Museum of Comparative Zoology, taken June 19 and September 14 and 15, 1914, by G. K. Noble.

This form is notable for being confined to the single island of St. Croix. It is very similar to the Porto Rican bird, but is distinguished by darker throat and somewhat lighter yellow of breast.

Family Mniotiltidae

Mniotilta varia (Linnaeus)

Black and White Warbler, Reinita, Gusanoero, Trepadora


Black and White Warbler, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Öologist, 1922, pp. 11, 177-178 (western Porto Rico); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


The black and white warbler is listed from Mona by Cory, presumably on the basis of record made by W. W. Brown, Jr., though Cory makes no statement regarding it.
On Porto Rico this species is a regular winter visitant that at times, usually during migration, appears quite common. The species is easily distinguished from other warblers by its plain black and white plumage, in which the color is arranged in longitudinal streaks, and by its habit of creeping quickly up the trunks or around and under the limbs of trees. It is found universally wherever there is tree or forest growth.

In 1912 I observed it at Rio Piedras, December 16, 1911, to January 4, 1912 (specimen, December 21); Manueyes, February 23; Fajardo, December 30, 1911 (specimen); Salinas, April 30; Caguas, one between January 5 and 14, 1912; Cayey, January 23; and Aibonito, January 26, 27 (specimen), 30 (specimen), and February 1. Bowdish found it at Mayaguez, October 10, 1901, and Danforth notes it October 12, 1924. Both Stahl and Struthers have recorded it as arriving from the north in August. Richmond reported it from Arecibo, April 1, and from Utuado, April 7 and 11, 1900. F. A. Potts, writing from Central Aguirre, noted the last on April 6, 1921, while Struthers in western Porto Rico observed it until April 18 of the same year. Danforth reported the last in 1922 as April 29 (which coincides closely with my date of April 30, 1912, at Salinas) and the last in 1924 as April 21.

I identified a bone of this species from cavern deposits near Morovis.

On Vieques Island Bowdish secured one on January 30, 1900. In 1912 I saw one near Porto Ferro on March 27, and again on March 29. On Culebra Island I shot one from a flock of warblers in migration on April 9, and recorded another on April 12. The Newtons report the species in winter on St. Croix; Cory had specimens from that island, and Nicoll records two taken there between February 19 and 21, 1904, when he reports the species as common. There are skins in the U. S. National Museum from St. Thomas secured by Robert Swift and F. A. Ober, and Nicoll collected the bird there between February 21 and 24, 1904.

**Compsothlypis americana pusilla** (Wilson)

Northern Parula Warbler, Reinita, Peche de Oro

*Sylvia pusilla* Wilson, Amer. Ornith., 1811, Vol. IV, p. 71. Pl. 28. Fig. 3. (Eastern Pennsylvania.)

Northern Parula Warbler, Danforth, Oologist, 1922, pp. 11, 178 (western Porto Rico); Bird-Lore, 1922, p. 41 (Mayaguez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico, Vieques, Culebra, Louis Peña, St. Croix, St. Thomas, Tortola, Virgin Gorda; winter visitant, common.

The parula warbler is the most common of the migrant warblers that come to Porto Rico and the Virgin Islands for the period of the northern winter. Stahl reported that this form arrives in Porto Rico in August, which coincides with the earliest authentic date available, that of August 10, 1921, recorded by Struthers. Richmond, in 1900, noted it at Utuado, April 11, and Ponce, April 16. I shot a specimen on the Río de la Lapa near Salinas, April 30, 1912. F. A. Potts writes me that he saw the bird last May 2, and Struthers observed it until May 7, 1921. Danforth reports the last at Mayagüez on April 15, 1922, and the last at Cartagena Lagoon on May 2, 1924. The bird is universally distributed wherever there are trees, from the mangrove swamps of the coast to the forests at the highest altitudes. The shade of mangó trees growing in the open is attractive to them. In my own field work I found it at Río Piedras from December 16, 1911, to January 4, 1912 (specimens); Mameyes, February 9 to 29 (specimens); Salinas, April 30 (specimens); Aibonito, January 26 to February 5 (specimens); Cayey, January 15 to 25 (specimens); Caguas, January 11 (specimen); and El Yunque de Luquillo, March 2 to 11 (specimens). On March 8 one was observed at 3000 feet elevation on El Yunque.

In the forests parula warblers are the most vociferous members of the groups of birds that gather to scold an intruder, and are always active, working quickly through the limbs in their incessant search for food.
Migratory movement was evident among them as early as February 14. After this date they were very restless, especially during the early morning, and there was a tendency among them while feeding to travel from east to west. In March and April I observed distinct waves of migration among them. By the last of March all were in fresh plumage, the feathers showing a beautiful sheen. After the beginning of April males began their songs and from then on sang continually, sometimes in the merest whisper, but usually as loudly as in the North.

On Vieques Island parula warblers are common winter visitants. Bowdish reported them in 1900, and Richmond recorded them there on March 24, 1900. During my stay there, from March 16 to April 3, 1912, spring migration was in force, so that parula warblers, passing through the island from east to west towards Porto Rico, outnumbered all others of their family. The blossoms of the muñeco tree (*Cordia collococca*), with their hosts of tiny, buzzing insects, were especially attractive to them at this season. The birds remained common here until my departure.

On Culebra they were also abundant from April 5 to 19, exceeding in numbers other migrant warblers and appearing in little waves of migration, so that their numbers fluctuated from day to day. They began to sing on April 11. Two were taken on April 9, and the birds were last observed on April 19, two days previous to my departure. I found them on Louis Peña Island on April 11.

The Newtons found the parula warbler in winter on St. Croix, and noted that most of these birds departed in March, though one was seen on May 6, 1858. Cory recorded it from St. Croix in 1891, and Nicoll shot an adult male there between February 19 and 21, 1904, when he found the species common. It was forwarded from St. Thomas to Cassin by Robert Swift, and there are skins from the same source in the U. S. National Museum. Cory received it from Winch, and Nicoll collected it on St. Thomas between February 21 and 24, 1904.

Winch secured specimens, reported by Cory, on Tortola and Virgin Gorda. It has not yet been secured on St. John, but must occur there.

The parula warbler is less than five inches in length, with the upper parts grayish blue and a greenish yellow patch on the back. The throat and breast are yellow with a blackish band, sometimes mingled with rufous, the abdomen is white and there are two white wing bars.

**Dendroica tigrina** (Gmelin)

Cape May Warbler, Reinita, Bijirita de Costa

( Porto Rico, specimens).—Stahl, Faun. Puerto Rico, 1883, pp. 59, 139
( Porto Rico, specimen).


Porto Rico, Vieques, St. Croix, St. Thomas; uncommon winter visitant.

The Cape May warbler may at times be common in Porto Rico, as Sundevall notes that he received a number from Hjalmarson, and Gundlach reports it as seen often in winter. Bowdish noted one in Mayagüez, October 30, 1900, and Danforth has said that it is a rare winter visitant in western Porto Rico. He observed one at Cartagenia Lagoon on April 8, 1922, and others at Mayagüez, February 19 and March 17, 1922. Struthers recorded it on January 14, 20 and 22 and November 24, 1921, near Mayagüez, and on February 26, 1922, south of Boquerón. There are two specimens in the Carnegie Museum taken at Guayama, March 7 and 9, 1912, by W. W. Worthington. Potts saw one at Santa Rita, near Guánica, January 29, 1924.

On April 4, 1912, I saw a fine male of this species in a flame-tree in the town of Isabel II, Vieques. It was leisurely in its movements, so that I was able to watch it at short range for several minutes.

The Newtons found it an uncommon winter visitant in St. Croix, and Cory has recorded a specimen sent to him from that island. There is a skin in the U. S. National Museum collected on St. Thomas by Robert Swift.

The male is easily told from other warblers by the chestnut-brown patch on the cheeks. Females and young are identified with some difficulty by one not an expert.

Dendroica petechia cruciana Sundevall

Porto Rican Golden Warbler, Yellow Neck, Wild Canary, Canario, Canario del Manglar, Reinita


Dendroica ruficapilla, Cory, Auk, 1890, pp. 374, 375 (Anegada, Virgin Gorda, specimens); Auk, 1891, p. 48 (St. Croix).

Dendroica petechia ruficapilla, Cory, Auk, 1896, p. 31 (Porto Rico, St. Thomas); Cat. West Indian Birds, 1892, p. 118 (Porto Rico, St. Thomas, Virgin Gorda, Anegada, St. Croix).

Dendroica bartholemica, Nicoll, Ibis, 1904, pp. 575, 576 (St. Thomas, specimens).


Porto Rico, Vieques, Culebra, Culebrita, Louis Peña, St. Croix, St. Thomas, Virgin Gorda, Anegada; resident.

During my field work the golden warbler was noted as follows: Quebradillas, July 2 to 6, 1912; Manatí, July 7 to 11 (specimens); Bayamón, July 20 to 25 (specimen); Martin Peña, January 2 (specimen); Maneyes, February 9 to 29 (specimens); Humacao, September 3 to 9; Yabucoa, May 3 to 10 (specimen); Maunabo, May 11; Patillas, May 13; Salinas, April 26 to May 2 (specimens); Juana Diaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31 (specimens); Aguadilla, June 9 to 12 (specimens). There are in the U. S. National Museum specimens shot at Luquillo, March 4, 1900; Arecibo, April 1 to 3, 1900, and Pueblo Viejo, February 17, 1900, by C. W. Richmond; at Ponce, January 31, 1889, and Huares, February 15, 1899, by A. B. Baker; and at Arroyo, February 3 and 4, by A. B. Baker and J. D. Milligan. In Porto Rico the resident golden warbler is confined entirely to the coastal plain, ranging inland along
the courses of the rivers to the base of the foothills, but never going farther. The highest point at which they were noted was at Quebradillas, where the birds were distributed over high flats, three or four hundred feet above the sea. In December and January, in the region about San Juan, I found these birds were confined mainly to mangroves and narrow bands of bush back of the beaches. Later, after the first of February, I saw them farther inland, where about Río Piedras they were common in shade trees near houses. It would seem that they spread out for the breeding season—a supposition that must be checked by further observations before it is accepted as certain. At Bayamón they were found in scanty growths of grass and weeds growing on gravel bars in the Bayamón River. At the Laguna de Guánica, where there were no bushes or mangroves, they frequented reeds and clumps of marsh grass. The dense growths of sea grape, or uvas de playa (Coccolobis), on sandy beaches form good cover for them. In all the coast towns one or two pairs nested in the plazas, where there were suitable trees.

These warblers are quick and active and, in spite of their bright coloration, are hard to see in the trees, where the movement of the leaves in the steady trade winds helps to hide them. They are seen at their best in mangrove growths bordering bays or lagoons. Here they show little fear, feeding about close at hand. The song of this warbler is loud and cheery, as in the yellow warbler of the United States (Dendroica aestiva). The call-note is a sharp chip. From February to June, which corresponds to the breeding season, males sing the whole day long, and an intruder in their haunts is greeted with loud expostulations. I saw no nests, but birds taken at Salinas on April 29, Yabucoa on May 6, and Yauco on May 18, 1912, were breeding. July 8, at Manatí, a young bird just from the nest was taken, and after this date young were common. The adults may remain paired throughout the year, for at Cabo Rojo, late in August, at a season when they were in full molt, male and female were invariably seen together. Danforth found that three eggs constituted the normal set and noted a few nests built in cat-tails at Cartagena Lagoon. The eggs are greenish white, spotted with rufous.

On Vieques Island the golden warbler is a common resident and is found in brushy pastures wherever trees or bushes afford shelter. Scattered trees growing in upland pastures, with the lower branches trimmed by browsing cattle to a uniform height above the ground, were favorite haunts, and in addition I found many of these warblers in the shade trees bordering the streets in the town of Isabel II. I secured a number of specimens between March 16 and April 3, 1912, and noted that the breeding season had not yet begun. Bowdish did not report this species
from Vieques, but Richmond collected a series there from March 25 to 28, 1900.

On Culebra Island I found golden warblers abundant from April 5 to 21, 1912, and collected a number. They ranged in mangroves bordering the lagoons, in trees in the dry pastures, or in heavy growths of sea grape on the beaches. They were paired and were about to begin nesting at this season.

On St. Croix the species is said to be common. The Newtons report that it builds in a low shrub, usually not more than six feet from the ground. They describe the nest as cup-shaped, softly lined with cotton or wool, and the eggs as three in number. Cory received specimens from St. Croix and Nicoll collected one there between February 19 and 21, 1904. Mortensen states that the species is known there as the wild canary. There are three skins in the Museum of Comparative Zoology taken on St. Croix, September 14 and 16, 1914, by G. K. Noble.

On St. Thomas in 1852 Knox describes the golden warbler as destructive to grapes. Robert Swift forwarded specimens to Cassin from that island, and in the U. S. National Museum are skins from the same collector. A specimen was taken at St. Thomas by Benedict and Nye between January 17 and 24, 1884, and Nicoll secured the form between February 21 and 24, 1904. Cyrus S. Winch sent specimens to Cory from Virgin Gorda and Anegada; a skin in the U. S. National Museum was secured by this collector on the island last named December 26, 1889.

Peters\(^{24}\) has indicated that the golden warblers of Porto Rico and the Virgin Islands should be known as *Dendroica petechia cruciana*. They are closely similar to *D. p. bartholemica*, which, in my opinion, ranges in the Lesser Antilles from the Anegada Channel south to Antigua, but are distinguished by slightly brighter, yellower hue of the dorsal surface, particularly in the males. Specimens from St. Thomas and St. John are intermediate, but it seems best to allocate them with *cruciana*, which makes the Anegada Channel a dividing line between the two forms.

The yellow, or golden, warbler of Porto Rico is bright greenish yellow above, becoming bright yellowish orange or even deep orange on the forehead and bright yellow below, streaked more or less distinctly with bright chestnut brown. Females are duller and lack the streaks below or have them only faintly indicated. Young in nestling plumage are grayish above and grayish white below.

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Dendroica magnolia (Wilson)

Magnolia Warbler, Reinita, Bijirita Manchada

Sylvia magnolia Wilson, Amer. Orn., 1811, Vol. III, p. 63, Pl. 23, Fig. 2. (Little Miami, near its junction with the Ohio; in magnolias near Fort Adams, on the Mississippi; near Philadelphia, Pa.)


Porto Rico; rare in winter.

Bello includes the magnolia warbler in his list of Porto Rican birds without comment and it is doubtful whether he secured specimens. Gundlach knew it only from its inclusion in an album of paintings by Bello. Bowdish saw one in the city of San Juan on September 26, 1899, and shot one in Mayagüez, December 26, 1900. Danforth has recorded it as rare in western Porto Rico; he reports it at Cartagena Lagoon, November 30, 1923, and at Mayagüez from March 25 to April 3, 1922, and on December 3, 1923. The species is apparently irregular in occurrence.

The species is distinguished from other warblers by the broad band of white across the middle of the tail, followed by a broad tip of black. The adult male has the crown gray, cheeks and back black, rump and under surface yellow, with breast and sides streaked with black. Immature birds are duller, with olive-green back, but are distinguished by the peculiar tail-marking.

Dendroica caerulescens caerulescens (Gmelin)

Black-throated Green Warbler, Reinita, Bijirita Aplomada


Porto Rico, rather rare in winter; Vieques, casual.

The black-throated blue warbler was reported by Gundlach from a painting made by Bello and a specimen in the collection of Blanco. Stahl recorded a male in his collection. I secured a specimen at Rio Piedras, December 23, 1911, noted adult males in the hills above Cayey, January 18 and 24, 1912, and found the bird common about Aibonito from January 26 to February 5 (adult female taken January 29, adult males January 30 and February 2.) At the Hacienda Catalina above Mameyes I observed three warblers on March 2 and 4, and on March 8 found them fairly common in the higher forests of El Yunque, where two females were taken, one at an altitude of 3100 feet. In the U. S. National Museum are two specimens taken by C. W. Richmond on El Yunque, February 26 and March 2, 1900.

Mr. F. A. Potts writes me that he saw a few black-throated blue warblers on March 27, 1921, in a coffee plantation near the Toro Negro dam, seven miles northwest of Villalba. Struthers secured specimens above Maricao on December 27 and 30, 1921, and Danforth in 1922 reported the birds as locally common near Mayagüez up to April 15. Three males in the collections of the Carnegie Museum were secured near Adjuntas by W. W. Worthington on April 4, 9 and 11, 1912.

This warbler appears to seek the forests of the interior hills and mountains during its winter residence in Porto Rico, and there ranges to the highest altitudes. Comparatively few of these birds are seen below an elevation of 500 feet above the sea, which may account for the small number of records for the species. The birds are active, like all other warblers, but frequent the shelter of trees, where they may be overlooked.

On Vieques Island, March 27, 1912, I observed several in migrating flocks of other warblers, but did not collect specimens.

The black-throated blue warbler is distinguished in all plumages by the prominent white spot across the center of the outer primaries in a wing otherwise plain in color. Males are grayish blue above, black on sides of head, throat and sides, and white on breast and abdomen. Females are greenish olive above and yellowish olive below.
Dendroica coronata coronata (Linnæus)

Myrtle Warbler, Reinita, Bijirita Coronada


Myrtle Warbler, Danforth, Oölogist, 1922, p. 178 (western Porto Rico, winter); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico and Vieques, fairly common in winter; Culebra, one record.

Bryant must have found this species in Porto Rico in some number, for in 1866 he wrote that the “southern migration of this bird is more abundant than I had supposed.” There is in the U. S. National Museum a skin taken on Porto Rico by Robert Swift, and Hjalmarson sent specimens to Sundevall in the sixties. Gundlach found it common, and states that the bird is the last of the migrants to arrive in fall, while it leaves for the north in March. During my work in 1912 I noted the first arrival in Caguas on January 5, and recorded the birds daily in the flame-trees of the plaza until January 14. At Caye Y I found them in trees bordering the roads from January 15 to 25 (specimen taken January 19), and at Aibonito saw one, February 2, in a tree standing in a pasture. Near Mameyes a few were noted in the swamps at Punta Picua, or in small trees in the town, from February 9 to 29 (specimen, February 12). On March 8, as I reached the bare rock marking the summit of the great mountain El Yunque, a myrtle warbler—a companion adventurer from North America—circled about me several times and finally disappeared in the forest below.
Danforth reported the myrtle warbler as fairly common in western Porto Rico, becoming more abundant toward spring, and saw the last on April 8, 1922, and April 1, 1924. He recorded the earliest arrival on December 14, 1923, and noted twelve at Cartagena Lagoon, December 22 of that year. Struthers found the bird very common in winter among low bushes near the lagoons of Guánica Valley. I have identified remains of this species from cavern deposits at Morovis. In the Carnegie Museum are specimens collected in 1912 by W. Worthington, as follows: two at Loiza, February 9 and 15; five at Guayama, March 1 to 9, and two from Santa Isabel, March 19 and 21.

On Vieques Island Bowdish collected specimens January 12 and 30, 1900. I saw one in the town of Isabel II on April 1.

There is in the U. S. National Museum a specimen taken by A. B. Baker on Culebra Island on February 9, 1899.

The myrtle warbler has a somewhat nondescript, streaked plumage, but may be identified always by the yellow spots on crown, rump, and either side of the breast—four in all. Its call is a low chip that is characteristic when once learned.

**Dendroica virens virens** (Gmelin)

Black-throated Green Warbler


Porto Rico, casual in winter.

The only record for the black-throated green warbler is that of a specimen in the Carnegie Museum secured at Adjuntas, Porto Rico, on April 5, 1912.

This warbler is somewhat smaller than the average for its genus, and is distinguished by the extensively yellow cheeks and large amount of white in the tail. It is bright olive-green above and white on the abdomen, with sides streaked with black. Adult males have the throat and breast extensively black, while in females and immature birds this area is more or less obscured by yellowish.

**Dendroica dominica dominica** (Linnaeus)

Yellow-throated Warbler, Reinita, Bijírita Dominica


Yellow-throated Warbler, Danforth, Oologist, 1922, pp. 11, 178 (western Porto Rico).

Sylvia pensilis; Ledru, idem., p. 205 (Porto Rico).

Sylvicola pensilis, Hartlaub, Isis, 1847, p. 611 (Porto Rico).


Porto Rico; winter visitant.

Sundevall received a specimen of the yellow-throated warbler from Hjalmarson. Gundlach reported it in Hjalmarson’s collection and said that the bird occurred in Porto Rico in winter from September to March. He indicates that he collected specimens. Danforth has reported it in November, and on December 31, 1921, in western Porto Rico; Struthers notes one seen January 29, 1922, in shade trees at Aguirre Central, and Potts reports that the bird last mentioned was present for six weeks during January and February.

Ledru has recorded the species from St. Thomas, but his record is dubious.

The yellow-throated warbler, similar in size to the myrtle warbler, is gray above, with forehead blackish, a yellow line in front of the eye, and a white superciliary streak. The cheeks and sides of the throat are black, the throat and breast yellow, belly white, and sides streaked with black.

Dendroica adelaidae Baird

Adelaide’s Warbler, Reinita, Bijirita Adelaide, Bijirita Mariposera

Dendroica adelaidae Baird, Rev. Amer. Birds, April, 1865, p. 212. (Porto Rico.)

Adelaide’s Warbler, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez).


SCIENTIFIC SURVEY OF PORTO RICO


Porto Rico and Vieques: resident, locally common. Adelaide's warbler was noted as follows during personal field work late in 1911 and 1912: Quebradillas, July 2 to 6 (specimens); Manatí, July 5 to 11; Río Piedras, December 16 to January 4 (specimens); Mameyes, February 9 to 29 (specimens); Marrabo, May 11; Patillas, May 13; Salinas, April 26 to May 2 (specimens); Juana Díaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31; Aguadilla, June 9 to 12; Cayey, January 22. Specimens in the U. S. National Museum taken by Bowdish come from Aguadilla, which is the only point where he saw these warblers. Gundlach recorded them at Mayagüez, Lares, Guánica, Arcibo and Vega Baja, in addition to points that have been mentioned. Hartert found them at Ponce, and in the Carnegie Museum is a skin taken at Loiza, February 7, 1912. Danforth found them in the limestone hills from Ponce to Boquerón and near Quebradillas. I have identified a bone of this species from cavern deposits near Morovis. Adelaide’s warblers are found mainly in low hills bordering the coastal plain, but do not penetrate far into the interior. I observed them near Cayey at an altitude of 1200 feet, but did not record them elsewhere above an altitude of 500 feet.

On the north side of Porto Rico I found them in second-growth forest that was tangled with vines and creepers, and as this association occurred mainly on steep-faced limestone hills in such regions, the warbler was encountered most commonly in such locations. Near Mameyes the birds were observed in dense growths bordering the coastal swamps as well as amid the hills farther inland. The dry open scrubs of the south coast were favored haunts; along the Río de la Lapa at Salinas I found them abundant.

They are quick and active in habit, feeding rapidly through the tips of twigs, tumbling after escaping moths, or darting out to seize insects that they have aroused. The dense cover that they affect conceals them well, so that they are often betrayed only by their active movements or their calls. Males sing at short intervals during forenoon and evening,
or occasionally during the middle of the day. The song is a sudden, loud trill consisting of one note rapidly repeated, and is quite similar in sound and character to the song of Grace’s warbler (Dendroica graciae). I heard also a low *tsee tsee*, somewhat like the notes of a gnatcatcher, and likewise a louder, scolding call.

The breeding season came in May and June. Struthers has recorded nesting birds in May, 1924. A nest that I found near Yauco on May 22, 1912, was in a forked limb of a bush growing in a thicket, at an elevation of four feet from the ground. Externally this nest was composed of gray moss, while the lining was fine grass. It was empty. Bowdish stated, on June 15, 1900, a juvenile recently from the nest. Immature birds in first fall plumage were seen on July 3, 1912, near Quebradillas, and from that date on were noted frequently. Adults were in molt in August.

From Vieques Island Adelaide’s warbler was not known until my visit in 1912. I found the birds locally common in the brush-grown valleys of the northern side of the island and in the dry scrubs of the south coast. They were breeding here in the latter part of March. Specimens taken on March 20, 21 and 25 do not differ in any way from skins from Porto Rico.

The species was named by Baird in honor of Miss Adelaide Swift, daughter of Robert Swift, who collected the type specimen in Porto Rico. The bird is gray above, with yellow on eyelids and superciliary stripe, and bright yellow below. There are two white wing bars.

This warbler feeds on small insects, mainly on leaf-hoppers and related forms, although weevils, caterpillars, moths and other insects are taken. It is a beneficial species.

Dendroica striata (J. R. Forster)

Black-poll Warbler, Reinita, Bijirita Estriada, Bijirita Rayada


(For Severn, West Coast of Hudson Bay.)


Porto Rico; rare in migration.
Gundlach states in one reference that he secured a black-poll warbler in September, but in another place says that he observed the species in Aguadilla in September and saw one that had been killed in Bayamón. The latter is probably the bird listed by Stahl as in his collection. Stahl states that the black-poll arrives in migration the middle of August, but this is doubtful, as the time indicated is too early to enable this bird to arrive from its northern home.

Struthers reports seeing the species near Maricaco on November 11 and 12, 1921.

Fall individuals of this species are obscurely marked, being olive-green above, streaked with black, and yellowish white below, streaked with black or dusky. There are two white wing-bars. Adult males have the crown black, the lower surface white, and the black streaks more sharply defined.

**Dendroica discolor** (Vieillot)

Prairie Warbler, Reinita, Rijirita Galana

_Sylvia discolor_ Vieillot, Ois. Amer. Sept., 1807, Vol. II, (1809?) p. 37, Pl. 98. (Eastern United States or Greater Antilles.)

Prairie Warbler, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Oologist. 1922, pp. 11, 178 (Porto Rico).


Mona, Porto Rico, Vieques, Culebra, St. Thomas, St. Croix, Tortola, Virgin Gorda; winter visitant.

The prairie warbler is listed by Cory for Mona Island, it is presumed on the basis of data secured by W. W. Brown, Jr., who collected for him on that island.
The species is common on Porto Rico, where it occurs in thickets, low bushes or hedges throughout the island, but it is not found where forest growth is heavy. Mr. F. A. Potts reports its arrival from the north on September 5, 1921, at Central Aguirre, and noted the last in spring on April 20. Danforth recorded the first on September 20, 1924, and the last at Cartagena Lagoon on April 22, 1922. There is in the U. S. National Museum a skin taken at Caguas, January 8, 1899, by A. B. Baker. On December 29, 1911, I collected a specimen at Fajardo, and on January 2, 1912, I found the birds fairly common in bushes back of the beach at Punta Maria, opposite Martin Peña, and secured two. One was taken at Cayey, January 17, and one at an elevation of 2000 feet, near Aibonito, on January 30. Danforth reports three near Maya-güez, December 18, 1921. The species seems more common during the period of migration, but remains in fair numbers through the winter.

Bowlidh found the prairie warblers common on Vieques Island, and secured specimens on January 27, 1900. Richmond in his notes recorded one on March 24, 1900. I found the species common from March 16 to April 3, 1912, and secured specimens on March 19 and 25. Migrant swarms of these and other warblers passed from March 19 to 27, during which there was marked diurnal movement among them toward the west.

On Culebra Island a prairie warbler was collected on February 9, 1899, by A. B. Baker, while I secured two on April 9 and 10, 1912. The birds were noted on April 6, 7, 9 and 10, and on April 9, during a wave of migrant warblers, several were noted. One that I shot on April 6 was so fat that grease soaked the entire plumage almost instantly.

The Newtons found the prairie warbler rather common on St. Croix in winter, noting its arrival on September 10, 1858, and the last on March 27 (year not given). Cory reports it from St. Croix in his collection, and Nicoll in 1904 found it abundant there from February 19 to 21. There is in the Museum of Comparative Zoology one taken on St. Croix by G. K. Noble, September 14, 1914. The Smithsonian Institution received a specimen from St. Thomas through the taxidermist and dealer John Akhurst in 1863, and Nicoll reports the species as taken there between February 21 and 24, 1904 Winch secured specimens for Cory on Tortola and Virgin Gorda.

During winter the birds are active in their search for food on the ground or among bushes, but keep in such cover that often it is difficult to see them clearly. They may be distinguished by their small size (smaller than that of the golden warbler), bright yellow underparts and the white displayed prominently in the tail. Adult males have distinct
black marks through and below the eye, black streaks on the sides and
a partly concealed patch of bright brown in the back—markings that
are obscured or lacking in females and young. All are bright yellowish
green above.

**Dendroica palmarum palmarum** (Gmelin)

*Palm Warbler, Reinita, Bijirita de Palmas, Bijirita Palmera*

Domingo.)

*Sylvia palmarum*, Ledru, Voy. Hes Ténériffe, Trinité, Saint Thomas, Sainte-

*Dendroica palmarum*, Bello, Zool. Gart., 1871, p. 339 (listed).—Gundlach,
Journ. für Ornith., 1874, p. 311; Journ. für Ornith., 1878, pp. 159, 167;
Fann. Puerto Rico, 1883, pp. 59, 139 (Porto Rico, specimens); Ornis,
1887, p. 451 (migrant).—Cory, Cat. West Indian Birds, 1892, p. 118
(Porto Rico).—Bowdish, Auk, 1903, pp. 18-19 (Porto Rico, winter).—

Porto Rico, rare winter visitant.

Gundlach and Stahl report specimens of the palm warbler, and Bow-
dish secured three in a mangrove swamp near San Juan on February
12, March 10, and April 8, 1900, respectively. A. B. Baker collected one
at Caguas, January 8, 1899, and Richmond and Stejneger saw several
and collected one near the beach at Arecibo on April 4, 1900. I shot a
female in a mangrove swamp near Mameyes on February 16, 1912, and
there is in the Carnegie Museum a further specimen taken at Santa

The palm warbler usually feeds on the ground, where it walks about
with steadily tilting tail, but is found at times among bushes or at the
margins of thickets. It is gray washed faintly with yellow below, yellow
on the under tail coverts, brownish gray above, with more or less chestnut
on the crown, yellowish green on the rump, and prominent white spots
in the tail.

**Seiurus noveboracensis noveboracensis** (Gmelin)

*Water-thrush, Pizpita de Mangle, Pizpita Chica*

(Louisiana and New York.)


*Motacilla noveboracensis*, Ledru, Voy. Hes Ténériffe, Trinité, Saint Thomas,

*Seiurus noveboracensis*, Newton, Ibis, 1859, pp. 142-143 (St. Croix).—Gundlach,
Journ. für Ornith., 1874, p. 311; Journ. für Ornith., 1878, pp. 159, 167;


Mona, Porto Rico, St. Croix, Culebra, Louis Peña; winter visitant from North America, fairly common.

Cory in 1892 lists this water-thrush from Mona Island presumably on the basis of specimens taken by W. W. Brown, Jr. (The bird reported by Bowdish from Mona is *Sciusus motacilla.*) This is probably a record from a migrant, since Mona appears too dry to provide a suitable winter home for this bird.

On Porto Rico the water-thrush is of regular occurrence in the coastal region, where it is fairly common in suitable localities. At Mameyes from February 9 to 29, 1912, I found it fairly abundant along the coast. One was seen at Cabo Rojo, August 30. Bowdish reports one taken at Mayagüez, November 30, 1900, and Richmond shot a bird at Arecibo, April 1, 1900, that I find represents this subspecies. Mr. F. A. Potts writes me that he saw the last water-thrush for the spring at Central Aguirre on April 17, 1921, while Struthers records the last in spring in western Porto Rico on April 23, 1921, and the first in fall on September 23, 1921. Danforth has recorded the water-thrush as common at Cartagena Lagoon, arriving September 3, 1924, and leaving April 30, 1924.

On Culebra Island, from April 5 to 21, 1912, water-thrushes were evidently in migration, as the number seen varied from day to day. During this period they were common. Both subspecies were represented, but females of the typical form were taken on April 6 and 12. I saw water-thrushes on Louis Peña, April 11.

The Newtons note the water-thrush as fairly common on St. Croix and Cory reports a specimen taken on that island.

It is probable that some of the records cited above may refer to Grinnell's water-thrush, which in life cannot be distinguished from the typical form.

In my field work in Porto Rico I found water-thrushes only in the mangrove swamps of the coastal region. Here they walk about over
the mud or along the arching mangrove roots, often where the light is so
dull that the birds would be almost indistinguishable were it not for the
constantly wagging tail whose motion betrays them. Their sharp call-
notes indicate their presence in many cases, although the birds be hidden
in the dense growth of roots and stems.

The water-thrush is dull olive above and light yellow below streaked
with dusky. There is a prominent buffy streak over the eye.

**Seiurus noveboracensis notabilis** Ridgway

Grinnell’s Water-thrush, Pizpita de Mangle, Pizpita Chica


Porto Rico, Culebra Island; winter visitant and migrant.

On February 14, 1912, I shot an adult male of this form in the man-
grove swamps at Punta Picua on the coast opposite Mameyes, and on
April 12 secured another near Playa Sardine on Culebra Island. As the
subspecies differs from the water-thrush *S. n. noveboracensis* only in
slightly larger size and in faintly grayer dorsal coloration, it may be
distinguished only with specimens in hand. Its abundance and occur-
rence are uncertain.

In habits it does not differ from the typical form.

**Seiurus motacilla** (Vieillot)

Louisiana Water-thrush, Pizpita Chica

*Turdis motacilla* Vieillot, Ois. Amer. Sept., 1807 (1808?), Vol. II, p. 9, pl. 65. (Kentucky.)

Louisiana Water-thrush, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Oologist, 1922, p. 178 (western Porto Rico); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).

*Seiurus motacilla*, Bowditch, Oologist, 1900, p. 74 (Vieques, specimens).—


*Seiurus noveboracensis* Bowditch (part), Auk, 1903, p. 19 (Mona, specimen).

Porto Rico and Vieques Island, fairly common winter visitant; Mona
Island, accidental.

The specimen of water-thrush secured by Bowdish on Mona Island on
August 18, 1901, which is preserved in the U. S. National Museum,
though reported as *S. noveboracensis*, proves on examination to be *S. motacilla*. The species must be only casual there in migration.

In 1912 I found the Louisiana water-thrush at Mameyes, February 9 to 29; Cayey, January 17 to 25 (three specimens January 17 and 22); Aibonito, January 29 (specimen) and February 1 and 2; and near the Hacienda Catalina, below El Yunque, March 4 and 7. Early writers have probably confused this bird with the true water-thrush, since the first record for the present species is that of Bowdish based on a specimen taken at Mayagüez, November 30, 1900. Struthers in 1921 found it near Mayagüez in spring until March 25, and reports the earliest arrival from the north in fall on August 31, 1921. Danforth saw it near Cartagena Lagoon, arriving September 6, 1924, and recorded the last for the spring on April 10, 1924, and April 22, 1922.

I found Louisiana water-thrushes in the mangrove swamps of the coast, but noted them also inland, where they followed the gravelly beds of rapid little streams that ran through coffee and banana plantations. They differ thus from *Seiurus noveboracensis*, which does not seem to frequent inland localities. Attention is always drawn to them by their sharp notes, which are higher pitched than those of the related species, and the steadily wagging tail instantly catches the eye as they walk along on the ground.

Bowdish found this species on Vieques Island and reports three specimens. One of these, in the U. S. National Museum, was taken on January 29, 1900, the other two on December 27, 1899, and January 22, 1900, respectively. There is another in the U. S. National Museum secured on Vieques by A. B. Baker on February 7, 1899. My records report the presence of this water-thrush until March 27, 1912.

The Louisiana water-thrush differs from the preceding species in whiter underparts tinged faintly with cream-buff on the flanks, larger bill, and entire lack of streaks on the throat.

**Seiurus aurocapillus aurocapillus** (Linnaeus) 25

Ovenbird, Pizpita Dorada


Ovenbird, Danforth, Oologist, 1922, p. 178 (western Portu Rico).


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25 Mr. Batchelder in Proc. New England Zoöl. Club, February 6, 1918, Vol. VI, p. 81, has described the ovenbird of Newfoundland as a distinct subspecies, *S. a. favicolor*. 
Steatorna chrysoptera, Newton, Ibis, 1859, p. 142 (St. Croix).


Porto Rico, Vieques, Culebra, St. Croix, St. Thomas: winter visitant.

In Porto Rico the ovenbird is fairly common in winter. Gundlach states that it arrives from the north in October: Bowdish noted October 14 as the earliest date of arrival at Mayaguez in 1901, and Struthers indicated October 18 as the earliest date of arrival in 1921, and April 18 as the last date of departure. Mr. F. A. Potts writes me that his latest record for Central Aguirre is April 18, 1921, while Danforth reports seeing the last at Mayaguez on April 20, 1922, and April 10, 1924, and the first arrival on September 24, 1924. During my field work I found the species at Rio Piedras from December 21, 1911 (specimen taken) to January 4, 1912: Cayey, January 19 (specimen); Aibonito, January 26 to February 5 (specimen, January 27); Mameyes, February 9 to 29 (specimen, February 23); Hacienda Catalina, below El Yunque, March 4 and 10. There is a skin in the U. S. National Museum taken by J. D. Milligan at Hucarcs, February 13, 1899, and C. W. Richmond noted the species at Utuado on April 6, 7 and 8, in 1900, securing a specimen on the last of the dates mentioned. Worthington, collecting for the Carnegie Museum, obtained specimens near Adjuntas on April 1, 4, 5, 8 and 10, in 1912.

On the coastal plain I found ovenbirds at times walking between the rows in the cane-fields and also noted them with water-thrushes in mangrove swamps. In other sections they were found in thickets or second-growth forests. On the slopes of El Yunque I observed them in the forests to an elevation of 900 feet, while at Aibonito they were found 1900 feet above the sea.

They walk quietly about on the ground with wagging tails, and, when frightened, fly up to rest for a time on some sloping limb until their alarm has passed, and then drop back again to the ground. In their winter homes these birds are silent.
On Vieques Island Bowdish observed several and collected one on January 16, 1900. Richmond, during the same year, saw one on March 24 and shot a specimen on March 28. In 1912 I found the birds fairly common from March 16 to 27 and secured skins on March 19 and 20. They occurred in sheltered areas in the dry thickets. On March 19 and again on March 27 they appeared in numbers in migration, indicating a considerable flight in fall beyond this point.

An ovenbird was secured on Culebra Island, February 11, 1899, by A. B. Baker, and there is a skin in the U. S. National Museum sent from St. Thomas by Robert Swift. The Newtons report the ovenbird on St. Croix as not common and say that it leaves for the north in April.

The ovenbird resembles the water-thrushes in form, in its habit of wagging the tail, and in the light underparts streaked with black, but is greenish olive above, with a partly concealed crown patch of cinnamon-buff bordered by indefinite streaks of black.

**Oporornis philadelphia** (Wilson)

*Mourning Warbler*

*Sylvia philadelphia* Wilson, Amer. Orn., 1810. Vol. II. p. 101, Pl. 14, Fig. 6. (Near Philadelphia, Pa.)

*Oporornis philadelphia*, Todd, Auk, 1925, p. 282 (Santa Isabel, Porto Rico, specimen).

Porto Rico, casual.

A female collected at Santa Isabel, Porto Rico, March 21, 1912, by W. W. Worthington and reported by Todd is the only record known for this bird in the West Indies. The species breeds in the eastern portion of the United States and normally winters from Nicaragua to Ecuador.

**Geothlypis trichas brachidactyla** (Swainson)

*Northern Yellowthroat, Pica-tierra, Reinita*

*Trichas brachidactyla* Swainson, Anim. in Menag., 1838, p. 295. (Northern Provinces of United States.)

Maryland yellowthroat, Potts, Auk, 1927, p. 120 (Central Aguirre).


*Sylvia trichas*, Hartlaub, Isis, 1847, p. 611 (listed).

Porto Rico: apparently very rare visitant in winter.

Gundlach says of the yellowthroat merely that he killed a bird of this species. Mr. F. A. Potts writes under date of May 15, 1921, that, on January 6, 1921, he saw a female and two males in mangroves three miles west of Central Aguirre. Danforth has recorded a male seen April 18, 1924, at Cartagena Lagoon.

The yellowthroat inhabits thick cover in swamps and marshes, where it may easily be overlooked as it feeds and moves under heavy cover. It is a small warbler, yellowish below and yellowish olive above, with a broad band of black like a veritable mask, extending from the eyes across the front of the head in the male. In the female this prominent identification mark is lacking. Assumption that the bird that comes to Porto Rico as a winter migrant is *G. t. brachidactyla* and not typical *G. t. trichas* is based on probability, for the former is the bird that goes regularly to Cuba and has been found in Jamaica. Specimens should be collected in Porto Rico when practicable.

**Setophaga ruticilla** (Linnaeus)

Redstart, Reinita, Candelita, Coll Rubio


Redstart, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Öölologist, 1922, pp. 11, 178 (western Porto Rico); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico, Vieques, Culebra, Louis Peña, St. Croix, St. Thomas, Tortola, Virgin Gorda; found during winter.

On Porto Rico the redstart is common through the season of winter wherever there are trees. I noted these birds alike in mangroves, forests, coffee plantations and shade trees about houses. Stahl stated that they arrived from the north the middle of August, but others do not record them until September. Bowdish noted the first comers at Mayagüez on September 24, 1900, and Danforth at the same point reports the first for 1921 on September 23. Mr. Potts saw the first one at Central Aguirre, September 18, 1921. The birds remain on the island until April. Richmond noted one at Ponce on April 16, 1900; Struthers reports the last one at Mayagüez on April 9, 1921, and F. A. Potts writes me that his latest record is of one seen April 29. Danforth saw the last on April 26, 1924, near Cabo Rojo Lighthouse.

During my field work I saw the redstart at Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Aibonito, January 26 to February 5; Cayey, January 15 to 25; Caguas, January 5 to 14, and on the lower slopes of El Yunque, above the Hacienda Catalina, March 2 and 4. The greater number of those seen were immature birds and females, though occasionally fully plumaged males were observed.

The redstart is the very essence of restless energy and in its active search for insects is seemingly never still. In the dense forests on El Yunque redstarts were seen up to 1500 feet, and elsewhere, in more open localities, were found at the highest altitudes. Next to the parula warbler, this is the most common of the wintering warblers. On Vieques Island Bowdish found it November 30, 1899, and Richmond recorded an adult male on March 24, 1900. From March 16 to April 4, 1912, these warblers were noted regularly and seemed to be in migration; they were found in especial numbers on March 27. On Culebra, in April, they were fairly common in company with other migrant warblers. Several adult males were seen, but most of those recorded were females or immature males. I found them, April 11, on Louis Peña Island and recorded the last one on Culebra, April 19.

The Newtons report the redstart as a winter visitant to St. Croix that is common in spring. They found it very numerous at the end of April, 1857, but in 1858 the greater part departed in March, though one was seen on May 1. The first to arrive in fall was recorded on September 6, 1858. Cory reports the species taken on St. Croix in 1891.

There are now four skins in the U. S. National Museum taken on St.
Thomas by Robert Swift, and in early days the Smithsonian Institution received one from that island through John Akhurst. M. J. Nicoll reports it taken on St. Thomas from February 21 to 24, 1904.

Cyrus S. Winch secured specimens for Cory on Tortola and Virgin Gorda.

The male redstart is a gorgeous creature with upperparts, throat and breast shining black, belly white and large patches of salmon red in wings and tail. In females and young males the black is replaced by grayish or ashy above and by white below, with wing and tail patches of dull yellow.

The species feeds entirely upon small insects and is a bird of considerable economic importance, destroying, as it does, many injurious forms.

Family Ploceidae
Subfamily Estrildinae

*Spennestes cucullatus cucullatus* Swainson

Hooded Weaver-finch, Diablito, Chupador de Arroz, Gorrión


Hooded Weaver-finch, Danforth, Oologist, 1922, p. 41 (Mayagüez).


Porto Rico, locally common; introduced from western Africa.

The hooded weaver-finch seems to have been long established in Porto Rico, since Bryant obtained specimens which he recorded in 1866; Sundevall received a number from Hjalmarson, and Gundlach in the seventies reported the species from Mayagüez, Lares, Quebradillas and Vega Baja. There is in the U. S. National Museum a skin collected by
Robert Swift in the winter of 1864-1865, one of three taken at that time. How the species came to be introduced is wholly unknown, though as a hypothesis we may suppose that it was brought in during the period when slave-ships with their human freight sailed from the west coast of Africa to Porto Rico. The present species, the scarlet-cheeked weaver, and the guinea fowl are believed to have become naturalized from this source.

The hooded weaver-finch is a common resident through the coastal plain to an altitude of 600 feet, and above that elevation I noted it only at Cayey (1275 feet) and Adjuntas (1550 feet). It was found at Manati, July 7 to 11, 1912; Bayamón, July 20 to 25; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Juana Díaz, August 24 to 31; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; and Añasco, June 7 to 9. Records for the interior are as follows: Utuado, August 3 to 9; Adjuntas, August 13 and 14; Ciales, July 12 to 18; Comerío, July 26 to 31; Cayey, January 15 to 25; and Caguas, January 5 to 14. A series of specimens was collected.

The birds are usually found in small flocks of from ten to twenty-five near the open banks of streams, borders of fields or in grass-grown pastures. Near Cabo Rojo, where they were very common, flocks of several hundred were encountered. These tiny birds feed close together, clustering on the ripening heads of malojillo (*Panicum*) to eat the seeds. When feeding on the ground, they shift continually, so that the flocks are in continual movement. When flushed, they rise in a close flock, with low churring notes, and fly a short distance into some tree, where the flock divides into twos and threes, the birds sidling along the limbs until they are as close to each other as possible, to remain contentedly until it is time to feed again. In August the young were gathered in large flocks and were roosting at night in dense mangó trees.

In May they were breeding. A nest found near Yabucoa, May 10, was built in a small tree on a steep slope, where there was no concealment whatever, and as a result the structure was visible on all sides. The nest was located about six feet from the ground, and was constructed of grass stems, in lengths of eight or ten inches, thatched so as to make a close structure, but with the ends projecting crisscross in every direction. The top was arched over, but the nest had no finished entrance, one whole side being open, giving it a very untidy appearance. It contained one young bird about three days old, and three eggs on the point of hatching. The eggs were opaque white in color and elongate elliptical in shape. Another nest, found near Yauco on May 22, resembled this one, but was not
yet finished. Like the first one, it was bulky, loosely roofed over, and had a slovenly appearance, due to the projecting straws. It was placed in a thinly leaved tree, with no attempt at concealment. Near Cabo Rojo the last of August these birds were preparing to raise a second brood, as the earlier nestlings were by this time old enough to care for themselves.

Seeds of various grasses and a few of sedges constitute the entire food. These seeds are nearly always shelled before being swallowed.

On comparison of a good series of skins, I find that the hooded weaver-finch of Porto Rico is *Spernestes c. cucullatus* from western Africa; it shows no approach to *S. c. scutatus*.

The adult bird is black, with a metallic sheen on crown, sides of head, throat, upper breast and tail, brownish gray on back and wings, white below, with sides, under tail coverts and rump barred with black, and a distinct spot of dark metallic green on either side. Immature individuals are plain brown, grayer above and brighter below. The bill is thick and heavy, and the bird is approximately three and one-half inches long.

**Estrilda melpoda melpoda** (Vieillot)

Scarlet-cheeked Weaver-finch, Gorrión


Scarlet-cheeked weaver-finch, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).

Gorrión, Gundlach, Journ. für Ornith., 1874, p. 312 (specimen).


*Sporopasarthus melipoda*, Bowdish, Auk, 1903, p. 13 (Mayagüez, Cabo Rojo Lighthouse).


Southwestern Porto Rico from Añasco to Santa Isabel, locally common; introduced from western Africa.

The scarlet-cheeked weaver-finch may have been introduced in the

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same manner as has been suggested for the hooded species. The first published record for it is that of Gundlach in 1874, who found it established on the coastal plain of Porto Rico from Añasco to Mayagüez and Cabo Rojo. There it is found today, and in addition extends beyond Yauco. In 1912 I secured specimens at Yauco from May 16 to 28, and at Cabo Rojo from August 24 to 31. The bird was seen at Mayagüez, June 6. There are in the U. S. National Museum two skins taken by Bowdish, July 23, 1901, "between Mayagüez and Cabo Rojo." A specimen in the Museum of Comparative Zoology received from A. Stahl and catalogued in the museum catalog in February, 1880, is marked Bayamón—a locality that, I believe, indicates merely Stahl's home and not the place of origin of this particular specimen. Potts reports the species east to Santa Isabel.

These tiny birds frequent marshes, dense, thorny thickets of the acacia known as rallo, and cane-fields. They are spirited little creatures, with quick, nervous movements, and, when alarmed, call continually. They are very active and climb through the bushes like titmice, their long tails adding to this resemblance. When feeding, they spread out somewhat, but, when excited, congregate closely, peering through the limbs before moving away, keeping well under cover. In the heat of the day they feed on the ground in patches of shade under the bushes. In the cane-fields they flush with quick calls, fly a few yards and then drop back out of sight. On the wing the long tail and short wings give them a quick, tilting flight, and they seldom fly far.

The ordinary call-note is a low *tsee tsee tsee*, or a low chattering call. Near Cabo Rojo, August 30, one female was seen feeding nearly grown young, regurgitating softened grass seeds from her throat for them. Bowdish noted breeding birds taken May 23 and 30, presumably at Mayagüez.

This weaver is brown above and gray below, with bright red cheeks, and a wash of darker red on rump and abdomen.

The difference in habit of life in the two weaver-finches established in Porto Rico may explain their present difference in distribution. The hooded species feeds in little companies in a manner suggestive of American goldfinches, and flies about openly through the country. It has thus become distributed through the lowlands of the entire island. The scarlet-cheeked weaver, on the other hand, is more secretive, and at any alarm disappears in the densest cover available. Its timidity prevents its wandering, except where suitable coverts are closely contiguous, and it has therefore covered in its range only a small part of the territory open to it.
Specimens that I collected are slightly darker in color than a series in the U. S. National Museum from Fernan-Vaz and have the red of the cheeks less intense. Grote\(^{27}\) says that the bird from the vicinity of Lake Chad is paler above than the typical form, and has named it *Estrilda melpoda tschadensis* (type locality, Andali, north Adamawa). He states also that birds from "Lower Guinea" are darker than those from "Upper Guinea." The faintly darker color of the Porto Rican series when compared with specimens from Fernan-Vaz (which may represent the area called by Grote "Upper Guinea") is due possibly to the origin of the Porto Rican stock somewhere in Angola. The Porto Rican bird is identified as typical *melpoda*.

**Family Icteridae**

**Dolichonyx oryzivorus** (Linnaeus)

Bobolink, Chamerigo

*Fringilla oryzicora* Linnaeus, Syst. Nat., ed. 10, 1758, Pt. 1, p. 179. (Cuba.)


Porto Rico, Vieques; casual in migration.

Pelzeln states that in the Paris Museum there is a specimen of the bobolink from Porto Rico and Cory and Gundlach record the species from Vieques. It is only casual in occurrence there in passage between its summer home in the north and its winter range in South America.

In ordinary migrant plumage the bobolink is olive-buff above streaked with black, and yellowish or buffy below. Males in breeding plumage are black with a cream-buff patch on the back of the neck, and the scapulars, lower back and upper tail coverts grayish white. The bird is about seven inches in length and has the tail feathers sharply pointed.

**Agelaius xanthomus** (Sclater)

Yellow-shoulder Blackbird, Mariquita, Capitán

*Icterus xanthomus* Sclater, Cat. American Birds, 1862, p. 131. ("Mexico"= Porto Rico.)

Yellow-shouldered Blackbird, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez).


\(^{27}\) *Journ. fär Ornith.,* 1922, p. 483


Porto Rico, common resident; Mona, apparently resident.

Cory received two skins from Mona Island collected by W. W. Brown, Jr., in 1892, and considered these as stragglers from Porto Rico. Since Bowdish found the species common there from August 9 to 21, 1901, it appears that it is resident. Two skins in the U. S. National Museum were taken by Bowdish, August 7 and 15. These (in worn plumage) do not seem to differ in any particular from skins from Porto Rico.

The yellow-shouldered blackbird is described by Taylor in 1864 as “excessively abundant.”

In 1912 I noted it as follows: Quebradillas, July 2 to 6; Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Salinas, April 26 to May 2; Juana Díaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Añasco, June 7 to 9, and Aguadilla, June 9 to 12. In the interior it was found at Lares, June 18 to July 1; Utuado, August 9; Ciales, July 12 to 18; Comerío, July 26 to 31; Caguas, January 5 to 14; and Hacienda Catalina, below El Yunque, March 2 to 11. I collected a series, and there are in the U. S. National Museum skins taken by Richmond at Arecibo, April 1 and 3, 1900, and at Utuado, April 10. In Porto Rico this blackbird is most abundant in the coastal region, extending inland along the open valleys of the larger streams. In the main it is found below an altitude of 800 feet. Lares (1200 feet) was the highest point at which it was observed, none being seen in the high
central mountain range. In fall, winter and spring, this species associates in small flocks, which travel over the country, returning at nightfall to some clump of trees or mangroves to roost. Morning and evening flights to or from these roosts are a common sight. The flocks pass with direct, though undulating flight, with an occasional flash of yellow showing in the wing. In mangrove swamps it is common to find a small group feeding in close array on the wet ground, or to encounter single individuals clambering through the branches, absorbed in their search for food. Often they are seen climbing actively up and down the long fronds of the coconut palms in oriole fashion, or walking sedately along on the ground among the cattle in the pastures.

The common call-note is a sharp chick, indistinguishable from that of the Porto Rican oriole; a low chuck is often heard. About their nests they give the sharp, staccato, scolding notes of the red-winged blackbird of the north, as they circle and wheel overhead. The males do not appear to sing a great deal, though odd, wheezy or reedlike notes, resembling those of the yellow-headed blackbird, are sometimes heard.

The breeding season is in May or June, the young being out of the nest by the end of the latter month; sometimes they nest as early as March. The nests of this species appear to be built usually in coconut or royal palms (Pl. LVI), as noted years ago by Moritz, the birds nesting, as a rule, in small colonies, though single pairs are sometimes found. When the nest is in a royal palm, the male spends much time resting on the tall projecting spike in the crown, where he postures with drooping wings and spread tail, but sings very little. When alarmed, the female flies up and clings to the side of the spike, just below him, while both scold vigorously at any intruder. All of the nests that I observed were in the axils of the long leaves. Gundlach says that the birds lay four eggs. In the breeding season they feed usually near the site of the nest, walking about on the ground, sometimes wading in the shallow water of the small streams or in drainage ditches. As soon as the young are on the wing, all gather in small flocks, remaining at first near the nesting colony, but going farther afield as they get stronger on the wing. They avoid the intense heat of the middle of the day by frequenting coffee plantations, clumps of bamboo and shaded perches of all kinds.

In mixed flocks with the Porto Rican grackle this blackbird feeds in newly plowed fields, following the plow for the grubs and insects exposed; it frequents cane-fields while the growth is small. In this way it does much good. Around Manatí large flocks of old and young frequented citrus groves, feeding on the ground and flying up to perch
in close flocks among the branches of the trees, preferably on dead limbs. In spring, with the other blackbirds, they frequent the bucarea trees (Erythrina sp.) to probe the handsome blossoms for their nectar.

Roughly estimated, nine-tenths of the food of this bird is animal and one-tenth vegetable. Numbers of harmful insects are destroyed. Injurious weevils are favorite food, cutworms are much relished, and a host of other insects, with a few spiders, make up the remainder. Of vegetable matter a little more than one-half is composed of corn taken from the ear when still in the milk. For the entire year this is a small amount, but during June some damage is done locally. In some instances it was found that the birds, though flocking in the cornfields, were not touching the grain. Throughout the season, as a whole, this blackbird is a beneficial species and should be allowed a small toll of grain grown by man as part payment for its usefulness throughout the rest of the year. Care should be taken not to confuse the work of blackbirds in the cornfields with that of rats, which are in some cases very destructive to the grain in localities frequented by the blackbirds. The blackbird merely pecks open the end of the ear and pulls off the kernel, while the rat gnaws off the husks, dropping a pile of refuse to the ground below and frequently destroying half the ear.

Male and female of the yellow-shouldered blackbird are identical in color, being black with yellow shoulder patches. Young in juvenile plumage resemble adults but are duller-colored.

Vieillot reported this species from St. Thomas, but I believe this record to be erroneous, as no one since has found the bird living on that island. The specimen in question must have been taken by Maugé, and so in all probability came from Porto Rico.

**Icterus portoricensis** Bryant

*Porto Rican Oriole, Calandra, Calandria*


Porto Rican Oriole, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico, common resident.

The Porto Rican oriole is universally distributed throughout the island where there is tree growth suitable as feeding ground, shelter for its nests and protection from its few enemies. Near the coast it is common in the long fronds of the coconut palms, where these grow in plantations, while inland it frequents coffee plantations or tracts of second-growth forest. It is found also in citrus groves, amid trees in some of the town plazas and in the shade trees of suburban homes.

Bones of the oriole were noted in cavern deposits near Morovís.

As indication of the general distribution of the oriole, I may mention that in 1912 I found it at Quebradillas, July 2 to 6; Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December 11, 1911, to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Mayagüez, May 11; Juana Díaz, August 17 to 22; Salinas, April 26 to May 2; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Añasco, June 7 and 8, and Aguadilla, June 9 to 12. In the interior the oriole was noted at Lares, June 18 to July 1; Maricao, May 29 to June 5; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerío, July 26 to 31; Aibonito, January 26 to February 5; Caguas, January 5 to 14; Cayey, January 15 to 25; and the Hacienda Catalina, below El Yunque, March 2 to 11; Bowdish in one account has recorded it as found on Vieques, but in an earlier statement says that it does not occur there. There is no definite record of it outside of Porto Rico proper.

The oriole is at times rather wild and keeps well concealed, but again comes into shade trees about houses. It feeds slowly through the tips of limbs, examining the leaves carefully, especially those that are curled for caterpillars, at need swinging head down to reach some desired point. This bird has the most beautiful song of any Porto Rican species—a clear whistle of several notes, pitched rather high in the scale. Its notes are uttered mainly morning and evening, and are among the few bird sounds to be heard by those afoot at dawn. The ordinary call is an
oriole-like *chick* or *chuck,* but these birds also utter a thin, high note like *pe-ee,* that resembles the call-note of a goldfinch or siskin.

The breeding season for the oriole extends from the beginning of May to the middle of July, and after the middle of June young in first plumage are common. The adults then begin to molt. This species breeds while in immature dress. The only nest found was in a grove of coconut palms, north of Manati, on July 8, swung from the underside of one of the long leaves, the nest being supported under the center of the rib by four radiating straps that attached it firmly, leaving only a small space between it and the underside of the midrib to serve as an entrance. It appeared to be woven strongly of fibrous materials. Bowdish describes a nest seen at Aguadilla as woven from fibrous strips of palm leaf. Gundlach reports that the oriole lays three eggs.

The oriole is fond of the sweet flower juices of plants and trees, the bucare (*Erythrina*) being visited frequently when in blossom, while the abundant nectar of the banana is a great attraction, several birds visiting the same flower in rapid succession. Near Aibonito the oriole was seen eating the pulp and juice of over-ripe wild sweet oranges (*chinás*), and had opened half a dozen on one tree. As the fruit in the cultivated groves is picked long before it reaches this stage, the bird could do no damage to the citrus industry. Its food, as shown by stomach examination, consists mainly of animal matter, and it consumes many grasshoppers, roaches, caterpillars and weevils. It is considered a highly beneficial species.

The adult Porto Rican oriole is between seven and eight inches in length, black with yellow epaulets, rump and under tail coverts. Male and female are alike in color. The immature bird is rich orange-brown throughout, brighter below. Individuals in transition plumage to the adult dress are common. The first, or juvenile plumage, is browner than the first fall dress. It is my belief that the birds keep the immature stage until they are a year old—as I saw breeding individuals in this plumage—and then molt into adult feather. The change seems to come irregularly as regards season, since I have seen molting birds from March to July. The dark feathers appear first on head and throat and extend gradually back over breast and back.

This species is closely allied to the oriole of Santo Domingo.
Icterus icterus ridgwayi (Hartert)

Troupial


Porto Rico, St. Thomas; said to have been introduced.

Gundlach states that he found the troupial established and breeding in fair numbers in the vicinity of Quebradillas. As the species was kept commonly as a cage-bird, he assumed that the original stock had escaped or had been released from captivity. Stahl had a specimen from Porto Rico and states that the species came originally from Venezuela. On January 5, 1912, below Aibonito, I saw an oriole that was not Icterus portoricensis and that I assumed to be the species here under discussion. Unfortunately, this bird was not collected.

The species is well known as a resident of St. Thomas. Benedict and Nye collected one there between January 17 and 24, 1884, and Cory had several specimens from that island. There are two in the U. S. National Museum, and one in the Museum of Comparative Zoology, taken on St. Thomas by F. A. Ober. The bird is mentioned from that island by Hartert.

Through the kindness of Mr. W. E. Clyde Todd I have borrowed from the Carnegie Museum eight skins of Icterus i. icterus and I. i. ridgwayi. The last mentioned is distinguished from typical icterus by longer bill and paler coloration, the culmen from base in icterus (irrespective of sex) ranging from 26.0 to 29.0 mm., and in ridgwayi from 31.5 to 33.2 mm. The three measured from St. Thomas have the culmen from base
33.2, 32.0 and 33.6 mm. respectively, and so resemble *ridgwayi*. They are, however, decidedly lighter yellow, less orange, throughout. The difference, if constant, is sufficient to warrant separation of the bird from St. Thomas as a distinct form—for which Cory (see synonymy above) has proposed the name *I. i. harterti*—and throws some doubt on the belief that the troupial has been introduced on that island. The matter of subspecific recognition of the St. Thomas bird is left in abeyance pending further examination of specimens.

A skin from Jamaica with the culmen 31.0 mm. long is also pale in color. It is identified as *ridgwayi* on the basis of size.

No skins have been seen from Porto Rico; records from that island are, therefore, included under *ridgwayi* merely as a matter of convenience.

The troupial in both sexes has the head and entire throat, back, wings and tail black, breast, abdomen, a broad band around the hindneck, lower back and rump, yellow or orange yellow, and a broad band on the wing white.

**Holoisocalus niger brachypterus** (Cassin)


Porto Rican Blackbird, Danforth, Oölologist, 1922, p. 10 (mention); Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


28. There is no indication of type locality in the original description other than Porto Rico. The statement above has been made by Peters from the fact that Cassin described this species from sixteen specimens in the Smithsonian Institution (and one without label in the Philadelphia Academy), these being from the north side of the island.


Porto Rico and Vieques, common resident. Of questionable record for Culebra.

The grackle (Pl. LXV) is one of the most characteristic birds of the cultivated fields of Porto Rico and is distributed in suitable country over the entire island. In the lowland fields, below five hundred feet altitude, it is the most common species of bird; at higher points individuals are encountered in small numbers. I found it at Quebradillas, July 2 to 6; Manatí, July 7 to 12; Bayamón, July 7 to 11; Río Piedras, December 16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Humacao, September 3 to 9; Yabucoa, May 3 to 10; Manatí, May 11; Patillas, May 12 to 13; Juana Díaz, August 17 to 22; Salinas, April 26 to May 2; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6 and 7; Añasco, June 8 and 9; Aguadilla, June 10 to 12. In the interior single birds were seen at Maricao, May 29 to June 5. Grackles were tolerably common at Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Caguas, January 5 to 14; Cayey, January 15 to 25; Aibonito, January 26 to February 5; Comerío, July 26 to 31; Cayey, January 15 to 25; and Caguas, January 5 to 14. There are specimens in the U. S. National Museum from San Juan, Húscar, Arecibo, Ponce and Luquillo.

The grackle is usually found in small flocks, that may include from three or four to twenty-five individuals, feeding on the ground in pastures or cultivated fields. Males strut about holding head and tail high as they call squeakily, while females walk back and forth seemingly pre-occupied with a busy search for food. The tail is deeply V-shaped, a conformation that is much exaggerated in flight, when the birds seem almost deformed. In rising from the ground the tail appears at times a hindrance. Thus in flying up into a palm they may fly out past the tree, and then return, because they do not appear to be able to rise at as sharp an angle as other birds of their size. The royal and coconut palms are favorite trees, in which they spend much time either in walking up and down the broad leaf-stems or in sitting quietly in the shade. Their
ordinary call-note is a grackle-like *chuck*, or a thin, high *tee tee tee*; the song may be represented by the syllable *k* see *ah-ah-h*, a wheezy effort given with spread wings and deeply V-shaped tail.

The main breeding season extends from April until August, the birds usually nesting in colonies in the royal or coconut palm (*Pl. LVI*), though at times choosing an isolated jobo (*Spondias mombin*) or other tree. Struthers found occupied nests at Anegado Lagoon, December 3, 1921. In the palms the nests are constructed in the large seed clusters and at the bases of the long leaves, often in close proximity to one another. Bowdish describes a nest examined at Aguadilla on July 24, 1900, as composed of grasses and bits of wild cotton, lined with rootlets and one feather. Taylor says that the egg is similar to that of other grackles, and Gundlach reports that from four to six eggs compose a set. Danforth found colonies breeding in the cat-tails at Cartagena Lagoon, building nests of grass and roots, with some mud and laying four to five eggs. These are variable in color, "but most of them have a putty-colored background marked with brownish red scrawls and blotches."

The birds are very active about their nesting colonies, continually flying back and forth, calling, singing and posturing, making a scene of the greatest animation. The work of nest-construction is carried on by the females, though the males always accompany them, strutting about on the ground as they search for material, and driving intruding males from the chosen nesting site on returning to the tree. Incubation, too, falls to the lot of the female, her spouse seemingly always following her on her expeditions for food, but when the young are hatched, both sexes care for them. After the middle of June it is a common sight to see the brownish black young following their parents, teasing for food with trembling wings, and when unnoticed protesting vigorously. In August these family parties join in small flocks that remain together until the next breeding season. These bands feed in the cultivated fields, pastures or sometimes on gravel bars in streams, where they may wade in the shallow water, turning over the leaves for aquatic insects, or, standing in water up to their bodies, splash and flutter while bathing. Danforth describes a roost of these birds in coconut palms at Peña Cortada, near Mayagüez, and says that in October, 1924, it was used nightly by 3000 birds.

The present species is widely recognized as the one most beneficial to agriculture in Porto Rico, and by good fortune it is also one of the most common. While cane and tobacco fields are being prepared for the crop, flocks of grackles follow the plow or feed in the overturned furrows,
eating the insects which are exposed. On the ground the grackles walk rapidly along, peering from side to side and following the working peons closely. Even when the cane is well grown, they may follow the rows while they are being cultivated, not only to obtain insects as food for themselves, but also for their young—at times far-distant. In the breeding season it is a common sight to see three or four flying from low-lying fields inland into the foothills with a white grub shining in each bill.

After the breeding season old and young feed much on different wild fruits, such as the icaco (*Chrysobalanus*), sapalo (*Palicourea riparia*) and moral (*Cordia nitida*). In spring they were seen taking the nectar from the bucare (*Erythrina*) and muñeco (*Cordia collococca*). Frequently birds had the throat full of this honey and the feathers of the head yellow with pollen. The fruit of the manzanillo (*Hippomane manchinella*) also was eaten to some extent.

Though the grackle eats fewer mole crickets than popular belief attributes to it, such large amounts of weevils, directly injurious to cane and other crops, are consumed that it still maintains its place in the foremost rank of the beneficial birds of Porto Rico. Nearly one-fifth of the food is composed of Orthoptera and many injurious bugs are destroyed. May beetles and white grubs are eaten voraciously and cutworms are a favorite food. Two of the birds that I examined had eaten cattle ticks, and the birds were observed on several occasions searching the cattle for their food. Considerable numbers of lizards and amphibians are eaten and with corn form the elements in the food that one would like to see spared. Most of the grain taken is secured in the month of July, and at least one-third of it is waste grain. The grackles frequent cornfields as they do cane for the shade offered from the heat of the sun, and so may not do damage even when present in numbers. No instance of damage of any extent came to my notice, depredations being confined to a few ears of corn—a toll justified by their services in destroying harmful pests which would do much more injury if unchecked. In general, the blackbird is a beneficial bird and the protection accorded it is well merited.

Mr. Bowdish speaks of the grackle on Vieques as present in large flocks, but in March, 1912, I found it only fairly common and rather local in its distribution. On Culebra Island Don Pedro Marqués informed me that at times he saw the mozambique near Playa Brava—a record that should be substantiated before it is accepted. I saw none during my work.
The mozambique is from nine and one-half to eleven inches in length and is black with bluish or greenish sheen. The eye appears almost white.

**Molothrus atronitens** Cabanis

Glossy Cowbird

*Molothrus atronitens* Cabanis, in Schomburgk, Reis. British Guiana, 1848, Vol. III, p. 682. (Coast region, British Guiana.)

*Molothrus sericeus*, Newton, Ibis, 1860, p. 308 (Vieques, specimen).

*Molothrus bonariensis*, Cory, Auk, 1886, p. 220 (Vieques); Cat. West Indian Birds, 1892, p. 124 (Vieques).


Vieques Island; accidental.

Newton records a specimen of this cowbird obtained by Riise on Vieques Island, apparently in 1859 or 1860. The species is resident from northern Brazil and Guiana to the island of Carriacou, and recently has been naturalized in Barbados, where it has been noted by Dr. Casey Wood.

**Family Thraupidae**

**Subfamily Thraupinae**

|**Piranga erythromelas**| Vieillot |29 |

Scarlet Tanager


*Piranga erythromelas*, Cory, Cat. West Indian Birds, 1892, p. 114 (Tortola).

Tortola, of uncertain record.

In the Auk for 1891, p. 47, Cory listed the scarlet tanager as collected by Winch on the island of Antigua, in the Lesser Antilles. In his Catalog of West Indian Birds, 1892, p. 114, he does not include Antigua in his references, but does list Tortola as a place of occurrence for the species. In the Catalog Mr. Cory, for his reference to West Indian Islands, adopted three series of numbers: one for the Bahama Islands, running

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29 Dr. Oberholser (Auk, 1919, pp. 575-576) has proposed to use *Tanagra olivacea* Gmelin (Syst. Nat., 1789, Vol. I, Pt. 2, p. 889) for the scarlet tanager on the basis of an analysis of original references to Pennant and Latham, as given by Gmelin, which cover a bird from New York, possibly a scarlet tanager. Since Gmelin also cites as his first reference Buffon, who describes a bird from Cayenne which should not be a scarlet tanager if the locality is correct, the name *olivacea* appears to be a composite of such uncertain identity that I hesitate to accept it for use.
from 1 to 34; one for the Greater Antilles, from 1 to 17, and one for the Lesser Antilles, from 1 to 34. In assigning West Indian ranges, the three sets are distinguished by the group prefixed before each set of numbers. Under the scarlet tanager we find “Bahamas, 6, 7; Greater Antilles, 1, 6, 14, 33,” which, translated by means of the numerical code indicated, reads: “Bahamas, islands of New Providence, Andros; Greater Antilles, islands of Cuba, Jamaica, Tortola,” with, however, no reference for 33, since the Greater Antillean numbers stop at 17. If we consider that the numbers 14 and 33 refer to the Lesser Antilles, we may translate them as Antigua and Barbados, for both of which there are records for the species. I believe, therefore, that Cory omitted to write “Lesser Antilles” before the two numbers in question, and that Tortola is thus not intended.]

**Nesospingus speculiferus** (Lawrence)

Porto Rican Tanager, Lloron, Verdoso, Verdedon de Especulo

*Chlorospingus speculiferus* Lawrence, Ibis, July, 1875, p. 383, Pl. 9, Fig. 1.39


Porto Rico, resident; fairly common on the middle slopes of El Yunque, and near Maricao, formerly of wider range, but now seemingly restricted to these localities.

The Porto Rican tanager (Pl. LXV) was described by George N. Lawrence in 1875 from a specimen obtained through Gundlach, who, however, says that he has no remembrance of handling the bird. The type skin, which is in the U. S. National Museum, bears on the original label the data, “Porto-Rico, Dr. Gundlach,” in Gundlach’s own handwriting. Gundlach believed that the skin was one of a lot obtained by his friend and student Blanco, near Aguas Buenas and sent to the Smithsonian Institution in Washington.

Though today the Porto Rican tanager is considered one of the rarer

39 The description was published in July, but the plate was issued with the October number.
birds of the island and is so restricted in range that few bird-lovers have found it in life, it seems formerly to have been quite common, since its bones outnumber the remains of all other birds in the accumulations of bird and mammal remains, supposed to have come from owl pellets, that are found in the cavern deposits near Morovis. It is my belief that the large number of *Nesospingus* in these pellet remains may be explained when it is remembered that this tanager gathers in flocks at nightfall to roost in clumps of palms, where the birds find shelter in seed clumps, axils of leaves, and the spathes surrounding seed heads or the central spike. In such situations they are easy prey for night-feeding owls. An owl might return nightly to such a roost, and inroads of this kind may have had a decided effect in reducing the numbers of the tanager.

From March 2 to 11, 1912, I found the Porto Rican tanager fairly common on the eastern and northern slopes of El Yunque above the Hacienda Catalina, ranging from the thickets and coffee plantations at seven hundred feet to the dense, dimly lighted forests at the summit of the mountain. Later, from May 29 to June 5, I noted these birds as common also about Maricao, this being the first record of the species for the western end of the island. Struthers reports them as still common at Maricao in 1923. Richmond in manuscript notes records one seen on April 12, 1900, between Utuado and Adjuntas, and I believe a small bird seen indistinctly in January, 1912, on the slopes of Mount Pelado above Cayey to have been this form. Dr. C. W. Richmond secured eight specimens on El Yunque from February 22 to March 2, 1900, while Stahl had two in his collection and sent a third to P. L. Sclater, which is now in the British Museum. In my own investigations I secured a fine series of skins and made many observations on habits.

Though in their haunts these tanagers were fairly common, to secure them was often difficult. The ordinary call-note is a sharp *chewp chewp*, repeated vigorously while the bird remains concealed in a growth of vines or in dense brush. Another note, heard less often, was a robin-like *tsweep tsweep*. As we passed along the trails, our attention was attracted by the call of one or two of these birds at a distance, or a tanager would appear suddenly in the bushes near by, scolding vigorously, but when they were silent, they were very hard to find. The few natives that are acquainted with them refer to them as “the crying birds,” from their loud notes, but many living in their haunts know nothing of them. On El Yunque during the day the tanagers were spread out through the brush singly, or occasionally in flocks of a dozen or more. At night, however, they gathered in bands and resorted to certain places to roost. Above the Hacienda Catalina they used as their nocturnal retreats three
or four royal palms that grew near the summit of a ridge. Until nearly
dark there would be no sign of them here. Then suddenly the thickets
and patches of gonduros (Cajanus cajan) would be alive with the birds
coming up the slopes, calling and scolding. From this low cover they
went up into the palms, and, with much chattering, fighting and flying
about, proceeded to settle for the night. The sexual organs in specimens
that I dissected indicated that the breeding season was near.

Near Maricao, in June, all were breeding, and no flocks were seen.
Here they frequented the coffee plantations almost entirely, working
actively through the trees above the coffee, flying and fluttering through
the twigs, to examine the leaves and undersides of the limbs, and occa-
sionally breaking out into their loud, scolding notes. Several times I
heard them singing a sweet warbling song that included many running
trills. Their flight is strong and undulating, but they seldom fly for long
distances, preferring to seek cover in the brush. No nests were seen,
though the birds were breeding.

Gundlach reports that Stahl found in a small tree, five meters from
the ground, a cup-shaped nest, beautifully formed from grass and
feathers loosely placed together and lined with fine grass. The egg was
white with a bluish cast, spotted with brown, especially about the larger
end, the brown disappearing toward the middle of the egg, and also with
spots and streaks of black. The egg measured 26 by 18.5 mm.

Three-fifths of the food of this tanager is composed of Orthoptera,
weevils, bugs, moths, caterpillars and spiders with an occasional lizard or
tree-toad. It also eats many wild fruits and berries and a few hard
grass seeds, which perhaps are taken to aid in digestion, since no sand or
gravel is eaten.

This tanager is dark olive-brown above, grayer on the head, grayish
white below, with olive brown under tail coverts and a small white spot
in the wing at the base of the outer primaries. Male and female are
similar, except that the latter is smaller and has the base of the lower
mandible little, if any, paler than the rest of the bill. In the male the
base of the lower mandible is distinctly whitish.

**Spindalis portoricensis** (Bryant)

*Porto Rican Spindalis, Reina Mora, Tomate, Llorosa, Reinona, Llorona*

1839, p. 596 (listed).

Porto Rican Spindalis, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez).


Porto Rico, common resident; generally distributed wherever there is tree growth, but less abundant in the lowlands than in the wooded hills of the interior.

I found spindalis at Quebradillas, July 2 to 6 (specimens); Manatí, July 7 to 11; Rio Piedras, December 16, 1911, to January 4, 1912 (specimens); above Mameyes, February 9 to 29 (specimens); Yabucoa, May 4; Patillas, May 12 to 13 (specimens); Juana Diaz, August 17 to 22 (specimens); Salinas, April 26 to May 2 (specimen); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 12; Lares, June 18 to July 1; Maricao, May 29 to June 5 (specimens); Ciales, July 12 to 18 (specimen); Aibonito, January 26 to February 5 (specimens); Caguas, fairly common, January 5 to 14; Utuado, August 3 to 9; Adjuntas, August 10 to 16 (specimens); Comerío, July 26 to 31; Hacienda Catalina, below El Yunque, March 2 to 11; Cayey, January 15 to 25 (specimens). There are skins in the U. S. National Museum from Ponce, Fajardo and Coamo. The birds may wander about somewhat with changing season and shifting food supply, for I saw them at points where Gundlach states explicitly that he did not find them. The spindalis frequent patches of second-growth forests as well as the borders of coffee plantations or hedges and are seen occasionally in citrus groves. They are often unsuspicious and may alight near at hand to peer curiously out from the shelter of leaves, or again are wary and take alarm at persons seen at a distance. Where food is abundant, they are often found in flocks. Their flight is strong and undulating, the birds sweeping along in graceful curves, perhaps alighting for a minute or two and then passing on. In this manner they cover considerable ground in their search for food. The call-note is a faint tseet, and males give a low chattering note. I heard no song from them,
but Danforth has recorded a weak though sprightly effort heard very rarely. The breeding season extends from the end of January to the middle of June, and occasional pairs may breed later. I found young birds recently grown very common during June and July, but took them occasionally throughout the year.

Bowdish has described two nests found on June 9, 1900, near Aguadilla in trees growing in small clumps near a cleared plantation. These nests were placed about ten feet from the ground, in forks of small mangó trees, and were frail, saucer-like structures, similar to those of the rose-breasted grosbeak, and built of bits of fine vines and tendrils. They contained two and three eggs respectively and incubation had begun. The set of two, now in the U. S. National Museum, has the ground color apparently dull white, almost entirely obscured by the merging of abundant blotches and washes of walnut brown. These eggs measure 23.7 x 18.2 mm. and 24.2 x 18.0 mm.

The food of the spindalis is almost entirely vegetable and it is, without doubt, the greatest agency for the distribution of seeds in the island. The species is roving in habit and covers considerable territory, appearing wherever there is food to satisfy its voracious appetite and then passing on. That the birds do not always confine their attacks to fruit and seeds is testified by the fact that, on at least two occasions, they were seen stripping climbing vines (Ipomoea) of their tender green leaves and eating them. At Río Piedras two came into a guanábano tree (Anona muricata), and in less than half an hour had almost entirely consumed two of the rough, prickly-skinned fruits, ten inches long and five inches in diameter. Near Cayey a male was seen opening a ripe wild orange (china) and eating the pulp and juice. On half a dozen wild trees near here about thirty oranges had been attacked in the same way. In cultivated groves the bird occurs, but was not seen doing any damage. Its work is unmistakable, as it tears a large opening in the fruit from which to extract the pulp, choosing only the ripest fruit.

The spindalis is frequently infested with a species of parasitic grub, which, though often present in numbers, in most cases does not appear to affect the vitality of the bird seriously. These grubs (the young stage of some fly) are found usually on the breast, lying just under the skin, and may occur on the abdomen and underside of the wings. One bird that I examined had about thirty of the parasites, but this was exceptional, two or three being the usual number.

The fruits and berries of the pomerosa (Jambosa jambos), camacey (Miconia racemosa), palo de perico (Coridius corymbosa), palo moro
(Psychotria brachiata), a wild fig (Ficus laevigata), and a parcha (Passiflora sexflora) are foods favored by this species.

The spindalis is not at present known to be injurious.

It is a bird of sparrow-like form, from six to six and a half inches in length. Males have the back green and the breast and throat yellow, with an orange spot on the lower throat and an orange circle around the hindneck. The head is black, with a white line over the eye and a white streak on the jaw. Females and young are dull greenish above and whitish below, streaked with dusky.

Subfamily Tanagrinæ

**Tanagra sclateri** (Sundevall)

Porto Rican Euphonia, Jilguero, Jilguero del País, Canario del País, Canario Criollo


Porto Rico; fairly common resident.

The euphonia in Porto Rico is apparently confined mainly to hilly regions and seldom comes into the level lowland stretches of the coastal plain. It has such specialized habits that a number of naturalists who have visited Porto Rico have failed to see it. Gundlach reported it as common, and in the U. S. National Museum there is one skin taken by him, with several from the Bryant collection. Bowdish during extensive field work obtained only one bird, which was killed by a boy on August 25, 1901, and given to him. A. B. Baker shot one at Caguas, January 13, 1899. Richmond did not see this species.

During 1912 I found it at Quebradillas, July 2 to 6 (specimens); Toa Alta, August 2; above Mameyes, February 23; Maunabo, May 11; Salinas, April 26 to May 2 (specimens); Juana Diaz, August 17 to 22 (specimens); Yauco, May 16 to 28 (specimens); Cabo Rojo, August 24
to 3; Maricao, May 29 to June 5 (specimens); Lares, June 18 to July 1; Utuado, August 3 to 9 (specimens); Adjuntas, August 10 to 16 (specimens); Aibonito, January 26 to February 5 (specimens); Ciales, July 15 and 17; slopes of El Yunque near the Hacienda Catalina, March 2 to 11 (specimen).

The euphonias are found in pairs or small flocks in natural forests and in the shade trees above the coffee plantations. They are rather active and hop quickly about, calling wheur or chit—it, the first being a whistle and the second a scolding call. The whistle is somewhat ventriloquial in character, but, when I heard it, I found it a safe rule to search the nearest clumps of mistletoe or capitana (*Phoradendron*), the seeds of which form the food of the euphonia, and here the birds were usually discovered. Growths of this parasite bearing an abundance of ripe berries are visited time after time. The birds usually keep in the thickest parts of the clumps and are hard to distinguish from the ever-present honey-creeper. They are at times rather shy, but usually respond readily to a whistled imitation of their notes, calling and hopping about excitedly. Their flight is bounding.

In January euphonias were in pairs and were nesting by the end of February. Gundlach found a nest with young in April, placed in the branches of a mangó tree, and says that it was built like the nest of other small birds. I took young birds, May 17, near Yauco and noted them as common until the first week in July. By August 10 many of the adults had completed the molt, though some did not gain their full plumage until later.

The males have a low song consisting of the rapid repetition of a single metallic phrase, preceded by louder explosive notes, with twittering interpolations. For this and their bright colors they are prized greatly as cage birds, and about Ponce and Juana Diaz bird-catching is a regular occupation of the boys. In 1912 the birds were offered in the markets for five and ten cents apiece. In 1923 Struthers reports that they sold in Mayagüez for fifty cents each. To catch the birds a euphonia, usually a female, is shut up in a wicker cage, and a convenient perch or the top of the cage smeared with a sort of bird lime. The cage is then placed in a bush, where the captive whistles loudly, calling down others that are at freedom; or the bird-catcher holds the cage in his hand, up toward the trees, where the free birds hop about excitedly, calling and whistling loudly. The crate is then moved rapidly back and forth or carried away, the boy running quickly, when the notes of the captive, as it is jolted back and forth inside, prove too much for the others, and
they come flying down. Once they alight, their fate is sealed, and in a few minutes they are inside the cage, captives themselves. In captivity the food is almost entirely ripe bananas. The birds appear to thrive on this diet, but do not live long.

In the late fall of 1910 Mr. Reed, then Presbyterian minister at Isabel II, made an attempt, apparently unsuccessful, to introduce the euphonia into Vieques Island. Forty birds were purchased in Ponce, and of these a dozen got away on the playa as they were being landed on Vieques. The others were confined in an outbuilding and during the next few months escaped a few at a time. They remained around Mr. Reed’s house for some time, as three months later a party of twelve were seen, but then disappeared.

In the stomachs of fifty-one of these birds I found the food to consist of the berries of mistletoe, known as capitana, of several species, from two to twenty seeds being present in each stomach. These seeds are small and are enclosed by an outer envelope in a thick, transparent, viscous fluid. In feeding the berry is broken and the inner portion swallowed without the outer covering. In dissecting the euphonias I found the seeds and viscous matter in the lower part of the intestines in the same condition apparently as those which still remained in the throat, though the nutritive matter had been removed by digestion. The birds act as distributors of their favorite food, as the gelatinous, stringy mucous surrounding the seeds, after passing through the alimentary canal, catches and lodges on the limbs of trees, where the seeds germinate and produce new plants. It is noticeable that the mistletoe is very abundant in the dry region of the south coast, as the seeds there are less liable to be washed to the ground by rains before the mucous dries and fastens them to the limbs than they are in regions of copious rainfall. Though mistletoe is considered injurious in some regions where it is abundant enough to kill trees so unfortunate as to act as hosts, no complaint was made of it in Porto Rico nor was any damage seen that could be attributed to it. Mistletoe was common in the trees grown as shade for the coffee, but no attempt was made to cut it out or keep it down, and infested trees were apparently healthy.

The euphonia is one of the most strikingly marked of Porto Rican birds. In the adult male the forehead, underparts, lower back and rump are deep rich yellow, the crown and hindneck bright blue, and the sides of the head, back, wings and tail metallic steel blue. Females have the yellow distinctly greenish and the steel blue replaced by dull green.
Family Fringillidae

Subfamily Richmondeninae

**Tiaris bicolor omissa** Jardine

Carib Grassquit, Parson. Parson Sparrow, Chamorro. Gorritón, Chamorro

*Bicolor*

Carib Grassquit, Danforth, Oölogist, 1922, p. 10 (Porto Rico); Bird-Lore, 1922, p. 41 (Mayagüez); Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


Porto Rico, Vieques, Culebra, Culebrita, St. Croix, St. Thomas, St. John, Virgin Gorda, Anegada; resident, common.

The Carib grassquit is an abundant resident in Porto Rico, and in most localities outnumbers the other species of the genus found in company with it. It was recorded in 1912 at Quebradillas, July 2 to 6; Manatí, July 7 to 11; Bayamón, July 20 to 25; Río Piedras, December
16, 1911, to January 4, 1912; Mameyes, February 9 to 29; Yabucoa, May 3 to 10; Maunabo, May 11; Patillas, May 12 and 13; Humacao, September 3 to 9; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 21 to 31; Añasco, June 7 and 8; Aguadilla, June 9 to 12. Inland birds were noted at Maricao, May 29 to June 5; Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerio, July 26 to 31; Caguas, January 5 to 14; Cayey, January 15 to 25; Aibonito, January 26 to February 5; and at the Hacienda Catalina, below El Yunque, March 2 to 11. It is distributed almost universally except in the heaviest forest and occurs wherever there is cover in growing cane, along maya hedges, or in thickets, coffee plantations and second-growth forest.

The grassquits are tame, unsuspicious little birds, found in pairs or in small flocks, that fly out with a quick up and down flight to alight in plain sight or under cover in bushes. As one rides through the cane-fields at dusk, they continually flutter along ahead, so that the cane is full of their rustlings. Though common in the open fields, they are at home in dense second-growth forest. Here they work through the trees, searching the limbs like honey-creepers.

The breeding season of this species appears to extend well through the year; fully-fledged young were observed from January to June in 1912, and breeding birds were taken in every month in which I collected. Loose flocks, mainly of young birds, were encountered all through the year, while the adults were in pairs and nesting. The nests found were located in maya hedges or bushes, only a foot or so from the ground, always concealed from view. One found in a coffee plantation near Yauco, May 21, was in the midst of a thick bush, about three feet from the ground, and was made of grass and weed stalks, arched over, with a rough opening at one side. The cup within, that contained the eggs, was made of very soft, fine grasses, and the eggs themselves were four in number, whitish, heavily marked with cinnamon, lined somewhat with black. Bowdish states that he has found nests from ten inches to fifteen feet from the ground and says that the opening in the side may be large or so small as barely to permit passage of the bird. In twenty-seven complete sets he noted two containing two eggs, twenty with three eggs, two with four eggs, and three with five eggs. Three eggs in a set in the U. S. National Museum collected by Bowdish, February 25, 1901, have the ground color white, spotted and washed with walnut brown, mainly about the large end. They measure 16.0 x 13.0 mm., 16.0 x 12.6 mm. and 16.0 x 12.9 mm.
Males sing constantly all day long from a post, weed, telephone wire or some other open perch. Theirs is a harsh, emphatic little song that reminded me of that of a dickcissel. In flight they frequently changed to a slow, direct wing beat, with trembling wings and head thrown back, and sang until another perch was reached. The call-note is a low tseet.

The food of this species is almost entirely vegetable. Seeds of all kinds of grasses and sedges and various weeds are taken eagerly and are usually swallowed entire and ground up in the muscular gizzard with the sand which is eaten for that purpose, but may occasionally be hulled neatly before being swallowed.

The grassquit was recorded by Bowdish from Vieques Island, and there are a number of specimens in the U. S. National Museum taken on that island by Richmond. From March 16 to April 3, 1912, I found it common, at times in sheltered gullies, but more often in the little grass-grown openings amid the brush. Birds taken were about to breed. On Culebra Island from April 5 to 21, 1912, they were especially common and specimens were collected near the lighthouse on Culebrita. At this time some were breeding, but others gathered in loose flocks containing several hundred individuals. Half a dozen pairs were nesting in the tall grass about one water-hole. In addition to a series that I secured here, there are in the U. S. National Museum two obtained by A. B. Baker on February 9, 1899.

The species, it is said, is very common on St. Croix, where Mortensen states that it is known as the "parson" because of its sober dress. The Newtons note that it nested from the middle of May to the end of July. The latest record for it is that of a male in the Museum of Comparative Zoology taken September 14, 1914, by G. K. Noble.

The species is said to be common on St. Thomas, where it has been noted by a number of visiting naturalists and where numbers of specimens have been taken. Knox reported it here as early as 1852, under the name of "parson sparrow"; Cassin received specimens from Robert Swift; a bird from the same source is in the U. S. National Museum with others collected by Benedict and Nye from February 21 to 24, 1904, and the species was sent from there to Cory by Winch. Winch also collected the species on Virgin Gorda and Anegada. A specimen in the U. S. National Museum from the island last named was taken December 23, 1889. Another in the same collection was shot on St. John by F. A. Ober.

The male Carib grassquit is grayish olive-green, with sides of head and underparts back to the abdomen black. Females and young males are plain brownish olive-green, whitish on the abdomen.
Specimens of this species from the islands from Porto Rico to the island of Tobago have been credited to the subspecies omissa. I believe, however, that careful study of a proper series will show that there are two or more subspecies in this range. The birds show seasonal variation with wear in plumage that renders comparison difficult, as it leads to much confusion in the characters displayed. Particularly does confusion result from the fact that the seasons on the different islands vary so that birds shot in one month in one part of their range may not be actually comparable with specimens taken at the same time elsewhere.

_Tiaris olivacea bryanti_ (Ridgway)

_Bryant’s Grassquit, Gorrión, Chamorro, Chamorro Bello_

_Eucitha bryanti_ Ridgway, _Auk_, 1898, p. 322. (Porto Rico.)
_Bryant’s Grassquit, Danforth, Bird-Lore, 1922, p. 41 (Mayagüez)._


_Eucitha brictita_, Bowdish, _Oologist_, 1900, p. 74 (Vieques; misprint for _bryanti_).

_Eucitha olivacea_, Cory, _Auk_, 1886, p. 208 (Porto Rico).  


_Porto Rico, Vieques, Culebra; resident._

In Porto Rico Bryant’s grassquit is common, but is less abundant than the related species. It is found entirely in the open, in pastures and cultivated fields, where it frequents the maya hedges or scanty growths of bushes, never living in dense thickets as the other grassquit frequently does. Small marshes covered with high grass are localities favored by it, as are brushy pastures where the grass is long. During my field work it
was found at Manati, July 7 to 11; Bayamón, July 20 to 25 (specimens): Rio Piedras, December 16, 1911, to January 4, 1912 (specimens): Mameyes, February 9 to 29 (specimens): Humacao, September 3 to 9 (specimen); Yabucoa, May 3 to 10 (specimen); Maunabo, May 11; Patillas, May 10 to 13 (specimen); Salinas, April 26 to May 2 (specimens); Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31 (specimens); Añasco, June 7 and 8; Aguadilla, June 9 to 12; Maricao, May 29 to June 5 (specimen); Lares, June 18 to July 1; Utuado, August 3 to 9; Adjuntas, August 10 to 16; Ciales, July 12 to 18; Comerio, July 26 to 31; Aibonito, January 26 to February 5; Caguas, January 5 to 14 (specimens); Cayey, January 15 to 25 (specimens); and Hacienda Catalina, below El Yunque, March 2 to 11. There are skins in the U. S. National Museum from San Juan, Cataño, Luquillo and Arroyo. From their choice of open haunt these grassquits are more common in the lowlands and foothill regions than in the higher hills of the interior, which have too much cover to suit their needs. Through the year they occur in small flocks that may comprise a family group or again may include fifteen or twenty individuals. When flushed, they fly with undulating flight to the nearest maya hedge or thicket, and then work rapidly away or, if not disturbed, drop down again to the ground to continue feeding. In the cane-fields as the laborers advance in cutting the crop, the grassquits retreat to adjacent pastures and hedges, ready to spread out again through the cane when the new growth is tall enough to shelter them. Gundlach says that in his time they came about the crude sugar mills then in operation to eat the sugar as it was manufactured.

Males sing constantly all day long, from some elevated perch, an insect-like trill which cannot be heard very far. The ordinary call-note is a faint tseep.

The breeding season apparently extends through the entire year. Most of the nests are placed low, usually in the grass bordering a ditch or other depression, or in fields where the grass is tall. They are formed like balls of fine grasses, with an entrance in the side. One found near Hacienda Catalina, on the lower slopes of El Yunque, on March 4, 1912, contained three eggs, white with a greenish tinge, spotted with cinnamon brown, the spots forming a slight wreath about the large end of the egg. Gundlach reports from two to three eggs in a set. Struthers found a nest containing eggs at Maricao on November 22, 1921. Bones of this species were identified in cavern deposits near Morovis. The bulk of the food of this species consists of grass seeds, as crab grass (Syntherisma
sanguinalis) and other common species of grasses, with occasionally a few seeds of sedge (Fimbristylis) or star grass (Hypoxis).

On Vieques Island Bowdish found this species in 1899, and specimens were collected there by A. B. Baker, February 7, 1899, and by C. W. Richmond, March 22, 1900. From March 16 to April 3, 1912, I found this grassquit common and collected a number. I saw a few along roads running through the cane-fields, but found most of them in the pastures in mixed flocks with the Carib grassquit. None of those taken were breeding. Bowdish reports a laying female shot on November 30, 1899.

On Culebra Island I collected a male on April 8, 1912, which was the only one seen, though search was made for others.

Bryant’s grassquit is only slightly more than four inches in length. Males are greenish olive above and grayish olive below, with the throat and a stripe over the eye bright yellow and the forehead, cheeks, and breast black. Females are paler, with a yellow line over the eye and a faint suggestion of yellow on the throat and black on the foreneck. Young in first plumage are often similar to Tiaria b. omissa, but are paler and slightly smaller.

Subfamily Carduelinae

Loxigilla portoricensis (Daudin)

Porto Rican Grosbeak, Gallito, Churri, Capitán, Come Gandul


Pitylus portoricensis, Hartlaub, Isis, 1847, p. 611 (listed).


The Porto Rican grosbeak is an inhabitant of thickets that is found on the coastal plain where there is suitable cover, but through force of circumstances it is more common in the hilly interior of the island, since extensive regions suited for its habitation are there available. Gundlach noted it at Furnias, Quebradillas, between Arecibo and Utuado, Jayuya and Aguas Buenas. In 1912 I found it at Quebradillas, July 2 to 6; Manati, July 7 to 11; Rio Piedras, December 16, 1911, to January 4, 1912; Salinas, April 26 to May 2; Juana Diaz, August 17 to 22; Yauco, May 16 to 28; Cabo Rojo, August 24 to 31; Mayagüez, June 6; Aguadilla, June 9 to 12; Maricao, May 29 to June 5; Lares, June 18 to July 1; Utuado, August 3 to 9; Ciales, July 12 to 18; Comerio, July 26 to 31; and Aibonito, January 26 to February 5. There are in the U. S. National Museum specimens from Mayagüez, Aguadilla, Las Marias, Lares and El Yunque. The bird is seemingly rare in the eastern third of the island, as the only record is that of one taken on El Yunque by Richmond, February 25, 1900. The grosbeak frequents coffee plantations or thickets, where it feeds on the ground and, when alarmed, slips rapidly away through the bushes, keeping well under cover. Only occasionally, in little-frequented localities, does it feed in the open. The flight is quick and tilting, and the birds are often seen dodging across from one patch of cover to the next. Males fly up into the tops of the trees and, keeping concealed in the leaves, sing a loud cardinal-like song. But for the number heard, one would consider them rather rare birds, so well do they keep hidden. This is one of the few birds of the island that sings constantly. The ordinary call-note is a low *tseet*.

The grosbeak nests rather irregularly throughout the year, the main period falling between February and the end of June. Struthers reports a nest from Mayagüez containing three eggs on March 18, 1921. One nest seen near Salinas was placed on a horizontal limb about thirty feet from the ground. One found, June 26, near Lares was in the top of a bent-over coffee tree, about five feet from the ground and, though large and bulky, was almost entirely concealed. The foundation was of dried banana leaves, above which sticks, grass and weed stems were built up to form a deep cup, lined with grass and rootlets. This nest contained three eggs. Bowdish describes a nest found, June 15, 1900, near Aguadilla. It was placed in a clump of twigs, eight feet from the ground, against the trunk of a small tree growing in a mass of bushes. The
nest was of weed and vine stems and dead leaves and was domed. The three eggs, now in the U. S. National Museum, have the ground color white with a faint cast of dull green, and are marked finely with lilac and walnut brown over the entire surface, the marking having a faint tendency to be drawn in short, fine lines more or less longitudinal to the long axis of the egg. These eggs measure 22.9 x 17.0 mm., 22.6 x 16.8 mm. and 22.6 x 17.0 mm. respectively.

Young are most abundant in July and August, when the adults are in molt, and males almost cease to sing. The young of this species pair when they are full-grown, often before they are in fully adult plumage.

At Lares it was claimed by some that this bird was responsible for damage to the coffee crop by stripping the berries for the sweet pulp surrounding them, but this I did not observe. In dense shrubbery I noted individuals sometimes scratching in the leaves to uncover food. It was surprising to see how well the black color of the males protected them in the dense shadows; only when in motion could their forms be made out, even though they were only a few feet away. They were observed eating various wild fruits, such as the icaco (Chrysobalanus) manzanillo (Hippomane manchinella), pomarosa (Jambosa jambos), and sapalo (Palicourea riparia). In their stomachs I found weevils and other insects and many seeds.

This species is about six and one-half inches in length. Adults are black, with chestnut-brown throat and foreneck, crown and under tail coverts. The young are brownish olive, with rufous under tail coverts.

[Spinus cucullatus] (Swainson)

Red Siskin, Dominiquito


Sundevall received a specimen of this South American species from Hjalmarson and included it as from Porto Rico. Gundlach informs us.

however, that this was a cage-bird. The red siskin has no valid standing in the Porto Rican list, since all records refer to this one individual.]

Subfamily Emberizinae

**Ammodramus savannarum borinquensis** Peters

Porto Rican Grasshopper Sparrow, Gorrión, Chamorro


Santo Domingan Grasshopper Sparrow, Danforth, Bird-Lore, 1924, p. 52 (Cartagena Lagoon).


*Ammodramus savannarum,* Cory, Cat. West Indian Birds, 1892, p. 112 (Porto Rico).—Bowdish, Auk, 1903, p. 13 (San Juan, Aguadilla, Mayagüez).

*Ammodramus savannarum passerinus,* Cory, Cat. West Indian Birds, 1892, p. 112 (Porto Rico).


Porto Rico; resident, of local distribution, confined principally to the coastal plain.

Gundlach secured a specimen of the grasshopper sparrow near Bayamón in July, Bowdish recorded it from San Juan, Aguadilla and Mayagüez, and in the U. S. National Museum is a skin taken near Caguas, January 12, 1899, by A. B. Baker. In 1912 I found a colony near Yabucoa on May 10 and collected a small series. From July 20 to 25 I found the species common in the extensive pastures bordering the Bayamón River, near Bayamón, and from August 24 to 31 noted it as fairly common near Cabo Rojo. Struthers records it near Manatí, January 14, 1922; Danforth, at Cartagena and Guánica lagoons; Potts, at various localities from Arroyo to Ponce. I have identified bones of this species from cavern deposits near Morovis.
The grasshopper sparrow in Porto Rico, as in the United States, is so quiet and inconspicuous that it is not readily noted. It frequents pastures or waste land (Pl. LVIII), where grass and weeds furnish low cover, and has been restricted in range in recent years through increase in the land area put under cultivation, as it does not adjust itself readily to changes in its chosen haunts.

As one passes through these haunts, the birds usually skulk to one side in the grass or fly with weak flight for a short distance only to drop again into cover. On the ground they creep along through the grass where it is open, or hop about, stretching up their heads to peer about and flirting their tails nervously. The song of the males, a weak effort that may be represented by the syllables tsick tssee—ee—ee—ee, is an insect-like succession of sounds, with the first syllables sharp and quick. When known, it usually attracts attention to the birds, which otherwise would be overlooked. The song is ventriloquial, the first part seeming to come from one side and the last from another. As a result, it is usually some time before the birds are located. They sing from a weed or other perch a foot or so above the ground, where their light-colored breasts betray their presence.

The grasshopper sparrow seems to nest from May to August, and it would appear that two broods are raised. Breeding birds were taken at Yabucoa in May, and young in juvenile dress were shot at Bayamón in July and near Cabo Rojo in August. Bowdish describes a nest noted near San Juan Bay as placed in a depression in a clump of grass, built of fine grasses with a domed top. It contained three eggs similar to those of the grasshopper sparrow of the United States. He took another set of three fresh eggs near Aguadilla, June 16, 1900. Danforth found a nest containing eggs at Cartagena Lagoon, May 23, 1924.

Adults in July and August were in worn plumage, some having the rectrices much abraded or even broken, but were not yet molting. Males were still singing and varied their usual effort with another song, a series of low, twittering notes even harder to locate than the usual effort. Their call-note is a low tsip.

Two-thirds of the food of the grasshopper sparrow is composed of Orthoptera, small beetles and other insects, and the remainder of grass, sedge and other small seeds.

The grasshopper sparrow is about four and three-fourths inches in length, with whitish throat and abdomen and a buffy breast. The crown is blackish with a distinct median stripe of buffy, and the upper parts are blackish, with a mingling of buff and rusty brown that is especially
prominent on the hindneck. The young in first plumage have the breast finely streaked with dusky and lack the mixture of rusty brown above.

In 1916 I listed the grasshopper sparrow of Porto Rico under the name *intricatus*, a form described by Hartert from Haiti. I did this on the basis of probability, though no specimens from Haiti were available at the time for comparison. Peters, with comparable material at hand, has shown that the Porto Rican birds are distinct from those of Haiti, being more similar to those of Jamaica, from which they differ in smaller size and darker buff. Birds from all localities are darker buff in fresh fall plumage than in the breeding season.

**[Melospiza lincolni** (Audubon)**

Lincoln’s Sparrow

*Fringilla lincolni* Audubon, Birds Amer. (folio), 1834, Vol. II, Pl. 193. (Near mouth of Natashquan River, Quebec.)

*Melospiza lincolni lincolni*, Danforth, Auk, 1925, p. 562 (La Plata, seen).

The Lincoln’s sparrow is listed by Danforth, who states that he saw one, December 14, 1923, in a brush pile near La Plata, Porto Rico. The record is unusual, because Porto Rico is far from the normal winter range of this North American species. As it was not collected, the bird is included here in brackets—a treatment in which Mr. Danforth concurs.]

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hines Naturforschers, 1901-1902, where the above is found on pp. 254-259.)

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February, 1907. On page 115 are given notes on Chamaepelia exigua Riley from Mona Island.

1912. Observations on the Genus Coereba, together with an annotated list of the species. Ibis, pp. 489-528, with map and one colored plate. (Coereba portoricensis on p. 512 is given from Porto Rico, Vieques, Culebra, St. Thomas and the Virgin Islands; slight differences between Porto Rican and Virgin Island birds are noted.)

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1864. Five Months in the West Indies. Part II, Martinique, Dominica, and Porto Rico. Ibis, pp. 157-173. (Notes on forty-eight species, including references to thirty-one observed in Porto Rico.)

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Tortola, Spanishtown and Krabbeneyland. From the Danish Kopenhagen, pp. 1-274. (Records little blue heron and Florida gallinule from St. Croix, and flamingo, parrot, and dove from Vieques.)

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Looking out from Corozal Cave
Slopes of Luquillo Mountains
Vegetation in Luquillo Mountains
Near Ciales

Along road from Manati to Morovis
Along road from Naguabo to Guayama

River near Coamo
A LARGE CAVE NEAR MOROVIS, THE CAVE OF SAN MIGUEL
Nesophontes edithae from Morovis, Porto Rico

Figs. 1a, 1b, No. 17094, ♂, × 1/1.
Figs. 1c, No. 11714, ♀, × 2/1.
Figs. 2a, 2b, No. 17109, ♀, × 1/1.
Figs. 3a, 3b, 3c, No. 17094, ♂, × 1/1.
Fig. 4, No. 17112, ♀, × 1/1.
Fig. 5, ♀, × 1/1.
Xenophontes edithile from Morovis, Porto Rico.
Figures natural size

Figs. 6a, 6b, 6c, right scapula; fig. 7, left scapula.
Figs. 8, 9, 10, ribs.
Figs. 11a, 11b, left humerus, ♂.
Figs. 12a, 12b, 12c, sacrum.
Figs. 13a, 13b, 13c, right ulna, ♂.
Figs. 14a, 14b, 14c, right radius.
Figs. 15a, 15b, 15c, right innominate, ♂.
Figs. 16a, 16b, 16c, left innominate, ♀.
Nesophontes edithae from Morovis, Porto Rico.

Figures natural size

Figs. 17a, 17b, 17c, right femur, ♂.
Figs. 18a, 18b, 18c, right femur, ♀.
Figs. 19a, 19b, 19c, right tibia, ♂.
Figs. 20a, 20b, left tibia, ♀.
Fig. 21, atlas.

Fig. 22, axis.
Fig. 23, thoracic vertebra.
Fig. 24, fifth cervical vertebra.
Fig. 25, lumbar vertebra.
Fig. 26, caudal vertebra.
Elasmobrontomys obliquis

Figures natural size

Figs. 1a, 1b. Skull, No. 17127, Morovis, Porto Rico.
Figs. 2. Left mandible, No. 17137b, Utuado, Porto Rico.
ELASMODONTOMYS OBLIGUUS

Figures natural size

Fig. 3. Skull, No. 17126, Morovis, Porto Rico.
Figs. 4a, 4b. Skull, No. 17132, Morovis, Porto Rico.
Fig. 5. Maxillary tooth-row of skull, No. 14171, Utuado, Porto Rico. × 2/1.
Elasmodontomys obliquus

Figures natural size

Figs. 1, 2. Mandible, No. 17137a, Utuado, Porto Rico.
Fig. 3. Mandibular tooth-row, No. 17137k, Morovis, Porto Rico.
Fig. 4. Scapula, No. 17144c, Morovis, Porto Rico.
Fig. 5. Scapula, No. 17144b, Morovis, Porto Rico.
ELASMORHONTOMYS OBLIGUUS

Figures natural size

Figs. 8a, 8b, 8c, 8d. Right ulna, No. 17142a, Utuado, Porto Rico.
Figs. 9a, 9b. Right radius, No. 17143c, Morovis, Porto Rico.
Blasmodontomys obliquus, from Utuado, Porto Rico

Figures natural size

Figs. 1a, 1b, 1c, 1d. Left femur, No. 17138k.
Fig. 2. Left tibia, No. 17139d.
Elasmobranchus obliquus, from Morovis, Porto Rico

Figures natural size
Figs. 3a, 3b, 3c, 3d. Left tibia, No. 17139j.
Figs. 4a, 4b. Right tibia, No. 17140a.
Fig. 1a. Left humerus, lateral aspect. No. 1746a, natural size.

Fig. 1b. Same bone, lateral aspect.

Plasmodium oblongi, from Puerto Rico.
Fig. 1c. Left innominate, No. 17146a, ventral aspect.
Fig. 2a. Sacrum, No. 17147a, dorsal aspect.
Fig. 2b. Same bone, lateral aspect.
Figures natural size
Elasmotherium obliquus

Figures natural size

Fig. 3. Atlas, No. 17148e, Morovis, Porto Rico, anterior aspect.

Figs. 4a, 4b. Axis, No. 17148d, Morovis, Porto Rico, anterior and lateral aspects.

Figs. 5, 6, 7, 8. Thoracic vertebrae, Porto Rico.

Figs. 9a, 9b. Caudal vertebra, dorsal and lateral aspects, Porto Rico.

Fig. 10. Rib, Porto Rico.
Elasmodontomys obliquus

Figures natural size

Fig. 5. Rib, Porto Rico.
Figs. 6a, 6b. Series of five cervical vertebrae, No. 17148g, Morovis, Porto Rico.
Figs. 7a, 7b. Lumbar vertebrae, No. 17148t, Morovis, Porto Rico.
Skulls of *Isolobodon portoricensis*, from Utuado, Porto Rico

Figures natural size

Figs. 1a, 1b, 1c. No. 38409a, type specimen.

Fig. 2. No. 40657a.
Skulls and mandibles of *Isolobodon portoricensis*, from Utuado, Porto Rico

Figures natural size

Fig. 3. No. 38400b.  
Fig. 4. No. 38400c.

Figs. 5a, 5b, 5c. No. 40057f.

Figs. 6a, 6b. No. 40057p.
SKULLS AND MANDIBLES OF Plagiodonia edium, FROM SANTO DOMINGO, PORTO RICO.
FOR COMPARISON WITH Isolobodon portoricensis

Figures natural size
Figs. 7a, 7b, 7d. No. 217112, U. S. N. M.
Figs. 8a, 8b, 8c. No. 217126, U. S. N. M.
Figures natural size

Figs. 1a, 1b. Right scapula, *Isolobodon portoricensis*, No. 38469b, Utuado, Porto Rico.
Figs. 3a, 3b. Left clavicle, *Elasmobdontomys obliquus*, No. 17145, Morovis, Porto Rico.
Fig. 4. Ribs of *Isolobodon portoricensis*, Porto Rico.
Figs. 5a, 5b, 5c. Right ulna, *Isolobodon portoricensis*, No. 40963, Utuado, Porto Rico.
Isolophodon portoricensis, from Uteado, Porto Rico

Figures natural size

Figs. 6a, 6b, 6c. Left ulna, No. 38409m.
Figs. 7a, 7b, 7c. Right humerus, No. 38409f.
Figs. 8a, 8b, 8c. Left radius, No. 38409m.
Figs. 9a, 9b, 9c, 9d. Right femur, No. 38409f.
Isolobodon portoricensis, from Utuado, Porto Rico

Figures natural size

Figs. 10a, 10b, 10c, 10d. Left femur, No. 40959a, juvenile?

Figs. 11a, 11b. Left tibia, No. 38409k.

Figs. 12a, 12b, 12c. Left fibula, No. 40961d.
Isolobodon portoricensis, from Utuado, Porto Rico

Figures natural size

Figs. 13a, 13b, 13c. Sacrum. No. 48409h.
Figs. 14a, 14b, 14c. Right innominate, No. 38409j.
SKULL OF HETEROPSOMYS INSULANS, FROM UTAUO, PORTO RICO

Figs. 1a, 1b, 1c, 1d, No. 14172. Type. \( \times 1 \frac{1}{4} \).
Fig. 1e. Same skull, maxillary tooth-row. \( \times 2 \frac{1}{4} \).
Fig. 1f. Mandible, *Heteropsomys insulans*, No. 14172, type, Utuado, Porto Rico.  × 5.1.

Fig. 1g. Mandibular molar series, *Heteropsomys insulans*, No. 14172, type, crown view.  × 2.1.

Fig. 2. Palate, *Homopsomys antillensis*, No. 17102, type, Utuado, Porto Rico.  × 1.1.


Fig. 3c. Skull, *Homopsomys antiquus*, No. 10129, Mus. Comp. Zool., Chales, Porto Rico, × 1/4.

Fig. 5. Atlas, *Heteropsomys insulans*, No. 14172, Utuado, Porto Rico. × 1 1/4.

Fig. 6. Lumbar vertebra, *Heteropsomys insulans*, No. 14172, Utuado, Porto Rico. × 1 1/4.

Figs. 7a, 7b, 7c. Skull fragment, *Heptaxodon bidens*, No. 17101, type, Utuado, Porto Rico. × 1/4.

Fig. 7d. Premolar, *Heptaxodon bidens*, No. 17101, Utuado, Porto Rico. × 2 1/4.

Fig. 8. Left mandible, *Heptaxodon bidens*, Morovis, Porto Rico. × 1 1/4.

Fig. 9. Crown view of lower premolar, *Heptaxodon bidens*, Morovis, Porto Rico. × 2 1/4.
Acratocynus oontrigonus, from near Morovis, Porto Rico

Skull, No. 17720, approximately seven-ninths natural size.

Right jugal, No. 17711, approximately natural size.
Acrotomus oregonensis, from near Morovis, Porto Rico

Two views of mandible, No. 17717, approximately natural size.
Acratocnus odontirigonus, from near Morovis, Porto Rico

Skull, No. 17720, approximately seven-ninths natural size.

Skull, No. 17721, approximately seven-ninths natural size.
Acratocnus odontrigonus, from near Morovis, Porto Rico

Skull, No. 17722, approximately nine-tenths natural size.

Skull, No. 17715, approximately four-fifths natural size.
Acrocynus odontoligatus, from near Morovis, Porto Rico.

Two views of right scapula, No. 17716a, slightly less than natural size.
Acratocnus odontigonus, from near Morovis, Porto Rico

Skull, No. 17715, approximately four-fifths natural size.

Skull, No. 17720, approximately seven-ninths natural size.
Acrotoxus major, from Utuado, Porto Rico

Figures natural size

Fig. 1. Mandible, No. 17169, type.

Fig. 2a. Fragment of skull, No. 17169, type.
Acratocnus major, from Utuado, Porto Rico

Figures natural size

Fig. 2b. Basal region of skull, No. 17169, type.

Fig. 2c. Orbital section, right side, of skull, No. 17169, type.
Figures natural size.

Figs. 6a, 6b. Fragments of sacrum, Acratocnus microtigrinus, Morovis, Porto Rico.

Fig. 7a. Left innominate, Acratocnus major, No. 17169, Utuado, Porto Rico.
Fig. 1a. Right tibia, Aeropus americana, St. Vincent, Porto Rico.
Fig. 2. Right tibia, Aeropus americana, St. Thomas, Porto Rico.
Fig. 3. Left tibia, Aeropus americana, St. Thomas, Porto Rico.
ACRATOCNUS ODONTIRIGONUS

Figures natural size

Figs. 4a, 4b. Left fibula, No. 17176a, Utuado, Porto Rico.
Figs. 5a, 5b. Left radius, No. 17364a, Morovis, Porto Rico.
Figures one to three, natural size.


ACRATOCRUS ODONTRIGONES

Figures about two-thirds natural size

Fig. 1. Right femur, No. 14176, Utuado, Porto Rico.
Fig. 2. Right femur, No. 17363a, Morovis, Porto Rico.
Figs. 3a, 3b. Left femur, No. 17363b, Utuado, Porto Rico.
Acrocanthosaurus, from Utuado, Porto Rico

Figures about five-sixths natural size

Fig. 3c. Left femur, *Acrocanthosaurus adetergans*, No. 173636.
Fig. 4. Distal extremity of left femur, *Acrocanthosaurus major*, No. 17169.
Figs. 5a, 5b. Left calcaneum, *Acrocanthosaurus adetergans*, No. 17177a.
Fig. 6. Right calcaneum, *Acrocanthosaurus major*, No. 17169.
Figs. 7a, 7b. Left astragalus, *Acrocanthosaurus adetergans*, No. 17178a.
Caudal series of vertebræ of *Acratocnus opostrigonius*, dorsal aspect. Morovis, Porto Rico. × 1/1
Figures natural size

Fig. 2. Pubic region, *Acratocnus odontrigonus*, Utuado, Porto Rico.
Fig. 3. Ungual phalanges of *Acratocnus*, various individuals, Porto Rico.
View of arid scrub on Desecheo Island
Taken June 14, 1912.

Grove of coconut palms and beach, a typical shore scene
Near Aguadilla, June 11, 1912.
Clump of royal palms, nesting sites for Porto Rican and yellow-shouldered blackbirds

Near Yauco, May 17, 1912.

Limestone formation typical of lower foothills of North Coast

Near Trujillo Alto, December 26, 1911.
View on El Yunque de Luquillo from an altitude of 800 feet
(The highest peak is the fourth from the right.) Taken March 6, 1912.

El Yunque de Luquillo from the village of Mameyes
Taken February 16, 1912.
Rolling pastureland, breeding ground of the Porto Rican grasshopper sparrow
Near Yabucoa, May 10, 1912.

Second growth forest in lowlands, with setting of canefield and pasture
On grounds of experiment station at Rio Piedras, December 20, 1911.
Rio Santiago near Yabucoa

Taken May 6, 1912.

LLume palms, with background of cane and low hills

Vieques Island, March 29, 1912.
Open rolling pastureland typical of Culebra Island
Taken April 9, 1912.

Northwestern end of Culebrita Island, Cayo Norte in distance
Taken April 15, 1912.
West Indian green heron, or Martinete (Butorides virescens maculatus)

(Courtesy of Biological Survey, U. S. Dept, Agric.)
Bare-legged owl, or mucaro (Gymnasio nudipes nudipes)

(Courtesy of Biological Survey, U. S. Dept. Agric.)
Porto Rican tody, or san pedrito (*Todus mexicanus*)

(Courtesy of Biological Survey, U. S. Dept. Agric.)
Gray kingbird, or pitirre (Tyrannus dominicensis dominicensis)

(Courtesy of Biological Survey, U. S. Dept. Agric.)
PORTO RICAN BLACKBIRD, OR MOZAMBIQUE (*Holoispicus niger brachypterus*)

(Courtesy of Biological Survey, U. S. Dept. Agric.)

PORTO RICAN TANAGER, OR VERDOSO (*Acosmpingus speculiferus*)

(Courtesy of Biological Survey, U. S. Dept. Agric.)
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